Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus

B.Tech. (Computer Engineering)

Effective from Academic Year 2022-23

Prepared by: - Board of Studies in Computer Engineering

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

Chairman – BOS   **Chairman – Academic Board**

Vision of the Institution

"To be globally acclaimed Institute in Technical Education and Research for holistic Socio-economic development".

Mission of the Institution

- 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.

Vision of the Department

"To be a leader in the world of computing education practising creativity and innovation".

Mission of the Department

- To ensure students' employability by developing aptitude, computing, soft, and entrepreneurial skills

- To enhance academic excellence through effective curriculum blended learning and comprehensive assessment with active participation of industry

- To cultivate research culture resulting in knowledge-base, quality publications, innovative products and patents

- To develop ethical consciousness among students for social and professional maturity to become responsible citizens
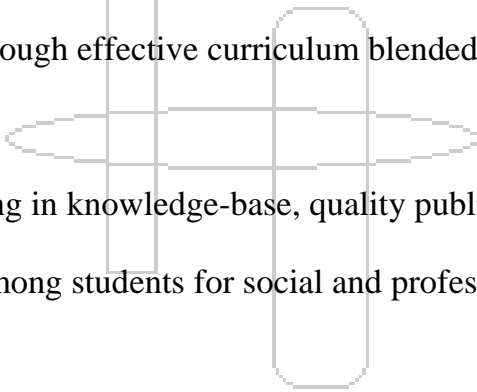
List of Programme Outcomes [PO]

PO	PO Statement

PO   **PO Statement**

PO1   **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2   **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3   **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4   **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.

PO5   **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.

PO6   **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.

PO7   **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.

PO8   **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9   **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10   **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.

PO11   **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.

PO12   **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.

List of PSO Statement

PSO1   Select and incorporate appropriate computing theory principles, data structures and algorithms, programming paradigms to innovatively craft scientific solution addressing complex computing problems.

PSO2   Adapt to new frontiers of science, engineering and technology by getting acquainted with heterogeneous computing environments and platforms, computing hardware architectures and organizations through continuous experimentation.

PSO3   Conceive well-formed design specifications and constructs assimilating new design ideas and facts for identified real world problems using relevant development methodologies and practices, architecture styles and design patterns, modeling and simulation, and CASE tools.

PSO4   Exercise research and development aptitude focusing knowledge creation and dissemination through engineering artifacts construction, preparation and presentation of engineering evidences using procedures, techniques, guidelines, and standards considering technology migration and evolution.

Program Educational Objectives (PEOs)

- Demonstrate application of sound engineering foundations to be a committed technology workforce

- Apply mathematical and computing theory knowledge base to provide realistic computer engineering solutions

- Exhibit problem-solving skills and engineering practices to address problems faced by the industry with innovative methods, tools, and techniques

- Develop professional and ethical practices adopting effective guidelines to acquire desired soft skills in the societal and global context

- Aim for continuing education and entrepreneurship in emerging areas of computing
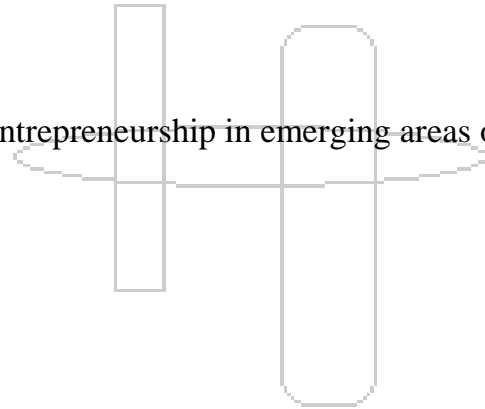
Title: Course Structure   **FF No. 653**

Branch: Computer   **Year:** S.Y.   **A.Y.:** 2022-23   **Module:** III

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme									Total	Credits
			Th	Lab	Tut	CA	MSA	ESA								
						Lab (%)	MSE (%)	HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)		
S1	MD2201	Data Science	2	2	1	-	-	20	-	20	20	20	20	100	4
S2	CS2221	Internet of Things	2	2	1	-	-	20	-	20	20	20	20	100	4
S3	CS2218	Object Oriented Programming	2	2	1	10	-	-	40	10	-	20	20	100	4
S4	CS2227	Database Management System	2	2	1	-		20	-	20	20	20	20	100	4
S5	CS2229	Design Thinking	-	-	-	-	-	-	-	-	-	-	-	100	1
S6	CS2230	Engineering Design and Innovation-III	-	12	-	-	30	-	-	-	-	-	70	100	6
		Total	**8**	**20**	**4**	**10**	**30**	**60**	**40**	**70**	**60**	**80**	**150**	**600**	**23**

Structure and syllabus of B.Tech Computer Engineering. A.Y. 2022-23

Vishwakarma Institute of Technology   Issue 01 : Rev No. 1 : Dt. 01/07/18

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

Branch: Computer   **Year:** S.Y.   **A.Y.:** 2022-23   **Module:** IV

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme								Total	Credits
			Th	Lab	Tut	CA	MSA	ESA							
						Lab (%)	MSE (%)	HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)		
S1	CS2202	Data Structures	2	2	1	10	-	-	40	10	-	20	20	100	4
S2	CS2225	Theory of Computation	2	2	1	-	-	20	-	20	20	20	20	100	4
S3	CS2228	Operating Systems	2	2	1	-	-	20	-	20	20	20	20	100	4
S4	CS2235	Computer Organization and Architecture	2	2	1	-	-	20	-	20	20	20	20	100	4
S5	CS2229	Design Thinking	-	-	-	-	-	-	-	-	-	-	-	100	1
S6	CS2230	Engineering Design and Innovation-III	-	12	-	-	30	-	-	-	-	-	70	100	6
		Total	8	20	4	10	30	60	40	70	60	80	150	600	23

Structure and syllabus of B.Tech Computer Engineering. A.Y. 2022-23

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

Branch: Computer   **Year:** T.Y.   **A.Y.:** 2022-23   **Module: V**

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week) Th	Lab	Tut	CA Lab (%)	MSA MSE (%)	ESA HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)	Total	Credits
S1	CS3051	Operating System	2	2	1	10	-	-	40	10	-	20	20	100	4
S2	CS3052	Computer Networks	2	2	1	-	-	20	-	20	20	20	20	100	4
S3	CS3205	Design and Analysis of Algorithms	2	2	1	-	-	20	-	20	20	20	20	100	4
S4	CS3215	Web Technology	2	2	1	10	-	-	40	10	-	20	20	100	4
S5	CS3055	Design Thinking - I	-	-	-	-	-	-	-	-	-	-	-	100	1
S6	CS 3057	Engineering Design and Innovation - V	-	12	-	-	30	-	-	-	-	-	70	100	6
		Total	8	20	4	20	30	40	80	60	40	80	150	600	23

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

Branch: Computer   **Year:** T.Y.   **A.Y.:** 2022-23   **Module: VI**

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme									Total	Credits
			Th	Lab	Tut	CA	MSA	ESA								
						Lab (%)	MSE (%)	HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)			
S1	CS3207	Compiler Design	2	2	1	-	-	20	-	20	20	20	20	100	4
S2	CS3226	Cloud Computing	2	2	1	-	-	20	-	20	20	20	20	100	4
S3	CS3202	Artificial Intelligence	2	2	1	-		20	-	20	20	20	20	100	4
S4	CS3220	Cyber Security	2	2	1	-		20	-	20	20	20	20	100	4
S5	CS3055	Design Thinking - I	-	-	-	-	-	-	-	-	-	-	-	100	1
S6	CS 3057	Engineering Design and Innovation - V	-	12	-	-	30	-	-	-	-	-	70	100	6
		Total	**8**	**20**	**4**	**-**	**30**	**80**	**-**	**80-**	**80**	**80**	**150**	**600**	**23**

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

Branch: Computer   **Year:** BTech   **A.Y.:** 2022-23   **Module:**   **VII**

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme							Total	Credits
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)		
OE1	MD4205	Marketing Management	2	0	0	10	-	30	-	30	-	30	100	2
OE2	CS4217	Human Computer Interaction	2	0	0	10	-	30	-	30	-	30	100	2
	CS4219	Internet of Things	2	0	0	10	-	30	-	30	-	30	100	2
	CS4222	Image Processing	2	0	0	10	-	30	-	30	-	30	100	2
	ET4230	Natural Language Processing	2	0	0	10	-	30	-	30	-	30	100	2
OE3	CS4272	Neural Networks	2	0	0	10	-	30	-	30	-	30	100	2
	CS4201	Cloud Computing	2	0	0	10	-	30	-	30	-	30	100	2
	ET4232	Deep Learning	2	0	0	10	-	30	-	30	-	30	100	2

	CS4271	Magic XPA/XPI	2	0	0	10	-	30	-	30	-	30	100	2
S4	CS4225	Major Project	0	22	0		-	30	-	70	-	-	100	11
		Total	**6**	**22**	**0**	**30**	**-**	**120**	**-**	**160**	**-**	**90**	**400**	**17**

Branch: Computer   **Year:** BTech   **A.Y.:** 2022-23   **Module:** VIII

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme								Total	Credits
			Theory	LAB	Tut.	CA		MSA		ESA					
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)			
S1	CS4232	Industry Internship	0	32	0	-	-	30	-	70	-		100	17
	CS4234	International Internship	0	32	0	-	-	30	-	70	-		100	17
	CS4202	Research Internship	0	32	0	-	-	30	-	70	-		100	17
		Total	**-**	**32**	**-**	**-**	**-**	**30**	**-**	**70**	**-**		**100**	**17**

Structure and syllabus of B.Tech Computer Engineering. A.Y. 2022-23

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Pattern "B21"

S. Y. B. Tech. Computer Engineering AY 2022-23

Module III Course Content

COURSE CODE: MD2201   **COURSE NAME: DATA SCIENCE**

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

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

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

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

Topic and Contents

Data science definition, raw data, processed data and their attributes, meta data, data cleaning, data science pipeline. **(3 Hours)**

Normal distribution, evaluating normal distribution, Binomial distribution, confidence Intervals, central limit Theorem, hypothesis testing **(6 Hours)**

Vector norms, Unconstrained Optimization **(4 Hours)**

Simple and multiple linear regression; Logistic regression, non-linear regression, polynomial regression **(4 Hours)**

Nearest Neighbor Classification – Knn approach, branch and bound algorithm, projection algorithm; Naïve Bayes Classification; Classification using decision trees, divisive and agglomerative clustering, K-means clustering **(6 Hours)**

Evaluation of model performance – Confusion matrices, sensitivity, specificity, precision, recall, F-measure, Classifier performance measurement metrics – Training & Testing strategies, Resubstitution, Hold-out, Cross validation, Bootstrap **(3 Hours)**

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 Practical's: (Any Six)

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 Course 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 Course 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 Course Group Discussion Topics:
1. PCA and ICA
2. Hierarchical and nonhierarchical systems
3. Linear - Non linear regression
4. Parametric-non parametric 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

Text Books: *(As per IEEE format)*
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: *(As per IEEE format)*
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: www.nptelvideos.in
1. https://www.edx.org/course/machine-learning-fundamentals-2
2. https://www.edx.org/course/foundations-of-data-analysis-part-1-statistics-usi
3. https://www.coursera.org/learn/statistical-inference/home/welcome
4. https://www.coursera.org/learn/data-scientists-tools/home/welcome

Course Outcomes:

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

1. Apply data processing and data visualization techniques
2. Perform descriptive and inferential statistical analysis
3. Utilize appropriate distance metrics and optimization techniques
4. Implement supervised algorithms for classification and prediction
5. Implement unsupervised classification algorithms
6. Evaluate the performance metrics of supervised and unsupervised algorithms

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

1. Data Scientist
2. Data Analyst
3. AI Engineer

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

COURSE CODE: CS2221   **COURSE NAME: INTERNET OF THINGS**

Course Prerequisites:
Students should have a basic Understanding of the Internet, Cloud, Networking Concepts and Sensors

Course Objectives:
The student will be able to
1. Understand IoT Architecture and framework.
2. Recognize and differentiate between the various use cases of different sensors, actuators, solenoid valve etc
3. Learn about fundamental concepts of networking and protocols.
4. Understand IoT Physical, Datalink and Higher layer Protocols.
5. Apply theoretical knowledge for Cloud computing.
6. Implement an IoT solution practically

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

Course Relevance:
The Internet of Things is transforming our physical world into a complex and dynamic system of connected devices on an unprecedented scale. Interne of Things is a system of interrelated computing and sensing devices and has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.
Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.
IoT is highly relevant in this growing ecosystem of internet-enabled devices. IoT offers increasing opportunities to collect, exchange, analyse and interpret data in real-time. This robust access to data will result in opportunities to further enhance and improve operations. In a world which is moving towards an increasingly connected future, Internet of Things (IoT) is the next big thing. Right from our homes to our cars to our cities, everything is being connected and the technology of IoT is right in the middle of it.

Topic and Contents

Introduction to IoT

Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels & Deployment Templates   **(4 Hours)**

IOT Platform Design Methodology

IoT Design Methodology Steps, Home Automation Case Study, Smart Cities, Health Care, Agriculture   **(4 Hours)**

IoT Devices

IoT System Design Cycle, Sensors - Terminologies, Calibration, Types, Specification, Use, Actuators - Types and Use, Prototype Development Platform - Arduino / Raspberry pi / Node MCU, Interface with Embedded System.   **(6 Hours)**

Introduction to Wireless Sensor Network

Sensor Node, Smart Sensor Network, Wireless Sensor Network, RFID - Principles and Components, Node MCU   **(4 Hours)**

Connectivity Technologies

Network Configuration in IoT, IoT Stack and Web Stack, IEEE 802.15.4 Standard, Zigbee, Bluetooth, MQTT, Cloud Architecture and Types, Cloud Service Providers   **(8 Hours)**

Case Studies (Any Two from following List to be covered☺

Smart lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Weather Report Bot, Air Pollution Monitoring, Forest fire Detection, Smart Irrigation, IoT Printer, IoT in Manufacturing Industry, IoT in Process Industry, IoT in Quality, Control Applications in Industry, IoT in Material Handling System in Industry, IoT in Automobile Industry, Navigation System, Connected Vehicles, Industry 4.0   **(4 Hours)**

List of Practical's: (Minimum Six)

1. Setting up Arduino / Raspberry Pi/ Node MCU ESP8266 : Basic handling , programming
2. LED Interfacing
3. Sensor interface to Node MCU/Arduino / Raspberry Pi Temperature measurement using LM35
4. Actuator interface to Node MCU /Arduino / Raspberry Pi Traffic Signal Control
5. Node MCU /Arduino / Raspberry Pi wireless communication Raspberry Pi as a web server
6. Node MCU/Arduino / Raspberry Pi Cloud interfacing and programming like Thingspeak Email alert using SMTP protocol
7. Sensor data acquisition on Mobile (Mobile APP) / Developing Application (WEB APP) with Django Text transfer using MQTT protocol
8. Home Automation using Cisco Packet Tracer

List of Course Projects:

1. Smart Agriculture System
2. Weather Reporting System
3. Home Automation System
4. Face Recognition Bot
5. Smart Garage Door
6. Smart Alarm Clock
7. Air Pollution Monitoring System
8. Smart Parking System
9. Smart Traffic Management System
10. Smart Cradle System
11. Smart Gas Leakage Detector Bot
12. Streetlight Monitoring System
13. Smart Anti-Theft System
14. Liquid Level Monitoring System
15. Night Patrol Robot
16. Health Monitoring System
17. Smart Irrigation System
18. Flood Detection System
19. Mining Worker Safety Helmet
20. Smart Energy Grid

List of Course 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. 5GinIoT
9. Middleware Technology
10. M2M energy efficiency routing protocol
11. IoT based Biometric Implementation
12. Complete IoT solution using AWS
13. A smart patient health monitoring system
14. IoT for intelligent traffic monitoring
15. Home automation of lights and fan using IoT

List of Group Discussion Topics:

1. Role of Internet of Things in development of India.
2. Manufacturing industries should make efforts to limit contribution to IoT.
3. Should countries put a ban on IoT for children?
4. Should IoT pay more attention to security rather than just expanding its horizon to the extremes?
5. IoT is the next big thing in technology.
6. IoT poses a huge risk to privacy, if they your system is hacked.
7. IoT is the next big thing for hackers trying to have access to your intimate data.
8. Pros and cons of over-usage of IoT at homes and offices.
9. IoT at battlefields will make life of soldiers safer and easier.
10. IoT will make way for robots to rule over humans one day.
11. IoT devices are making people lazier and obese.
12. IoT needs to be regulated before it goes out of limits and poses serious threat.

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 Industry4.0

Surveys:

1. Autonomous Vehicles

2. ListofIndiancompanieswhichofferIoTsolutionsforagricultureandfarming.Describethepro blem 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. Makeanexhaustivelistofeverythinginside,justoutside(immediatesurroundings)andon the auto body which must be "observed" for safe and comfortable driving using autonomous vehicles.

5. Compare different Cloud Service providers in the market.

Text Books: *(As per IEEE format)*

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-on Approach", (Universities Press)

2. PethuruRajandAnupamaC.Raman,"TheInternetofThings:EnablingTechnologies,Platform s,and Use Cases", (CRC Press)

Reference Books:

1. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", Wiley

2. OvidiuVermesan&PeterFriess"InternetofThingsApplications- FromResearchandInnovationtoMarket Deployment", ISBN:987-87-93102-94- 1,RiverPublishers

3. Joe Biron and Jonathan Follett, "Foundational Elements of an IoT Solution," by Joe Biron

MOOCs Links and additional reading material:

1. https://proed.stanford.edu/course/view.php?id=191
2. https://nptel.ac.in/courses/106/105/106105166/
3. https://create.arduino.cc/projecthub/electropeak/getting-started-w-nodemcu-esp8266-on-arduino-ide-28184f

Course Outcomes

1. Demonstrate fundamental concepts of Internet of Things (CO Attainmentlevel:2)
2. Recognize IoT Design Methodology Steps(COAttainmentlevel:3)
3. Select sensors for different IoT applications (COAttainmentlevel:3)
4. Analyze fundamentals of networking (COAttainmentlevel:4)
5. Apply basic Protocols in IoT (CO Attainmentlevel:4)
6. Provide IoT solutions practically with the help of case study(COAttainmentlevel:5)

Future Courses Mapping:

Other courses that can be taken after completion of this course

1. Ad-Hoc Networks
2. Cyber Security
3. Wireless Networks
4. Industry 4.0
5. Big Data

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.

COURSE CODE: CS2218   COURSE NAME: OBJECT ORIENTED PROGRAMMING

Course Prerequisites: Basic course on programming

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

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

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

Topic and Contents

Introduction:

What is Object Oriented Programming (OOP)? The need of OOP, Characteristics of OOP.

Java overview: Classes and Objects, Java object storage, Access Modifiers, this reference, main method, Static vs Instance block, Static methods vs Instance methods in Java.

Constructors: Constructors in Java, Default constructor, Parameterized constructor.

Input and Output: Byte Stream vs Character Stream, use of Scanner Class.

Arrays in Java: Arrays in Java, initialization, Default Array values, multi-dimensional array, java.util .Arrays class, string class, string buffer, string builder.

Methods in Java: Methods, Parameters passing, Returning Multiple values.

Inheritance: Inheritance in Java, Types, Constructor in Inheritance, Using final with Inheritance,

Accessing superclass member, Parent and Child classes having same data member, Base vs derived class reference. Polymorphism: Method Overloading, Overloading main(), Static vs Dynamic Binding, Method Hiding. Private and final methods, Passing and Returning Objects in Java

Exception Handling: Exceptions, types, types of handling exception, Checked vs Unchecked Exceptions, Throw and Throws, User-defined Exception.

Interfaces and Abstract Classes: Interface and its usage, Abstract Class and its usage, Difference between Abstract Class and Interface, Nested Interface, Nested Class, Inner class, Anonymous

Collection in Java: Collections Class, Using Iterators, Iterator vs Foreach, Array List, Vector, Map, Set.

Multithreading: Thread life Cycle, Thread Priority, Thread Methods.

File Handling: File Processing, Primitive Data Processing, Object Data Processing, Connecting Java with database (JDBC/ODBC).

Java GUI: Swing, Components. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key).

File Handling: File Processing, Primitive Data Processing, Object Data Processing, Connecting Java with database (JDBC/ODBC).

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File Handling: File Processing, Primitive Data Processing, Object Data Processing, Connecting Java with database (JDBC/ODBC).

Java GUI: Swing, Components. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key).Swing, Components. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key).

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 comparing 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 Buffer Reader Class
10. String, String buffer and String builder

List of Group Discussion 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
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6. Methods in Java
7. Java String Methods
8. Passing array to a function and Jagged array examples
9. Reading input using Scanner and Buffer Reader Class
10. String, String buffer and String builder

List of Practical's:

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 Course Projects:
   1. Airline reservation system
   2. Course management system
   3. Data visualization software
   4. Electricity billing system
   5. e-Healthcare management system
   6. Email client software
   7. Library management system
   8. Network packet sniffer
   9. Online bank management system

10. Online medical management system

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 aArrayList 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

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/over
view

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

Future Courses Mapping:

  Advanced Data Structures, Advanced Java, Spring Frame Work, Grails Frame Work

Job Mapping:

 Java Programmer, Application Developer, Design Engineer, Senior Software Developer

COURSE CODE: CS2227   COURSE NAME: DATABASE MANAGEMENT SYSTEMS

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

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

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

Course Relevance:

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

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

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

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

Course Contents

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 operations, fetching a word from memory, storing a word in memory, Execution of a complete instruction. Micro-operations, Hardwired Control, Example- Multiplier CU. Micro-programmed Control: Microinstructions, Microinstruction- sequencing: Sequencing techniques, Micro-program sequencing

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

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

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

List of Practical's: (Any Six)

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

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

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

List of Course Group Discussion Topics:
1. GPU computing: CUDA
2. Memory System
3. Replacement Algorithms
4. Pipelining
5. Cache Coherance
6. Virtural Memory
7. Hazards in pipelining
8. Super Computer
9. Modern computer generations
10. Parallel computing models

List of Home Assignments:

Design:

1. Write the sequence of control steps required for the single bus organization for each of the following instructions:

   1. ADD the (immediate) number NUM to register R1

   2. ADD the contents of memory location NUM to register R1

   Assume that each instruction consists of two words. The first word specifies the operation and addressing mode, and second word contains the number NUM

2. Configure a 32 Mb DRAM chip. Consider cells to be organized in 8K X 4 array. Find out the number of address lines.

3. A set associative cache consists of 64 lines, or slots, divided into four-line sets. Main memory contains 4K blocks of 128 words each. Analyze the format of main memory addresses with proper explanation.

4. A one pipeline system takes 50 ns to process a task. The same task can be processed in 6 segment pipeline with a clock cycle of 10 ns. Determine the speedup ratio of pipeline for 100 tasks. What is maximum speedup ratio?

Case Study:

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

Survey:

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

Blog:

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

Text Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", 7th

Edition, Pearson Prentice Hall Publication, ISBN 81-7758-9 93-8.

2. C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill Publication, ISBN 007-120411-3.

3. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill ISBN 0-07-113342-9

4. Douglas Hall, "Microprocessors and Interfacing", 2nd Edition, Tata McGraw Hill Publications, ISBN 0-07-025742-6.
5. Peter Abel, "Assembly Language Programming," 5th Edition, Pearson Education Publications, ISBN 10:013030655.

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

MOOCs Links and additional reading material:
1. www.nptelvideos.in
2. https://www.udemy.com/
3. https://learn.saylor.org/
4. https://www.coursera.org/
5. https://swayam.gov.in/

Course Outcomes:

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

Future Courses Mapping:
Advance Computer Architecture, Advance Operating Systems

Job Mapping*:*
Application Developers, System programmer

CS:CS2230   COURSE NAME: ENGINEERING DESIGN AND INNOVATIONS-III

Course Prerequisites: Problem Based Learning

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.

6. To develop an ecosystem to promote entrepreneurship and research culture among the students

Credits:.6   **Teaching Scheme Theory:…. Hours/Week**

Tut: … Hours/Week

Lab: 12 ours/Week

Course Relevance: Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which 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. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project centric learning will also redefine the role of teacher as mentor in the learning process. 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.

Preamble - The content and process mentioned below is the guideline document for the faculties students to start with. It is not to limit the flexibility of faculty and students; rather they are free explore their creativity beyond the guideline mentioned herewith. For all courses of ED, labora course contents of "Engineering Design" are designed as a ladder to extend connectivity of soft technologies to solve real world problems using an interdisciplinary approach. The ladder in the for gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Bio (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Hu Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

- There should be a team/group of 4-5 students.
- A supervisor/mentor teacher assigned to individual groups.

· It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

- Students must focus to initiate the task/idea .The idea inception and consideration shall be from following areas as a real world problem:
- Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.
- This is the sample list to start with. Faculty and students are free to include other areas which meet the society requirements at large.
- The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated disciplinary subject frame/domain.
- A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.
- By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

Teacher's Role in PCL :

- Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- 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:

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

Developing Inquiry Skills:

- Students in PCL are expected to develop critical thinking abilities by constantly relating: What they read to do? What they want to do with that information?
- They need to analyze information presented within the context of finding answers.
- Modeling is required so that the students can observe and build a conceptual model of the required processes.
- Use the following mechanism to maintain the track of moving towards the solution.
  How effective is …….?   How strong is the evidence for ………? How clear is ……?
- What are the justifications for thinking? Why is the method chosen?
- What is the evidence given to justify the solution?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.

- Skills required by students in information literacy include:
- · How to prepare the search? How to carry out the research
- Sorting and assessing of information in general

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

ED Sample Case Studies : -

With the adaptation of industry communication standards, Raspberry Pi and Sensors projects can be taken up :

1) Design of wireless voice controlled fire extinguisher in societies and organizations.

2) Design of wireless energy meter reading and sending meter readings to MSEB office.

3) Design of remote controlled automatic light on-off systems in societies and organizations.

4) Design of RFID based library management system.

5) Design of wireless fingerprint based college attendance system.

6) Design of wireless home automation system.

...not limited to.....Faculty and students are free to include other area which meets the society requirements at large.

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.

Higher levels of the Booms Taxonomy - analyze, apply, evaluate and create.

Text Books: *(As per IEEE format)*

1.   *A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*

2.   *Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.*

1.   *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro*

Reference Books: *(As per IEEE format)*

1.   *De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.*

2.   *Project management core textbook, second edition, Indian Edition , by Gopalan.*

3.   *The Art of Agile Development. By James Shore & Shane Warden.*

Course Outcomes:

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

CO1:   Identify the real life problem from societal need point of view

CO2:   Choose and compare alternative approaches to select most feasible one

CO3:   Analyze and synthesize the identified problem from technological perspective

CO4:   Design the reliable and scalable solution to meet challenges

CO5:   Evaluate the solution based on the criteria specified

CO6:   Inculcate long life learning attitude towards the societal problems

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO3	PO4, PO5, PO8	PO6, 7, 9, 11	PO12, PSO1, PSO2, PSO4
3	3	2	2, 2, 2	2, 2, 2, 1	2, 3, 2, 2

CO attainment levels

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

Future Courses Mapping:

Mention other courses that can be taken after completion of this course

Job Mapping:

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

Software Engineer, Software Developer, IT Engineer

Module IV Course Content

COURSE CODE:CS2202   **COURSE NAME: DATA STRUCTURES**

Course Prerequisites: Basic programming Skills (C/C++).

Course Objectives:

1. To introduce the basic concepts of data structures and algorithms.

2. To emphasize 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 associate data structures in developing and implementing efficient algorithms.

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

Tutorial: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: This is a basic 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. Data Structures are a crucial part of computer algorithms as they allow programmers to do data management efficiently. A wise selection of data structures can improve the performance of a computer program or algorithm in a more useful way.

SECTION-I

Arrays [CO-1] [PO-1]**:** Representation and application of Single and Multidimensional arrays, SparseMatrix.

Sorting Techniques [CO- 1] [PO- 1]**:** Merge Sort, Quick Sort, Heap sort.

Linked Lists [CO- 2] [PO-2]**:** Dynamic memory allocation, Singly Linked Lists, Doubly linked Lists,Circular linked lists and Generalized linked lists, Applications of Linked list, introduction to Vectors and Application.

Stack [CO-2] [PO-2]**:** Stack representation and Implementation using arrays and Linked lists. Applications of stack in Recursion, Expression conversions and evaluations.

Queues [CO- 2] [PO-2]**:** Representation and implementation using array and Linked lists, Types of queue. Applications of Queues: Job Scheduling, Josephus problem etc.

SECTION-II

Trees and Graphs and Hashing.

Trees [CO-4] [PO- 4]**:** Basic terminology, representation using array and linked lists. Tree Traversals: Recursive and Non recursive, Operations on binary tree. Binary Search trees (BST), Threaded Binary Tree.

Graphs [CO-5] [PO-8]**:** 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.

Searching techniques [CO-3] [PO- 4]**:** Linear Search, Binary search with Analysis.

Hashing [CO-6] [PSO- 1]**:** Hashing techniques, Hash table, Hash functions. Collision handling and Collision resolution techniques.

Tutorials:

List of Tutorials (Any Thirteen)

1) Sorting Techniques: Insertion, Merge sort, Bubble, Shell Sort, Radix Sort. [CO- 1] [PO-1]

2) Generalized Linked Lists. [CO-3] [PO-4]

3) Problem solving using stack (Maze problem, Tower of Hanoi).   [CO- 2] [PO- 2]

4) Expression conversion like infix to prefix and postfix and vice versa. [CO- 2] [PO-2]

5) Priority Queues and Job Scheduling Algorithm.   [CO- 2] [PO-2]

6) Threaded Binary tree and Stack less Traversals using TBT. [CO-4] [PO- 4]

7) AVL Tree. [CO- 4] [PO-4]
8) Red-Black Tree. [CO-4] [PO-4]

9) B-Tree. [CO-4] [PO-4]

10) B+-Tree. [CO- 4] [PO-4]

11) Applications of Graph in Network problems. [CO- 5] [PO- 8]

12) Searching Techniques: Ternary Search, Fibonacci Search.   [CO- 3] [PO-4]

13) Design of Hashing Functions and Collision Resolution techniques.   [CO-6] [PSO-1]

Practical's:

List of Practical's (Any Six)

 1) Assignment based on Sorting. [CO-3] [PO- 4]

 2) Assignment based on linked list. [CO-2] [PO- 2]

3) Assignment based on Stack Application (Expression conversion etc). [CO- 2] [PO-2]

4) Assignment based on Queue Application. [CO- 2] [PO-2]

5) Assignment based on BST operations (Create, Insert, Delete and Traversals). [CO-4] [PO- 4]

6) Assignment based on various operations on Binary Tree (Mirror image, Height, Leaf node display, Level wise display etc.) [CO-4] [PO- 4]

7) Assignment based on Graph traversal: DFS and BFS. [CO- 5] [PO-8]

8) Assignment based on MST using Prim's and Kruskals Algorithm. [CO-5] [PO- 11]

Course Projects:

List of Course Project Topics

1) Finding Nearest Neighbors. [CO-3] [PO- 4]

2) Calendar Application using File handling. [CO- 6] [PSO-2]

3) Path finder in Maze. [CO-3] [PO- 4]

4) Word Completion Using Trie. [CO- 4] [PO- 4]

5) Bloom Filters. [CO-3] [PO-4]

6) Different Management Systems. [CO- 1] [PO- 1]

7) Scheduling Applications and Simulation. [CO- 3] [PO-4]

8) Shortest Path Applications. (Kirchhoff's Circuit, TSP with Scenario.). [CO- 3] [PO-4]

9) Efficient Storage and Data Retrieval Systems. [CO-3] [PO- 4]

10) Different Gaming Application. [CO-2] [PO- 2]

Suggest an assessment Scheme:

MSE, ESE, HA, CVV, Lab Assignment, Course Project.

Text Books:

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:

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

MOOCs Links and additional reading material:

- www.nptelvideos.in,
- www.geeksforgeeks.org
- https://www.youtube.com/watch?v=244YpoG1pqA&list=PLrikLQMZHuSonRoDheibeb9ffd9phWIyu&index=5
- https://classroom.volp.in/

Course Outcomes:

The student will be able to –

1)To interpret and diagnose the properties of data structures with their memory representations and time complexity analysis.(1)

2)To use linear data structures like stacks, queues with their applications.(2)

3)To implement operations like searching, insertion, deletion, traversing mechanism etc. on various data structures with the help of dynamic storage representation.(3)

4)To demonstrate the use of binary tree traversals and to perform various operations on Non-linear data structures.(5)

5) To analyze the Graph data structure and to solve the applications of Graph data structures.(4)

6)To design the appropriate data structure by applying various hashing Techniques.(3)

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO4	PO4	PO8, PO11	PO12,PSO1 , PSO2
2	3	3	2	2, 1	2, 3, 2

CO attainment levels

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

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, Systems Programming, Data Science 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.*

COURSE CODE:CS2225   **COURSE NAME: THEORY OF COMPUTATION**

Course Prerequisites: Introduction to discrete mathematics, proof techniques, basic familiarity with programming/computing.

Course Objectives:

1. Students will learn basic concepts such as alphabet, strings, Languages, Decision problems, etc and will be able to work with the abstract formal setup

2. Students will be able to design deterministic/nondeterministic automata for regular languages, also he will be able to prove non regularity of languages through application of Pumping Lemma and Myhill-Nerode theorem.

3. Students will gain understanding of the role of non-determinism in Automata theory

4. Students will be able to design Context free grammars, Push down automata for context Free Languages

5. Student will be able to design Turing Machines for various computational problems and see the equivalence of TM model with high level programming languages.

6. Student will be able to comprehend meaning of undecidability in the context of Turing Machine Model and understand the inherent limits of computation.

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

Tutorial: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: This is a foundational course for Computer Science and Engineering. The central theme of the course is to study what makes certain computational problems very hard and the others easy? Is there some concrete theoretical evidence for the exhibited hardness of the problems? The course explores these questions, first by introducing students to the abstract notion of computation and models of computation. Starting from very simple model of state machines to finally cumulating into the Turing machine model (which is a foundation of modern-day computers), several models in between are studied. For every model, questions such as, which computational problems can be/cannot be solved in the model? how efficiently a problem can be solved in a particular model? various closure properties of model are studied. Throughout the course emphasis is given to proving things with concrete mathematical arguments.

The course is very important for understanding the concept of computation in more abstract set-up. Wherever one wants to formally talk about underlying model, the restrictions imposed by the model, what is the power and limitations of the model, the principles learnt in this course are useful. Due to abstract nature of the course, the principles learnt have wide applicability. The course is an essential prerequisite for several advanced courses such as Computational Complexity, Advanced Algorithms, Foundation of Logic, Quantum Computation, Parallel computation, Circuit Complexity etc. On more applied side: The Automata theoretic models, concept of Context Free Grammar and Pushdown Automata studied in the course are very important for Compiler design. The models discussed during the course have direct applications to several machine learning models, Natural Language processing, Artificial Intelligence, Functional Programming.

Once the student gains expertise in thinking abstractly about underlying models of computation it facilitates in systematic study of any other domain (in computer science or otherwise) which demands logical thinking and abstraction.

This course is also relevant for students who want to pursue research career in theory of computing, computational complexity theory, Natural Language Processing, advanced algorithmic research.

SECTION-I

Topics and Contents:

Unit-I Finite Automata: [COs Mapped: 1, 2, 3] [POs Mapped: 1, 2, 3, 4]

Introduction to Automata, Computability and Complexity theory, Automaton as a model of computation, Central Concepts of Automata Theory: Alphabets, Strings, Languages. Decision Problems Vs Languages. Finite Automata, Structural Representations, Deterministic Finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, transition table, Language of DFA, construction of DFAs for Languages and proving correctness, Product construction, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Conversion of NFA with epsilon transitions to DFA, Applications and Limitation of Finite Automata. **[4 Hrs]**

Unit-II Regular and Non-Regular Languages: [COs Mapped: 1, 2, 3] [POs Mapped: 1, 2, 3, 4]

Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleene's Theorem: Equivalence Regular expressions and DFAs (without proof), Closure properties of Regular Languages (union, intersection, complementation, concatenation, Kleene closure), Decision properties of Regular Languages, Applications of Regular expressions. Myhill-Nerode theorem and applications: proving non-regularity, lower bound on number of states of DFA, State Minimization algorithm, Equivalence testing of DFAs. Non-Regular Languages, Revisiting Pigeon-Hole principle, Pumping Lemma for regular Languages. **[6 Hrs]**

Unit-III Context Free Grammars (CFG):[COs Mapped: 1, 2, 4] [POs Mapped: 1, 2, 3, 9]

Context Free Grammars: Definition, Examples, Derivation, Languages of CFG, Constructing CFG, correctness proof using induction. Closure properties of CFLs (Union, Concatenation, Kleene closure, reversal). Derivation trees, Ambiguity in CFGs, Removing ambiguity, Inherent ambiguity. Normal forms for CFGs: CNF and GNF (without proof). Decision Properties of CFLs (Emptiness, Finiteness and Membership). Applications of CFG. **[4 Hrs]**

SECTION-II

Topics and Contents:

Unit-IV Push Down Automata: [CO's Mapped: 1, 2, 3, 4] [POs Mapped: 1, 2, 3, 4, 9]
Description and definition, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic, Non-deterministic PDAs, CFG to PDA construction (with proof). Equivalence of PDA and CFG (without proof). Intersection of CFLs and Regular language. Pumping lemma for CFLs, non-Context Free Languages, Chomsky hierarchy**. [5 Hrs]**

Unit-V Turing Machines: [COs Mapped: 5, 6] [POs Mapped: 12, 13]

Basic model, definition, and representation, Instantaneous Description, Language acceptance by TM. Robustness of Turing Machine model and equivalence with various variants: Two-way/One-way infinite tape TM, multi-tape TM, non-deterministic TM, Universal Turing Machines. TM as enumerator. Recursive and Recursively Enumerable languages and their closure properties. **[5 Hrs]**

Unit-VI Introduction to Undecidability: [COs Mapped: 5, 6] [POs Mapped: 12, 13]

Church-Turing Thesis and intuitive notion of Algorithm, Encoding for Turing machines and countability of set of all Turing machines. Existence of Turing unrecognizable languages via Cantor's diagonalization. Undecidability of Halting problem. Examples of undecidable problems: Post Correspondence Problem, Hilbert's 10th Problem, Tiling problem (without proof). Example of Turing unrecognizable language. Decision properties of R, RE languages. **[4 Hrs]**

Tutorials:

List of Tutorials (Any Thirteen)

Unit I, II [COs Mapped: 1, 2, 3] [POs Mapped: 1, 2, 3, 4]

1. Problem solving based on deterministic and non-deterministic finite automata.
2. Problem solving based on Regular expressions.
3. Problem solving based on Pumping Lemma.

4. Understanding Myhill-Nerode theorem.

Unit III, IV [COs Mapped: 1, 2, 3, 4] [POs Mapped: 1, 2, 3, 4, 9]

5. Context Sensitive Languages, Definition and Examples of Context Sensitive Grammars
6. Problem solving on Pushdown Automata.
7. Problem solving on Context Free Grammars.
8. Pumping lemma for CFLs.

Unit V, VI [COs Mapped: 5, 6] [POs Mapped: 12, 13]

9. Problem solving on Turing Machines.
10. Introduction to countable and uncountable sets (countability of set of natural numbers, integers, rational numbers. Uncountability of set of real numbers, points in plane, set of all binary strings). Problem solving on Countability
11. Problem solving on undecidability
12. Recursive and Recursively Enumerable languages and their closure properties
13. Post Correspondence Problem for unary alphabets.

Practical's:

List of Practical's (Any Six)

[COs Mapped: 1, 2, 3, 4, 5, 6] [POs Mapped: 1, 2, 3, 4, 9, 12, 13]

1.**Problem Solving based on Basic Counting:** Propositional logic, Introduction to proofs: direct, contraposition, contradiction, counterexamples, principle of mathematical induction, strong induction. Proving correctness of programs.

Elementary set theory, relations, functions, basic counting principles, permutations, combinations, generalized permutations and combinations (with/without repetitions, distinguishable/indistinguishable objects), Binomial coefficients and identities. Double counting, combinatorial proof technique, Pigeon-Hole Principle and some applications, Inclusion Exclusion Principle, and applications.

Recurrence relations, modeling using recurrence relations (some examples Fibonacci numbers, Catlan numbers, Derangements, Tower of Hanoi, partitions), generating functions and their application in counting.

2. Problem Solving based on Basic Discrete Probability:
Definition of probability, examples, independence of events, conditional probability, union bound, inclusion exclusion, Bayes' rule, discrete random variables, expectation, variance, linearity of expectation, sum of independent random variables, Markov and Chebyshev inequality, weak law of large numbers, standard distributions (Bernoulli, Binomial, Geometric), coupon collector problem, birthday paradox, probabilistic recurrences. Uniform generation of combinatorial structures.

Indicator random variables and their role in algorithm analysis.

3. Problem Solving based on Modular Arithmetic:
Number theory – Integers, division algorithm, divisibility and congruences, gcd and Euclid's Algorithm, extended Euclid's algorithm, application to modular inversion, prime numbers, Euclid's proof for infinitude of primes, unique factorization, Fermat's little theorem, Euler's phi function, Euler's theorem, Chinese remainder theorem, Fast modular exponentiation.

4. Problem Solving based on Graph Theory:
[To be taught in combinatorial perspective] Graphs, different representations, properties of incidence and adjacency matrices, directed/undirected graphs, degree of a vertex, connected components, paths, cycles in graph, Eulerian and Hamiltonian tours, Trees, properties of trees,

Simple combinatorial problem solving based on graphs, bipartite graphs (graph with only odd cycles, 2-colorable graphs), Planar graphs, Euler's theorem for planar graph, Graph colorings, matching in bipartite graphs

Seminars:

List of Course Seminar Topics

1. NFA Vs DFA
2. Pumping Lemma and Applications
3. Closure properties of Regular languages
4. Decision properties of Regular languages
5. Chomsky hierarchy
6. Application of TOC principles in compiler design
7. Hilbert's 10th problem
8. Context Free and Context sensitive grammars
9. Pumping Lemma for CFL and applications
10. Recursive and Recursively enumerable languages

List of Home Assignments:

List of Design Based Home Assignments

1. Solve 5 challenging problems on NFA, DFA
2. Solve 5 challenging problems on non-regular, regular languages
3. Solve 5 challenging problems on Context free grammars, PDAs
4. Solve 5 challenging problems on Turing machines
5. Solve 5 challenging problems on undecidability

List of Case Study Based Home Assignments

1. Randomized algorithms for pattern matching
2. Myhill-Nerode theorem and applications
3. Chomsky-Schützenberger Theorem and Dyck languages
4. Lambda Calculus
5. Hilbert's 10th Problem

List of Blog Based Home Assignment

1. Finite Automata
2. Timed Automata and applications
3. Buchi Automata
4. Non-regular languages
5. Countability

List of Survey Based Home Assignments

1. Pattern Matching algorithms
2. Parsers
3. Evolution of models of computations
4. Role of nondeterminism in theory of computation
5. Closure and decision properties of Context free languages

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.

ESE: 20% + Seminar: 20% + Home Assignments: 20%+ Discrete-Maths evaluation: 20% + CVV: 20%

Text Books: *(As per IEEE format)*

1. Hopcroft J, Motwani R, Ullman, Addison-Wesley, "Introduction to Automata Theory, Languagesand Computation", Second Edition, ISBN 81-7808-347-7.
2. Michael Sipser, Course Technology, "Introduction to Theory of Computation", Third

Edition,ISBN-10: 053494728X.
3.. "Discrete Mathematics and its applications" by Kenneth Rosen (William C Brown   Publisher)

Reference Books: *(As per IEEE format)*

1. J. Martin, "Introduction to Languages and the Theory of Computation",
Third edition, Tata McGraw-Hill, ISBN 0-07-049939-x, 2003.
2. Daniel I. A. Cohen, "Introduction to Computer Theory", Wiley-Second Edition, ISBN-10 :
04711377

MOOCs Links and additional reading material:

   www.nptelvideos.in

Course Outcomes:

 Course Outcomes:

On the completion of course, student will be able to

1. Infer the applicability of various automata theoretic models for recognizing formal languages.
2. Discriminate the expressive powers of various automata theoretic and formal language theoretic computational models.
3. Illustrate significance of non-determinism pertaining to expressive powers of various automata theoretic models.
4. Comprehend general purpose powers and computability issues related to state machines and grammars.
5. Explain the relevance of Church-Turing thesis, and the computational equivalence of Turing machine model with the general-purpose computers.
6. Grasp the theoretical limit of computation (independent of software or hardware used) via the concept of undecidability.

CO-PO Map:

CO1	CO2	CO3	CO4	CO5	CO6
PO1, PO3	PO2, PO3	PO4	PO9	PO12	PSO13
3, 2	3, 1	2	1	2	3

CO attainment levels:

CO number	1	2	3	4	5	6
Attainment level	2	3	3	4	5	5

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Compiler design, Computational Complexity theory, Computability theory, Advanced Algorithms, Natural Language Processing, Artificial Intelligence

Job Mapping:

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

Wherever one wants to formally talk about underlying model, the restrictions imposed by the model, what is the power and limitations of the model, the principles learnt in this course are useful. Due to abstract nature of the course, the principles learnt have wide applicability, let it be domain of Machine learning, Natural Language processing, Compiler design, Parallel computation, for each of them having background of Theory of Computation is very useful. If student wants to pursue higher education/ research in Computer Science, this course is must.

COURSE CODE: CS2228   COURSE NAME: OPERATING SYSTEM

Course Prerequisites: Computer Architecture & organization, Data Structure

Course Objectives:

1. To learn functions of Operating System

2. To learn the importance of concurrency and how to implement concurrent abstractions correctly in an OS.

3. To learn OS scheduling policies and mechanisms.

4. To deal with deadlock

5. To learn memory management schemes in various ways to improve performance, and how this impacts system complexity

6. To learn design & develop the Operating system from a scratch.

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

Tutorial: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: Every digital device we use runs on an operating system. This course is a fundamental course in computer engineering curriculum & used as a prerequisite to study advanced courses like distributed systems, parallel computing, etc.

SECTION-I

Topics and Contents:

Unit-I : Introduction to OS:[CO1] [PO Mapped - PO1]

What is OS, Interaction of OS and hardware, Goals of OS, Basic functions of OS, OS Services,

System Calls, Types of system calls. Shell: Linux commands, OS shell, Shell programming.

Unit-II : Process Management: [CO's Mapped – CO2] [PO Mapped -PO1, PO2, PO4]

Processes: Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control. Concurrency: Issues with concurrency, Principles of Concurrency Semaphores, Mutex.

Unit-III : Process Scheduling[CO's Mapped CO3] [PO Mapped- PO1, PO2, PO4]

Uniprocessor Scheduling: Scheduling Criteria, Types of Scheduling: Preemptive, Non-preemptive, Long-term, Medium-term, Short-term. Scheduling Algorithms: FCFS, SJF, RR, and Priority.

SECTION-II

Topics and Contents:

Unit-IV : Deadlocks: [CO4] [PO1, PO2]

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

Unit-V : Memory Management: [CO5] [PO2, PO4]

Memory Management concepts: Memory Management requirements, Memory Partitioning: Fixed, Dynamic Partitioning, Buddy Systems, Fragmentation, Paging, Segmentation, Address translation.Virtual Memory: Concepts, Swapping, VM with Paging, Page Table Structure, Inverted Page Table, Translation Look aside Buffer, Page Size, VM with Segmentation,VM with combined paging and segmentation. Swapping issues: Thrashing

Unit-VI : File Management: [CO's Mapped CO6] [PO Mapped PO1, PO9, PO12]

File Management: Concepts, File Organization, File Directories, File Sharing. Record Blocking, Secondary Storage Management, Free Space management, Security. Disk Scheduling: FCFS, SCAN, C-SCAN, And SSTF.

Tutorials:

List of Tutorials (Any Thirteen)

Tut 01 Statement: Evolution of Operating Systems[CO1] [PO1]

Tut 02 Statement: Types of Operating Systems [CO1] [PO2]

Tut 03 Statement: Structure of Operating System[CO1] [PO1]

Tut 04 Statement: Mutual Exclusion- H/w & S/w Approach[CO2] [PO2]

Tut 05 Statement: CPU Scheduling algorithms [CO3] [PO2]

Tut 06 Statement: Multiprocessor Scheduling[CO3] [PO2]

Tut 07 Statement: Deadlock Avoidance & detection.[CO4] [PO2]

Tut 08 Statement: Placement Strategies [CO5] [PO2]

Tut 09 Statement: Buddy System[CO5] [PO2]

Tut 10 Statement: Page Replacement Algorithms[CO5] [PO2]

Tut 11 Statement: Address translation in paging & segmentation[CO5] [PO2]

Tut 12 Statement: Disk scheduling algorithms[CO5] [PO2]

Tut 13 Statement: File Organization[CO5] [PO2]

Tut 14 Statement: File Systemmanagement [CO5] [PO2]

Practical's:

List of Practical's (Any Six)

Lab 01:Statement: Execution of Basic & Advanced Linux Commands. [CO1] [PO1]

Lab 02: Statement :Write shell script covering – basic arithmetic, control structures, loops, execution of Linux command in shell, command line arguments, functions and arrays.[CO1] [PO1]

Lab 03: Statement :Solve synchronization problems – Reader writer problem, Producer consumer problem & dinning philosopher problem using mutex & semaphore.[CO2] [PO2]

Lab 04: Statement :Implement CPU scheduling algorithms[CO3] [PO2]

Lab 05: Statement :Implement Banker's algorithm[CO4] [PO1, PO2]

Lab 06: Statement :Implement deadlock detection algorithm[CO4] [PO1, PO2]

Lab 07: Statement :Implement placement strategies.[CO5] [PO1, PO2, PO4]

Lab 08: Statement :Implement buddy system.[CO5] [PO1, PO2, PO4]

Lab 09: Statement :Implement page replacement algorithm[CO5] [PO1, PO2, PO4]

Lab 10: Statement :Implement disk scheduling algorithm[CO5] [PO1, PO2, PO4]

Course Projects:

List of Course Project Topics

1. Design and implementation of a Multiprogramming Operating System: Stage I

CPU/ Machine Simulation

Supervisor Call through interrupt

2. Design and implementation of a Multiprogramming Operating System: Stage II

Paging

Error Handling

Interrupt Generation and Servicing

Process Data Structure

3.Design and implementation of a Multiprogramming Operating System: Stage III

i. I/O Channels& I/O buffering

ii. Multiprogramming

iii. I/O Spooling

List of Home Assignments:

List of Design Based Home Assignments

HA_D 01 : I/O Management [CO5] [PO1,PO2, PO4]

HA_D 02: File Management [CO5] [PO1,PO2, PO4]

HA_D 03 : Disk Scheduling[CO5] [PO1,PO2, PO4]

HA_D 04 : Memory Management [CO5] [PO1,PO2, PO4]

List of Case Study Based Home Assignments

HA_CS 01Process Management in Linux[CO2] [PO Mapped]

HA_CS 02Process Management in Android [CO's Mapped] [PO Mapped]

HA_CS 03Memory Management in Linux[CO5] [PO1,PO2, PO4]

HA_CS 04Memory Management in Android[CO5] [PO1,PO2, PO4]

HA_CS 05Process Management in Windows[CO1, CO2] [PO1,PO2, PO4]

List of Blog Based Home Assignment

HA_Blog 01File System of Windows[CO1, CO5] [PO1,PO2, PO4]

HA_Blog 02File System of Linux[CO1, CO5] [PO1,PO2, PO4]

HA_Blog 03File System of Android[CO1, CO5] [PO1,PO2, PO4]

HA_Blog 04File System of iOS[CO1, CO5] [PO1,PO2, PO4]

HA_Blog 05Memory Management in Windows[CO1, CO5] [PO1,PO2, PO4]

List of Survey Based Home Assignments

HA_Survey 01 Mobile OS used in Smart Phones[CO1] [PO1,PO2, PO4]

HA_Survey 02 OS used in data centers[CO1] [PO1,PO2, PO4]

HA_Survey 03 Distributed OS & applications [CO1] [PO1,PO2, PO4]

HA_Survey 04 Mutiprocessor Scheduling [CO3] [PO1,PO2, PO4]

Suggest an assessment Scheme:

Suggest an assessment Scheme:

Text Books: (As per IEEE format)

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.

Reference Books: (As per IEEE format)

1. Silberschatz A., Galvin P., Gagne G ; "Operating System Principles"; 7th Edition, John Wiley and Sons.

2. YashavantKanetkar; "Unix Shell Programming", 2nd Edition, BPB Publications.

3. Forouzan B. A., Gilberg R. F.; "Unix And Shell Programming", 1st Edition, Australia Thomson Brooks Cole.

4. Achyut S. Godbole ,AtulKahate; "Operating Systems", 3rd Edition, McGraw Hill.

MOOCs Links and additional reading material:

1. www.nptelvideos.in

Course Outcomes:

On the completion of course, student will able to

1. Discuss the functions of a contemporary Operating system with respect to convenience, efficiency and the ability to evolve.

2. Implement concurrent abstractions correctly in an OS to solve real world problems.

3. Use various CPU scheduling algorithms to construct solutions to real world problems.

4. Correlate the mechanisms related to deadlock handling in real life situations.

5. Distinguish memory management schemes & file management systems in various ways to improve performance, and analyze the impact of it on system complexity.

6. Design & develop the Operating system from a scratch.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3	PSO 4
1	2															
2	2	2		1												
3	2	5		1												2
4	2	3														3
5	2	2		1												
6	2								2			3				
Avg	2	3		1					2			3				2.5

CO attainment levels:

CO1- 2

CO2 - 3

CO3 -3

CO4 - 3

CO5 - 4

CO6 - 5

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Distributed Operating System, Parallel Computing

Job Mapping:

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

System Analyst, System Administrator, System Engineer

CS:CS2230   COURSE NAME: ENGINEERING DESIGN AND INNOVATIONS-III

Course Prerequisites: Problem Based Learning

 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.

6. To develop an ecosystem to promote entrepreneurship and research culture among the students

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

Tut: Hours/Week

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. Along with course based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which 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. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project based learning will also redefine the role of teacher as mentor in the learning process. 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.

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 ED, laboratory course contents of "Engineering Design" are designed as a ladder to extend connectivity of software technologies to solve real word problem using interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

- There should be a team/group of 4-5 students.
- A supervisor/mentor teacher assigned to individual groups.

· It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

- Students must focus to initiate the task/idea .The idea inception and consideration shall be from following areas as a real world problem:
- Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.
- This is the sample list to start with. Faculty and students are free to include other areas which meet the society requirements at large.
- The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated disciplinary subject frame/domain.
- A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.
- By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

Teacher's Role in PCL :

- Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- 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:

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

Developing Inquiry Skills:

- Students in PCL are expected to develop critical thinking abilities by constantly relating: What they read to do? What they want to do with that information?
- They need to analyze information presented within the context of finding answers.
- Modeling is required so that the students can observe and build a conceptual model of the required processes.
- Use the following mechanism to maintain the track of moving towards the solution. How effective is …….?   How strong is the evidence for ………?   How clear is ……?
- What are the justifications for thinking?   Why is the method chosen?
- What is the evidence given to justify the solution?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.
- Skills required by students in information literacy include:
- ·   How to prepare the search?   How to carry out the research

- Sorting and assessing of information in general

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

EDI Sample Case Studies : -

With the adaptation of industry communication standards, Raspberry Pi and Sensors, following projects can be taken up:

1) Design a deployable product for soil moisture detection

2) Design a deployable product for temperature detection

3) Design a deployable product for pressure detection

3) Design a deployable product smoke detection

4) Design a deployable product for motion detection

5) Design a deployable product for collision detection

6) Design a deployable product for sound detection

...not limited to.....Faculty and students are free to include other areas which meet the society requirements at large.

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.

To focus on the higher levels of the Booms Taxonomy analyze, apply, evaluate and create.

Text Books: *(As per IEEE format)*

1. *A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*

2. *Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.*

2. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro*

Reference Books: *(As per IEEE format)*

1. *De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.*

2. *Project management core textbook, second edition, Indian Edition , by Gopalan.*

3. *The Art of Agile Development. By James Shore & Shane Warden.*

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

https://worldwide.espacenet.com/

Course Outcomes:

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

CO1: Identify the real life problem from societal need point of view

CO2: Choose and compare alternative approaches to select most feasible one

CO3: Analyze and synthesize the identified problem from technological perspective

CO4: Design the reliable and scalable solution to meet challenges

CO5: Evaluate the solution based on the criteria specified

CO6: Inculcate long life learning attitude towards the societal problems

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2, PO8	PO3	PO4, PO5, PO8	PO6, PO7, PO9, PO12	PO12, PSO1, PSO2, PSO4
3	3, 1	2	2, 2, 2	2, 2, 2, 1	2, 3, 2, 2

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

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

T.Y. B. Tech. (Computer Engineering)

Effective from Academic Year 2022-23

Prepared by: - Board of Studies in Computer Engineering

Pattern "C21"

T. Y. B. Tech. Computer

Engineering AY 2022-23

Module V courses

COURSE CODE: CS3051   **COURSE NAME: OPERATING SYSTEM**

Course Prerequisites: Computer Architecture & organization, Data Structure

Course Objectives:

1. To learn functions of Operating System

2. To learn the importance of concurrency and how to implement concurrent abstractions correctly in an OS.

3. To learn OS scheduling policies and mechanisms.

4. To deal with deadlock

5. To learn memory management schemes in various ways to improve performance, and how this impacts system complexity

6. To learn design & develop the Operating system from a scratch.

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

                                                   Tutorial: 1 Hours/Week

                                                   Lab: 2 Hours/Week

Course Relevance: Every digital device we use runs on an operating system. This course is a fundamental course in computer engineering curriculum & used as a prerequisite to study advanced courses like distributed systems, parallel computing, etc**.**

SECTION-I

Topics and Contents:

Unit-I Operating Systems Overview: An introduction to the operating system, functions of OS, OS Services, System Calls, Types of system calls. [CO1] [PO1]

Unit-II Title: Process Management: -Process Concept, Process States: 2, 5, 7 state models, Process Control. Threads: Multithreading models, Thread implementations. Concurrency: Issues with concurrency, Principles of Concurrency, Mutual Exclusion: S/W approach, Semaphores, Mutex and Monitors. Readers-Writer's problem, Producer Consumer problem, Dining Philosopher problem. [CO2] [PO1, PO2, PO4]

Unit-III : CPU Scheduling : - Uniprocessor Scheduling : Preemptive, Non preemptive, Long-term, Medium-term, Short term scheduling. Scheduling Algorithms: FCFS, SJF, RR, Priority. [CO3] [

PO1, PO2, PO4]

SECTION-II

Topics and Contents:

Unit-IV: Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery. [CO4] [PO1, PO2]

Unit-VMemory Management: Memory Management requirements, Memory Partitioning: Fixed, Dynamic Partitioning, Fragmentation, Buddy Systems, Paging, Segmentation, Address translation. Virtual Memory: Concepts, Swapping, VM with Paging, Page Table Structure, Inverted Page Table, Translation Lookaside Buffer, VM with Segmentation with combined paging and segmentation. Thrashing. [CO5][PO1, PO2, PO4]

Unit-VI File Management: Concepts, File Organization, File Directories, File Sharing. Record Blocking, Secondary Storage Management, Free Space management, Security.   [CO6] [PO1, PO9, PO12]

Tutorials:

List of Tutorials (Any Thirteen)

Tut 01 Statement: Linux Commands   [CO1] [PO1]

Tut 02 Statement: Shell Script [CO1] [PO2]

Tut 03 Statement: Types of OS [CO1] [PO1]

Tut 04 Statement: System Call[CO1] [PO1]

Tut 05 Statement: Synchronization Problems[CO2] [PO2]

Tut 06 Statement: Problems on CPU Scheduling[CO3] [PO2]

Tut 07 Statement: Problems of Deadlock detection, avoidance [CO4] [PO2]

Tut 08 Statement: Problems on Placement Strategies[CO5] [PO2]

Tut 09 Statement: Problems on page Replacement Algorithms[CO5] [PO2]

Tut 10 Statement: Problems on address translation in paging & segmentation CO5] [PO2]

Tut 11 Statement: Problems on Disk scheduling algorithm[CO5] [PO2]

Tut 12 Statement: iOS -Case Study[CO1] [PO]

Tut 13 Statement: Android OS -Case Study[CO1] [PO1]

Practical's:

List of Practical's (Any Six)

Lab 01 Statement : Execution of Basic & Advanced Linux Commands. [CO1] [PO1]

Lab 02 Statement : Write shell script covering – basic arithmetic, control structures, loops, execution of Linux command in shell, command line arguments, functions and arrays.[CO1] [PO1]

Lab 03 Statement:Solve synchronization problems – Reader writer problem, Producer consumer problem & dinning philosopher problem using mutex & semaphore.[CO2] PO2]

Lab 04 Statement:Implement CPU scheduling algorithms[CO3] [PO2]

Lab 05 Statement : Implement Banker's algorithm[CO4] [PO1]

Lab 06 Statement:Implement deadlock detection algorithm[CO4] [PO1]

Lab 07 Statement:Implement placement strategies.[CO5] [PO4]

Lab 08 Statement:Implement buddy system.[CO5 , CO6] [PO4]

Lab 09 Statement:Implement page replacement algorithm[CO5, CO6] [PO4]

Lab 10 Statement:Implement disk scheduling algorithm[CO5, CO6] [PO1, PO10]

Course Projects:

List of Course Project Topics

1.Design and implementation of a
i. CPU/ Machine Simulation
ii. Supervisor Call through interrupt
Design multi programming operating system phase 1
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. I/O Channels& I/O buffering

ii. Multiprogramming
iii. I/O Spooling
4. Design multi programming operating system phase 1 with arithmetic & logical instructions
5.Design multi programming operating system phase 3 with swapping

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.

Text Books: *(As per IEEE format)*

1. *Stalling William; "Operating Systems", 6thEdition, Pearson Education.*
2. *Silberschatz A., Galvin P., GagneG.; "Operating System Concepts", 9th Edition, JohnWiley and Sons.*
3. *D M Dhamdhere; "Systems Programming & Operating Systems"; Tata McGraw HillPublications, ISBN – 0074635794*
4. *John J Donovan; " Systems Programming " ; Tata Mc-Graw Hill edition , ISBN-13978-0-07-460482-3*

Reference Books: *(As per IEEE format)*

1. *Silberschatz A., Galvin P., Gagne G ;"Operating System Principles" 7th Edition John Wiley and Sons.*
2. *YashavantKanetkar; "Unix Shell Programming", 2 nd Edition, BPB Publications.*
3. *Forouzan B. A., Gilberg R. F.; "Unix And Shell Programming", 1 st Edition, Australia Thomson Brooks Cole.*
4. *Achyut S. Godbole ,AtulKahate; "Operating Systems", 3 rd Edition, McGraw Hill.*

MOOCs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:

On the completion of course, student will able to

1. Discuss the functions of a contemporary Operating system with respect to convenience, efficiency and the ability to evolve.

2. Implement concurrent abstractions correctly in an OS to solve real world problems.

3. Use various CPU scheduling algorithms to construct solutions to real world problems.

4. Corelate the mechanisms related to deadlock handling in real life situations.

5. Distinguish memory management schemes& file management systems in various ways to improve performance, and analyze the impact of it on system complexity.

6. Design & develop the Operating system from a scratch.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
1	2															
2	2	2		1												
3	2	5		1												2
4	2	3														3
5	2	2		1												
6	2								2			3				
Avg	2	3		1					2			3				2.5

CO attainment levels:

CO1- 2

CO2 - 3

CO3 -3

CO4 - 3

CO5 - 4

CO6 - 5

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Distributed Operating System, Parallel Computing

Job Mapping:

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

System Analyst, System Administrator, System Engineer

COURSE CODE: CS3052　　　　　　**COURSE NAME: COMPUTER NETWORKS**

Course Prerequisites:　Operating System, Theory of Computer Science

Course (Learning) Objectives:

1. To learn the data communication model, signal generation, data encoding, digital modulation and demodulation required for wired and wireless communication networks.

2. To learn the physical layer which includes transmission mediums, physical layer devices, transmission modes and topologies, performance issues for intranet and internetworks.

3. To learn multiple access schemes and wide area network connectivity for intranet and internetworks.

4. To learn IP protocol and routing algorithms for packet switching service framework used in intranet and internetworks.

5. To learn TCP and UDP protocol to provide quality of service over packet switching service framework used for intranet and internetworks.

6. To learn to select, design, develop, analyze and evaluate client server solutions for societal requirements at large.

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

　　　　　　　　　　　　　　　　　　　　　　　　　　Tutorial:　1 Hours/Week

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　Lab:　2 Hours/Week

Course Relevance:　The key technology of the information age is communications. Data communications and networking is a truly global area of study, both because the technology enables global communication over telephone lines and Internet. Data communication and networking is the backbone of all IT infrastructures in the world. These technologies and applications often emerge in communication within countries of countries and spread rapidly around the world.

　　　SECTION-I

Topics and Contents:

Unit-I Data Communication Networking Fundamentals and Physical Layer:
[CO1 → PO1, PO2, PO5 – CO Strength - 3,2,2]

Communication Model:　Source, Transmitter, Transmission System, Receiver, Destination, Data

Terminal Equipment (DTE), Data Communication Equipment (DCE). **Transmission Configurations:** Point to Point and Multipoint. **Transmission Modes:** Synchronous and Asynchronous. **Transmission Methods**: Serial and Parallel. Communication. **Communication Modes:** Simplex, Half Duplex, and Full Duplex. **Line Coding:** Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding, Differential Manchester Encoding. **Modulation:** Analog Modulation: Amplitude, Frequency, Phase. Pulse Modulation Techniques: PCM, PAM, PWM, PPM. **Digital Modulation:** ASK, FSK, MSK, GMSK, PSK, BPSK, PSK, QAM, CPM, OFDM and multicarrier modulations.**[3 Hrs]**

Networking Fundamentals: **Types of Computer Networks:** LAN, MAN, WAN, PAN, Internet, internet and Intranet. **Network Architectures:** Client-Server; Peer To Peer. **Network Architecture Modes:** Infrastructure and Ad-hoc mode. **Network Topologies:** Mesh, Star and Hierarchical. **Reference Models:** OSI, TCP/IP. Design Issues for Layers. Is ATM still used? Is ISDN dying? Is Frame Relay outdated? Is SNA still present in the Market? **[3 Hrs]**

Physical Layer: **Transmission Mediums:** Air, Water, Vacuum, Coaxial, Cat5, Cat5e, Cat6, Cat6a, Cat7, Cat8, OFC - Single and Multicore. **Networking Devices Wired and Wireless:** NIC, Repeater, Bridge, Switch, Modem, Router, Gateways and Access Point.   **[2 Hrs]**

Unit-II Logical Link Control
[CO2 → PO1, PO2, PO3, PO5, PO12, PSO01 –CO Strength -3,2,2,2,3,3]

Logical Link Control: **Design Issues:** Services to Network Layer, **Framing**, **Error Control:** Parity Bits, Hamming Codes and CRC. **Flow Control Protocols**: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol, **WAN Connectivity:** PPP and HDLC. PPPoE, PPPoA. Is DOCSIS used in 2022? Do we use DSL line in 2022? Do we use coaxial cable in 2022? Is PPP still used? **[4 Hrs]**

Unit-III Medium Access Control:
[CO3 → PO1, PO2, PO3, PO4, PO6, PO7, PSO04 – CO Strength 2,3,2,1,1,3,2]

Medium Access Control: **Channel Allocation:** Static and Dynamic, **Multiple Access Protocols:** Pure and Slotted ALOHA, CSMA, WDMA. **Legacy Standard** : 10 Mbps IEEE 802.3 Standard(Ethernet), Wiring Schemes and Frame Formats, CSMA/CD, Binary Exponential Back-off Algorithm. **High Speed Ethernet Standards:** Fast, Gigabit and 10Gigabit. **Wireless Standards:** Radio Spectrum, Frequency Hopping (FHSS) and Direct Sequence (DSSS), IEEE 802.11a/b/g/n/ac, IEEE 802.15, IEEE 802.15.4 and IEEE 802.16 Standards, CSMA/CA **[4 Hrs]**

SECTION-II

Topics and Contents:

Unit-IV Network Layer:
[CO4 → PO1, PO2, PO3, PO4, PO5,PO6, PO7, PO8,PO9, PSO01,PSO2,PSO3 – CO Strength 3,3,3,2,1,2,3,3,3,3,3,1]

Network Layer: **Switching Techniques:** Circuit, Message and Packet Switching. **Logical**

Addressing: IPv4 and IPv6, Subnetting, NAT, CIDR. **Network Layer Protocols:** IP, ICMP, Routing Protocols: Distance Vector, Link State, and Path Vector. **Routing in Internet:** RIP ,OSPF, BGP, **Congestion control and QoS**, MPLS, Mobile IP, **Routing in MANET** : AODV, DSR **[6 Hrs]**

Unit-V Transport Layer
[CO5 → PO1, PO2, PO4, PO5, PSO02 – CO Strength -3,3,2,3,3]

Transport Layer: Services: Berkeley Sockets, Addressing, Connection Establishment, Connection Release, Flow control and Buffering, Multiplexing. **HTH Layer Protocols:** TCP, TCP, TCP Timer management, UDP. Quality of Service: **TCP Congestion Control**. **Traffic Shaping:** AIMD. **Real Time Support Protocols**: Real Time Transport protocol(RTP), Stream Control Transmission Protocol (SCTP), Quality of Service (QoS), **Differentiated services, TCP and UDP for Wireless [4 Hrs]**

Unit-VI Application Layer:
[CO6→ PO1, PO2, PO4, PO10, PO12, PSO04 – CO Strength 3,3,2,3,3,2]

Application Layer: Address Resolution: Domain Name System (DNS). WWW: Hyper Text Transfer Protocol (HTTP) and HTTPS with SSL. Web Service. Email: SMTP, MIME, POP3 and Webmail. File Transfer: FTP, Dynamic Logical Addressing: Dynamic Host Control Protocol (DHCP), Design, development and evaluation of scalable enterprise application using communication and service frameworks. **[4 Hrs]**

Tutorials:

List of Tutorials (Any Thirteen)

 List of Tutorials:

Unit-I Data Communication Networking Fundamentals and Physical Layer: [CO1,CO2]

1) **Examples and analysis of Encoding Methods**: Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding, Differential Manchester Encoding

2) **Line coding, Channel Encoding and modulations Techniques**: used in IEEE 802.3 standard and its extensions, IEEE 802.11 standards and its extensions for 100 Mbps, 1 GbE, 1 Gbps, 2.5 Gbps, 5 Gbps, 10 Gbps, 25Gbps, 40 Gbps, 100 Gbps networks. Chanel Encodings in 3G, 4G and 5G Mobile Networks

Unit-II Logical Link Control [CO2]

3) **Examples on Network Performance parameters**: RTT, Delay, Bandwidth, Throughput and efficiency

Unit-III Medium Access Control: [CO3]

4) PHY and MAC Layer IEEE 802.3 Standards For Copper: Overview of 10 Mbps Ethernet, Fast Ethernet, GbE -Gigabit Ethernet, 2.5 Gigabit Ethernet, 5 Gigabit Ethernet, 10 Gigabit Ethernet, 25 Gigabit Ethernet,40 Gigabit Ethernet, 100 Gigabit Ethernet

5) PHY and MAC Layer IEEE 802.3 Standards For Optical Fiber: 100 Mbps Fast Ethernet, GbE -Gigabit Ethernet, 2.5 Gigabit Ethernet, 5 Gigabit Ethernet, 10 Gigabit Ethernet, 25 Gigabit Ethernet,40 Gigabit Ethernet, 100 Gigabit Ethernet

6) PHY and MAC Layer IEEE 802.11 Wireless LAN Standards: IEEE 802.11, Wi-Fi 1/IEEE 802.11a, Wi-Fi 2/IEEE 802.11b, Wi-Fi 3/IEEE 802.11g, Wi-Fi 4/IEEE 802.11n, Wi-Fi 5/IEEE 802.11ac, IEEE 802.11ad (WiGig), IEEE 802.11ah (HaLow), Wi-Fi 6/IEEE 802.11ax, Wi-Fi 6/IEEE 802.11ay, Wi-Fi 6/IEEE 802.11by, Wi-Fi 7/IEEE 802.11be

Unit-IV Network Layer: [CO4]

7) Examples of Network Layer Logical Addressing

      (a) Classful IP and CIDR : Subnetting, IP Prefixes

      (b) NAT Mapping: Public to Private IP and Port Mapping

      (c) Packet Delivery in Internetwork : Packets traversing through different subnetworks with different MTU and Speeds

      (d) Packet Dropping Probabilities of Routers

8) Examples of Network Layer Routing

      (a) Shortest Path and Spanning Tree

      (b) Dijkstra's Algorithm

      (c) Distance Vector Routing

      (d) Link State Routing

      (e) ECMP

Unit-V Transport Layer [CO5]

9) Examples of Transport Layer

      (a) TCP Connection Establishment: SYN and ACK, Normal Packets

      (b) Flow Control : Calculating Optimal Size of Sliding Window

      (c) Cumulative ACK scheme

(d) Smoothed RTT

(e) Slow Start and Additive Increase

Unit-VI Application Layer: [CO6]

10) Examples of Application Layer

(a) DNS: URL Domain Processing

(b) Performance of HTTP1.0 and HTTP1.1

(c) CDN

Practical's:

List of Practical's (Any Six)

Unit-I Data Communication Networking Fundamentals and Physical Layer: [CO1]

1) Write a program in C++/JAVA to implement - Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding and Differential Manchester Encoding.

2) Setting up small computer networks and Hands on networking commands:
Set up a small wired and wireless network of 2 to 4 computers using Hub/Switch/Access point. It includes installation of LAN Cards, Preparation of Cables/ Installation and Configuration of Access Point, Assigning unique IP addresses and use of ping utility. Hands on for network commands - ping, pathping, ipconfig/ifconfig, arp, netstat, nbtstat, nslookup, route, traceroute/tracert, nmap.

Unit-II MAC and Logical Link Layer [CO2, CO3]

3) Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC. Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode.(50% students will perform Hamming Code and others will perform CRC). Further extend it to real implementation of CRC over Ethernet standard.

4) Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in peer to peer mode and demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode. Further extend it to real implementation of Flow Control over TCP protocol.

Unit-IV Network Layer: [CO2,CO3,CO4]
5) Write a program to find the shortest path using Dijkstra Equation for Link State Routing Protocol which is used by Open Shortest Path First Protocol (OSPF) in the Internet for the network flow provided by instructor.

Unit-V Transport Layer [CO4,CO5]

6) Write a program using TCP Berkeley socket primitives for wired /wireless network for following

a. Say Hello to Each other (For all students)

b. File transfer (For all students)

c. Calculator (Arithmetic) (50% students)

d. Calculator (Trigonometry) (50% students)

Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode.

7) Write a program using UDP Berkeley Sockets for wired/wireless network to enable file transfer (Script, Text, Audio and Video one file each) between two machines. Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode.

Unit-VI Application Layer: [CO3,CO4,CO5,CO6]

8) Understanding protocol stack of Intranet
Analyze packet formats of Ethernet, IP, TCP and UDP captured through Wireshark for wired networks.

9) Develop a client-server to demonstrate the behavior of HTTP1.0, HTTP1.1, HTTP1.2 and HTTP2.0 protocols.

CO-PO-PSO Mapping For Course Projects, Seminars, Home Assignments

All course projects, Seminars, Home Assignments should be a mixed blend of:

Communication Framework [Encoding, Modulation, Physical, MAC and Logical Link Control] and Service Framework TCP/IP [HTTP,FTP,SMTP,TCP,UDP,IP,ICMP,PPP] and Use of front end, Server side and backend Technologies [HTML5, CSS#, JavaScript, JQuery, PHP, MySQL]

In each category problem statement, backward and forward compatibility or support or obsolete or current in terms of communication framework, Service Framework and Technological Frameworks must be correlated

For example: For the course project "Simulation of modulation and demodulation for 100 Mbps Ethernet Network", major focus is on Communication framework but students must extent their work to relate whether it supports to Service Framework and Technological Frameworks.

Use of Communication Frameworks Fundamentals of Data Communication, Physical Layer, Logical Link Control and Medium Access Control			Use of TCP/IP Framework and Technological frameworks at front end, Server Side and Backend Use of socket programming to understand Enterprise Application using frameworks at front end and Server Side and Backend		
CO1	CO2	CO3	CO4	CO5	CO6
18	16	16	18	16	16

Course Projects:

List of Course Project Topics

1.. Simulation of modulation and demodulation for digital telephone lines

2. Simulation of modulation and demodulation for 100 Mbps Ethernet Network

3. Simulation of modulation and demodulation for Gigabit Ethernet Network

4. Simulation of modulation and demodulation for 10Gigabit Ethernet Networks

5. Simulation of modulation and demodulation for 3G for mobile networks

6. Simulation of modulation and demodulation for 4G mobile networks

7. Develop a tool fox for line encoding methods

8. Develop a tool fox for modulation and demodulation methods

9. Design and deploy TCP based Multithreaded HTTP client server for accessing student activity data in the institute.

10. Design and deploy TCP based Multithreaded FTP client server to share institute level notices.

11. Design and deploy UDP based Multithreaded TFTP client server for your class

12. Design and deploy TCP based Multithreaded SMTP and POP3 mail client server for your campus.

13. Design and deploy TCP based Multithreaded Chat client server for your class.

14. Design and deploy UDP based Multithreaded Chat client server for your class.

15. Design and deploy UDP based Multithreaded Audio Conferencing client server for computer engineering department.

16. Design and deploy UDP based Multithreaded Video Conferencing client server for computer

17. Implementation of RIP/OSPF/BGP using Packet Tracer

18. Simulation of AODV routing protocol using Packet Tracer/ NS3/OMNet

Seminars:

List of Course Seminar Topics

 1. MIMO Technology For Wi-Fi

2. Underground and underwater data Communications

3. Transmission technologies for 4G mobile networks

4. Transmission technologies for 5G mobile networks

5. Autonomous systems in the Internet

6. IP Addressing using IPv6

7. RIP implementation for campus network

8. OSPF implementation in Internet

9. BGP implementation in Internet

10. Simple Network Management Protocol implementation in Internet

Group Discussion:

List of Group Discussion Topics

1. Energy-Efficient Architectures For Communication System

2. Satellite Communication System

3. Data Communication in Software Defined Networks

4. Cognitive Radios for Future Communication Frameworks

5. Fast Ethernet (Encoding Framing, Modulation, Multiplexing, Diameter etc)

6. Gigabit Ethernet (Encoding Framing, Modulation, Multiplexing, Diameter etc)

7. 10G Ethernet (Encoding Framing, Modulation, Multiplexing, Diameter etc)

8. IEEE 802.11b protocol based on HR-DSSS for wireless physical layer standard

9. IEEE 802.11g protocol based on ERP-OFDM for wireless physical layer standard

10. IEEE 802.11n protocol based on HT-OFDM for wireless physical layer standard

11. IEEE 802.11ac protocol based on VHT-OFDM for wireless physical layer standard

List of Home Assignments:

List of Design Based Home Assignments

1. Design a communication framework for irrigation system

2. Design a communication framework for automated car

3. Design a communication framework for smart city applications

4. RIP Routing Protocol for Intranet in VIT campus

5. OSPF Routing Protocol for Internet on India

6. BGP Routing Protocol for Asia continent

List of Case Study Based Home Assignments

1. WiTricity technology for industrial applications

2. Multiple access schemes implemented in 4G mobile networks

3. RFCs for wired TCP based reliable communication

4. RFCs for wireless TCP based reliable communication

5. RFCs for SSL Certificates

List of Blog Based Home Assignment

1.Journey of line encoding methods

2. Journey of modulation techniques

3. Internet Logical Addressing

4 Internet Routing Protocols

5. Applications Layer Protocols

List of Survey Based Home Assignments

1.Analogy to digital transformations on communication systems

2. Routing protocols for MANET

3. IEEE 802.1 Physical layer standard for Internet

4. IEEE 802.15.4 standard for IoT applications

5. IEEE 802.11 Wireless Standards for Wi-FI

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.

PPT(Seminar/Group Discussion)-(MSE 30M+ ESE 70M =20M), Home Assignments-(ESE 100M-20M), Course Project- (100M-20M), ESE Theory Exam –(60M-20M), Comprehensive Viva Voce –(100M-20M)20

Text Books: *(As per IEEE format)*

1. *Andrew S. Tanenbaum, "Computer Networks",5th Edition, PHI, ISBN 81-203-2175-8.*
2. *Kurose, Ross "Computer Networking a Top Down Approach Featuring the Internet", Pearson; 6th edition (March 5, 2012), ISBN-10: 0132856204*
3. *Fourauzan B., "Data Communications and Networking", 5th edition, Tata McGraw- Hill, Publications, 2006*

Reference Books: *(As per IEEE format)*

1. Matthew S. Gast "802.11 Wireless Networks", O'Reilly publications; 2nd Edition.

2. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols" Prentice Hall, 2004
3. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, ISBN: 0-470-09510-5

MOOCs Links and additional reading material:

www.nptelvideos.in, www.coursera.com, www.udemy.com

Course Outcomes:

On the completion of course, student will able to

1. Select line encoding, modulation, topology, essential components of physical layer, data transmission rates to design computer networks.

2. Estimate reliability issues based on error control, flow control and pipelining by using bandwidth, latency, throughput and efficiency.

3. Propose mechanisms for server channel allocation in wired and wireless computer networks

4. Develop Client-Server architectures and prototypes by the means of correct standards, protocols and technologies

5. Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols

6. Compare sustainable engineering practice indicating the scientific purpose and utility of communication frameworks and standards.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
1	3	2			2											
2	3	2	2		2							3				
3	2	3	3	2		2	3									2
4	3	3	3	2	1	2	3	3	3				3	3	1	
5	3	3		2	3										3	
6	3	3		2						3		3				
Avg	2.84	2.67	2.67	2.67	2.67	2	3	3	3	3	0	3	3	3	1	2

CO attainment levels:

Attainment Levels: 1, 5, 3, 4, 2, 4

Future Course Mapping:

Mention other courses that can be taken after completion of this course

High Speed Networks, Wireless Networks, Mobile Networks, Network Security, Cyber Security

Job Mapping:

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

Network Engineer, Network Stack Developers, Application Developer

CS: CS3205   **COURSE NAME: 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 the ability to formulate computational problems in the 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.
6. Students will be able to incorporate algorithm design principles, data structures and provide efficient solutions for complex computational problems.

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

Tutorial: 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-I

Topics and Contents:

Unit-I: Basic introduction and time and space complexity analysis:[COs Mapped: 3] [POs Mapped: 2, 3]

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). Using Recurrence relations and Mathematical Induction to get asymptotic bounds on time complexity. Master's theorem and applications. **[4 Hrs]**

Unit-II Divide and Conquer: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

General strategy, Analyzing Quick sort, Merge sort, Finding a majority element, Order statistics (randomized and deterministic algorithms), Efficient algorithms for Integer arithmetic (Euclid's algorithm, Karatsuba's algorithm for integer multiplication, fast exponentiation). **[4 Hrs]**

Unit-III Dynamic Programming: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

General strategy, simple dynamic programming-based algorithms to compute Fibonacci numbers, binomial coefficients, Matrix Chain multiplication, Coin change problem, 0-1 Knapsack, Traveling Salesperson Problem, All pair shortest path algorithm, Longest increasing subsequence problem, Largest independent set for trees. **[6 Hrs]**

SECTION-II

Topics and Contents:

Unit-IV Greedy and Backtracking strategy: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

Greedy: General strategy, Analysis and correctness proof of minimum spanning tree and shortest path algorithms, fractional knapsack problem, conflict free scheduling.

Backtracking: General strategy, n-queen problem, backtracking strategy for some NP-

complete problems (e.g. graph coloring, subset sum problem, SUDOKU) **[4 Hrs]**

Unit-V Introduction to complexity classes and NP-completeness: [COs Mapped: 3, 4] [POs Mapped: 2, 3, 6]

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) **[6 Hrs]**

Unit-VI Introduction to Randomized and Approximation algorithms: [COs Mapped: 3, 5] [POs Mapped: 2, 3, 12]

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, Karger's Min-cut algorithm, coupon collector problem,

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. **[4 Hrs]**

Tutorials:

List of Tutorials (Any Thirteen)

Unit I: [COs Mapped: 3] [POs Mapped: 2, 3]

1. Problem solving based on asymptotic notations, solution of recurrences
2. Proving correctness of algorithms: some techniques

Unit II, III, IV: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

3. Problem solving based on Divide and Conquer strategy (Binary search interesting applications, counting inversions)
4. Advanced problem solving based on Divide and Conquer strategy (Discrete Ham-Sandwich theorem, efficient algorithm for Josephus problem)
5. Problem solving based on Dynamic Programming strategy (Largest sum contiguous block and generalizations, Optimal binary search tree (OBST) construction)
6. Advanced problem solving based on Dynamic Programming strategy (Winning strategy for two player games, Variants of shortest path algorithms)

7. Problem solving based on Greedy strategy with emphasis on proof of correctness
8. Problem solving based on Backtracking strategy

Unit V: [COs Mapped: 3, 4] [POs Mapped: 2, 3, 6]

9. reducing NP problems to Integer Linear Programming**.**
10. Problem solving based on complexity classes, NP-completeness.

Unit VI: [COs Mapped: 3, 5] [POs Mapped: 2, 3, 12]

11. Problem solving based on Randomized Algorithms
12. Problem solving based on Approximation Algorithms

Practical's:

List of Practical's (Any Six)

Unit II, III, IV: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

1. Assignment based on some simple coding problems on numbers, graphs, matrices
2. Assignment based on Divide and Conquer strategy (e.g. majority element search, finding kth rank element in an array)
3. Assignment based on Divide and Conquer strategy (e.g. efficient algorithm for Josephus problem using recurrence relations, fast modular exponentiation)
4. Assignment based on Dynamic Programming strategy (e.g. Matrix chain multiplication, Longest increasing subsequence)
5. Assignment based on Dynamic Programming strategy (e,g, All pair shortest path, Traveling Sales Person problem)
6. Assignment based on Greedy strategy (e.g. Huffman encoding)
7. Assignment based on Backtracking (e.g. graph coloring, n-queen problem)

Unit VI: [COs Mapped: 3, 5] [POs Mapped: 2, 3, 12]

8. Assignment based on analysis of quick sort (deterministic and randomized variant)
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

Course Projects:

List of Course Project Topics

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

Seminars:

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

Group Discussion:

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:

List of Design Based Home Assignments

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

List of Case Study Based Home Assignments

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

List of Blog Based Home Assignment

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

List of Survey Based Home Assignments

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

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.

Text Books: *(As per IEEE format)*

4. *Cormen, Leiserson, Rivest and Stein "Introduction to Algorithms" ,PHI 3nd edition, 2009. ISBN 81-203-2141-*

5. Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson, 1st edition, 2005. ISBN 978-81-317-0310-6
6. Dasgupta, Papadimitriu, Vazirani "Algorithms" McGraw-Hill Education; 1 edition (September 13, 2006), ISBN-10: 9780073523408, ISBN-13: 978-0073523408

Reference Books: *(As per IEEE format)*

5. Motwani, Raghavan "Randomized Algorithms", Cambridge University Press; 1 edition (August 25, 1995), ISBN-10: 0521474655, ISBN-13: 978-0521474658
6. Vazirani, "Approximation Algorithms", Springer (December 8, 2010), ISBN-10: 3642084699, ISBN-13: 978-3642084690Gerd Keiser, MC Graw Hill International edition, optical fiber communication , third edition

MOOCs Links and additional reading material:

1. *www.nptelvideos.in*

Course Outcomes:

Course Outcomes:

On the completion of course, student will able to

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:

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO3,PO4	PO2,PO3	PO6	PO12	PSO1
3	2,3	2,3	2	2	3

CO attainment levels:

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

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Advanced Algorithms, Computational Complexity, Computational Geometry, Algorithmic Number Theory, Algorithmic Graph Theory

Job Mapping:

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

Algorithm design lie at heart of any Computer Science/Engineering application. Once the student gains expertise in Algorithm design and in general gains ability of Algorithmic thinking, it facilitates in systematic studying any other domain (in computer science or otherwise) which demands logical thinking. Algorithm design is an essential component of any job based on programming. All Industries in computer Engineering always look for a strong knowledge in Algorithm design and Data structures. If student wants to pursue higher education/ research in Computer Science, this course is must.

COURSE CODE:CS3215   **COURSE NAME:WEB TECHNOLOGY**

Course Prerequisites: Computer Networks

Course Objectives:

1. To describe most commonly used HTML5 and CSS3 tags and attributes for website development.

2. To associate event handling with HTML5 forms and CSS3 using javascript as a front-end technology for website development.

3. To extend HTML5 and CSS3 and javascript front end technologies with PHP and Mysql as a serverside and backend technologies for website development.

4. To simplify website development using REST API and Spring boot as server-side technologies.

5. To build single page applications using REACT as a reusable UI component technology as client-side technology

6. To assemble REACT as a front-end technology and Node js as a server-side technology to develop enterprise applications

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

Tutorial: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: The key technology of the information age is global communication. Web technology is a truly global area of study as it enables global communication with the help of web sites. Web technologies are the backbone of all IT infrastructures and their applications in the world. These technologies and applications often emerge in communication within countries of countries and spread rapidly around the world. The main objective of the course is present the basic web technology concepts that are required for developing web applications. The key technology components are descriptive languages, server-side program elements and client-side program elements. In addition, the course gives specific contents that are beneficial for developing web-based solutions, like relational data-base communication basics and information security principles and approaches. Most of the jobs available in the IT industries are web technology related.

SECTION-I

Topics and Contents:

Unit-I Front End Tools [CO1→PO1, PO2, PO5 – CO Strength 3,2,2]

Introduction to web technology, internet and www, Web site planning and design issues. HTML5: structure of html document, HTML elements: headings, paragraphs, line break, styles, colors, fonts,

links, frames, lists, tables, images and forms, CSS, Bootstrap, XML, JSON. [4 Hrs]

Unit-II Client-Side Technologies [CO2➔PO1, PO2, PO3, PO5, PO12 – CO Strength 3,2,2,1,3]

JavaScript: Overview of JavaScript, Data types, Control Structures, Arrays, Functions and Scopes, HTML5 forms Validation, Objects in JS, DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM. JQuery: Introduction to JQuery, Loading JQuery, selecting elements, changing styles, creating elements, appending elements, removing elements, handling events. [6 Hrs]

Unit-III Server-Side Technologies

[CO3➔ PO1, PO2, PO3, PO4, PO6 - CO Strength 2,3,3,2,3]

PHP: Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, File Handling, Exception Handling, E-mail validations, MySQL with PHP [4 Hrs]

SECTION-II

Topics and Contents:

Unit-IV Spring Boot [CO4➔PO1, PO2, PO3, PO7, PO10, PSO4 – CO Strength 3, 2, 3, 3, 3, 3]

Overview of Spring Boot, Spring Framework, Installing Spring Boot, Build Tool Maven/Gradle/Ant, Core Features, Spring Security, Web Applications, JPA for database connectivity, working with SQL and NoSQL, Messaging, Testing, Deploying Spring Boot Applications, Monitoring. [6 Hrs]

Unit-V React [CO5➔ PO1, PO2, PO4, PO5, PO8, PO11, PSO1, PSO3–CO Strength 3, 3, 2, 3, 3, 3, 3, 3]

Introduction to React, React component, JSX, Render function, Component API, Component lifecycle, State, Props, Mixins, Component composition, Pass data from parent to child, Pass data from child to parent, Component styling, Forms, Events, Refs, Keys, Router, Flux. [4 Hrs]

Unit-VI Node JS [CO6➔PO1, PO2 PO4 PO9 – CO Strength 3, 2, 2, 3]

Introduction to Node JS, Installation of Node JS, Node JS Modules, Node Package Manager (npm), Creating Web server, File System, Express JS, Serving Static Resources, Database connectivity. [4 Hrs]

Tutorials:

List of Tutorials (Any Thirteen)

Unit-I Front End Tools [CO1, CO2]

1) Examples of html and CSS
2) Examples of Bootstrap and XML

Unit-II Client-Side Technologies [CO2]

3) Examples of html form validation (a)Email Validation (b)Mob No Validation
4) Examples of JavaScript and JQuery

Unit-III Server-Side Technologies [CO3]

5) Examples of PHP

Unit-IV Spring Boot [CO4]

6) Examples of MySQL
7) Examples of Springboot

Unit-V React [CO5]

8) Examples of React

Unit-VI Node JS [CO6]

9) Examples of Node js

Practical's:

List of Practical's (Any Six)

Unit-I Front End Tools [CO1, CO2]

1) Installation and configuration and testing working of XAMPP server for local host.

2) Develop a basic web page using the HTML tags you learned in class. (Develop a responsive web page for your CV using multiple column layout.)

Unit-II Client-Side Technologies [CO1, CO2, CO3]

3) Create an admission Template form for VIT admission Process? Perform the validation for email and phone no fields (Develop a responsive web site for your CV having video background for first page and perform the validation using email or mobile number as username and a password of min length 11 consisting at least one uppercase letter one digit and one special character.)

4)Create an one IT company Template with video in Background (The Web Page must be Responsive and the page contains video in Background)

5) Write a JavaScript program to reverse the elements of a given array.

6) Develop a website using toggleable or dynamic tabs or pills with bootstrap and JQuery

Unit-III Server-Side Technologies [CO1, CO2, CO3]

7) Assume we have a file named "webtech.txt", write the correct syntax to open and read the file content.

8) Write a program to calculate Electricity bill in PHP (a) You need to write a PHP program to calculate electricity bill using if-else conditions. (b) Conditions For first 50 units – Rs. 3.50/unit For next 100 units – Rs. 4.00/unit For next 100 units – Rs. 5.20/unit for units above 250 – Rs. 6.50/unit You can use conditional statements.

Unit-IV Spring Boot [CO1, CO3CO4, CO5]

9) Create three MySQL database tables and write php scripts to read, insert & delete data through web interface.

10) Design and implement a website using REST API and Spring Boot.

Unit-V React [CO1, CO4, CO5]

11) Design and implement a website using REST API, Spring Boot and MySQL/Oracle.

12) Design and implement a website using REACT, Spring Boot and MySQL/Oracle.

Unit-VI Node JS [CO1, CO4, CO5, CO6]

13) Design and implement a website using REACT, Node Js and MySQL/Oracle.

Course Projects:

List of Course Project Topics

1. Develop a Website with NLP as a backend

2. Student Grievance System

3. Workflow Management System for MNC

4. Browser-based Game Website using HTML, CSS, JavaScript, Bootstrap

5. Develop an web application that help to farmers to solve their farming problems

6. GST Billing Software for Small Business

7. Online Crime Reporting System using PHP

8. Develop an Online College Voting System

9. Develop an Online Loan Processing System for Farmers.

Seminars:

List of Course Seminar Topics

1.Evolution of Web Technology

2. CSS and Bootstrap

3. JavaScript and JQuery

4. JSON and AJAX

5. Cookies & Sessions

6.PHP and MySQL

7. Angular JS

8. Java Servlets

9. Java Server Pages (JSP)

10. JSP and Servlets

11. JavaBeans

12. Model-View_Controllor (MVC) Paradigm

13. Web Services

14. Strut

15. SOAP

Group Discussion:

List of Group Discussion Topics

1. Evolution of web technologies

2.HTML v/s XML

3.JavaScript and PHP

4. 21st Century Web Technologies

5. Sql Vs MangoDB[

 6. Internet Privacy

7. Ruby

8. Rails

9. Groovy

10. Grails

11. EJB

List of Home Assignments:

List of Design Based Home Assignments

1) Website for restaurant
2) Website for e-book shop
3) Website for on-line music store
4) Website for guest visiting your society
5) Website for web search engine

List of Case Study Based Home Assignments

1) Emerging Web Technologies
2) Databases for Servers
3) A case study of JQuery used in any real-time healthcare web application

    4) SOAP

    5)   Angular versions

List of Blog Based Home Assignment

1) Frond End Technologies
2)   Client-Side Technologies
3)   Server-Side Technologies
4)   Web Services
5)   EJB Applications

List of Survey Based Home Assignments

1)   Survey on Frond End Technologies
2) Survey on Client-Side Technologies
3) Survey on Server-Side Technologies
4)   Component based technologies

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.

MSE, ESE, Seminar, Group Discussion, Home Assignments, Course Project, Lab evaluation, CVV

Text Books: *(As per IEEE format)*

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

Pearson Education, 2007, ISBN 978-0131856035.

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

Reference Books: *(As per IEEE format)*

7. *Marty Hall, Larry Brown,"Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.*
8. *H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429.*
9. *Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.*
10. *Xue Bai et al: The web Warrior Guide to Web Programming, Thomson, 2003*

MOOCs Links and additional reading material:

2. https://www.w3.org/html
3. HTML, The Complete Reference
4. http://www.htmlref.com/
5. http://w3schools.org/
6. http://php.net/ https://jquery.com/
7. https://developer.mozilla.org/en-US/docs/AJAX
8. http://www.tutorialspoint.com/css/

Course Outcomes:

On the completion of course, student will able to

1. Create front end web pages using HTML5 and CSS3 tags and attributes

2. Provide validation mechanism and event handling in a website using javascript as a front end technology

3. Integrate front end with serverside and backend technologies for commercial websites using PHP and Mysql

4. Write Web API/RESTful API application programming interface to communicate with Spring boot as a serverside technology.

5. Build single page applications using REACT as a reusable UI component technology as client side technology and Spring boot and Node Js as server side technologies

6. Design and develop three tier enterprise application using client side, server side and back end

CO-PO Map:

	Program Outcomes (PO)												PSO			
	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CS3215.1	3	2			3											
CS3215.2	3	2	2		1							3				
CS3215.3	2	3	3	2		3										
CS3215.4	3	2	3				3			3						3
CS3215.5	3	3		2	3			3			3		3		3	
CS3215.6	3	2		2					3							
Average	2.8	2.3	2.7	2.0	2.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0

CO attainment levels:

Attainment Levels: 1, 2, 3, 4, 4, 5

Future Course Mapping:

 Mention other courses that can be taken after completion of this course

Mobile Application Development

Job Mapping:

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

Software Engineer, Web Developer, IT Engineer, UI Developer

Module VI Courses

COURSE CODE: CS3226   **COURSE NAME: CLOUD COMPUTING**

Course Prerequisites: Operating Systems, Computer Networks, Database Management System

Course Objectives:

1. To become familiar with cloud computing and its ecosystem

2. To acquire basics of virtualization and its importance

3. To evaluate in-depth analysis of Cloud Computing capabilities and its services.

4. To configure and implement storage services.

5. To analyze different cloud-based services to meet a set of given requirements.

6. To design security aspects for cloud computing

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

                                           Tutorial: 1 Hours/Week

                                           Lab: 2 Hours/Week

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

SECTION-I

Topics and Contents:

Unit-I Introduction to Cloud Computing
[CO1 ➔ PO1, PO2, PO5 – CO Strength - 2,1,1]

Recent trends in computing, Cluster computing, Distributed computing ,Evolution of cloud computing, Cloud versus traditional architecture, Cloud Computing Architecture, Google Cloud architecture, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Public cloud, Private cloud, Hybrid cloud, Community cloud **[4 Hrs]**

Unit-II Virtualization
[CO2➔ PO1, PO2, PO3, PO4, PO5- CO Strength -2,2,1,1,1]

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 auto scaling, Basics of virtualization and implementation challenges. System virtualization technologies-architectures and internals. KVM, Xen, VMware.

Memory virtualization-virtualization techniques, ballooning, deduplication and sharing. Network

and storage virtualization, Virtual machine migration and replication techniques pre-copy and post-copy techniques, applicability to system availability. **[6 Hrs]**

Unit-III   Cloud Services
 [CO3→] [PO1, PO2, PO3, PO4, PO5, PO7, PO8, PSO4 – Strength - 3,2,2,2,2,3,3,2]

Service Oriented Architecture (SOA), Web services, Web 2.0, Web OS. Introduction to IaaS, PaaS, SaaS. 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) Docker flow, orchestration with Docker, dynamic linking and legacy linking of containers. The GCP Console, understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs. **[4 Hrs]**

SECTION-II

Topics and Contents:

Unit-IV   Cloud Storage
[CO4→PO1, PO2, PO3, PO4, PO5, PO6, PO9- Strength 3,2,2,2,3,3,3]

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. OpenStack: NOVA, Neutron, Keystone Cinder, Swift and Glances, VMware Suit, Apache Cloud Stack **[4 Hrs]**

Unit-V Service Management
[CO5 →   PO1,PO2,PO3,PO4,PO5,PO9,PO11,PSO2-Strength 3,3,1.3,3,1,2,3]

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., Introduction to configuration and management tools Ansible, Architecture of DevOps. **[4 Hrs]**

Unit-VI Cloud Network and Security
[CO6→   PO1, PO2, PO3, PO4, PO5, PO10, PO12 - Strength 2,2,1,3,1,3]

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. 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. **[6 Hrs]**

Tutorials:

List of Tutorials (Any Thirteen)

List of Tutorials:

Unit-I   Introduction to Cloud Computing [CO1] [CO2]

1) Install VirtualBox/VMware Workstation with different Linux or Windows Operating Systems.

2) Study Google Cloud Architecture.

Unit-II   Virtualization [CO2]

3) Find a procedure to launch virtual machine

4) Find a procedure to transfer the files from one virtual machine to another virtual machine.

Unit-III   Cloud Services [CO3]

5) Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

 6) Install Google App Engine. Create hello world app and other simple web applications using python/java.

Unit-IV   Cloud Storage [CO4]

7) Launch the Web Applications using GAE launcher.

8) Install Hadoop single node cluster and run simple applications like wordcount.

Unit-V Service Management [CO5]

9) Use AWS Pricing Calculator: Create estimate for EC2 Compute cost for VM instance. Use region closest to you. Find On demand cost and compare the pricing for other regions.

Unit-VI Cloud Network and Security [CO6]

9) Launch EC2instane and explore Public/Private/Elastic IP

Practical's:

List of Practical's (Any Six)

Unit-I   Introduction to Cloud Computing [CO1] [CO2]

1) To setup AWS accounts and launch instances.

Unit-II   Virtualization [CO2]

2) To install an OS using VirtualBox/ VMWare Workstation. Add Storage to create new virtual disk.

3) To Deploy Virtual Machine on hypervisor such as KVM, ESXi. Take Backup and Migrate them.

Unit-III   Cloud Services [CO3]

4) To use Infrastructure as a Service to facilitates for creating and deleting compute resources. Create network and attach volumes to run instances.

5) To install docker on window/linux and build docker image from docker hub.

6) Deploy a stateless/stateful application on Kubernetes cluster.

Unit-IV   Cloud Storage [CO4]

7) To work on different Cloud Storage Services.

Unit-V Service Management [CO5]

8)To create login into AWS and use S3 Bucket Service for storage.

Unit-VI Cloud Network and Security [CO6]

9) Develop elastic services for dynamic load scenario using AWS APIs. Build load balancer and explore on scalability, fault detection and performance.

Course Projects:

List of Course Project Topics
1. Creating Google Account to store files and programs.
2. Creating Account to Store Images.
3. Creating a Warehouse Application in SalesForce.com
4. Creating an Application in SalesForce.com using Apex programming Language.
5. To study and implement Web services in SOAP for JAVA Applications.

6. Implementation of Para-Virtualization using VMWare 's Workstation/ Oracle's Virtual Box and Guest Operator System.
7. Installation and Configuration of Hadoop.
8. AWS Case Study: Amazon.com.
9. Case Study of Google App Engine.

10. Case Study of Face book.

Seminars:

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

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

Group Discussion:

List of 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:

List of Design Based Home Assignments

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).

List of Case Study Based Home Assignments

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.

List of Blog Based Home Assignment

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.

List of Survey Based Home Assignments

1. Disaster Recovery in Cloud Computing.

2. Cloud Economics.

3. Data archiving solutions.

4. Salesforce.

5. Dropbox.

Suggest an assessment Scheme:

MSE, ESE, GD, Seminar, HA

Text Books: *(As per IEEE format)*

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: *(As per IEEE format)*

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", SPD,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

https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/

https://aws.amazon.com/what-is-cloud-computing/

https://www.ibm.com/in-en/cloud/learn/cloud-computing

Course Outcomes:

Course Outcomes:

On the completion of course, student will 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 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	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CS3226.1	2	1			1											
CS3226.2	2	2	1	1	1											
CS3226.3	3	2	2	2	2		3	3								2
CS3226.4	3	2	2	2	3	3			3							
CS3226.5	3	3	1	3	3				1		2			3		

CS3226.6	2	2	1	3	1				3		3				
Average	2.50	2.00	1.40	2.20	1.83	3.00	3.00	3.00	2.00	3.00	2.00	3.00		3.00		2.00

CO attainment levels:

Attainment Levels:1,2,3,5,4,3

Future Course 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

COURSE CODE:CS3202 COURSE NAME: ARTIFICIAL INTELLIGENCE

Course Prerequisites:

- A course on "Computer Programming and Data Structures"

- A course on "Mathematical Foundations of Computer Science"

- Some background in linear algebra, data structures and algorithms, and probability will be helpful

Course Objectives:

1. To learn the distinction between optimal reasoning Vs. human like reasoning

2. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.

3. To learn different knowledge representation techniques.

4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

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

Tutorial: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: Technologies driven by artificial intelligence (AI) have transformed industries and everyday life. The possibilities for AI applications are virtually unlimited and sought after in practically every industry segment.That's why global organizations are actively recruiting professionals with specialized skills and proficiencies needed to develop future AI technological innovations.

SECTION-I

Topics and Contents:

Unit-I Title: Fundamentals of Artificial Intelligence
Introduction: A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, Types of production systems, Turing Test. **Intelligent Agents**: Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. **Formulation of problems**: Vacuum world, 8 queens, Route finding, robot navigation.[

CO1, CO2] [PO1, PO2]

Unit-II Title: UninformedSearch Strategies

Uninformed Search Methods: Depth First Search, Breadth First Search, Depth Limited Search,Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies.[CO3] [PO3, PSO1]

Unit-III Title: Informed Search Methods:

Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means Ends Analysis, **Game playing:** Minimax Search, Alpha-Beta Cut offs, Waiting for Quiescence.[CO3, CO6] [PO3]

SECTION-II

Topics and Contents:

Unit-IV Title: Logical Agents:

Knowledge based agents, Wumpus world. **Propositional Logic**: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. **First order Logic**: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.
[CO4] [PO2]

Unit-V Title: Basics of PROLOG:

Representation, Structure, Backtracking. **Expert System**: Design, Implementation, Case study of Expert System in PROLOG.[CO4] [PO2]

Unit-VI Title: Planning:

Blocks world, STRIPS, Implementation using goal stack, **Planning with state space search:** Forward state space search, Backward state space search, Heuristics for state space search. Partial Order Planning, Planning Graphs, Hierarchical planning, Least commitment strategy.

Conditional Planning, Continuous Planning.   [CO5] [PO4]

Tutorials:

List of Tutorials

 [CO1] [PO1]

1. AI problem formulation   [CO1] [PO1]
2. Task Environment [CO1] [PO1]

3. AI Problem Characteristics [CO1] [PO1]
4. Missionaries and Cannibals Problem [CO2] [PO2]
5. Water Jug Problem [CO2] [PO2]
6. Monkey Banana problem [CO2] [PO2]
7. 8 Puzzle Problem [CO2] [PO2]
8. Magic Square problem [CO2] [PO2]
9. Tic-Tac Toe Problem [CO3] [PO3]
10. Robot Navigation [CO5] [PO4]
11. Propositional Logic Examples [CO5] [PO4]
12. Predicate Logic Examples [CO5] [PO4]
13. Mini Expert system examples [CO5] [PO4]

Practicals:

List of Practical's

1. Implementation of AI and Non-AI technique by implementing any two player game [CO1,CO2] [PO1,PO2]
2. Implementation of Uninformed strategies [CO1,CO2] [PO1,PO2]
3. Implementation of Informed strategies[CO2,CO3] [PO2,PO3]
4. Implementation of CSP Problem [CO3] [PO3]
5. Implementation predicate logic using PROLOG[CO5] [PO4]
6. Implementation of Expert system using PROLOG[CO5] [PO4]

Course Projects:

List of Course Project Topics (Sample topics)

Course Project 01 Statement: --------------------------- [CO's Mapped] [PO Mapped]

1. Inventory management E Commerce   [CO1] [PO1]
2. stock market price prediction [CO1] [PO1]
3. Object Identification / detection [CO2] [PO2]
4. Product Delivery Drones [CO3] [PO3]
5. Pick and drop robotic arm [CO4] [PO2]
6. Arrangement of blocks [CO2] [PO2]
7. Smart city water / light management system [CO2] [PO2]
8. Human Tracking system [CO2] [PO2]
9. Automatic Interview Conduction system [CO3] [PO3]
10. Student Information Chatbot Project. [CO3] [PO3]
11. Product Review Analysis For Genuine Rating. [CO3] [PO3]
12. Customer Targeted E-Commerce [CO4] [PO2]
13. College Enquiry Chat Bot [CO2] [PO2]
14. Artificial Intelligence HealthCare Chatbot System [CO3] [PO3]

15. Intelligent Tourist System Project [CO3] [PO3]

Seminars:

List of Course Seminar Topics

Seminar 01 Statement: --------------------------- [CO's Mapped] [PO Mapped]

1. Fundamentals of Artificial Intelligence [CO1] [PO1]
2. Intelligent Agents [CO1] [PO1]
3. Uninformed searching Techniques [CO2] [PO2]
4. Informed searching Techniques [CO2] [PO2]
5. Gaming Techniques [CO2] [PO2]
6. Planning Techniques [CO5] [PO4]
7. Applications of AI [CO6] [PO3]
8. Predicate Logic [CO4] [PO2]
9. Propositional Logic[CO4] [PO2]
10. Adversarial Search Techniques [CO4] [PO2]

List of Home Assignments:

List of Design Based Home Assignments

1. Design of intelligent algorithm for AI Accessibility [CO3] [PO3]
2. Design of AI algorithm for Robot Navigation. [CO3] [PO3]
3. Design of AI algorithm forCustomer Experience [CO3] [PO3]
4. Design of AI algorithm forData-Informed Design [CO3] [PO3]
5. Design of AI algorithm forAI Decision Making [CO3] [PO3]
6. Design of AI algorithm forany application for Children [CO3] [PO3]
7. Design of AI algorithm forproblems of Senior Citizens [CO3] [PO3]
8. Design of AI algorithm for ecommerce Applications [CO3] [PO3]
9. Design of AI algorithm forEnterprise UX Design [CO3] [PO3]
10. Design of AI algorithm as Teaching Aid for teachers [CO3] [PO3]

List of Case Study Based Home Assignments

HA_CS[CO's Mapped] [PO Mapped]

1. How Automobile Sector Is Preparing For The 4th Industrial Revolution using AI [CO3] [PO3]
2. How Indian Retail Giant Is Using AI And Robots To Prepare For The 4th Industrial Revolution [CO3] [PO3]
3. Rolls-Royce And Google Partner To Create Smarter, Autonomous Ships Based On AI [CO3] [PO3]
4. The Amazing Ways Tesla Is Using Artificial Intelligence And Big Data [CO3] [PO3]
5. The Incredible Ways John Deere Is Using Artificial Intelligence To Transform Farming[CO3] [PO3]
6. Challenges/Issues in AI applications [CO3] [PO3]
7. Research problems in AI [CO3] [PO3]
8. AI in Search Engine [CO3] [PO3]
9. Future of AI [CO3] [PO3]
10. AI in Agriculture [CO3] [PO3]

List of Blog Based Home Assignment

1. AI Trends [CO3] [PO3]
2. AI Research [CO3] [PO3]
3. AI Chatbot [CO3] [PO3]
4. Chatbot Magazine [CO3] [PO3]
5. AI Medical / Agriculture [CO3] [PO3]
6. AI Challenges [CO3] [PO3]
7. Knowledge based Inference Engine [CO3] [PO3]
8. Rule based inference Engine [CO3] [PO3]
9. Truth maintenance system[CO3] [PO3]
10. AI in CSP problems [CO3] [PO3]

List of Survey Based Home Assignments

1. Adaption of AI in 2020 [CO3] [PO3]
2. AI in Industry [CO3] [PO3]
3. AI in Digital Marketing [CO3] [PO3]
4. AI in Gaming [CO3] [PO3]
5. AI after Covid-19 [CO3] [PO3]
6. AI in rule based systems [CO3] [PO3]
7. Analysis of Search Engines : AI perspective [CO3] [PO3]
8. Page rank algorithms in AI [CO3] [PO3]
9. AI in Ecommerce [CO3] [PO3]
10. Analysis of Expert systems in medical diagnosis [CO3] [PO3]

Suggest an assessment Scheme:

HA, Seminar, MSE, ESE, Lab, CVV

Text Books: *(As per IEEE format)*

1. *Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill*
2. Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.
3. Deepak Khemani: "A First Course in Artificial Intelligence", Mc Graw Hill
4. Saroj Kaushik: "Artificial Intelligence" Cengage Publication

Reference Books: *(As per IEEE format)*

1. Ivan Bratko : "Prolog Programming For Artificial Intelligence" , 2nd Edition Addison Wesley,1990.
2. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley
3. Patterson: "Introduction to AI and Expert Systems", PHI
4. Nilsson: "Principles of Artificial Intelligence", Morgan Kaufmann.
5. Carl Townsend, "Introduction to turbo Prolog", Paperback, 1987

MOOCs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:

On the completion of course, student will able to

1. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.
2. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
3. Evaluation of different uninformed and informed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.
4. Formulate and solve a given problem using Propositional and First order logic.
5. Analyze the AI problem using different planning techniques.
6. Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CS3202.1	2															
CS3202.2		2														
CS3202.3			2										1			
CS3202.4		1														
CS3202.5				3												
CS3202.6			1													
Average	2	3	3	3									1			

CO attainment levels:

CO-Number	1	2	3	4	5	6
Attainment Level	2	2	3	1	3	1

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Machine Learning

Job Mapping:

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

AI Data Analyst, Data Scientist

COURSE CODE: 3220   **COURSE NAME: CYBER SECURITY**

Course Prerequisites: Computer Networks

Course Objectives:

1. Learners must be able to discover the programming bugs that will be malicious code, they also must be able to explain various attacks and resolve the bugs to mitigate the treats.

2. Learners must be able to apply various cryptographic techniques to secure the systems developed.

3. Discover and explain various authentication and authorization methods with the access control

4. Articulate the use of various standard security protocols for the layered architecture.

5. Articulate the urgent need for cyber security in critical computer systems, networks, and World Wide Web, and explain various threat scenarios

6. Articulate the cyber threats to critical infrastructures

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

Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance:

SECTION-I

Topics and Contents
Introduction to Security : Key security properties - Confidentiality, Integrity, Availability. Risk Management, Understanding Governance- Policies, Framework, Laws, Regulations, Guidelines and Compliance, Risk based Management

Cryptography:
Private key cryptography: Role of random numbers & nonce in security, Importance of prime numbers
Data Encryption Standard: Block cipher, Stream cipher, Feistel structure, round function, block cipher modes of operation, S-DES, Attacks on DES, S-AES, AES.
Public key cryptography: RSA: RSA algorithm, Key generation in RSA, attacks on RSA. Elliptic Curve Cryptography (ECC): Elliptic Curve over real numbers, Elliptic Curve over Zp, Elliptic Curve arithmetic.
Data Integrity: Certificates, Introduction to Hashing, Properties of Hash function, HASH + SALT, hashing algorithms (SHA1, SHA2)
Authentication and Authorization: Network Access Control: SHA-512, Kerberos, Multifactor authentication

Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application, IPsec.

Introduction to Security Attacks and Hacking: Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, countermeasures - Avoiding attacks, Security services. Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, IP spoofing, Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing.

SECTION-II

Introduction to Digital Forensics, Data Recovery and OS Forensics, Email Crimes and Violations, Cyber Forensics.

IoT Security: Definitions of OT, IoT, IIoT, & ICS), Introduction to most widely used protocols in IoT environment - MQTT and CoAP.

Blockchain: Introduction to Blockchain, Decentralized System & Distributed Ledger Technology, Blockchain Computing Power, Hash & Merkle Tree with Hands on Examples, Multiple Use-Cases of Blockchain, Different Types of Blockchain, Public Blockchain, Private Blockchain, Consensus and Types of Consensus with examples Smart Contracts in Blockchain, Need of Smart Contracts, Developing Smart Contracts, Programming basics of Solidity (Data Types) and Advanced Solidity, EVM in relation with Smart Contracts and Gas Price, Running and Debugging Smart Contracts in Remix (Detailed), Deploy and Debug Smart Contract with Truffle

Smart Contracts in Ethereum Blockchain, Crypto-Economics and Cryptocurrency, Types of Cryptocurrency and Cryptography, Valid and Invalid Transactions, Permissioned Blockchain(RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance), Blockchain for Enterprise – Overview, Blockchain Components and Concepts, Hyperledger Fabric – Transaction Flow

Hyperledger Fabric Details, Fabric – Membership and Identity Management, Hyperledger Fabric Network Setup, Hyperledger Composer, Use cases.

List of Tutorials:
1. Mathematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm), algebraic structures (Groups, Rings, Fields, Polynomial Field).
2. Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack.
3. Chinese remainder theorem.
4. hashing algorithms MD5

5. Email security: PGP and SMIME
6. Computer forensics, facebook forensic, mobile forensic, cyber forensic, digital forensic
7. Study of Snort
8. Nessus: a Security Vulnerability scanning tool
9. OWASP Zed Attack Proxy (ZAP).
10. Source Code Analysis Tools
11. Metasploit/Ollydbg
12. Testing SSL
13. Testing for Brute Force Password
14. Testing for SQL Injection

List of Practicals: (Any Six)
1) Acquisition of System Information/ RAM/Volume Shadow Copy/Detecting Encryption in information.
2) Forensic of Disc Image/ Registry/ Meta data/ RAM
3) Simplified DES implementation
4) Simplified AES implementation
5) Encryption and Decryption by RSA algorithm
6) Implementation of ECC over Diffie Hellman Key Exchange Protocol
7) Implementation of authentication algorithms
8) Digital forensic of images
9) Forensics of Video alteration
10) Vulnerabilities finding in Mobile/ computer/ digital devices

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

List of Course Seminar Topics:
1. Blcokchain architecture and its implementation
2. Cloud Security
3. Mobile Security
4. IoT and Security Issues/ Security Models for IoT
5. Darkweb
6. Docker Security
7. Access control methods for online social media and various organizations
8. Security of Android Vs IOS
9. Machine learning and SCADA Security
10. Security Applications for Smart Cities

List of Course Group Discussion Topics:
1. Security Issues in Android and IOS devices
2. Industry 4.0 and security
3. Blockchain and E-voting system
4. Security of Aadhar Card and other digital cards
5. Automated Home Appliances and Security
6. Programming Bugs and Malicious code in information security
7. Indian Cyber laws and Deficiencies
8. Social Media and Cyber Security
9. Child abuse on online social media and security
10. Need of cyber crime and security in school education.

List of Home Assignments:
Design:
1. Design a secure system using cryptography techniques for security of multimedia files.
2. Design a secure system using steganography for hiding data files in image/video
3. Design a system for educational institutes using authentication and authorization techniques, also give details about the access control policies that must be implemented for the design of system by various places.
4. Design a secure system using SSL/TLS/IPSec for the various organizations
5. Design a system for the analysis of cyber crime using various cyber forensic techniques and compare each technique with respect to integrity, confidentiality, availability
Case Study:
1. How to improve the security of social media? Write a detail case study
2. Find out the vulnerability issues in educational institutes websites/online systems and give solutions to these problem. Perform a detailed case study of the various issues.

3. Write a detail case study about the banking security flows and solutions to these flows.

4. Give a detail case study of the antivirus system giving the flows and solutions to it.

5. Perform the detail case study of various operating systems used for mobile devices and give a secure solution to one for widely used OS.

Blog

1. Dark Web

2. Crypto currency and Economy

3. Cyber crime and solutions

4. Authentication and Access control for social media

5. Cyber forensic and Cyber laws

Surveys

1. Survey on various blockchain related issues/ cryptocurrency/ application systems developed using blockchain

2. Survey on various authentication and access control methods for different applications

3. Steganography and Biometric Systems for authentication

4. Survey of various attacks and its effect on Indian economy and its analysis

5. Problems over Integer Lattices: A Study

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.

Text Books: *(As per IEEE format)*

1. William Stallings; "Cryptography and Network Security-Principles and Practices" 6th Edition , Pearson Education, 2014, ISBN13:9780133354690.
2. Bernard Menezes, "Network Security and Cryptography", 1st Edition, Cengage Learning, 2010, ISBN 81-315-1349-1.
3. Raef Meeuwisse, "Cybersecurity for Beginners", 2nd Edition, Cyber Simplicity, 2017, ISBN-9781911452157

Reference Books: *(As per IEEE format)*

1. M. Speciner, R. Perlman, C. Kaufman, "Network Security: Private Communications in a Public World", Prentice Hall, 2002
2. Michael Gregg, "The Network Security Test Lab: A Step-By-Step Guide", Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

3. Matt Bishop, "Computer Security: Art and Science", 1st Edition, Pearson Education, 2002, ISBN 0201440997.
4. Charlie Kaufman, Radia Perlman and Mike Spencer, "Network security, private communication in a public world", 2nd Edition, Prentice Hall, 2002, ISBN 9780130460196.
5. V.K. Pachghare, "Cryptography and Information Security", 2nd Edition, PHI, 2015, ISBN-978-81-203-5082-3.

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

Course Outcomes:

1) . Analyze cryptographic techniques using a mathematical approach by examining nature of attack.
2)Identify and establish different attacks on the system
3) Justify various methods of authentication and access control for application of technologies to various sections of industry and society.
4) Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization
5) Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.
6) Analyze various types of cyber crime by detecting the crime

CO PO Map

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CS3201.1	3	**3**		3	**2**	2		3	1				3		1	3
CS3201.2	2	3	**3**		1	2		3	1						1	3
CS3201.3	3	3	1	**3**	3	3	3	**3**	1			3		3	1	3
CS3201.4	3	2	3	2			2	3	3	3	2	1				2
CS3201.5	3	2	1	1	3	3	3	3			3	2		3	3	3
CS3201.6	2	2	3	2	1		2		3	3	3	3				
Average	2.67	2.5	2.2	2.2	2	2.5	2.5	3	1.8	3	2.67	2.25	3	3	1.5	2.8

CO attainment levels

Future Courses Mapping:

Blockchain Technologies
Ethical Hacking and Network Defense
Cloud and Data Security

Job Mapping:
Security Engineer/Network Security Engineer
Information Security Analyst
Cyber Security Analyst
Cyber Security Associate
Manager-Information Security Secvices
Security Consultant
Penetration Testing Engineer

CS:CS3257   COURSE NAME: ENGINEERING DESIGN AND INNOVATIONS-V

Course Prerequisites: Problem Based Learning

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.
6. To develop an ecosystem to promote entrepreneurship and research culture among the students.

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

Tut: Hours/Week

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. Along with course based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which 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. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project based learning will also redefine the role of teacher as mentor in the learning process. 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.

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 ED, laboratory course contents of "Trends in Engineering Technology" are designed as a ladder to extend connectivity of software technologies to solve real word problem using interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

- There should be a team/group of 4-5 students.
- A supervisor/mentor teacher assigned to individual groups.

· It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

- Students must focus to initiate the task/idea .The idea inception and consideration shall be from following areas as a real world problem:
- Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.
- This is the sample list to start with. Faculty and students are free to include other areas which meet the society requirements at large.
- The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated disciplinary subject frame/domain.
- A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.
- By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

Teacher's Role in PCL :

- Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- 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:

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

Developing Inquiry Skills:

- Students in PCL are expected to develop critical thinking abilities by constantly relating: What they read to do? What they want to do with that information?
- They need to analyze information presented within the context of finding answers.
- Modeling is required so that the students can observe and build a conceptual model of the required processes.
- Use the following mechanism to maintain the track of moving towards the solution.
  How effective is …….?   How strong is the evidence for ………?   How clear is ……?
- What are the justifications for thinking?   Why is the method chosen?
- What is the evidence given to justify the solution?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.

- Skills required by students in information literacy include:
- How to prepare the search?   How to carry out the research
- Sorting and assessing of information in general

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

EDI Sample Case Studies : -

1) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis

2) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for SAM and BAM processing and analysis

3) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for Gnome NGS processing and analysis

4) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for population genetics simulation

5) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for proteomics processing and analysis

 ...not limited to.....Faculty and students are free to include other area which meets the society requirements at large.

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.

Higher levels of the Booms Taxonomy - analyze, apply, evaluate and create.

Text Books: *(As per IEEE format)*

1.   A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017

2.   Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.

Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro

Reference Books: *(As per IEEE format)*

1.   De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.

2.   Project management core textbook, second edition, Indian Edition , by Gopalan.

3.   The Art of Agile Development. By James Shore & Shane Warden.

Course Outcomes:

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

CO1:   Identify the real life problem from societal need point of view

CO2:   Choose and compare alternative approaches to select most feasible one

CO3:   Analyze and synthesize the identified problem from technological perspective

CO4:   Design the reliable and scalable solution to meet challenges

CO5:   Evaluate the solution based on the criteria specified

CO6:   Inculcate long life learning attitude towards the societal problems

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2, PO4	PO3, PO5	PO4, PO5, PO8	PO6, PO7, PO9, PO11	PO12, PSO2, PSO3, PSO4
3	3, 3	2, 3	2, 2, 2	2, 2, 2, 1	2,3,2,2

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

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

Final Year B. Tech.

(Computer Engineering)

Pattern "D21"

Effective from Academic Year 2022-23

Prepared by: - Board of Studies in Computer Engineering

Module VII Courses

MD4205: Marketing Management

Credits: 02   **Teaching Scheme: - Theory 2 Hrs/Week Lab: 0 hrs /week**

Section-I

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

2. **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

3. **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 -II

1. **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.

2. **Branding**

   Reasons for branding, functions of branding features of types of brands, kinds of brand name.

3. **Pricing Policies**

   Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions,

4. **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,

5. **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

Text Books: *(As per IEEE format)*

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

Reference Books: *(As per IEEE format)*

| 1. | Wiliam J Stanton | Fundamentals of Marketing | McGraw Hill |
| 2. | R.S.N. Pillai and Mrs. Bagavathi | 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

FF No. : 654

Syllabus Template

CS4217:: Human-Computer Interaction

Course Prerequisites: NA

Course Objectives:

1. To categorize IT applications based on measurable human factors,

2. To study the user community through user survey and/or field visit,

3. To design user-friendly user interfaces with due consideration of interface theory and principles,

4. To apply usability evaluation methods to identify the usability issues with IT applications,

5. To understand the kind of documentation required for IT applications,

6. To integrate web and mobile app design approaches as per user requirements

 Credits: 02   **Teaching Scheme Theory: 02 Hours/Week**

Course Relevance: Human-Computer Interaction (HCI) is a multi-disciplinary 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 life of their users. It helps every computing, web or mobile application to become really user-centered, increasing its users as well as related sales.

SECTION-1

Topics and Contents:

Fundamentals of Human Computer Interaction (HCI): Definition of HCI, Interdisciplinary Nature, Related Disciplines, 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, Task Analysis - GOMS, Contextual Inquiry, Work Models, Interaction Styles, Empathy Maps.

Design Process: Design Concept, Three Pillars of Design, Process of Design, Ethnographic

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Observations, Participatory Design, Internationalization, Interaction Design Patterns.

SECTION-1I

Topics and Contents:

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.

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, 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 Home Assignments:

Designs:
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 Studies:
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

Blogs:
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

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.

Home Assignments, MSE, ESE

Text Books: *(As per IEEE format)*

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: *(As per IEEE format)*

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 study the user community through user survey and/or field visit.

3. Students will be able to design user-friendly user interfaces as per user requirements and UI design principles.

4. Students will be able to apply a suitable usability evaluation method to identify the usability issues.

5. Students will be able to understand the kind of documentation required for IT applications.

6. Students will be able to enhance UI designs as per desired web or mobile app design approach.

CO PO Map:

CO1	CO2	CO3	CO4	CO5	CO6
PO3	PO4	PO8	PO10	PO11	PSO4
3	3	2	2	1	3

CO Attainment Levels:

CO1   ----------3

CO2   -----------3

CO3   -----------2

CO4   -----------2

CO5   ------------1

CO6 -------------3

Future Courses Mapping:

User Interface Design,

Usable Security,

Intelligent User Interfaces

Job Mapping:

UI Designer, Product Designer, Software Engineer, Mobile App Developer and other jobs

COURSE CODE: CS4219   **COURSE NAME: INTERNET OF THINGS**

Course Prerequisites: Microprocessor, Computer Network

Course Objectives:

1. To learn the terminology, technology and its applications of IoT

2. To analyze Embedded suite widely used in IoT.

3 .To describe the concept of M2M with necessary protocols

4. To understand the cloud storage for IoT applications.

5. To optimize resources for different IoT applications

6. To understand Real world IoT Design constraint.

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

Course Relevance: IoT is regarded as the significant frontier that can improve almost all activities in our lives. Most of the devices, which have not previously been connected to the internet, can be networked and respond the same way as smart devices. Internet of Things and related technologies improve the convenience, comforts and security of our homes and be more efficient and cost effective in the way we consume services such as energy. IOT will help track and monitor a huge range of our own physiological functions.

SECTION-I

Topics and Contents:

Unit-I : Introduction and Application to Internet of Things   [CO1:PO1,PO2,PO3]

Need of IoT, Towards the IoT, Design methodology, Strategic Research and Innovation Directions, Future Internet Technologies, IoT Smart X Application: Smart Cities, Smart Energy & Smart Grid, Smart Mobility & transport, Smart Home, Smart Building & Infrastructure, Smart Factory & Manufacturing, Smart Health, Smart Logistics & Retails.

Unit-II : Embedded Suite for IoT   [CO2:PO1,PO2,PO5]

Introduction to Arduino and Raspberry Pi, Understanding the Arduino and Raspberry Pi board and its Components, recognizing the Input/output, GPIO connectivity.

Unit-III : Wireless Technologies   [CO3:PO1,PO2,PO5,PO7]

Protocol Standardization for IoT, Machine to machine (M2M) and WSN Protocols, Basics of RFID, RFID Protocols , Issues with IoT Standardization, Protocols- IEEE 802.15.4, ZigBee, IPv6 technologies for IOT

SECTION-II

Topics and Contents:

Unit-IV : IoT Networking   [CO4:PO1,PO2,PO7,PO10,PO12]

Star, Mesh, Tree, and Overview of networking Protocols: TCP/IP, 6LowPan, IoT Devices Application Level Protocol Service parameter in MQTT

Unit-V : IoT Security   [CO5:PO1,PO2,PO5,PO9,PO11,PO12]

PRIVACY, SECURITY & GOVERNANCE: Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT Platforms for Smart Cities, First Steps towards a Secure Platform, Smart Approach. Data Aggregation for the IoT in Smart Cities

Unit-VI : Cloud Analytics for IoT Application   [CO6:PO1,PO2,PO10,PO11,PO12]

Introduction to cloud computing, Difference between Cloud Computing and Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT, Connecting IoT to cloud, Cloud Storage for IoT Challenge in integration of IoT with Cloud

List of Home Assignments:

List of Design Based Home Assignments

1. IoT Based Smart Waste Management System   for   Smart city

2. IoT Based Smart Street Light

3. IoT Based Smart Grid System

4. IoT based Water Quality Management system using Arduino

5. IoT Smart Home automation using Node MC

6. IoT Smart Parking using RFID

7. IoT based fire detection system using FPGA

8. MQTT based monitoring system fir coal mine using raspberry pi

9. MQTT home automation using raspberry pi

10. Web server using ARM 7

List of Case Study Based Home Assignments

1. IOT Real Time Dash Board

2. IOT and Block chain

3. IOT Sensor Gateway

4. IOT Operational Analytics
5. Autonomous trucks reduce driver fatigue and improve road safety

6. Industrial Internet of Things

7. IoT Enabled Next Generation Farming

8. The Tesla IoT Car

9. Role of IoT in Supply chain management

10. Ecosystem for Logistics Industry with IoT

List of Blog Based Home Assignment
1. Monitoring environmental conditions to improve safety and prevent environmental accidents

2. Today's hard hats and safety goggles could be tomorrow's sensored vests and work sites. Can an IoT enabled ecosystem prevent accidents from happening in the first place

3. How can machines tell us when they are about to break down?Using connected technologies to predict maintenance saves clients time and money

4. Automation benefit from IoT

5. Farmers used to rely on clouds for rain. Today's digital cloud helps maximize crop yield, optimize seeding, automate harvesting, and more

6. Security and Privacy issues for IoT application
7. Suitability of MQTT protocols for IoT application

8. Interoperability issues in IoT 9.Toward Industry 4.0 With IoT

9. IoT Applications in Logistics and Supply chain managements

10. Data management for IoT applications

List of Survey Based Home Assignments
1. The future of IOT Connectivity

2. IoT applications value creation for industry

3. IoT involvement in Software development, selling software for IoT products

4. IOT Platform

5. The internet of things (IoT) represents the Fourth Industrial Revolution

6. Cloud support for IoT Application

7. Interdependencies of BIG data and IoT

8. IoT enabled Smart manufacturing

9. Role of Internet of Things for Electric Vehicle

10. Secure Vehicular Area Network

11. Security attacks on IoT Devices

12. IoT vs. Industrial IoT: What's the difference?

Suggest an assessment Scheme:

Mid Sem Exam, End Sem Exam, Home Assignment, CVV

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.

Text Books: *(As per IEEE format)*

1. *Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Sta matis Karnouskos,David Boyle, "From Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. to the Internet of Things:*
2. *Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013*
3. *Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014. (ISBN-13: 978-0124076846)*

Reference Books: *(As per IEEE format)*

1. *Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014*
2. *Daniel Minoli John Wiley & Sons ,,Building the internet of things with ipv6 and mipv6, The Evolving World of M2M Communications, ISBN: 978-1-118-47347-4*
3. *Cassimally, Hakim, "Designing the Internet of Things", Wiley Publications, ISBN 10: 111843062X*
4. *Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013. (ISBN-13: 978- 1430257400)*

MOOCs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:

On the completion of course, student will able to

1. To understand fundamentals of IoT including essence, basic design strategy and process modeling.

2. Understand building blocks of Internet of Things and characteristics of Sensors and Communication Devices

3. Demonstrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

4. Analyze Data flow by means of standards, protocols, technologies.

5. Implement Security protocols to prevent internal and External damage.

6. Describe the main concepts, key technologies, strengths, and limitations of cloud computing and its relation with IoT.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	1	1		1	1							0			
2	2	2	2		1		3						3			
3	3	3	2	2		2	3					3				2
4	2	2	2	3	1	1		3	3				3	3	1	
5	2	1	1	2	3	2								3		
6	2	1	1	2	0					3						
Avg	2.84	2.67	2.67	2	2	2	3	3	3	3	0	3	3	3	1	2

CO attainment levels:

1 4 3 2 5 2

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Job Mapping:

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

Data Architect, Test Engineers

COURSE CODE:CS4222   **COURSE NAME: IMAGE PROCESSING**

Course Prerequisites:

Fourier transform, Z-transform, Laplace Transform

Course Objectives:

1. To describe different color models and image processing techniques
2. To analyze image condition and deduce enhancement algorithms
3. To understand Segment the image to identify the region of interest.
4. To develop an algorithm to recognize the specified objects in the given image.
5. To learn different compression techniques

Credits: 02   **Teaching Scheme Theory: Hours/Week**

        Tutorial: Hours/Week

        Lab: 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-I

Topics and Contents:

Unit 1 Title: 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 sampling and quantization.

Unit 2 Title: Image Enhancements Spatial domain: Memory-less operations, Spatial domain image enhancements: Denoising filters, Smoothing Operation, Sharpening Operation, and Contrast stretching /enhancement, histogram and histogram equalization

Unit 3 Title: Image Enhancements Frequency domain: FFT, Convolution, Sampling and fourier transform of Sampled functions, DFT of one variable, Filtering in frequency domain, Image Smoothing

SECTION-II

Topics and Contents:

Unit 4 Title: 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.

Unit 5 Title: Morphological Operation: Binary Morphology, Erosion Dilation, Opening and Closing.

Unit 6 Title: Image compression: Introduction and need, Coding redundancy, classification of compression techniques (Lossy and lossless- JPEG, Run Length Coding, Huffman Coding, Shannon fano coding).

Seminars:

List of Course Seminar Topics

List of Course Seminar Topics:

1. Challenges in Automated Video Surveillance [CO1][PO2]
2. Tumor detection in MRI images [CO2][PO5]
3. Eye gaze tracking for HMI: Pros, cons and implementation [CO3][PO8]
4. Roll of image processing in Industry 4.0 [CO4][PO10]
5. Parallelism for performance enhancement in image processing [CO5][PO12]
6. Vision based ADAS [CO6][PO4]
7. Computational photography [CO1][PO2]
8. Computational microscopy [CO1][PO2]
9. Automatic navigation using Visual SLAM [CO1][PO2]
10. Animoji [CO1][PO2]

Group Discussion:

List of Group Discussion Topics

List of Course Group Discussion Topics:

1.   Lines Vs. Corners as features [CO1][PO2]

2.   Hough Transform for line detection Vs. RANSAC [CO2][PO5]

3.   Fourier domain denoising Vs. Spetial domain denoising [CO3][PO8]

4.   Kernel size Vs. Speed of operation [CO4][PO10]

5.   Histogram equalization Vs. Gamma correction [CO5][PO12]

6.   OTSU Vs Adaptive thresholding [CO6][PO4]

7.   Compression techniques [CO1][PO2]

8.   Color models [CO1][PO2]

9.   SIFT Vs SURF [CO1][PO2]

10.   Roll of image processing in security [CO1][PO2]

List of Home Assignments:

List of Design Based Home Assignments

Design:

1. Design an algorithm to identify fault in a "PCB inspection system" as shown below [CO1][PO12]

2. Design an algorithm to perform segmentation of the image below to extract the mango from its   background   [CO2][PO5]

3. Design   an   algorithm   to   get   from   image   1   to   image   2   [CO3][PO8]

4. Design   an   algorithm   to   recognize   character   "0"   in   the   image   below   [CO5][PO12]

5. Design an algorithm to compress a 300x300 pixel image with horizontal black to white gradient as shown below [CO6] [PSO4]

List of Case Study Based Home Assignments

1.   Cam-scanner: Document scanning app [CO1] [PO2]
2.   Tesseract OCR library [CO2][PO5]
3.   Instagram filters [CO3][PO8]
4.   OpenCV [CO5] [PO12]
5.   Google Street View [CO6] [PSO4]

List of Blog Based Home Assignment

1.   Image processing on Embedded platforms [CO1] [PO2]
2.   Face recognition system security analysis for authentication [CO2][PO5]
3.   Image processing in MSME for effective automation [CO3][PO8]
4.   H.264 codec for image streaming [CO5] [PO12]
5.   Role of mathematics in image processing [CO6] [PSO4]

List of Survey Based Home Assignments

Surveys

1. Image quality metrics [CO1] [PO2]
2. Vision based self-driving car safety [CO2] [PO5]
3. Compression techniques & codecs [CO3] [PO8]
4. State of the art applications such as AR/ XR [CO5] [PO12]
5. Human recognition in social networking apps like Facebook [CO6] [PSO4]

Suggest an assessment Scheme:

HA,CVV,PPT/GD, ESE

Text Books: *(As per IEEE format)*

7. *Rafael Gonzalez & Richard Woods, "Digital Image Processing," 3ʳᵈ Edition, Pearson publications, ISBN 0132345633.*

8. *Anil K. Jain, "Fundamental of Digital Image Processing," 5th Edition, PHI publication, ISBN 13: 9780133361650.*

Reference Books: *(As per IEEE format)*

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.

MOOCs Links and additional reading material:

9. https://nptel.ac.in/courses/117/105/117105135/
10. https://nptel.ac.in/courses/106/105/106105032/
11. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs58/
12. https://www.coursera.org/learn/computer-vision-basics

Course Outcomes:

Course Outcomes:

On the completion of course, student will able to

1. Apply various corrective geometric transforms on a distorted image. (PO2)
2. Determine and implement required image enhancement techniques using open source technologies such as OpenCV (PO5)
3. Deploy optimized algorithms for lossless and lossy compression techniques which ensures expected performance on a variety of hardware architectures. (PO8)
4. Contribute to an algorithmic solution for social and personal security (PO10)
5. Differentiate between various mathematical transforms and its use for a given use case (PO12)
6. Deduce a solution for a given industrial problem (PSO4)

CO-PO Map:

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO5	PO8	PO10	PO12	PSO4
3	3	2	2	1	3

CO attainment levels:
CO1- 3 CO2- 4 CO3- 3 CO4- 2 CO5-1 CO6-3

Future Course Mapping:

Mention other courses that can be taken after completion of this course

1. Augmented Reality
2. Multimedia Processing

Job Mapping:

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

1. Augmented Reality Experience Designer
2. Automation Engineer
3. Embedded Software Developer
4. Image Processing Expert

COURSE CODE: ET4230   **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: 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-1I

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

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. 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:

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 solution to it. (Co Attainment level - 5)

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO3	PO7	PO10	PO11	PSO4
3	3	2	2	1	3

CO attainment levels

1. CO1 - Level 3
2. C02 - 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.

COURSE CODE: CS4201   **COURSE NAME: CLOUD COMPUTING**

Course Prerequisites: Operating Systems, Computer Networks, Database Management System

Course Objectives:

1. To become familiar with cloud computing and its ecosystem

2. To acquire basics of virtualization and its importance

3. To evaluate in-depth analysis of Cloud Computing capabilities and its services.

4. To configure and implement storage services.

5. To analyze different cloud-based services to meet a set of given requirements.

6. To design security aspects for cloud computing

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

Tutorial: 1 Hours/Week

Lab: 2 Hours/Week

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

SECTION-I

Topics and Contents:

Unit-I   Introduction to Cloud Computing
[CO1 → PO1, PO2, PO5 – CO Strength - 2,1,1]

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. **[4 Hrs]**

Unit-II   Virtualization
[CO2→ PO1, PO2, PO3, PO4, PO5- CO Strength -2,2,1,1,1]

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 auto scaling. **[4 Hrs]**

Unit-III   Cloud Services
[CO3→] [PO1, PO2, PO3, PO4, PO5, PO7, PO8, PSO4 – Strength - 3,2,2,2,2,3,3,2]

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 **[6 Hrs]**

SECTION-II

Topics and Contents:

Unit-IV   Cloud Storage
[CO4→PO1, PO2, PO3, PO4, PO5, PO6, PO9- Strength 3,2,2,2,3,3,3]

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. **[4 Hrs]**

Unit-V Service Management
[CO5 →   PO1,PO2,PO3,PO4,PO5,PO9,PO11,PSO2-Strength 3,3,1.3,3,1,2,3]

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. **[4 Hrs]**

Unit-VI Cloud Network and Security
[CO6→   PO1, PO2, PO3, PO4, PO5, PO10, PO12 - Strength 2,2,1,3,1,3]

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. **[6 Hrs]**

List of Home Assignments:

List of Design Based Home Assignments

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).

List of Case Study Based Home Assignments

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.

List of Blog Based Home Assignment

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.

List of Survey Based Home Assignments

1. Disaster Recovery in Cloud Computing.

2. Cloud Economics.

3. Data archiving solutions.

4. Salesforce.

5. Dropbox.

Suggest an assessment Scheme:

MSE, ESE, HA

Text Books: *(As per IEEE format)*

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: *(As per IEEE format)*

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", SPD,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

https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/

https://aws.amazon.com/what-is-cloud-computing/

https://www.ibm.com/in-en/cloud/learn/cloud-computing

Course Outcomes:

 Course Outcomes:

On the completion of course, student will 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 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	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CS3053.1	2	1			1											
CS3053.2	2	2	1	1	1											
CS3053.3	3	2	2	2	2		3	3								2
CS3053.4	3	2	2	2	3	3			3							
CS3053.5	3	3	1	3	3				1		2			3		
CS3053.6	2	2	1	3	1					3		3				
Average	2.50	2.00	1.40	2.20	1.83	3.00	3.00	3.00	2.00	3.00	2.00	3.00		3.00		2.00

CO attainment levels:

Attainment Levels:1,2,3,5,4,3

Future Course 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

Syllabus Template

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

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 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

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 – 25 Marks

6. ESE –25Marks

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	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

      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

Syllabus Template

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-II

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: *(As per IEEE format)*

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: *(As per IEEE format)*

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

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO5	PO7	PO10	PO11	PSO4
3	3	2	2	1	3

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

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-1I

Topics and Contents

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(20)

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: *(As per IEEE format)*

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 Map
CO1 –PO3(3)
CO2 –PO5(3)

CO3 –PO7(2)
CO4 –PO11(1)
CO5-PO12(1)
CO6-PSO3(3)

CO attainment levels
CO1 –3
CO2 -3
CO3 –2
CO4 –1
CO5-1
CO6-3

Future Courses Mapping:

High Performance Computing
Distributed Computing

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

COURSE CODE: CS4225/CS4226   **COURSE NAME: MAJOR PROJECT**

Course Prerequisites: Project Based Learning

Credits:.11.......   **Teaching Scheme Theory: …22... Hours/Week**

Aim

This course addresses the issues associated with the successful management of a   project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and working with peers to create desired outcomes. The Project Work can lead to:

- Transform existing Ideas into conceptual models.
- Transform conceptual models into determinable models.
- Use determinable models to obtain system specifications.
- Select optimum specifications and create physical models.
- Apply the results from physical models to create real target systems.

Project Group and Topic Selection and Synopsis:

The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members. The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice and address the problem by formulating a solution for the identified problem. The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted.

Overview of the Course:

1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).
2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student's own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students

must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.

3. The project must be based on a Fresh Idea or Implementation of a Theoretical Problem – meaning that there is not a known Solution to the design problem Or Create a Better Solution.

4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.

5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting , Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.

6. Upon project completion, the Student Project Group will prepare a detailed Project Report consisting Semester I Preliminary Project document along with Detailed System Design Document, Implementation and Testing Document with conclusion and future scope of the Project Work. All the documents indicated will have a prescribed format. The Project Report ideally should consist of following documents : (Exceptions may be there based on the nature of the project, especially if some of the following documents are not applicable to a particular project as determined by the project guide, coordinator and head of department).

Sr.	Project Item
1	Project Cover Front Page
2	Project Completion Certificate [Institute]
3	Project Completion Letter [In case of Sponsored Projects]
4	Acknowledgments
5	Table of Contents
6	List of Figures
7	List of Tables
8	Project Synopsis [Problem Background, Existing System Details, Proposed Solution]
9	Feasibility Study Report
10	Project Plan
11	System Requirement Specification
12	System Analysis Document: UML Use Case Diagrams
13	System Analysis Document: UML Sequence Diagrams
14	System Analysis Document: UML State Diagrams

15	System Design Document with Module Specifications
16	System Implementation
17	System Testing and Experimental Findings
18	Conclusion
19	References

7. The Project Work will be assessed jointly by a panel of examiners consisting faculty and industry experts. The Project Groups will deliver the presentation and demonstration of the Project Work which will be assessed by the panel.
8. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on presentation skills, questions based on the Project Work and overall development effort taken by the candidates.

Note:
The student needs to design and develop solution for the identified technological problem in the area of Computer Engineering or Information Technology of their choice. The Project Implementation needs to be completed using best possible use of available technologies as applicable to deal with the complexity of the project. The Project Group will prepare a detailed report of the project work which will be approved by the concerned faculty member. The Project Report need to be submitted both in Hard form and Soft form in CD. The Soft Copy of the Project Report must accompany other project deliverables as well.

Assessment: MSE and ESE
1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Group formation and identification of individual responsibility	10
4	Objective of Project activity	10
5	Knowledge of domain, latest technology and modern tools used /to be used	10
	TOTAL	**50**

End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of project as per problem	10

	statement	
2	Design, Testing / Experimentation, Analysis / Validation	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Regular interaction with guide	10
	TOTAL	**100**

Course Outcomes:

Upon completion of the course, graduates will be able to -

CO1: Identify the real life problem from societal need point of view

CO2: Prepare the requirement engineering , feasibility analysis documents

CO3:Form the teams and share responsibilities according to individual skill strengths

CO4:Create design documents to build software solutions

CO5:Develop software solutions based on standard engineering specifications

CO6: Perform the verification and validation up to the mark

CO attainment levels

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

CO-PO Map:

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CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO4, PO5, PO12	PO6, PO9	PO3	PO5, PO8	PSO3, PSO4
3	3, 3, 2	2, 2	2	2, 2	3, 3