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 2020-21

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 publcations, 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

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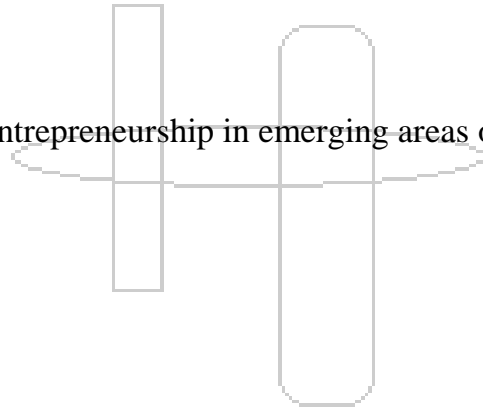
Title: Course Structure   **FF No. 653**

Branch: Computer   **Year:** S.Y.   **A.Y.:** 2020-21   **Module:** III

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	MD2201	Data Science	3	2	1	10	20	10	15	10	15	20	100	5
S2	MD2202	Applied Electronics	3	2	1	10	20	10	15	10	15	20	100	5
S3	MD2203	Mechanical and System Engineering	3	2	1	10	20	10	15	10	15	20	100	5
S4	CS2213	Engineering Design-I	0	0	2	-	-	30	-	70	-	-	50	1
S5	CS2214	Software Design-I	0	0	2	-	-	30	-	70	-	-	50	1
S6	CS2207	Software Development Project-I	0	6	0	-	-	30	-	70	-	-	100	3
S7	CS2209	Engineering Design and Innovation-III	0	8	0	-	-	30	-	70	-	-	100	4
		Total	**9**	**20**	**7**	**30**	**60**	**150**	**45**	**310**	**45**	**60**	**700**	**24**

Structure and syllabus of B.Tech Computer Engineering. A.Y. 2020-21

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

Branch: Computer   **Year:** S.Y.   **A.Y.:** 2020-21   **Module:** IV

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	CS2202	Data Structures	3	2	1	10	20	10	15	10	15	20	100	5
S2	CS2204	Computer Architecture & Operating Systems	3	2	1	10	20	10	15	10	15	20	100	5
S3	CS2206	Data Communication and Networks	3	2	1	10	20	10	15	10	15	20	100	5
s4	CS2218	Object Oriented Programming	3	2	1	10	20	10	15	10	15	20	100	5
S5	CS2208	Software Development Project-II	0	6	0	-	-	30	-	70	-	-	100	3
S6	CS2210	Engineering Design and Innovation-IV	0	8	0	-	-	30	-	70	-	-	100	4
		Total	**12**	**22**	**4**	**40**	**80**	**100**	**60**	**180**	**60**	**80**	**600**	**27**

Structure and syllabus of B.Tech Computer Engineering. A.Y. 2020-21

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

Branch: Computer   **Year:** T.Y.   **A.Y.:** 2020-21   **Module: V**

Subject No.	Subject Code	Subject Name	Theory	LAB	Tut.	HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)	Total	Credits
			Teaching Scheme (Hrs/Week)			**CA**		**MSA**		**ESA**				
S1	CS3201	Computer Network Technology	3	2	1	10	20	10	15	10	15	20	100	5
S2	CS3203	System Software	3	2	1	10	20	10	15	10	15	20	100	5
S3	CS3202	Artificial Intelligence	3	2	1	10	20	10	15	10	15	20	100	5
S4	CS3208	Cyber Security	3	2	0	10	20	10	15	10	15	20	100	4
S5	CS3209	Engineering Design and Innovation-III	0	8	0	-	-	30	-	70	-	-	100	4
S6	CS3211	Engineering Design	0	0	2	-	-	30	-	70	-	-	100	1
		Total	**12**	**16**	**5**	**40**	**80**	**70**	**60**	**110**	**60**	**80**	**600**	**23**

Structure and syllabus of B.Tech Computer Engineering. A.Y. 2020-21

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

Branch: Computer   **Year:** T.Y.   **A.Y.:** 2020-21   **Module: VI**

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	CS3205	Design and Analysis of Algorithms	3	2	1	10	20	10	15	10	15	20	100	5
S2	CS3204	Automated Software Engineering	3	2	1	10	20	10	15	10	15	20	100	5
S3	CS3206	Data Science	3	2	1	10	20	10	15	10	15	20	100	5
S4	CS3207	Compiler Design	3	2	0	10	20	10	15	10	15	20	100	4
S5	CS3210	Engineering Design and Innovation-IV	0	8	0	-	-	30	-	70	-	-	100	4
		Total	**12**	**16**	**3**	**40**	**80**	**70**	**60**	**110**	**60**	**80**	**500**	**23**

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

Branch: Computer   **Year:** BTech   **A.Y.:** 2020-21   **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 (%)		
S1	MD 4203	Business Proposal Writing	2	0	0	10	-	30	-	30	-	30	100	2
S2	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
	ET4241	Advanced Communication Engineering	2	0	0	10	-	30	-	30	-	30	100	2
S3	CS4213	Network Security	2	0	0	10	-	30	-	30	-	30	100	2
	CS4201	Cloud Computing	2	0	0	10	-	30	-	30	-	30	100	2

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	CS4208	Algorithmic Number Theory	2	0	0	10	-	30	-	30	-	30	100	2
	ET4232	Deep Learning	2	0	0	10	-	30	-	30	-	30	100	2
	IT4202	Computer Vision	2	0	0	10	-	30	-	30	-	30	100	2
S4	CS4226	Major Project	0	20	0		-	30	-	70	-	-	100	10
		Total	**6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**16**

Branch: Computer   **Year:** BTech   **A.Y.:** 2020-21   **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	CS4233	Industry Internship	0	32	0	-	-	30	-	70	-		100	16
	CS4235	International Internship	0	32	0	-	-	30	-	70	-		100	16
	CS4231	Project Internship	0	32	0	-	-	30	-	70	-		100	16
		Total	**-**	**32**	**-**	**-**	**-**	**30**	**-**	**70**	**-**		**100**	**16**

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Pattern "B20"

S. Y. B. Tech. Computer Engineering AY 2020-21

Module III Course Content

MD2201:: DATA SCIENCE

Course Prerequisites:

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

Course Objectives:

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

Credits: 5

Teaching Scheme Theory: 3 Hours/Week

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance:

The course is offered in S.Y. B.Tech. to all branches of Engineering

Data Science is a multidisciplinary field. It uses scientific approaches, procedures, algorithms and frameworks to extract knowledge and insight from a huge amount of data.

Data Science uses concepts and methods which belong to fields like information technology, Mathematics, Statistics, Computer Science etc.

Data Science influences the growth and improvements of the product by providing a lot of intelligence about customers and operations, by using methods such as data mining and data analysis.

The course is relevant to all branches of Engineering and beyond, since data is generated as an obvious outcome of many processes.

SECTION-1

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

SECTION-2

Supervised Learning – line fitting, residuals, correlation; line fitting by least squares regression; outliers in linear regression; Inference for linear regression; Multiple regression; Model selection; Logistic regression, Nearest Neighbor Classification – Knn; Naïve Bayes Classification – Bayesian methods, Bayes algorithm; Classification using decision trees and learners
Unsupervised Clustering - K-means clustering; Evaluation of model performance – Confusion matrices, sensitivity, specificity, kappa statistics, precision, recall, F-measure, ROC curve etc.; Methods of cross-validation, Bootstrapping; Meta-learning through ensemble approach – Bagging, boosting, Random Forests strategies.

Applications of Data Science – Indicative List:
  Predicting default cases in the Banking Industry;
  Predict passengers' survival in a Ship mishap evaluation technique;
  Classify Junk emails based on probability;
  Classify malicious websites;
  SMS Spam collection data:
  Gender recognition by voice;
  Store Item Demand Forecasting:
  Predict 3 months of item sales at different store

List of Tutorials:

1. Data Visualization
2. Distances and Projections
3. Singular Value Decomposition
4. Principal Component Analysis
5. Optimization
6. Normal & Binomial Distribution
7. Hypothesis Testing
8. ANOVA test
9. Linear Regression
10. Logistic Regression
11. Nearest Neighbor Classification
12. Decision Trees based classification
13. Naive Bayes classification
14. Clustering
15. Evaluation of model performance
16. Bagging & Boosting approaches

List of Practicals: (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
    Standard sampling practices for a successful survey for reliable sample data

List of Home Assignments:

Case Study: A very large number of resources are available for data generated out of case study. Unique Home assignments will be set up for all groups
Surveys: Principles of surveying will be implemented by groups to demonstrate use of data science principles in home assignments

Assessment Scheme:

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

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

CO-PO Mapping:

CO1	CO2	CO3	CO4	CO5	CO6
PO1, PO2, PO3,PO6	PO1, PO2, PO3, PO4, PO5, PO12, PSO1	PO1, PO2, PO3, PO4, PO5, PO12, PSO1	PO1, PO2, PO3, PO4, PO5, PSO1, PSO3	PO1, PO2, PO3, PO4, PSO1, PSO3	PO1, PO2, PO3
2, 2, 1, 2	3, 3, 3, 3, 2, 2, 2	3, 3, 3, 3, 2, 2, 2	3,3,3,2,2,3,2	3,3,3,2,3,2	2,2,2

Future Courses Mapping:

1. Deep Learning
2. Reinforcement Learning
3. DBMS
4. Big Data
5. Data Mining
6. Information Retrieval
7. Recommendation Systems
8. Cloud Computing – AWS
9. IOT
10. Artificial Intelligence
11. Pattern Recognition

12. Natural Language Processing
13. Computer Vision
14. Machine Vision
15. Fault Diagnosis
16. Optimization
17. Bioinformatics
18. Computational Biology
19. Econometrics
20. Supply Chain
21. Ergonomics
22. Operations Research
23. Nano-informatics

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

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

MD2202::APPLIED ELECTRONICS

Course Prerequisites: Concepts of modern physics

Course Objectives:

1. To familiarize with working and applications of electronic devices and circuits
2. To introduce various signals, systems and its analysis
3. To understand concepts of feedback control system and its performance analysis
4. To design basic digital circuits and understand their applications
5. To know basics of power devices, components and their applications
6. To comprehend fundamentals of communication system

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

                                       Tut: 1 Hours/Week

                                       Lab: **2** Hours/Week

Course Relevance:

Now-a-days, there are lots of electronic and electro-mechanical systems with embedded electronics for their control.

A knowledge of fundamentals of electronics and major functioning of electronic devices and systems can assist an engineer to better communicate and collaborate for the design / manufacturing of various systems**.**

SECTION-1

Devices & Circuits

    Role of Applied Electronics, Basic Electronic Components, RLC Circuits, Diode Applications, Transistor as an Amplifier, Operational Amplifier Circuits.

Signals & Systems

    Signals, Systems, Impulse Response & Convolution, Signal Operations , Basic Image Processing Techniques, Transforms.

Control Systems

    Signal Flow Graphs, Block diagram reduction, System Stability, Bode Plots, Network Theorems, Single & Two Port Networks.

SECTION-2

Digital Electronics

Boolean Algebra, Combinational Logic Circuits, Sequential Logic Circuits, Converters

Power Electronics

Power Devices, Power Circuits, Power Supply, SMPS, UPS, Batteries

Communication

Communication System, Analog Communication, Digital Communication, Wireless Communication Basics, Communication Protocols, Mobile Communication

List of Practicals: (Any Six)

1. Identification of Electronics components & Devices
2. Study of Series Resonance & Parallel Resonance Circuit
3. Diode as clipper & clamper
4. Common Emitter Amplifier
5. OPAMP Inverting & Non-Inverting Amplifier - Self study
6. Generation of Signals & Signal Operations
7. Implementation of Analog Filter
8. Implementation of Image Pre-processing Techniques
9. Design and evaluation of second order system
10. Design lead / lag compensating network for the given specifications
11. Understand the functioning of logic gates, implementation and verification of truth tables.
12. Design of code converter
13. Design and implement a Combinational logic circuit for given boolean equation
14. Design and implement Mod-n Counter using J-K flip flops
15. Design and implement Sequence generator using shift register
16. Combinational logic design using Multiplexers
17. Gate Firing Circuits for SCR's: To trigger an SCR by using R, RC & UJT triggering circuits and observe the output waveforms for different firing angles.
18. To construct a single-phase half-controlled bridge rectifier and to observe the output waveforms with a. R load, b. RL Load, c. RLC Load, using MATLAB
19. Build Double sideband suppressed carrier (DSBSC) modulator and demodulator. Observe spectral components of time-domain signal using Digital Storage Oscilloscope (DSO).
20. Build Frequency modulator (FM).
21. Simulation of Analog communication system.
22. Simulation of Digital communication system.

List of Course Projects:

1. Design and implement 230V AC Bulb On-Off switch using BJT & Relay
2. Design and Implement OR & AND logic circuits using P-N diodes.
3. Design and Implement NAND & NOR gate using Transistor
4. Design Band Pass Filter using RLC circuit
5. Design and implement Low Pass Filter using OPAMP
6. Function Generator
7. Image Enhancer
8. Automated Inspection System (IP Based)
9. Noise Removal System
10. Spectrum Analyser
11. Smart Lift Control System
12. On off temperature controller
13. Alcohol Sensing Display With Alarm Project
14. Temperature control in Room
15. Smart Traffic Control System
16. Season Based Automatic Street Lights Switching
17. Display Object Counter On 7 Segment Display
18. Home Automation Using Touch Screen
19. Motion Based Automatic Door Opener
20. Solar lighting system with auto tracking
21. Design Staircase lighting using flip flops
22. Design battery level indicator
23. Design 4 bit error checker/ generator circuit
24. Design parity generator for 3 bits input.
25. Design Digital to Analog Converter circuit using DAC0808
26. Digital IC tester
27. Battery Charger using Controlled Rectifier
28. Precise Illumination Control of Lamp using Thyristors (Intensity control of lighting)
29. Develop a switching/triggering circuit for a power device (SCR / power BJT / power MOSFET / IGBT)
30. Fan Regulator– Speed Control and Rotation Direction Control
31. Solar Lamp
32. Home automation system using Packet Tracer
33. Simulation of Analog/Digital Communication System
34. Pre-emphasis and De-emphasis for FM
35. Design of Anti aliasing filter
36. Design of Audio System
37. Implementation of Adaptive Delta modulator to avoid slope overload distortion

38. Generation of discrete PAM signal

List of Course Seminar Topics:

1. Role of impurities in formation of P & N type of Material
2. Zener diode as voltage regulator and avalanche break down
3. CLASS A, CLASS B, CLASS C & CLASS D types of amplifiers
4. Role of Q factor in series resonance and parallel resonance
5. Optoelectronic devices
6. Different Electronics Devices Used in Industries
7. PCB design criteria for RF applications
8. Different types of Heat sinks for Power semiconductor devices
9. Different types of PCB connectors
10. Liquid Crystal Display Device
11. Types of PCB & PCB Design Rules
12. LiDAR Technology
13. OLED Technology
14. Surveillance-camera System
15. RFID Technology
16. Compressed Image Processing
17. Wireless Power Transmission Technology
18. Laplace Transform
19. Fourier Series
20. Fourier Transform
21. Important Attributes of an Image
22. Working of Automatic washing Machine
23. System of Bread Toaster
24. Recent standards used in Control System Industry
25. How Infrared Thermal Gun works?
26. Working of Automatic Tea/ coffee vending machine
27. PLC Based Product Sorting Machine
28. Use of Electronics in Automobile industry
29. Use of Electronics in Chemical Industries
30. Hydraulic Control Systems
31. Fuzzy Controllers
32. Distributed Control Systems
33. Data Acquisition System
34. Pneumatic Control System Components
35. E-P & P-E converters

36. Digital Logic Families
37. Digital Circuit Design using PLA & PAL
38. Different analog to digital (ADC) conversion techniques
39. Different digital to analog (DAC) conversion techniques
40. Role of Memory Devices in Embedded Systems
41. Algorithmic state machines and sequential logic circuits
42. Switch capacitor
43. Hazards in digital circuits
44. Alphanumeric codes
45. Field Programmable Gate Arrays (FPGA)
46. Digital integrated circuits Characteristics: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margins
47. Advances in Analog-to-Digital Converters over the Last Decade
48. Hybrid Electric Vehicles
49. Applications of Power Diodes
50. Role of Power Electronics in Renewable Energy Deployment
51. Insulated-gate bipolar transistor (IGBT)
52. Role of Power Electronics Technology to Energy Efficiency and CO_2 Reduction
53. Industrial Laser power supply
54. Traction control of Electric Vehicles
55. Electric Bikes
56. Subway and locomotive propulsion
57. Power control of welding arc furnace
58. How new technologies are affecting health (Physical and mental)
59. various Wireless technologies that could make 5G faster
60. Effect of Mobile phones on health
61. Harnessing technology for better mental health services
62. Cognitive radio
63. Software defined radio
64. Applications of Radar in defense
65. Working of Jio fibre
66. Bluetooth Applications
67. MANETs and VANETs

List of Course Group Discussion Topics:

1. Role of Surface mount technology in Electronic circuits
2. Types of Diodes and their applications
3. Role of MOSFET in the electronics switching circuits
4. Characteristics of ideal OPAMP
5. 555 Timer IC and its applications
6. Can PCB be considered as a graph (Data Structures)?
7. Display Technology
8. Photo Sensing Devices
9. Solid state relay Vs Electromechanical relay
10. Role of electronics in mechanical & Allied industries
11. Next Generation Photo Voltaics
12. Next Generation MOSFETS (e-GaN MOSFET)
13. Convolution in Image Processing
14. 5G Communication - System Perspective
15. Significance of Impulse Response
16. Fourier Series vs Fourier Transform
17. Applications of Laplace Transform
18. Convolution Integral
19. Impulse Response vs Step Response
20. Significance of LTI System
21. Causality of LTI System
22. Linear System vs Non-linear System
23. Analog System vs Digital System
24. Stability criterion for Control Systems
25. Process controller
26. Open loop and closed loop systems
27. Applications of Electronics in Boilers
28. Sensors used in Automobile industries
29. Modelling a mechanical system for system analysis
30. Modelling a Electrical system for system analysis
31. Applications of Bode plot in System Stability
32. Intelligent Controller
33. Automation in production industries
34. Role of digital electronics in the field of consumer electronics
35. Role of digital electronics in the field of Communication
36. Importance of Military grade integrated circuits
37. Edge triggered & level triggered digital circuits
38. Applications of digital electronics in mechanical systems

39. What is Digital in Digital Electronics?
40. What is Analog in Analog Electronics?
41. How does digital technology improve our lives ?
42. Digitization: Pros & Cons
43. Journey of television from CRT to LED
44. Application Specific Integrated Circuits (ASICs)
45. History of Microprocessor
46. Energy Storage Technologies / Techniques
47. Linear Regulated Power Supply and SMPS
48. Pros and Cons of Power Electronics Converters
49. Smart Electric Grid
50. Motor Drives - Types and Applications
51. Role of Power Electronics in Climate Change
52. Materials used in Power Electronics for improved performance and efficiency
53. Power electronics in biomedical field
54. Miniaturization of Power electronics devices - Challenges
55. Role of Circuit Breakers - Types and Applications
56. Digital Revolution in communication systems - Pros and Cons
57. Effects of noise and distortion on analog and digital signal
58. Effect of sampling rate, bit rate on audio quality
59. Use of Satellites in Disaster Management in India
60. Submarine Communication for Global Internet Connectivity
61. Internet of Things
62. Wi-Fi-- Security and Privacy
63. Wireless Sensor Networks
64. Wireless Connectivity - Anytime anywhere
65. Connected Cars

List of Home Assignments:

Design

1. Design Voltage multiplier circuit using diodes and capacitors
2. Design of transistorized regulated power supply
3. Design of RLC Impedance matching circuit
4. Design of astable multivibrator using OPAMP
5. Design of Audio Amplifier
6. Satellite For Amateur Radio
7. Face Detection System
8. Detection of Breathing
9. Pitch Recognition System
10. Denoising Audio Signal
11. Design PID controller for Flow Control loop
12. Design PI controller for Level Control loop
13. Design PID controller for Temperature Control loop
14. Design PID controller for DC motor speed control
15. Design Token Number Display System
16. Design Talking Token Number Display System using CMOS key encoder and seven segment display and Speech encoder
17. Design water level controller using logic gates & relays.
18. Design LED chaser
19. Design Digital Voltmeter using ICL7107 and 7 Segment Display
20. UPS / Emergency Lighting Systems
21. Electric-door openers
22. Induction Cooking
23. AC Regulator
24. Battery Supplied Vehicle - Power Supply
25. Design a BPSK modulation/demodulation system
26. Design Pulse Amplitude modulation system.
27. Design Pulse Code modulation and demodulation.
28. Design Delta modulation and demodulation.
29. Design Quadrature phase shift keying modulation and demodulation.
30. Design frequency shift keying modulation and demodulation

Blog

1. Transistor Parameter Models
2. FET Vs BJT
3. Role of semiconductor devices in Power Electronics
4. Future of the nanoelectronics
5. Safety standards in electronics industries.
6. Quantum Physics
7. 7G Communication System
8. Wireless Power Transmission System
9. Plastic Solar Cell System
10. Nanotechnology in Electronics
11. Haptic Technology
12. Steady state response of any process loop
13. Will addition of poles / zeros affect the performance of the system?
14. Will addition of poles / zeros affect the stability of the system?
15. How can a PID controller improve the performance of the system?
16. Different control schemes and criterion for selection of appropriate contact scheme
17. Handling digital devices
18. Significance of number systems
19. Impact of digital electronics on industry development
20. Low power ADCs
21. Low Pin Count Microcontrollers
22. High Frequency considerations in Power Electronics
23. VAR compensation
24. Voltage Dip Restorer
25. Regenerative Braking
26. Multilevel Inverters
27. Are we ready for the Information war?
28. 24 Hour Connectivity - Boon or Curse
29. Personal data security
30. Radar for Car Safety
31. GPS Applications
32. Mission Shakti

Survey

1. Transistors and their packaging

2. Applications of RLC circuits in industries
3. Different Types of Oscillators used in industries
4. Worldwide Fabrication Lab scenario
5. Solar Power Energy generation in india using PV Cells
6. Remote Sensing Methods
7. Electronic Systems in Healthcare
8. Electronics Systems in Defense
9. Morphological Operators in Image Processing
10. Biggest Systems in the World
11. Different types of PLCS
12. Comparisons on PI, PID and PD controller.
13. Different types of open loop processes used in industry
14. Different types of closed loop processes used in industry
15. IEEE Papers
16. Digital Integrated Circuits manufacturing companies across the world and their turnover (min 3)
17. Use of Successive Approximation Register ADC in advanced microcontrollers
18. Effects of Power Quality issues on digital circuits
19. Use of Microcontrollers in different areas w.r.t industry 4.0
20. Active Power Devices
21. High voltage DC Transmission (HVDC)
22. Electric Drives
23. Flexible AC transmission systems (FACTS)
24. Battery energy storage system (BESS)
25. Adverse effects of 5G technology
26. Is India ready for Industry 4.0?
27. Evaluation of performance of 5G
28. How radio Mirchi Works? - A Technical Perspective
29. Indian satellite program
30. Best satellite internet provider 2020

Case Study

1. Process carried out at fabrication LAB
2. Different soldering techniques
3. Transition from vacuum tubes to solid state devices
4. Electronics used in boiler
5. Data centers and their cooling
6. Biometric Voting Machine

7. Speech Signal Analysis
8. Weapon Detection System
9. Intensity Modulation Technique
10. Voice based Security System
11. Different control system and control strategies used in dairy industry
12. Control System at Pharmaceutical industry
13. Control System at Thermal Power plant
14. Control System at Water Purification plant
15. Control System at Sugar factory
16. Evolution of Automation in Indian Industries
17. Simulation based digital circuit design
18. Integrated Circuits: SSI, MSI, LSI, VLSI, ULSI
19. Digital electronics in Vehicular communication (Protocols, Circuits)
20. Transition from electromechanical systems to Electronics systems
21. Application of Power Electronics in Automotive Power Generation
22. SMPS Applications in the PowerTrain System- The power train systems of HEVs, electric vehicles and ICE need the following SMPS conditioners such as: Regenerative braking (AC/DC), On-board charger (AC/DC), Dual-battery system (DC/DC), Traction motor (DC/AC)
23. Electric Locomotives
24. Aircraft power system / Space Shuttle Power Supply
25. Hybrid Electric Vehicles
26. GMRT
27. PA System / Home Theatre System
28. Missile Guidance System
29. Air Traffic Control
30. Satellite Service for Crop Management in India
31. 2G Spectrum distribution in India during 2005

Assessment Scheme:

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

Text Books: *(As per IEEE format)*

1. *Varsha Agrawal Anil K. Maini, Electronic Devices and Circuits, Wiley, Kindle Edition*
2. *Thomas L Floyd: Electronic Devices (Conventional Current Version), Pearson,10th Edition*
3. *Nagrath Gopal - Control System Engineering*
4. *Norman Nise - Control Systems Engineering, Sixth Edition, Wiley*
5. *R.P. Jain, ―Modern Digital Electronics‖, TMH, 2012, ISBN–13: 978-0-07- 066911-6.*
6. *M D Singh, K B Khanchandani; Power Electronics; 2 nd Edition; TMH.*
7. *M. H. Rashid; Power Electronics Circuits, Devices and Applications; 3 rd Edition; PHI*
8. *Simon Haykin,Principles of Communication Systems , John Wiley, 2nd Ed*
9. *Louis E Frenzel, Principles of Electronic Communication Systems, Tata McGraw Hill Publications, Third Edition.*
10. *H. Taub and D. Schilling, Principles of Communication Systems , TMH, 2003.*
11. *Simon Haykin, Digital Communications, John Wiley,2005*
12. *Theodore S. Rappaport, Wireless Communications: Principles and Practice Pearson Education India, 2009*

Reference Books: *(As per IEEE format)*

1. *Robert L. Boylestad, Electronic Devices and Circuit Theory, Pearson; 11 edition*
2. *Mahmood Nahvi & Joseph A. Edminister, Schaum's Outline of Electric Circuits, McGraw-Hill Education; 6 edition*
3. *Katsuhiko Ogata - Modern Control Engineering, Prentice Hall*
4. *Anil K. Maini : Digital Electronics: Principles And Integrated Circuits 1st Edition, ISBN: 978-0-470-51051-3*
5. *N. Mohan, T. M. Undeland and W.P. Robbins; Power Electronics: Converters, Applications, and Design; 3rd edition; John Willey and Sons, Singapore.*
6. *P. C. Sen; Modern Power Electronics; S. Chand and Co, New Delhi.*
7. *B.P. Lathi, Communication Systems, BS Publication, 2006.*
8. *B. Sklar, Digital Communication, Pearson, Second Edition.*
9. *Simon Haykin, Analog & Digital Communications, Wiley Publications.*
10. *Wayne Tomasi, Electronic Communication Systems, Fourth Edition.*
11. *Simon Haykin, Digital Communications, Wiley Publications, Fourth Edition.*

Moocs Links and additional reading material:

1. Introduction to Electronics: https://www.coursera.org/learn/electronics
2. Linear Circuits 2: AC Analysis: https://www.mooc-list.com/course/linear-circuits-2-ac-analysis-coursera
3. https://www.udemy.com/share/101GL4/ (Electrical Engineering : Introduction to Signals and Systems)
4. https://www.udemy.com/share/101Yzu/ (Signal processing problems, solved in MATLAB and in Python)
5. NPTEL: Digital Circuits By By Prof. Santanu Chattopadhyay, IIT Kharagpur, https://swayam.gov.in/nd1_noc19_ee51/preview
6. NPTEL: Courses-Electrical Engineering-NOC Fundamentals of Power Electronics https://nptel.ac.in/courses/108/101/108101126/
7. NPTEL: Wireless Communication-https://youtu.be/CUyF0YGIA5Y?list=PL3607D4A9E70266F9

Course Outcomes:

1. Build basic circuits using different electronic devices

2. Classify various signals and systems for different applications

3. Illustrate performance analysis of feedback control system

4. Construct digital circuits for various applications

5. Choose the appropriate power devices and circuits for its applications in power electronics

6. Describe various communication systems

CO-PO Mapping:

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO4	PO5, PO9	PO8, PO11	PO12, PSO1, PSO2
3	3	3	2, 1	2, 1	1, 3, 2

Future Courses Mapping:

Industrial Electronics, Industrial Automation, Robotics, Wireless Communication, Mechatronics, Hybrid/Electric Vehicles, Energy Harvesting, Digital Signal Processing

Job Mapping:

This course will help the students to build foundation for interdisciplinary job opportunities in the field of
1. Automation,
2. Robotics,
3. Automobiles,
4. Communication etc

MD2203::MECHANICAL & SYSTEM ENGINEERING

Course Prerequisites: Basic statistics, Probability distribution

Course Objectives:

1. To introduce the Mechanical and Industrial Engineering discipline and its applications to students.
2. Develop capacities in integrating knowledge of design along with other aspects of value addition in the conceptualization and manufacturing stage of various products.
3. To develop an ability to design a system, component, or process to meet desired needs within realistic constraints
4. To impart knowledge on selection of suitable manufacturing process for the typical component
5. To understand the application of various Mechanical Measurement techniques in engineering applications.
6. This course provides a solid foundation in core mechanical and industrial engineering disciplines, critical thinking and problem-solving skills

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

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance:

Mechanical and System Engineering has a strong flavor of design and hands-on experience. The course includes a study of a number of engineering topics to design systems relevant to the contemporary industries. The areas introduced are design philosophy, Heat Transfer, Manufacturing Science, System Engineering.

SECTION-1

Materials and Material Selection

Types of Materials, Properties of materials, Effect of alloying elements, Application of materials in mechanical, chemical, electronics and software industry, Selection of Material, Basic Heat Treatment Processes

Manufacturing Processes

Casting, welding, Brazing, Soldering, Material forming, Sheet Metal working, Surface treatments, Machining Processes, Advanced Machining Processes like Additive manufacturing, Photo chemical Machining and Laser Beam Machining etc., Automation and Types of Automation, Introduction to Computer Integrated Manufacturing

Mechanical Measurement

Engineering Measurements, Measurement Errors, Uncertainties of Measurement, Temperature Measurement, Pressure Measurement, Force measurement, Strain

Measurement, Torque Measurement, Velocity Measurement Flow Measurement Torque Measurement, Vernier calipers, Micrometer or Screw Gauge, Dial Gauge or Dial Indicator, Spirit Level, Concept of Geometric dimensioning and tolerancing.

Design Philosophy

Engineering Design, Product Development Process, Problem, Types of Design, Phases of Engineering design, Definition and Need Identification to Detailed Design, Ergonomic and Aesthetic Aspects in Design, Design for Manufacturing

SECTION-2

Operations Strategy

Manufacturing vs Service Operations, Concept of Process as applied to manufacturing and services, SIPOC (Supplier-Input-Process-Output-Customer), Process Choices in Manufacturing: Project, Job Shop/Job Order, Batch, Mass/Assembly, Continuous Process

Quality Assurance

Quality – Concept, Definitions, Quality attributes for products & services, Cost & Value of quality, Inspection – 100% vs Sampling, Statistical Process Control, TQM, Six Sigma Concept – Measurements, DMAIC & DMADV, 7 QC Tools – Check sheets, Histogram, Fishbone diagram, Pareto diagram, Scatter Diagram

Logistics & Supply Chain Management

Logistics Management, Functions – Transportation, Warehousing, Inventory Management, Material handling & Packaging, Order (Information) Processing, Supply Chain – Types: Product SC, Service Spares SC, Service SC, Sustainable SC – Green SC, Reverse Logistics

Project Management

Projects – Definition, Characteristics, Classification, Project Life Cycle Phases – Concept/Initiation, Feasibility, Planning & Organization, Implementation, Clean-up & Shut Down Phase, Project Planning – Project Charter, Statement of Works, Network Analysis – PERT/CPM

List of Tutorials: (Any Three)

In the tutorial students are expected to present a technical seminar (PPT) relevant to Mechanical and System Engineering (MSE). Also, students (in a group of 4/5 students) are expected to discuss any technical novel topic related to Mechanical and System Engineering.

List of Practicals: (Any Six)

1. Tension test on Mild Steel and Aluminum
2. Brinell hardness test on different materials
3. Demonstration on Lathe Machine, Milling and drilling Machine
4. Demonstration of CNC Lathe Machine Operation
5. Demonstration of various welding methods
6. Coordinate Measuring machine
7. Laser Beam Machining
8. 3D Printing Machine
9. Injection Molding Machine
10. Study of basic measuring instruments, Vernier Caliper, Micrometer, Dial Indicator, Profile Projector etc.
11. Experiment on profile projector and vision measuring system
12. Case study on Product Design Philosophy
13. Use of 7 quality tools implementation (using MS Excel)
14. Use of Statistical process Control (SPC) for manufacturing/Service industry (using MS Excel)
15. Implementation of Define and Measure phase of Six Sigma to manufacturing/Service industry (using standard templates made in MS Excel)
16. Case studies on Operation strategies
17. Implementation of Project Management concepts for managing projects (using MS Excel)

List of Course Projects:

1. Material selection
2. New material development
3. Smart materials usage
4. Manufacturing process selection for complex parts
5. Use of manufacturing for simple parts
6. Model for measurement system
7. Model for measuring instrument
8. New Product Design for customer satisfaction
9. Operation strategy of manufacturing / service industry
10. Implementation of Six sigma (At least first two phases i.e. Design and Measure) for manufacturing and service industry
11. Use of seven quality tools for improvement of product or service quality
12. Implementation of Statistical Process Control (SPC) for manufacturing or service industry

13. Supply chain management study for a manufacturing/service industry
14. Analysis of logistics management of a manufacturing/service industry
15. Implementation of Project Management concepts for a manufacturing/service industry
16. Use of software for project management

List of Course Seminar Topics:

1. Composite Materials and their applications
2. Additive Manufacturing
3. Design for Manufacturing
4. Laser Beam Machining
5. Photo chemical Machining
6. PCB Manufacturing
7. Manufacturing of semiconductor devices
8. Selection of material
9. Alloying materials
10. Materials used for Automobile applications
11. Materials used for Aerospace and space applications
12. Energy Management
13. Non renewable Energy Sources
14. Pollution and remedial measures for it
15. Heat Treatment of materials
16. Coordinate Measuring Machine
17. Non contact type inspection methods
18. Geometric dimensioning and tolerancing
19. SIPOC for manufacturing industry
20. SIPOC for service industry
21. DIMAC
22. DMADV
23. Surface treatments
24. Six sigma and its applications
25. Use of 7 quality tools
26. Statistical Process control for manufacturing industry
27. Statistical Process control for service industry
28. Cost of quality and value of quality
29. Quality Philosophy
30. Introduction to logistics and supply chain Management

31. Applications of SCM in various sectors
32. Types of SCM
33. Project Management Basics
34. Use of Network analysis for project Management
35. Use of CPM/PERT for project Management
36. Product Life cycle management
37. Automation and Robotics
38. Metal Matrix composite processing
39. Recent trends in quality Management
40. Total Quality Management
41. Smart Materials
42. Shape Memory Alloys
43. Friction Stir Welding
44. Incremental Sheet Forming
45. CNC Machine
46. Virtual Manufacturing

List of Course Group Discussion Topics:

1. Methods of force measurement
2. Force sensing technology
3. Surface modification technology
4. Application and use of carbon fiber reinforced plastic
5. Effect of non metallic alloying elements
6. Materials used in electronic industry
7. Modern trends in heat treatment technology
8. Use of simulation in manufacturing
9. Electro chemical machining
10. Electro beam machining
11. Water jet machining
12. Thermodynamic laws - real life applications
13. Measurement of heat transfer rate
14. Laser metrology
15. Virtual gauging
16. Design for inspection
17. Electronic gauges
18. Gauging automation
19. Use of nanotechnology in material science
20. Use of computers in design and development process. including CAE, CAM.
21. Use of highly reliable plastic materials in engineering.

22. Emerging integration of mechanism with electronics.
23. Liberal use of instrumentation in mechanical systems
24. 3D printing in industrial scale
25. Micro Electro - Mechanical Systems
26. Computer aided manufacturing
27. Just in time production
28. Lean production
29. E-Supply chain management
30. Automation and operation strategy
31. Shifting from B2B model to B2B2C model
32. Business process management
33. Six sigma for continuous business growth
34. Quality circle
35. The Toyota production system
36. Taguchi Method
37. Zero defect program
38. QFD
39. Green Supply chain management
40. Closed loop supply chain
41. Forecasting product returns
42. Effect of SCM on BIG data and AI
43. Impact of Industry 4.0 on SCM
44. Resilient supply chain
45. Sustainability issues in supply chain
46. Block supply chain
47. AI and Project management
48. IOT and project management
49. Risk analysis in Project Management
50. Role of computer in Project Management

 List of Home Assignments:

1. Stress strain relationship for various ductile materials
2. Stress strain relationship for various brittle materials
3. System and types of forces
4. Stress, strain and their types
5. Basics of Factor of Safety in design and engineering
6. Engineering materials and their properties
7. Alloys and Composite materials
8. Materials for various Engineering applications
9. Selection of material for various industrial applications
10. Heat treatment of engineering materials
11. Selection of manufacturing processes for various industrial applications
12. Joining processes and their applications
13. Deformation processes and their applications
14. Sheet metal operations
15. Conventional and non-conventional machining processes
16. Casting Processes and their applications
17. Additive manufacturing: concept and applications
18. Thermal machining processes
19. Chemical and electrochemical machining processes
20. Mechanical machining processes
21. Geometric dimensioning and tolerancing
22. Industrial automation: History and development
23. Computer integrated manufacturing
24. Heat transfer concept and applications
25. Laws of thermodynamics
26. Power generating and power absorbing devices.
27. Manufacturing and service industries and operations
28. SIPOC diagram
29. Types of production systems
30. Quality assurance and its role in industries
31. Quality, its cost and value
32. Quality control and SPC
33. Total Quality Management
34. Six Sigma: Concept and methodology
35. Applications of 7 QC tools
36. Logistics Management and its functions
37. Supply chain Management and types of supply chain
38. Project Management

39. Project life cycle
40. Network Analysis
41. Project charter

Survey/Design (Broad areas)

1. Design of simple components for manufacturability
2. Establishing part dimensions based on stress strain calculations
3. Development of SIPOC diagram for various processes
4. Data collection, design of control charts for variables and their interpretation
5. Six Sigma: Define and measure phase
6. Problem solving using 7 QC tools.

Design:

1. Engineering Design Principles
2. Design for Manufacturing
3. Design for Assembly
4. Asthetic Considerations in Design
5. Ergonomic considerations in Design
6. Design for Quality
7. Design for Six Sigma
8. Quality Function Deployment

Case Study:

1. Case study on material selection for electronic industry, chemical industry, aerospace and automobile industry etc.
2. Case study on selection of manufacturing process for given component
3. Difficult to cut materials and effective strategies to manufacture for the same
4. Complex part measurement using measuring instruments
5. Case study on CMM
6. Design thinking case study
7. Case study on selection of operation strategy
8. Use of DMAIC for product company
9. Use of DMAIC for service industry
10. Supply chain management case study
11. Logistics management of industry
12. Project management case study

Blog

1. New materials for manufacturing industry

2. Materials for industry 4.0

3. Smart Materials

4. New product development

5. Micro Machining

6. Advance machining Processes

7. Robotics and Automation

8. 3 D Metal printing

9. Supply chain management and block chain

10. Quality need of hour

11. Lean Six sigma

12. Project management tools and techniques

Surveys

1. Manufacturing processes in Industry

2. Use of Materials for industry applications

3. Effectiveness of CMM

4. Operation strategies of manufacturing companies

5.Operation strategies for service industry

6. Quality control in the era of industry 4.0

7. Machine vision usages

8. In line gauging

9. Supply chain methods used for manufacturing and service industry

10. Project management principles and its execution

Assessment Scheme:

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

Text Books: *(As per IEEE format)*

1. *G. Shanmugam and S. Ravidran ; Basic Mechanical Engineering; Tata McGraw Hill Publications*
2. *S. Ramamrutham; Strength of Materials; 15th Edition, Dhanpat Rai Publishing Company*
3. *Beer P. Johnson, E. Russell Johnstn Jr., John T. Dowolf, David F. Mazurek; Mechanics of Materials, 2nd edition, McGrawHill publications.*
4. *P. N. Rao; Manufacturing Technology; Vol I & II; Tata McGraw Hill Publications*
5. *Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014*
6. *V Raghavan; Material Science and Engineering; Prentice Hall of India; New Delhi*
7. *P. K. Nag; Engineering Thermodynamics; Tata McGraw Hill Publications*
8. *Amitava Mitra; Fundamentals of Quality Control & Improvement; 2nd edition, Pearson Education 2002*
9. *Sunil Chopra & Peter Meindl, Supply Chain Management - Strategy, Planning & Operation –Pearson Education*

Reference Books: *(As per IEEE format)*

1. *Gere and Temoshenko; Mechanics of Material; 4th Edition, CBS Publishers*
2. *V.B.Bhandari, Elements of Mechanical Engineering, Tata McGrawHill Publications*
3. *R. K. Jain Production Technology, Khanna Publishers*
4. *Chaudhari, Hajra ; Elements of workshop technology Vol I and II; Media promoters and Publishers*
5. *J. M. Juran & F. M. Gryna; Quality Planning and Analysis; 5th Edition, McGraw-Hill, 1993*
6. *Logistics & Supply Chain Management: Cases and Concepts – Raghuram*
7. *Y Cengel and Boles; Thermodynamics - An Engineering Approach; Tata McGraw Hill Publications*

MOOC Links and additional reading material:
www.nptelvideos.in
1. https://swayam.gov.in/nd1_noc20_me67/preview:Fundamentals   of   manufacturing processing
2. https://www.coursera.org/learn/mechanics-1:Stresses and strains
3. https://www.coursera.org/learn/thermodynamics-intro:Thermodynamics   and   Heat transfer
4. https://www.coursera.org/learn/uva-darden-project-management : Project Planning
5. https://www.coursera.org/specializations/project-management : Project Planning
6. https://www.coursera.org/learn/material-behavior : Materials
7. https://www.coursera.org/learn/six-sigma-principles
8. https://www.coursera.org/specializations/supply-chain-management

Course Outcomes:

1. Develop conceptual understanding of engineering design for any component and also to select the appropriate manufacturing methods.
2. Select the suitable material based on its mechanical, chemical and other properties for

given engineering applications.

3. Understand basics of thermodynamics, heat transfer and sources of energy .
4. Understand nature of manufacturing and service operations; apply principles of operations strategy for process choice and plan and organize projects
5. Understand and apply principles of quality management, quality tools and six sigma methodology
6. Identify the key elements and processes in supply chain and their interaction

CO-PO Mapping

CO1	CO2	CO3	CO4	CO5	CO6
PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO2, PSO3, PSO4	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO2, PSO3, PSO4	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO2, PSO3, PSO4	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO2, PSO3, PSO4	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO2, PSO3, PSO4	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO2, PSO3, PSO4
2, 2, 2, 1, 1, 3, 2, 2, 1, 1, 1, 1	2, 2, 2, 1, 1, 3, 2, 2, 1, 1, 1, 1	2, 2, 2, 1, 1, 3, 2, 2, 1, 1, 1, 1	2, 2, 2, 1, 1, 3, 2, 2, 1, 1, 1, 1	2, 2, 2, 1, 1, 3, 2, 2, 1, 1, 1, 1	2, 2, 2, 1, 1, 3, 2, 2, 1, 1, 1, 1

Future Courses Mapping:

This course will map to following courses at TY and Final year of Production and Mechanical Engineering
Machining Processes, Manufacturing Engineering, Machine Design, Operations management, Project Management

Job Mapping:

With the successful completion of this course Students can acquire skills required for following job profile in manufacturing and service industry
1. Manufacturing Engineer
2. Design Engineer
3. Project Manager
4. Quality Control Engineer

CS2213: ENGINEERING DESIGN-I

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: 01   **Tut: 2** 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 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.

SECTION-1

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guidelines 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 world problems using an 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).

Topic and Content: Industry Standards for Communication Using Python

RS232 Serial Port Communication (pySerial) – Opening ports, Configuration of Port, Listening ports, Accessing ports, Data transfer and Termination of ports. PySerial support classes for Native ports, RS485 support and RFC 2217 Network ports, Exceptions, Constraints, Module functions and attributes, Threading, Asyncio and tools. Interfacing with RS232.

USB Interface Serial Port Communication (PyUSB) – Opening ports, Configuration of Port, Synchronous and Asynchronous communication, Listening ports, Accessing ports, Data transfer and Termination of ports. Interfacing Microcontrollers is USB Ports.

Wireless USB - communication protocol of wireless USB adapter (ESP8266) and wireless repeaters in Wi-Fi.

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Zigbee for personal area wireless ad hoc network.

XBee in Python - 802.15.4, ZigBee, DigiMesh, Point-to-Multipoint, or Wi-Fi and must be configured to operate in the same network.

List of Practical's: (Any Six)

1) PC To PC Communication using RS232

2) PC To any device Communication using RS232

3) PC To PC Communication using wired USB in client server mode

4) PC To any device Communication using wired USB in client server mode

5) Wireless mouse communication with USB

6) Wireless keyboard communication using USB

7) Wired and Wireless Transmission of Data between Pen drives

8) Setting up small network using Zigbee communication protocol

 ...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.

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

Text Books: *(As per IEEE format)*

1. *https://pyserial.readthedocs.io/en/latest/tools.html*
2. *USB Design by Example by John Hyde and USB Complete by Jan Axelson*

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, PO4, PO5	PO5, PO7, PO8	PO7, PO8, PO9, PO12	PO12, PSO1, PSO2
3	3, 3	2, 2, 3	2, 2, 2	2, 2, 2, 1	2, 3, 3

CO attainment levels

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

Job Mapping:

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

 Software Engineer, Software Developer, IT Engineer

CS2214: SOFTWARE DESIGN-I

Course Prerequisites: C and JAVA Language

Course Objectives:

1. To develop problem solving ability using programming skills 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:.1   **Tut: 2** Hours/Week

Course Relevance: Software project development comes under the category of project based learning (PBL). PBL is an instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world by using domain specific language technologies.

PBL is "learning by doing."

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 PBL 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.

Topic and Content: Computer Vision Using OpenCV

Creating a image, Scanning Image, Binarization of scanned image, Removal of Noise from scanned image, Resizing, cropping and exporting images, Converting image into black and white, Thinning of binarized image, Skew detection and correction of scanned image, Image normalization, Segmenting the image using threshold, Geometric operation on Images -Edge detection, Edge detection with Canny operator, contour detection, feature extraction, computing gradient of image, Computing Gradient Histograms, finding region of request from deep learning requirements, Erosion and dilation-morphological operations on image. Offline video input, Video input from camera, Camera input, Convolution, classification and change detection. Applications of image processing in machine learning and computer vision.

List of Practical's: (Any Six)

In all the experiments take the input as a single image and then dataset. First carry out all assignments by using C/C++/JAVA and then perform same assignment using OpenCV.

1) Getting Started with OpenCV installation and configuring OpenCV with DevCPP or Code Blocks or Visual C++ and running sample code.

2) Perform image manipulation on given images- read, write, view images, and conversion between different formats.

3) Perform special transformations using convolution and correlation.

4) Perform frequency transformations using Fourier transform.

5) Perform histogram modification and explore histogram as an enhancement technique.

6) Perform filtering operation - noise identification and filtering to remove it.

7) Perform morphological transformations - dilation and erosion

8) Perform segmentation using edge detection. Detect boundaries between two regions using different gradient approximations.

9) Perform segmentation using thresholding. Divide the image in regions depending on the gray level.

10) Capture live video using OpenCV, process it, detect features and track down the object

...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.

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

Text Books: *(As per IEEE format)*

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

Reference Books: *(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.*
3. *K. D. Soman and K. I. Ramchandran, "Insight into wavelets - From theory to practice," 2nd Edition PHI, 2005.*

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, PO7, PO9, PO12	PO12, PSO1, PSO2
3	3	2, 2	2, 2	2, 2, 2, 1	2, 3, 3

CO attainment levels

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

Job Mapping:

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

 Software Engineer, Software Developer, IT Engineer

CS2207::SOFTWARE DEVELOPMENT PROJECT-I

Course Prerequisites: C and Python, Problem Based Learning

Course Objectives:

1. To develop problem solving ability using programming skills 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:.3.......   **Teaching Scheme Theory:…. Hours/Week**

Tut: … Hours/Week

Lab: 6 Hours/Week

Course Relevance:

Software project development comes under the category of project based learning (PBL).

PBL is an instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world by using domain specific language technologies.

PBL is "learning by doing."

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 PBL 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**.**

Teacher's Role in PBL :

- Teacher is not the source of solutions; rather he will 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.

Selection of Project/Problem:

- The problem-based project oriented model for learning is recommended. 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.
- There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and structure of the activity.
- Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.
- Activities may include- Solving real life problems, investigation, /study and Writing reports of in depth study, field work.

Student's Role in PBL:

- Students must have the ability to initiate the task/idea .They should not be mere imitators.
- They must learn to think.
- Students working in PBL must be responsible for their own learning.
- . Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PBL are actively constructing their knowledge and understanding of the situation
- Students in PBL are expected to individually.

Developing Inquiry Skills:

- Students in PBL 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

Sample Software Project Statement based on Computer Vision with OpenCV

1) Design and deploy a system for traffic board sign detection for moving autonomous car in all-weather conditions.

2) Design and deploy a system for object identification and collision avoidance for unmanned vehicles.

3) Design and deploy a system for real time image compression for interactive real time application.

4) Design and deploy a system for real-time writing Devanagari character detection and conversion in unicode format.

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

Course Outcomes:

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

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

CO2:   Recognize algorithms, programming constructs and data structures in building software

solutions

CO3: Analyze and synthesize the identified problem from technological perspective

CO4: Apply ethical principles in utilizing skills and knowledge to design the reliable and scalable solution to meet challenges using modern tools

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	PO 6,7,9,12	PO12, PSO1, PSO2
3	3	2, 2	2, 2	2, 2, 2, 1	2, 3, 3

CO attainment levels

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

Job Mapping:

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

Software Engineer, Software Developer, IT Engineer

CS2209::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 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 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 world problems using an 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?

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- 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

CS2202::DATA STRUCTURES

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

Course Objectives:

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

2.To understand concepts about searching and sorting techniques.

3. To construct and implement various data structures and abstract data types including lists, stacks, queues, trees, and graphs.

4. To make understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.

5. To emphasize the importance of data structures in developing and implementing efficient algorithms.

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

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance: This is 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.

SECTION-1

Arrays, Stacks, Queues and Linked Lists

Arrays: Representation and application of Single and Multidimensional arrays, Time & Space Complexity Analysis.

Sorting Techniques: Quick Sort, Heap sort with Analysis.

Searching techniques: Linear Search, Binary search with Analysis.

Linked Lists: Dynamic memory allocation, Singly Linked Lists, Doubly linked Lists, Circular linked lists and Generalized linked lists, Applications of Linked list.

Stack: Stack representation and Implementation using arrays and Linked lists. Applications of stack in Recursion, Expression conversions and evaluations.

Queues: Representation and implementation using array and Linked lists, Types of queue. Applications of Queues: Job Scheduling, Josephus problem etc.

SECTION-2

Trees, Graphs and Hashing

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

Advanced Trees: Introduction, AVL tree, R-B tree, B tree and B+ tree.

Graphs: Terminology and representation using Adjacency Matrix and Adjacency Lists, Graph Traversals and Application: BFS and DFS, Connected graph, Bipartite Graph, Detecting Cycle in graph. Minimum Spanning tree: Prims and Kruskals Algorithm, Shortest Path Algorithms, Union Find.

Hashing: Hashing techniques, Hash table, Hash functions. Collision handling and Collision resolution techniques.

List of Tutorials: (Any Three)

   1) Sorting Techniques: Insertion, Merge sort, Bubble, Shell Sort, Radix Sort.

   2) Searching Techniques: Ternary Search, Fibonacci Search.

   3) Problem solving using stack (Maze problem, Tower of Hanoi).

   4) Expression conversion like infix to prefix and postfix and vice versa.

   5) Priority Queues and Job Scheduling Algorithm.

   6) Generalized Linked Lists.

7) Threaded Binary tree and Stack less Traversals using TBT.

8) B and B+ Tree.

9) Applications of Graph in Network problems.

10) Design of Hashing Functions and Collision Resolution techniques.

11) Cuckoo Hashing**.**

List of Practical's: (Any Six)

1) Assignment based on Sorting and Searching.

2) Assignment based on Stack Application (Expression conversion etc.)

3) Assignment based on Queue Application(Job scheduling, resources allocation etc.)

4) Assignment based on linked list.

5) Assignment based on BST operations(Create, Insert, Delete and Traversals)

6) Assignment based on various operations on Binary Tree (Mirror image, Height, Leaf node display, Level wise display etc.)

7) Assignment based on AVL and R-B tree.

8) Assignment based on DFS and BFS

9) Assignment based on MST using Prim's and Kruskals Algorithm.

10) Assignment based on Finding shortest path in given Graph.

11) Assignment based on Hashing.

List of Projects:

1. Finding Nearest Neighbors.

2. Calendar Application using File handling.

3. Path finder in Maze

4. Word Completion Using Tire.

5. Bloom Filters.

6. Different Management Systems.

7. Scheduling Applications and Simulation.

8. Shortest Path Applications. (Kirchhoff's Circuit, TSP with Scenario.)

9. Efficient Storage and Data Retrieval Systems.

10. Different Gaming Application.

List of Course Seminar Topics:

1. Asymptotic Notations in Data structures.

2. Hash Table, Heaps and Their applications.

3. Analysis of Merge Sort, Quick Sort and Bubble Sort for Best, Average and Worst Case.

4. Solving N-queen and Josephus Problem using Backtracking , Stack and Queue respectively.

5. Priority Queue in Job Scheduling.

6. Application of Stack in Backtracking problems.

7. Priority Heap and min-Max Heap.

8. Data Structures for Languages and Libraries.

9. Multidimensional and Special Data Structures.

10. Algorithm Designing using Divide and Conquer

List of Course Group Discussion Topics:

1. Application based comparison of Sorting Algorithms.

2. Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?

3. Advanced trees: which is the best? (AVL,RB,B,B+) when? how? why?

4. Scenario Based Comparison: Kruskals vs Prims Algorithm.

5. Hashing application in today's technology. Is it necessary?

6. Application based comparison: Stack vs Queues.

7. B- Tress VS B+ Trees: Which is to be consider? When ? Why?

8. Need and Role of Different tree Traversals.

9. Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?

10. Linked List application in today's technology. Is it necessary?

List of Home Assignments:

Design:

1. Design Single Source multiple destination Shortest Path Algorithm For Driving Application.

2. Expression Tree and Topological Sorting application in Problem solving.

3. Scheduling Algorithms using Queue.

4. Implementation of B and B+ trees for database management.

5. GLL application to Solve problems on Multivariable Polynomial. Consider suitable example.

Case Study:

1. Consider a Suitable Example for Hashing Application. Study its Merits, Demerits and Design.

2. Consider different real life examples where different sorting, Searching techniques have been used. Why used? How? Comparative study.

3. Why there is a need of different tree traversal algorithms? Consider different real life examples where they are used. Why? How?

4. Game Base study for data structures.

5. Compare different graph traversal algorithm by considering different real life examples where they have used.

Blog

1. Comparative Application of Prims vs Kruskals Algorithm in real life scenarios.

2. AVL Tree vs RB Tree with applications

3. Need of different Sorting techniques.

4. How Hashing is useful in recent technologies? Consider any application related to it.

5. Role of Stacks and Queues in problem Solving.

Surveys

1. How application of Graph Search Algorithms (DFS and BFS) is there in recent technologies? Consider some real life technologies.

2. How Advanced Trees Data structure plays important role in Database management?

3. Survey of Data Structures for computer Graphics applications.

4. A survey on different hashing Techniques in programming.

5. Graph algorithms in Network Application.

Suggest an assessment Scheme:

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

Comprehensive Viva Voce - 20 Marks

Text Books:

1. 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

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	PO5	PO8, PO11	PO12, PSO1, PSO2
3	2	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.

CS2204: COMPUTER ARCHITECTURE AND OPERATING SYSTEM

Course Prerequisites: Basics of computer system, data structures and programming languages

Course Objectives:

1. To illustrate the structure, function, characteristics and performance parameters of a computer system.
2. To explore several computer architectures.
3. To discuss memory organization in computer system
4. To understand the basic concepts and functions of the operating system.
5. To gain knowledge of process synchronization, its mechanism and CPU scheduling
6. To get familiar with deadlock and memory management techniques as a function of the operating system.

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

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: This course focuses on CISC and RISC computer architecture. The Operating System acts as a platform for information exchange between your computer's hardware and the applications running on it. A computer software/hardware architect is deeply involved in the development and design of new software or hardware.

SECTION-1

Introduction: Evolution of Computer Systems, Basic Operation of a Computer, Memory Addressing and Languages, Software and Architecture Types

CISC: Architecture of 8086, Instruction types, instruction format, instruction cycle, Addressing Modes, Assembly Language Programming of 8086.**RISC:** Architecture, Instruction set, Pipelining, Programming and Application **Measuring CPU performance**: Choice of benchmarks, summarizing performance results, Amdahl's Law

Control Unit: Single Bus CPU organization, register transfers, performing an arithmetic/ logic operation, fetching a word from memory, storing a word in memory, Execution of a complete instruction. Micro-operations, Hardwired Control, Micro-programmed Control:

Microinstructions

Memory System: Need of memory system, Hierarchical memory system, Characteristics, Size, Access time, read cycle time and address space,Processor memory interaction, Static and Dynamic ram, Memory interfacing and addressing, Memory hierarchy design,Cache memory:Cache size vs block size, Mapping functions.

SECTION-2

Overview of Operating System: What is OS? Interaction of OS and hardware, Goals of OS, Basic functions of OS, OS Services, System Calls, Types of system calls, Types of OS: Batch, Multiprogramming, Time sharing, Parallel, Distributed & Real-time OS

Process management: Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control, Multithreading models, Thread implementations – user level and kernel level threads, Concurrency: Issues with concurrency, Principles of Concurrency, Mutual Exclusion: OS/Programming Language Support: Semaphores, Mutex , Classical Process Synchronization problems, Uniprocessor Scheduling, Scheduling Algorithms: FCFS, SJF, RR, Priority.

Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery, **Memory Management:** Requirements, Memory Partitioning, Fragmentation, Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit, Paging, Segmentation, Address Translation, Virtual Memory, VM with Paging, Page Table Structure, Translation Lookaside Buffer, Page Size, VM with Segmentation, Page Replacement Policies: FIFO, LRU, Optimal

List of Tutorials: (Any Three)
1. Instructions encoding.
2. Performance parameter (Amdahl's law)
3. Performance through pipelining.
4. Control Unit: Micro-operation and Micro-instruction.
5. Cache mapping functions.
6. Draw the Gantt charts and compute the finish time, turnaround time and waiting time for the following algorithms:
    a. First come First serve b) Shortest Job First (Preemptive and Non preemptive)
    b. Priority (Preemptive and Non preemptive) d) Round robin
7. Check whether the given system is in a safe state or not using Banker's Deadlock Avoidance algorithm.
8. Check whether the given system is in a deadlock state or not using the Deadlock Detection algorithm.
9. Using the following placement algorithm, check whether memory can be allocated to a given process or not.
    a. First fit b) Best fit c) Worst fit d) Next fit

10. Calculate the number of page faults for a reference string for the following page
11. replacement algorithms: a) FIFO b) LRU c) Optimal

List of Practical's: (Any Six)

1. Write an ALP to perform arithmetic operations.
2. Write an ALP using an array.
3. Write an ALP using stack memory.
4. RISC Programming
5. Execution of Basic and Advanced Linux commands
6. Write a shell script program.
7. Write a program demonstrating use of different system calls.
8. Implementation of Classical problems using Threads and Mutex/Semaphore.
9. Write a program to compute the finish time, turnaround time and waiting time for the following algorithms: a) First come First serve b) Shortest Job First (Preemptive and Non preemptive) c) Priority (Preemptive and Non preemptive) d) Round robin
10. Write a program to check whether given system is in safe state or not using Banker's Deadlock Avoidance algorithm
11. Write a program for following placement algorithm check whether memory can be allocated to given process or not by using following methods: a) First fit b) Best fit c) Worst fit d) Next fit
12. Write a program to calculate the number of page faults for a reference string for the following page replacement algorithms: a) FIFO b) LRU c) Optimal

List of Projects:
  1. Linux based application using Shell Scripting
  2. Design and implementation of a Multiprogramming Operating System: Stage I
 i. CPU/ Machine Simulation
    ii. Supervisor Call through interrupt
  3. Design and implementation of a Multiprogramming Operating System: Stage II
 i. Paging
    ii. Error Handling
    iii. Interrupt Generation and Servicing
    iv. Process Data Structure
 4. Design and implementation of a Multiprogramming Operating System: Stage III
     i. Multiprogramming
    ii. Virtual Memory
    iii. Process Scheduling and Synchronization
    iv. Inter-Process Communication
    v. I/O Handling, Spooling and Buffering
  5. Design and implementation of a Multiprogramming Operating System for arithmetic and logical operations: Stage I
 i. CPU/ Machine Simulation

ii. Supervisor Call through interrupt
6. Porting of Linux on Embedded Platform and basic I/O programming
7. Comparison of various processors using simulators.
8. RTOS Programming
9. Designing of CPU
10. Linux kernel programming
11. Parallel Computing using CUDA

List of Course Seminar Topics:

1. Pentium Processor - a complete architecture
2. Microprogram sequencing
3. Improvement of Performance Measurement of Processor: Memory Banking
4. GPU Architecture
5. Micro-Programmed Control Unit used in Recent Computer.
6. Parallel Computers
7. I/O processors
8. Effect of clock on CPU performance
9. Edge computing
10. In-Memory Computing
11. Computer Architectures for vision system
12. RISC -V architecture
13. Cyber Physical Systems
14. Cyber System Debugging
15. Neuromorphic computing
16. Quantum Computing
17. The Challenges of Building Inferencing Chips
18. Hardware accelerator in computer architecture

List of Course Group Discussion Topics:

1. OS Structures
2. System call Vs API
3. Classical process synchronization problems
4. Process Vs Threads
5. Inter-process Communication (IPC)
6. Real Time Scheduling
7. Disk Scheduling
8. Best OS for smartphones-Android, iOS, windows, blackberry
9. Shared and Distributed Memory microprocessor
10. Flynn's Taxonomy
11. Booting Process of different Operating Systems.

List of Home Assignments:
Design:

1. Report Generation using Shell Script and AWK

2. Library Management System using Shell
3. Inter Process Communication in Linux
4. Design any real time application using job scheduling
5. Design any application using Android
6. DRAM design
7. Embedded System design
8. Real Time System design

Case Study:
1. Intel I3
2. Intel I7
3. Microsoft Windows 10
4. Linux
5. Android
6. Raspberry PI
7. NVIDIA core
8. Supercomputer architecture

Blog:
1. ARM Vs Intel
2. Protection and Security of OS
3. Comparative study of different mobile OS
4. Operating Systems for IoT Devices
5. Performance Measurement of CPU: Pipelining
6.ARM Microcontroller versions
7.Operating System Forensics
8. IOT Architecture

Surveys:
1. Computer System Memory Management and Optimization Techniques
2. Multiprocessor organization
3. A Survey of Mobile OS
4. Analysis and Comparison of CPU Scheduling Algorithms
5. Malware Analysis, Tools and Techniques
6. Laptop Operating Systems
7. Desktop Operating Systems
8. Pipelining hazards
9. Elements of modern computers

Suggest an assessment Scheme:

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

Text Books: (As per IEEE format)

1. *William Stallings; "Computer Organization and Architecture: Designing for Performance"; 7th Edition; Pearson Prentice Hall Publication's 81-7758-9 93-8*
2. *C. Hamacher, V. Zvonko, S. Zaky; "Computer Organization"; 5th Edition; Tata McGraw HillPublication; ISBN 007-120411-3*
3.*Douglas Hall; "Microprocessors and Interfacing";2nd Edition; Tata McGraw Hill Publications; ISBN 0-07-025742-6*
4. *Stalling William; "Operating Systems"; 6th Edition; Pearson Education; ISBN: 0-13-031999-5.*
5.*Silberschatz A., Galvin P., Gagne G.;"Operating System Concepts" ; 9th Edition; John Wiley and Sons*
6. *John L. Hennessy, David A. Patterson; "Computer Architecture-A Quantitative Approach", 5th edition, Elsevier Publication*
7. *Andrew Sloss,Dominic Symes,Chris Wright;"ARM System Developer's guide Designing and optimizing system software";Elsevier Publication*

Reference Books: (As per IEEE format)

1.*Hwang and Briggs; "Computer Architecture and Parallel Processing"; Tata McGraw Hill Publication; ISBN 13: 9780070315563.*
2. *A. Tanenbaum; "Structured Computer Organization"; Prentice Hall Publication; ISBN 81 – 1553-7.*
3. *Silberschatz A., Galvin P., Gagne G; "Operating System Principles"; 7th Edition, John Wiley andSons.*
4. *Yashavant Kanetkar; "Unix Shell Programming"; 2nd Edition, BPB Publications*
5. *Sumitabha Das; "Unix Concepts and Applications"; 4th Edition, TMH.*

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

Course Outcomes:
The student will be able to –

1) Illustrate the structure, function, characteristics and performance parameters of a computer system such as benchmarks, Amdahl's law, price and power.
2) Explore the knowledge of Computer Architectures such CISC and RISC
3) Discuss static, dynamic and cache memory in computer system
4) Understand the functions of a contemporary Operating system with respect to convenience, efficiency and the ability to evolve.
5) Apply various CPU scheduling algorithms and process synchronization mechanisms.
6) Identify the mechanisms to deal with Deadlock and primary memory management.

CO PO Map:

CO1	CO2	CO3	CO4	CO5	CO6
PO3	PO4	PO5	PO7	PO9	PSO2
3	3	2	2	1	1

CO attainment levels:

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

Future Courses Mapping: Advance Computer Architecture, Advance Operating System, Unix Operating System, Linux programming, Distributed System/Computing, High Performance Computing, Embedded Systems, System Programming, Compiler

Job Mapping: Linux Administration, Kernel Developers, Application Developers, System programmer, Computer Architects,Cyber Security analyst,System administrator

CS2206::DATA COMMUNICATION AND NETWORKS

Course Prerequisites: Digital Electronics

Course Objectives:

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

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

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

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

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

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

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

Tut: 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-1

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 Modes: Simplex, Half Duplex, Full Duplex. Time Domain Concepts: Continuous signal, discrete signal, periodic signal. Frequency Domain Concepts: Bandwidth, Data Rate, Channel Capacity, Error Rate, Noise. Nyquist Sampling Rate, Shannon Channel Capacity, SNR. 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..

Networking Fundamentals: LAN, MAN, WAN, PAN, Internet, internet and Intranet. Reference Models: OSI, TCP/IP. Design Issues for Layers. Network Architectures: Client-Server; Peer To Peer. Network Types: Infrastructure and Ad-hoc mode. Transmission Mediums: Coaxial, CAT5, 5e, 6, 6a, 7, OFC. Network Topologies: Mesh, Star and Hierarchical. Network Devices: NIC, Repeater, Bridge, Switch, Modem, Router, Gateways and Access Point. Examples on network performance parameters using RTT, delay, bandwidth, throughput and efficiency.

SECTION-2

Logical Link Control: Design Issues: Services to Network Layer, Framing, Error Control and Flow Control. Error Control: Parity Bits, Hamming Codes and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol, WAN Connectivity: PPP and HDLC. Medium Access Control: Channel Allocation: Static and Dynamic, Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA. IEEE 802.3 Standard: Ethernet, Wiring Schemes and Frame Formats, CSMA/CD (as legacy standard), 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. Network Layer: Switching Techniques: Circuit, Message and Packet Switching. Logical Addressing: IPv4 and IPv6 is addressing, Subnetting, NAT, CIDR. Network Layer Protocols: IP, ICMP, Routing Protocols: Distance Vector, Link State, and Path Vector. Congestion Control and QoS Transport Layer: Services: Berkeley Sockets, Addressing, Connection Establishment, Connection Release, Flow control and Buffering, Multiplexing. HTH Layer Protocols: TCP, TCP Timer management, UDP. Quality of Service: TCP Congestion Control. Traffic Shaping: AIMD.   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)

List of Tutorials: (Any Three)

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

2) Examples and analysis on Modulation and demodulation: PCM, FSK, BFSK, MSK, GMSK, PSK,QAM

3) Examples on network performance parameters : RTT, Delay, Bandwidth, Throughput and efficiency

4) Analyze packet formats of Ethernet, IP, TCP and UDP captured through Wireshark for wired network.

5) 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

6) 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

7) 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

 8) Examples of Application Layer

(a) DNS: URL Domain Processing

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

(c) CDN

List of Practical's: (Any Six)

1) Demonstration of line encoding methods - Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding, Differential Manchester Encoding with the help of utilities.

2) Demonstration of modulations and demodulations - PCM for Voice Communication, FSK and BFSK modulation of digital radios, MSK and GMSK for Mobile Communication, PSK for LANs, RFID and Bluetooth, QAM for TV Transmission with the help of utilities.

3) Connect two computers using RS-232D cable and write a program to transfer file using serial communication

4) Connect two computers using USB cable to form client server mode and write a program to transfer file from server to client using serial communication.

5)Demonstration of Frequency Hopping Spread Spectrum (FHSS) and   Direct Sequence Spread Spectrum (DSSS) used in broadband communication

 6)Setting up small computer networks:

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, Assigning unique IP addresses and sharing C drive on each machine.

7) Installation of Web server:

Installation and configuration web server using Apache Tomcat for Linux. Hands on for network commands - ping, pathping, ipconfig/ifconfig, arp, netstat, nbtstat, nslookup, route, traceroute/tracert, nmap. Access the web pages from another computer.

8) TCP Socket Programming using Single Thread

Write a program using TCP sockets for following

    a. Say Hello to Each other

    b. File transfer

    c. Calculator

Capture the packets between client and server using Wireshark Packet Analyzer Tool for peer to peer mode.

9) UDP Socket Programming using Single Thread

Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines. Capture the packets between client and server using Wireshark Packet Analyzer Tool for peer to peer mode.

10) Understanding protocol stack of Intranet

Analyze packet formats of Ethernet, IP, TCP and UDP captured through Wireshark for wired networks.

11) Link State Routing Protocol

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.

List of Projects:

1. USB to RS232 serial communication

2. RS232 to USB serial communication

3. Simulation of modulation and demodulation for digital telephone lines

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

5. Simulation of modulation and demodulation for Gigabit Ethernet Network

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

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

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

9. Develop a tool fox for line encoding methods

10. Develop a tool fox for modulation and demodulation methods

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

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

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

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

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

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

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

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

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

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

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

List of Course 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:

Design:

 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

Case Study:

 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

Blog

 1.Journey of line encoding methods

2. Journey of modulation techniques

3. Internet Logical Addressing

4 Internet Routing Protocols

5. Applications Layer Protocols

Surveys

 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.

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

Comprehensive Viva Voce - 20 Marks

Text Books: *(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:

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. Design mechanisms to demonstrate server channel allocation in wired and wireless computer networks

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

5. Demonstrate sustainable engineering practice indicating the scientific purpose and utility of communication frameworks and standards.

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

CO PO Map

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

CO attainment levels

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

Future Courses Mapping:

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

CS2218::OBJECT ORIENTED PROGRAMMING

Course Prerequisites: C++ and JAVA

Course Objectives:

1) Learn object-oriented programming features
2) Using class, inheritance and polymorphism to develop real world applications
3) Adapt Best Practices of Class Design by using Standard Templates Library
4) Resolve computing problems by applying the knowledge of Exception handling and Multithreading
5) Propose 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

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

Tut: 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-1

Object Oriented Programming in C++ :
What is object oriented programming? Why do we need object oriented Programming? Characteristics of object-oriented languages, C vs C++, Data Types, Structures, Class, Object, data abstraction, class scope and accessing class members, separating interface from implementation, controlling access to members.

Constructors, Destructors, Copy Constructor, Objects and Memory requirements, Static Class members, Data abstraction and information hiding, Inline function, Friend Functions. Operator

Overloading: Concept, Operator overloading, Overloading Unary Operators, Binary Operators.

Inheritance: Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Types of Inheritance, Public and Private Inheritance, Ambiguity in Multiple Inheritance, constructors in derived classes, Aggregation.

Polymorphism: Concept, Types of polymorphism, relationship among objects in inheritance hierarchy, Function overloading, Virtual Functions.
Functions: Function prototype, Parameter passing, Recursion, Correctness issues, Breaking larger programs into functions

Pointers- indirection Operators, Memory Management: new and delete, this pointer, Pointers to Objects, Pointer to derived classes. Function pointers.
Heap memory management, memory leaks and dangling pointers, design classes which hide memory management.
Pure virtual function, Abstract classes, Templates. Standard Library, Best Practices of Class Design.

SECTION-2

Object Oriented Programming in Java :
Java characteristics, Classes and Objects, Methods and Constructors. Information hiding: access modifiers, Static keyword: class variables and instance variables, Class methods and instance methods. Arrays, Strings. Inheritance: Types of inheritance, Constructors in Derived Classes, Overriding & Hiding Fields & Methods, Interfaces.

Polymorphism: Static and Dynamic. Abstract classes & methods, Final classes & methods. Recursion example. Exceptions, checked & unchecked exceptions, User-defined exceptions.
Basic array processing strategies including passing arrays to functions, Applications illustrating use of arrays to store ordered and unordered sequences, sets Multidimensional arrays.
String, vector and Map classes, Applications.
Recursive algorithms involving arrays, Structures and classes

Multithreading: Thread life Cycle, Thread Priority, Thread Methods, Inter-thread Communication, Producer-Consumer using Java

Introduction to Streams, types of streams: iostreams, Readers and Writers, Print writer, Stream Benefits.
File management: File Management and Processing, Primitive Data Processing, Object Data Processing

Introduction to computers using graphics. Java GUI: Applet, Applet Vs Application. AWT, Swing, Components. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key), Menus, Jtables

List of Course Seminar Topics:

1. 1.Constructors and destructors
2. Inline Function and Friend Functions
3. Operator overloading
4. Static data members and member functions
5. Need of abstract classes in designing solution to real world problems
6. Use of pure virtual function in designing solution to real world problems
7. Inheritance in CPP and relationship in base class and derived class constructors.
8. Modes of inheritance, types and ambiguity in multiple inheritance.
9. Interface
10. Overriding, Hiding Fields & Methods
11. Super Keyword in Java Inheritance
12. Main within the class & Outside Class
13. File Handling in Java
14. IO stream in Java
15. JAVA Memory Management
16. Abstract classes and methods

List of Course Group Discussion Topics:

1. Need of constructors and destructors
2. Static keyword
3. Advantage of inline, friend function
4. Thread life cycle and Inter thread communication in Java
5. Difference between virtual function and inline function in C++
6. New operator vs use of object pointers in C++
7. Role and significance of constructors and destructors in inheritance.
8. Inheritance in Cpp vs java
9. File handling in Java vs C++
10. Memory management in Java
11. Inheritance - Types of Inheritance
12. Constructor
13. Java Access Modifiers
14. Exception handling in CPP Vs Java
15. Method overloading and overriding
16. Event handling in Java / Applets

List of Practicals: (Simple)

1. Create a C++ program to show the order of constructors and destructors.
2. Demonstrate the concept of a constructor with default arguments
3. Create a C++ program to show the working of Static Keyword in
4. Static variables in a Function
5. Write a C++ program to show the concept of a friend class
6. Write a C++ program to show overloading of a binary operator
7. Write a C++ program to show overloading of an inline function
8. Write a C++ program for drawing shapes of triangle, rectangle, hexagon, using abstract classes.
9. Write a C++ program for all functions in calculator using virtual functions
10. Implement C++ program to implement a base class consisting of the data members such as name of the student, roll number and subject. Create two derived classes called test-containing marks of two subjects & other derived class called result calculates result of the student. Use multilevel Inheritance. The program should have the facilities. i) Build a master table ii) List a table iii) Insert a new entry iv) Delete old entry v) Edit an entry vi) Search for a record.
11. Implement C++/Java program to create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called function get_data() to initialize base class data members and another member function display_area() to compute and display the area of figures. Make classes to suit their requirements. Using these three classes, design a program that will accept dimension of a triangle or a rectangle interactively, and display the area. Remember the two values given as input will be treated as lengths of two sides in the case of rectangles, and as base and height in the case of triangles, and used as follows: Area of rectangle= x*y Area of triangle =1/2*x*y
12. Write a java program to take String input from Keyboard using IOStream concept
13. Program to Read characters from the text file using Java FileReader class.
14. Program to write the contents onto a File.
15. Write Java program which implements interface.
16. Write a Program in java for Integer sort and string sort

List of Practicals: (Moderate Complex)

1. Create a program in c++ to show the concept of copy constructor.
2. Create a C++ program to show the working of Static Keyword in Static variables in a class & Static functions in a class
3. Create two classes DM and DB which stores the value in distances. DM stores distance in meters and centimetres and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results may be a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimetres depending on the object on display.

4. Write a C++ program to show overloading of a Unary operator
5. Write a C++ program to show the advantage of using an inline function over a macro
6. Create an Employee class with data members as employee id, name and date of joining. Derive class WageEmployee with data members as hours and rate and class Manager with data members as No of subordinates, basic salary and DA from class Employee. Derive SalesPerson class from WageEmployee class. Use multiple inheritance to derive class SalesManager from classes i.e SalesPerson and Manager. Assume suitable data members and member functions. Display the summary using inheritance.
7. Create employee bio-data using following classes i) Personal record ii))Professional record iii) Academic record Assume appropriate data members and member function to accept required data & print bio-data. Create bio-data using multiple inheritance.
8. Write a Java menu driven program to to perform various operation on file 1) create new file 2)add data in file 3)rename file 4) display absolute path of file 5) check file is readable and writable or not 6) check file is directory 7) reading contents of file 8) count the characters of a file 9) delete a file
9. Program to copy contents of one file to another file using IOstream concept
10. Program for accepting students data and write that data in a file and read file data
11. Write Java program which imports user defined package and uses members of the classes contained in the package.
12. Program in Java to create a player class. Inherit the classes Cricket player, Football player and Hockey player from player class.
13. Write a java program to implement: a) Bubble sort b) selection sort C) Insertion sort
14. Write a java program to implement:
15. Quick Sort
16. Merge Sort
17. WAP to create your own exception as NegativeSizeException whenever negative values are put in an array.
18. Create a abstract class employee, having its properties & abstract function for calculating net salary and displaying the information. Drive manager & clerk class from this abstract class & implement the abstract method net salary and override the display method.
19. Create two classes DM and DB which stores the value in distances. DM stores distance in meters and centimetres and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results may be a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimetres depending on the object on display.
20. Write C++ program for addition, subtraction, multiplication and division of two complex numbers using operator overloading.
21. Write C++ program for addition, subtraction of two-Time using operator overloading.
22. e.q. 2:00 + 4:10 = 6:10
23. 11:10 + 5:50 = 5:00
24. Create multiplication function as friend function.

List of Course Projects:

1) A library management software where admin can add/view/delete librarian and librarian can add/view books, issue, view issued books and return books using Java.
2) Sudoku Game
3) Student Report Management System/ School billing system/ Online Education Teaching portal / online Quiz management System
4) Cricket score sheet
5) Online Bank Management System / online grocery management / Bookshop inventory management system / online ticket booking
6) Medical store management system
7) Create a simple car racing game. the arrow keys are used for navigation. the space key will toggle between pause/play. There are hurdles during race. If user car hits the hurdle then game over. if user car take over the hurdle the increase the score by 1 point.
8) Online Feedback System
9) Create project to manage second hand car selling business online
10) Create a stock market trading simulation program using object oriented concepts

List of Home Assignments:

HA (Design)
1. Address book using Swing and Files
2. Book Shopping cart using Swing and Database
3. Text editor using Swing
4. Online MCQ test using Multithreading
5. Inventory Management using frontend as Swing and backend as My SQL

HA (Blog)
1. Write a blog on C++ truths and myths.
2. Write blog on Security and loopholes in C++.
3. Write a blog on Standard uses of Java
4. Write a blog on Java truths and myths.
5. Generic classes in C++
6. JDBC
7. Producer and Consumer problem

HA (Survey)
1. Features popular among developers
2. Difficulties faced by developer community
3. **HA (Case Study)**
4. Real world systems which use c++ for its implementation
5. Real world systems which use java for its implementation

Assessment Scheme:

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

Text Books:

1. E. Balagurusamy; "Object oriented programming with C++"; 4th Edition,Tata McGrawHill.

2. Herbert Schildt; "Java: The Complete Reference"; 7th Edition, Tata McGraw Publication.

Reference Books:

1. R. Lafore; "The Waite Group's Object oriented Programming in C++"; 3rd Edition, Galgotia Publications.

2. E. Balagurusamy; "Programmmng with Java";5thEdition,Tata McGraw-Hill.

3. Cay S Horstmann, Gary Cornell; "Core Java 2 Volume – I ", 8th Edition, Pearson Education.

4. BjarneStroustrup ;" Object-Oriented Programming in C++ " ;4th Edition, Sams Publishing.

Moocs Links and additional reading material:

C++ Introduction | C ++ Tutorial | Mr. Kishore- Naresh Technology-
https://www.youtube.com/watch?v=l0qvxPPISuY&list=PLVlQHNRLflP8_DGKcMoRw-
TYJJALgGu4J

Programming in C plus plus – Prof P.P. Das- NPTEL- https://www.youtube.com/watch?

v=LZFoktwiars&list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY

Course Outcomes:

The student will be able to –

1. Understand object-oriented programming features

2. Develop real world applications using class, inheritance and polymorphism

3. Adapt Best Practices of Class Design by using Standard Templates Library

4. Solve computing problems by applying the knowledge of Exception handling and Multithreading

5. Design solutions by choosing suitable data structures such as Array, Vector, Map etc

6. Implement applications using Java I/O and event-based GUI handling principles

CO-PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2, PO3	PO3, PO5, PO7, PSO3	PO4, PO9	PO11	PO12, PSO1, PSO2
3	2, 3	3, 2, 2, 2	3, 1	1	2, 2, 3

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

CS2208::SOFTWARE DEVELOPMENT PROJECT –II

Course Prerequisites: C++ and JAVA

Course Objectives:

1. To develop problem solving ability using programming skills 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:.3.......   **Teaching Scheme Theory:…. Hours/Week**

Tut: Hours/Week

Lab:..6..Hours/Week

Course Relevance: Software project development comes under the category of project based learning (PBL). PBL is an instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world by using domain specific language technologies. PBL is "learning by doing."

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 PBL 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**.**

Teacher's Role in PBL :

- Teacher is not the source of solutions; rather he will 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.

Selection of Project/Problem:

- The problem-based project oriented model for learning is recommended. 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.
- There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and structure of the activity.
- Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.
- Activities may include- Solving real life problems, investigation, /study and Writing reports of in depth study, field work.

Student's Role in PBL:

- Students must have the ability to initiate the task/idea .They should not be mere imitators.
- They must learn to think.
- Students working in PBL must be responsible for their own learning.
- . Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PBL are actively constructing their knowledge and understanding of the situation
- Students in PBL are expected to individually.

Developing Inquiry Skills:

- Students in PBL 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

Sample Software Project Statement based on Java and Mobile Application Development

 1) Design and deploy an android app for real time criminal detection on the basis of database provided by the police department.

2) Design and deploy an android app for real time health alarm generation like Aarogya Setu.

3) Design and deploy a system for real time home kitchen accidents and appliances control.

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

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, PO3	PO2, PO8, PO11, PO12, PSO3, PSO4	PO3, PO4, PSO1	PO5, PO8	PO6,7,9,12	PO12, PSO1, PSO2
3, 3	3, 2, 2, 2, 3, 3	2, 2, 1	2, 2	2, 2, 2, 1	2, 3, 3

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

CS2210::ENGINEERING DESIGN AND INNOVATIONS-IV

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 ……?
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- ·   How to prepare the search?   How to carry out the research
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 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

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 2020-21

Prepared by: - Board of Studies in Computer Engineering

Pattern "C20"

T. Y. B. Tech. Computer

Engineering AY 2020-21

Module V Courses

CS3201::COMPUTER NETWORK TECHNOLOGY

Course Prerequisites: Data Communications

Course Objectives:

1. To understand packet switching architectures of networking reference models.

2. To learn communication framework working for TCP and UDP protocols.

3. To analyze the working of application layer protocols.

4. To learn front end, client side, server side and back end technologies.

5. To develop three tier websites using client side, server side and back end technologies

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

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance: The key technology of the information age is communications. Computer network is a truly global area of study, both because the technology enables global communication over telephone lines and the Internet. Computer Networks and 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. Most of the jobs available in the IT industries are web technology related.

SECTION-1

Network Layer: Review of OSI and TCP/IP Models. Functions of network layer, Switching Techniques: Circuit and Packet Switching. Network Layer Protocols: IP Protocol, ICMP Protocol, Logical Addressing: IPv4 and IPv6 is addressing, Subnetting, NAT, CIDR. IP, ICMP, Routing Protocols: Distance Vector, Link State, and Path Vector. Routing on the Internet: RIP, OSPF and BGP. Congestion Control and QoS. Transport Layer: Virtual and Datagram Circuits, Berkeley Sockets, Addressing, Connection Establishment, Connection Release, Flow control and Buffering, Multiplexing. HTH Layer Protocols: TCP, TCP Timer management, UDP. Quality of Service: TCP Congestion Control. Traffic Shaping: AIMD. 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).

SECTION-2

Web Development Process, Front End Tools: Introduction to web technology, internet and www, Web site planning and design issues, HTML5: structure of html document, HTML elements: headings, paragraphs, line break, colors& fonts, links, frames, lists, tables, images and forms, , CSS, Bootstrap , XML. **Client Side Technologies:** HTML5 forms Validation, JavaScript: Overview of JavaScript, Data types, Control Structures, Arrays, Functions and Scopes, 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. Introduction to JSON. **Server Side Technologies:** PHP: Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, File Handling, Exception Handling, E-mail, MySQL with PHP, AJAX

List of Tutorials: (Any Three)

1)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

2)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

3)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

4)Examples of Application Layer

(a)DNS: URL Domain Processing

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

(c)CDN

5)Examples of html and CSS

6)Examples of html form validation

(a)Email Validation

(b)Mob No Validation

7) Examples of Bootstrap and XML

8) Examples of JavaScript and JQuery

9) Examples of PHP

10) Examples of PHP and MySQL

List of Practical's: (Any Six)

1)Setting up small computer networks:

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, Assigning unique IP addresses and sharing C drive on each machine.

2)Installation of Web server:

Installation and configuration web server using Apache Tomcat for Linux. Hands on for network commands - ping, ipconfig, ifconfig, arp, netstat, nbtstat, nslookup, route, traceroute, tracert, nmap and access the web pages from another computer.

3) TCP Socket Programming using Single Thread

Write a program using TCP sockets for following

       a. Say Hello to Each other

       b. File transfer

       c. Calculator

Capture the packets between client and server using Wireshark Packet Analyzer Tool for peer to peer mode.

4) UDP Socket Programming using Single Thread

Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines. Capture the packets between client and server using Wireshark Packet Analyzer Tool for peer to peer mode.

5) Understanding protocol stack of Intranet

Analyze packet formats of Ethernet, IP, TCP and UDP captured through Wireshark for wired networks.

6)Distance Vector Routing Protocol

Write a program to find the shortest path using Bellman Ford Equation for Distance Vector Routing Protocol which is used by Routing Information Protocol (RIP).

7)Link State Routing Protocol

Write a program to find the shortest path using Dijkstra's Equation for Link State Routing Protocol which is used by Open Shortest Path First Protocol (OSPF) in the Internet.

8) Preparation of TCP, IP Packets (Demo Assignment)

Write a program to prepare TCP and UDP packets using header files and send the packets to the destination machine in peer to peer mode. Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode.

9) Develop a basic web page using the HTML tags you learned in class.

10) Create an admission Template form for VIT admission Process? Perform the validation for email and phone no fields

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

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

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

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

15) Create three MySQL database tables and write php scripts to read, insert & delete data

16) 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

List of Projects:

1.TCP based Multithreaded HTTP client server

2.TCP based Multithreaded FTP client server

3.UDP based Multithreaded TFTP client server

4.TCP based Multithreaded SMTP and POP3 mail client server

5.TCP based Multithreaded Chat client server

6.UDP based Multithreaded Chat client server

7.UDP based Multithreaded Audio Conferencing client server

8.UDP based Multithreaded Video Conferencing client server

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

10.Simulation of AODV routing protocol using NS2/NS3/OMNet

11. Cloud based file sharing platform

12. Develop a Website with NLP as a backend

13. Student Grievance System

14. Workflow Management System for MNC

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

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

17. GST Billing Software for Small Business

18. Online Crime Reporting System using PHP

19. Develop an Online College Voting System

20. Develop an Online Loan Processing System for Farmers.

List of Course Seminar Topics:

1. IP Addressing using CIDR

2. IP Addressing using IPv6

3. RIP implementation for campus network

4. OSPF implementation in Internet

5. BGP implementation in Internet

6. Simple Network Management Protocol implementation in Internet

7. Evolution of Web Technology

8. CSS and Bootstrap

9. JavaScript and JQuery

10. JSON and AJA**X**

11. Cookies & Sessions

12. PHP and MySQL

List of Course Group Discussion Topics:

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

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

3. 10G Ethernet (Encoding Framing, Modulation, Multiplexing, Diameter etc)

4. IEEE802.11b protocol based on HR-DSSS for wireless physical layer standard

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

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

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

8. Evolution of web technologies

9.HTML v/s XML

10.JavaScript and PHP

11. 21st Century Web Technologies

12. Sql Vs MangoDB

13. Internet Privacy

List of Home Assignments:

Design:

1. RIP Routing Protocol using packet tracer

2.OSPF Routing Protocol using packet tracer

3.BGP Routing Protocol using packet tracer

4.Front end and Back end Design for Student Grievance System

5. IGRP Protocol

Case Study:

1. RFC for wired TCP

2. RFC for wireless TCP

3. RFC for HTTPS

4.Emerging Web Technology

5.Databases for Servers

6. A case study of JQuery used in any real-time healthcare web application

Blog

1. Internet Logical Addressing

2. Internet Routing Protocols

3. Applications Layer Protocols

4. Frond End Technologies

5. Client Side Technologies

6. Server Side Technologies

7. Web Services

Surveys

1.IEEE 802.1 Physical layer standard for Internet

2. IEEE 802.3 Ethernet Standard for LAN

3. IEEE 802.11 Wireless Standard for Wi-FI

4. Survey on Frond End Technologies

5. Survey on Client Side Technologies

6. Survey on Server Side 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.

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

Comprehensive Viva Voce - 20 Marks

Text Books: *(As per IEEE format)*

1. *Andrew S. Tenenbaum, "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. *Achyut Godbole & Atul Kahate," Web Technologies: TCP/IP to Internet Application Architectures" , McGraw Hill Education publications, Third Edition, 2016*

4. *Ralph Moseley & M. T. Savaliya, "Developing Web Applications", Wiley publications, Second Edition, 2014*

Reference Books: *(As per IEEE format)*

1. *Fourauzan B., "Data Communications and Networking", 5th edition, Tata McGraw- Hill, Publications, 2006*

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

3. *C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols" Prentice Hall, 2004*

4. *Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, ISBN: 0-470-09510-5*

5. *Adam Bretz& Colin J Ihrig, "Full Stack Javascript Development with MEAN", SPD, First Edition 2015, Indian Reprint September 2015*

6. *GiulioZambon, " Beginning JSP, JSF and Tomcat", Apress Publication, Second Edition, 2013*

7. *Jeremy McPeak& Paul Wilton," Beginning JavaScript", Wrox Publication, Fifth Edition, 2015*

Moocs Links and additional reading material:

www.nptelvideos.in, w3schools.com, www.coursera.com

Course Outcomes:

1. Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols
2. Demonstrate sustainable engineering practice indicating the scientific purpose and utility of communication frameworks and standards.
3. Develop Client-Server architectures and prototypes by the means of correct standards, protocols and technologies.
4. Understanding web technology architectures for TCP/IP service networks.
5. Design of small case websites using front end, server side and backend technologies.
6. Development of enterprise websites web sites using client side frameworks, server side and backend technologies.

CO PO Map

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

CO attainment levels

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

Future Courses Mapping:

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

High Performance Networks, Wireless Networks, Mobile Networks, IoT

Job Mapping:

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

Software Engineer, Web Developer, IT Engineer, Network Administrator

CS3203::SYSTEM SOFTWARE

Course Prerequisites: Computer Organization, Data Structure

Course Objectives:

1. Understand structure & function of Operating System
2. Learn CPU scheduling algorithms
3. Deal with deadlock
4. Learn memory management techniques.
5. Understand different system software's & their functionalities.
6. Design device drivers for Linux.

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

                                                               Tut: 1 Hours/Week

                                                               Lab: **2** Hours/Week

Course Relevance:

Systems software are programs that manage the resources of the computer system and simplify applications programming.

They include software such as the operating system, database management systems, networking software, translators, and software utilities.

This course is considered as core subject as it supports the hardware abstraction to users.

SECTION-1

Introduction to OS: What is OS, functions of OS, OS Services, System Calls, Types of system calls Types of OS, Structures of OS: Monolithic, Layered, Virtualization

Processes: Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control. Threads: Multithreading models, Thread implementations, threads, Symmetric Multiprocessing. Concurrency: Issues with concurrency, Principles of Concurrency Mutual Exclusion: H/W approaches, S/W approach, OS/Programming support: Semaphores, Mutex and Monitors. Readers-Writers problem, Producer Consumer problem, Dining Philosopher problem.

Process Scheduling: Uni-processor Scheduling, Scheduling: Preemptive, Non preemptive,

Long-term, Medium-term, Short term scheduling. Scheduling Algorithms: FCFS, SJF, RR, Priority.

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

SECTION-2

Memory Management: Memory Management concepts: Memory Management requirements, Memory Partitioning: Fixed, Dynamic Partitioning, Buddy Systems Fragmentation, Paging, Segmentation, Address translation.

Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit.

Virtual Memory: Concepts, Swapping, VM with Paging, Page Table Structure, Inverted Page Table, Translation Lookaside Buffer, Page Size, VM with Segmentation, VM with Combined paging and segmentation.

Page Replacement Policies: FIFO, LRU, Optimal, Clock.

Introduction to System Software: Introduction, software types, software hierarchy, components of system software, machine structure, interfaces, address space, levels of system software, recent trends in software development. Language processors: Programming languages and language processors, fundamentals of language processing, life cycle of a source program, language processing activities, data structures for language processing: search data structures, allocation data structures.

Introduction to Device Driver: Requirements of Device Drivers, Role of Device Drivers, Classes of Devices, Security issues, Design issues, PCI Bus Drivers, The Peripheral Component Interconnect (PCI) Interface, Peripheral component interconnect (PCI) addressing, Boot time, Configuration registers and initialization, Linux PCI initialization, Old-style PCI probing, USB Drivers.

List of Tutorials: (Any Three)

1) Linux simple & advanced commands

2)   Shell Script

3) Classical Problems of Synchronization

4) CPU Scheduling Algorithms

5) Deadlock Prevention, Avoidance, detection algorithms

6) Memory Cache Mapping techniques

7) Memory placement strategies

8) Memory Page replacement algorithms

9) Disk Scheduling Algorithms

10) Device Drivers

List of Practical's: (Any Six)

1) Write a shell script.
2) Solve Classical Problems of Synchronization using mutex & semaphore.
3) Implementation of CPU Scheduling Algorithms.
4) Implementation of Deadlock Prevention, Avoidance, detection algorithms
5) Implementation of Memory placement strategies – best fit, first fit, next fit & worst fit.
6) Implementation of Page replacement algorithms
7) Implementation of Disk Scheduling Algorithms
8) Write a device driver for char device
9) Write a device driver for block device
10) Write a device driver for network device

List of Projects:

1.. Design and implementation of a multi programming operating system phase 1

i. CPU/ Machine Simulation

ii. Supervisor Call through interrupt

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

i. Paging

ii. Error Handling

iii. Interrupt Generation and Servicing

iv. Process Data Struc

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

i. I/O Channels

ii. Multiprogramming

iii. I/O Spooling

4. Design multi programming operating system phase 1 with arithmetic & logical instruction

5.Design multiprogramming operating system phase 3 without swapping

6. Design multi programming operating system phase 3 with swapping

7. Write a linux character device driver module that implements the open(), close(), read() and write() system calls for a character device.

8. Write a device driver on linux system.

9. Design a kernel module for linux/ unix

10. Design & Implementation of DLL on Linux shared library.

List of Course Seminar Topics:

1. Android Operating System
2. Paging & Segmentation in Windows OS
3. Linux Architecture
4. Linux Administration
5. Windows Administration
6. Android Administration
7. Device Administration in Windows 10
8. System Calls
9. DLLs in Linux
10. DLLs in Windows

List of Course Group Discussion Topics:

1.Types of operating systems

2. Structure & function of OS

3. Types of CPU scheduling algorithms

4. Desktop OS & mobile OS

5. Memory management in Desktop OS & mobile OS

6. Process management in Desktop OS & mobile OS

7. Device management in Desktop OS & mobile OS

8. Deadlock recovery techniques

9. Deadlock prevention & avoidance strategies

10. Deadlock avoidance & detection strategies

11. File system in desktop OS & mobile OS.

List of Home Assignments:

Design:

1.   I/O Management
2.   File Management
3.   Disk Scheduling
4.   File Management
5.   File System

Case Study:

1. Process Management in Linux
2. Process Management in Androi
3. Memory Management in Linux
4.   Memory Management in Android
5. Process Management in Windows

Blog

1. File System of Windows
2. File System of Linux
3. File System of Android
4. File System of iOS
5. Memory Management in Windows

Surveys

1. Mobile OS used in Smart Phones
2. OS used in data centers
3. Distributed OS & applications
4. Device Drivers for various devices

Suggest an assessment Scheme:

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

Group Discussion - 15 Marks
End Semester Examination - 10 Marks

Comprehensive Viva Voce - 20 Marks

Text Books: *(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.*

3. *D M Dhamdhere; "Systems Programming & Operating Systems"; Tata McGraw Hill Publications, 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. *Yashavant Kanetkar; "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 , Atul Kahate; "Operating Systems", 3 rd Edition, McGraw Hill.*

5. *Robert Love, " Linux System Programming " ;O'Reilly, ISBN 978-0-596-00958-8*

6. *Mahesh Jadhav; " Easy Linux Device Driver "; HighTechEasy publishing, Second edition.*

7. *Ray Duncan; "Advanced MSDOS programming"; Microsoft press*

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

https://nptel.ac.in/courses/106/105/106105214/

Course Outcomes:

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

2) Demonstrate knowledge in applying system software and tools available in modern operating system.

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

4) Identify the mechanisms to deal with Deadlock.

5) Understand the organization of memory and memory management.

6) Discriminate among different System software and their functionalities.

CO PO Map

CO1- PO2(2)

CO2-PO3(3)

CO3-PO4(3)

CO4- PO10(2)

CO5-PO12(1)

CO6-PSO3(3)

CO attainment levels

 CO1-5

CO2-2

CO3-3

CO4-2

CO5-1

CO6-4

Future Courses Mapping:

 Distributed Operating Systems

High Performance Computing

Distributed Computing

Compiler Design

Job Mapping:

System Administrator (Linux)

Quality Engineer

Operating System Analyst

Data Developer

CS3202 :: ARTIFICIAL INTELLIGENCE

Course Prerequisites: Mathematics, Data Structures

Course Objectives:

1. To introduce the concepts, techniques and building blocks of Artificial Intelligence.

2. To evaluate the searching Techniques and its implementation

3. To Analyze planning techniques and its applications in developing solutions to real-world problems.

4. To apply information gained through knowledge representation and uncertainty to a given situation

5. To generate an ability to design, analyze and perform experiments on real life problems using various AI Techniques.

6. To build artificial intelligence models and implement in real life scenario.

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

                                           Tut: 1 Hours/Week

                                           Lab: **2** Hours/Week

Course Relevance:

Artificial intelligence (AI) is currently one of the hottest buzzwords in tech and with good reason.

The last few years have seen several techniques that have previously been in the realm of science fiction slowly transformed into reality.

The importance of Artificial Intelligence has been increasing as a growing number of companies are using these technologies to improve their products and services, evaluate their business models, and enhance their decision-making process.

SECTION-1

Fundamentals of Artificial Intelligence: Introduction, A.I. Representation, Non-AI and AI Techniques, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, structure of agents, problem solving agents, and problem formulation.

Searching: Depth First Search, Breadth First Search, Generate and test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means-Ends Analysis. Game playing: Minimax Search, Alpha-Beta Cutoffs.

Planning: Blocks world, STRIPS, Implementation using goal stack, Partial Order Planning, Hierarchical planning, and least commitment strategy. Conditional Planning, Continuous Planning.

SECTION-2

Knowledge Representation: Knowledge based agents, Wumpus world, Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, First order Logic: Representation, Reasoning Patterns, Forward and Backward Chaining. Basics of PROLOG: Representation, Structure, Backtracking, Expert System, MYCIN, DART, ZOON,

Uncertainty: Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Forward rules and Backward rules, Justification based Truth Maintenance Systems, Semantic Nets Statistical Reasoning, Markov Networks.

List of Tutorials: (Any Three)

1) Intelligent Agents and Environments

2) Uninformed searching Techniques

3) Informed searching Techniques

4) Gaming

5) Planning

6) Blocks world

7) STRIPS

7) Wumpus world

8) Propositional Logic

9) Expert System

10) Chat bots and Robotics

List of Practical's: (Any Six)

1. Tic-Tac-Toe Game playing

2. Analysis of AI and Non-AI technique by implementing any two player game.

3. Implement Uninformed (Exhaustive) searching Technique/s

4. Implement Informed (Heuristic) searching Technique/s

5. Implement steepest ascent hill climbing for 8-puzzle/other application

6. Wumpus world

7. Propositional Logic

8. Expert System

9. Chat bots and Robotics

10. Implement simple hill climbing for 8-puzzle / other application

11. Analysis of Constraint satisfaction Problems.

12. Implement Robotic hand

13. Implement Perception model for detection

List of Projects:

1   Inventory management E Commerce

2   stock market price prediction

3   Identification / detection

4   Product Delivery Drones

5   Pick and drop robotic arm

6   Arrangement of blocks

7   Smart city water / light management system

8   Human Tracking system

9   Automatic Interview Conduction system

10 Student Information Chatbot Project.

11. Product Review Analysis For Genuine Rating.

12 Customer Targeted E-Commerce

13 College Enquiry Chat Bot

14 Artificial Intelligence HealthCare Chatbot System

15   Intelligent Tourist System Project

List of Course Seminar Topics:

1) Basic Concepts Artificial Intelligence

2) Intelligent Agents

3)Uninformed searching Techniques

3) Informed searching Techniques

4) Gaming Techniques

5) Planning Techniques

6) Applications of AI

7) Wumpus world

8) Propositional Logic

9) Expert System

10) Chat bots

11) AI Robots

List of Course Group Discussion Topics:

1. Artificial Intelligence and Machine Learning

2. Artificial Intelligence and Data science

3. Artificial Intelligence applications

4. Artificial Intelligence future

5. Artificial Intelligence after 10 years / 2030

6. Uninformed searching and Informed searching Techniques

7. Chatbots and Recommender systems

8. Will Automation and AI Reduce or Increase Jobs.

9. Cashless Economy using AI

10. AI in covid-19 situations

List of Home Assignments:

Design:

1. AI Accessibility Design
2. Best Artificial Intelligence Design for any one application
3. AI Customer Experience Design
4. AI Data-Informed Design
5. AI Decision Architecture
6. AI application Designing for Children
7. AI Designing for Senior Citizens
8. AI in eCommerce Design
9. AI Enterprise UX Design
10. AI Experience Design

Case Study:

1. How Mercedes Is Preparing For The 4th Industrial Revolution using AI

2. How Indian Retail Giant Is Using AI And Robots To Prepare For The 4th Industrial Revolution

3. Rolls-Royce And Google Partner To Create Smarter, Autonomous Ships Based On AI

4. The Amazing Ways Tesla Is Using Artificial Intelligence And Big Data

5. The Incredible Ways John Deere Is Using Artificial Intelligence To Transform Farming

Blog

1. AI Trends

2. AI Research

3. AI Chatbot

4. Chatbot Magazine

5. AI Medical / Agriculture

Surveys

1. Adaption of AI in 2020

2. AI in Industry

3. AI in Digital Marketing

4. AI in Gaming

5. AI after Covid-19

Suggest an assessment Scheme:

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

Comprehensive Viva Voce - 20 Marks *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.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

Course Outcomes:

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

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

2. Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc)

3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).

4. Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

5. Use various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent.

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

www.eduplus.in

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO4	PO5	PO6	PO10	PSO3
2	3	3	2	1	3

CO attainment levels

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

Future Courses Mapping:

Artificial Neural Networks, Machine Learning, Soft Computing, Deep Learning.

Job Mapping:

 AI Scientist, AI Developer, AI Designer,

CS3208::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: Hours/Week

Lab: **2** Hours/Week

Course Relevance:

The increased use of digital technologies and interconnection of these devices has widely increased.

This increase of internet use is leading towards the frouds on the internet due to malicious intentions.

It is need of time to understand the various types of attacks, attack goals and reasons for the attack such as vulnerability etc.

Also it is also important to know the various ways by which information can be secured at the time of transmission.

It is very important to have in- depth knowledge about the authentication of the users on the system developed, authorization is also important.

As the crime increases the security expert must be able to know the crime has happened or not, how to detect it. What are the various application layer issues for security? This gives the scope of relevance of the study of this course**.**

SECTION-1

Introduction to Attacks and Hacking: Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services. Trustworthiness, Ethical issues and practices, Tradeoffs of balancing key security properties - Confidentiality, Integrity, Availability. Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks. Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing, Introduction to Ethical Hacking, Anonymity, Information Gathering, Scanning Networks, Vulnerability Analysis, Operating System Hacking, Hacking Wireless Networks,

Cloud Hacking, IoT Hacking,

Cryptography:

Private key cryptography: Mathematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm), algebraic structures (Groups, Rings, Fields, Polynomial Field). Role of random numbers 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. Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack. Elliptic Curve Cryptography (ECC): Elliptic Curve over real numbers, Elliptic Curve over Zp, Elliptic Curve arithmetic. Diffie-Hellman key exchange using ECC.Chinese remainder theorem.

SECTION-2

Authentication and Authorization: Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control, SHA-512, Kerberos, X.509 authentication service

IP Security, Session Management, Web Security, Database Security, File Security, Mobile Security

Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer

Security, HTTPS standard, Secure Shell (SSH) application

Email security: PGP and SMIME

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

Cyber Security: Cyber Attack, Cyber Reconnaissance, Crimes in Cyber Space-Global Trends & classification, e-commerce security, Computer forensics, facebook forensic, mobile forensic, cyber forensic, digital forensic, Introduction to MQTT and CoAP for IoT.

List of Practical's: (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.

HA:10 Lab 10 CP 10 PPT 15 GD 15 MSE 10 ESE 10 CVV 20

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 attainment levels

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

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

CS3211: ENGINEERING DESIGN

Course Prerequisites: Problem Based Solving

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

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

Tut: 2 Hours/Week

Lab:....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 guidelines 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 world problems using an 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).

Topic and Content: Research in computational biology using CPython

Ecology, Next-generation Sequencing, Clinical Oncology Next-generation Sequencing, Sanger sequencing for DNA, Next-generation sequencing (NGS) for DNA, Illumina next-generation sequencing (INGS) method is based on sequencing-by-synthesis (SBS), and reversible dye-terminators for DNA, genomic DNA, Polymerase chain reaction (PCR), library construction, Southern blotting Southern blotting laboratory technique to detect a specific DNA sequence in a blood or tissue sample., hybridizations, Single nucleotide polymorphisms (SNP), SNP analysis, Molecular diagnostic assays, Sequence comparison and phylogenetic reconstruction, Complex analysis with proteomics data.

List of Practical's: (Any Six)

 1) Study of protein, population genetics, big genomics dataset

2) Biopython – Hand's on to use bioinformatics library of CPython

3) PyVCF – Use of bio library for Next-generation Sequencing processing and analysis

4) Pysam – Use bio library for SAM and BAM processing and analysis

5) HTSeq – Use of bio library for Gnome NGS processing and analysis

6) SimuPop – Use of bio library for population genetics simulation

7) DendroPY – Use of bio library 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.

To focus on the higher levels of the Bloom's 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.*
3. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro*

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, PO5	PO4, PO5, PO8	PO6, PO7, PO9, PO11	PO12, PSO1,PSO2, PSO4
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

CS3209:ENGINEERING DESIGN AND INNOVATION-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 "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

Module VI courses

S3205::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.

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

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance: This is a foundational course for Computer science and Engineering. This course develops algorithmic thinking capability of students. Designing algorithms using suitable paradigm and analysing the algorithms for computational problems has a high relevance in all domains where computer science plays a crucial role (equally in Industry as well as research). This course is also an essential pre-requisite for advanced domain specific algorithmic courses such as Algorithmic Graph Theory, Algorithmic Number Theory, Computational Geometry, Motion planning and Robotics, etc, to give a few examples.

Once the student gains expertise in Algorithm design and in general gains ability of Algorithmic thinking, it facilitates in systematic study of any other domain (in computer science or otherwise) which demands logical thinking.

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

SECTION-1

Basic introduction and time and space complexity analysis:

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

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

Dynamic Programming: General strategy, simple dynamic programming based algorithms to compute Fibonacci numbers, binomial coefficients, Matrix Chain multiplication, Optimal binary search tree (OBST) construction, Coin change problem, 0-1 Knapsack, Traveling Salesperson Problem, All pair shortest path algorithm, Longest increasing subsequence problem, Largest independent set for trees.

SECTION-2

Greedy and Backtracking strategy:

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

Backtracking: General strategy, n-queen problem, backtracking strategy for some NP-complete problems (e.g. graph coloring, subset sum problem, SUDOKU)

 Introduction to complexity classes and NP-completeness:

Complexity classes P, NP, coNP, and their interrelation, Notion of polynomial time many one reductions reduction, Notion of NP-hardness and NP-completeness, Cook-Levin theorem and implication to P versus NP question, NP-hardness of halting problem. NP-Complete problems

(some selected examples from - Satisfiability problem, Circuit-SAT, 3-CNF SAT, vertex cover problem, independent set problem, clique problem, Hamiltonian-circuit problem, subset sum problem, Integer Linear Programming.), reducing NP problems to Integer Linear Programming**.**

Introduction to Randomized and Approximation algorithms:

Introduction to randomness in computation, Las-Vegas and Monte-Carlo algorithms, Abundance of witnesses/solutions and application of randomization, solving SAT for formulas with "many" satisfying assignments, randomized quick sort, Las-Vegas and Monte-Carlo algorithms for majority search, Karger's Min-cut algorithm, coupon collector problem, randomized data structures (randomized BST, skip lists)

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

List of Tutorials: (Any Three)

1) Problem solving based on asymptotic notations, solution of recurrences

2) Problem solving based on Divide and Conquer strategy

3) Advanced problem solving based on Divide and Conquer strategy

4) Problem solving based on Dynamic Programming strategy

5) Advanced problem solving based on Dynamic Programming strategy

6) Problem solving based on Greedy strategy

7) Problem solving based on Backtracking strategy

8) Proving correctness of algorithms: some techniques

9) Adversary lower bound technique

10) Problem solving based on complexity classes, NP-completeness.

11) Randomized Algorithms

12) Approximation Algorithms

List of Practical's: (Any Six)

1) Assignment based on some simple coding problems on numbers, graphs, matrices

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

3) Assignment based on Divide and Conquer strategy (e.g. majority element search, finding kth rank element in an array)

4) Assignment based on Divide and Conquer strategy (e.g. efficient algorithm for Josephus problem using recurrence relations, fast modular exponentiation)

5) Assignment based on Dynamic Programming strategy (e.g. Matrix chain multiplication, Longest increasing subsequence)

6) Assignment based on Dynamic Programming strategy (e,g, All pair shortest path, Traveling Sales Person problem)

7) Assignment based on Greedy strategy (e.g. Huffman encoding)

8) Assignment based on Backtracking (e.g. graph coloring, n-queen problem)

9) Assignment based on Las-Vegas and Monte-Carlo algorithm for majority element search

10) Assignment based on factor-2 approximation algorithm for metric-TSP

List of Projects:

1. Applications of A* algorithm in gaming

2. Pac-Man game

3. File compression techniques

4. Solution of Maze (comparing the backtracking based solution and Dijkstra's algorithm)

5. Different exact and approximation algorithms for Travelling-Sales-Person Problem

6. Creation of Maze using backtracking

7. Knight tour algorithms

8. Network flow optimization and maximum matching

9. AI for different games such as minesweeper, shooting games, Hex, connect-4, sokoban, etc

10. SUDOKU solver

11. Graph theoretic algorithms

12. Computational Geometry Algorithms

13. AKS primality testing

14. Algorithms for factoring large integers

15. Randomized algorithms for primality testing (Miller-Rabin, Solovay-Strassen)

16. Slider puzzle game

List of Course Seminar Topics:

1. Divide and Conquer Vs Dynamic Programming

2. Greedy strategy

3. NP-hardness

4. Backtracking strategy

5. Dynamic Programming Vs Greedy

6. Computational Complexity

7. Philosophical relevance of P Vs NP question

8. Complexity classes

9. Space complexity

10. Compression Techniques

11. Real world applications of Graph theoretic algorithms

12. Approximation algorithms

13. Hardness of approximation

14. Pseudorandom number generators

List of Course Group Discussion Topics:

1. Greedy Algorithms

2. Dynamic Programming strategy

3. Dynamic Programming Vs Greedy

4. NP-completeness

5. P Vs NP question

6. Algorithm design paradigms

7. Different Searching techniques

8. Backtracking strategy

9. Relevance of Cook-Levin theorem

10. Randomness in computation

11. Approximation Algorithms

12. Application of Recursion

List of Home Assignments:

Design:

1. Problem solving based on Divide and Conquer strategy

2. Problem solving based on Dynamic Programming strategy

3. Problem solving based on Greedy strategy

4. Problem solving based on Backtracking strategy

5. Problems on Randomized Algorithms

6. Problems on Approximation Algorithms

7. Problems on NP completeness

Case Study:

1. AKS primality test

2. Quadratic sieve factoring algorithm

3. Huffman Encoding, LZW encoding

4. Network flow optimization algorithms

5. Approximation algorithms for TSP

5. Cook-Levin theorem and its relationship with intractability of computational problems

7. Sorting techniques

Blog

1. Approximation Algorithms

2. Randomized Algorithms

3. Computational Geometry Algorithms

4. Number Theoretic Algorithms

5. Graph Theoretic Algorithms

6. P Vs NP Problem

7. Complexity classes

8. Greedy Algorithms

9. Divide and Conquer Vs Dynamic Programming

Surveys

1. Primality Testing Algorithms

2. Integer Factoring Algorithms

3. NP-complete problems

4. Compression Techniques

5. Shortest Path Algorithms

6. Algorithms for finding Minimum Weight Spanning Tree

6. SAT solvers

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

2. Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson, 1ˢᵗ edition, 2005. ISBN 978-81-317-0310-6

3. Dasgupta, Papadimitriu, Vazirani "Algorithms" McGraw-Hill Education; 1 edition (September 13, 2006), ISBN-10: 9780073523408, ISBN-13: 978-0073523408

Reference Books: *(As per IEEE format)*

1. Motwani, Raghavan "Randomized Algorithms", Cambridge University Press; 1 edition (August 25, 1995), ISBN-10: 0521474655, ISBN-13: 978-0521474658

2. Vazirani, "Approximation Algorithms", Springer (December 8, 2010), ISBN-10: 3642084699, ISBN-13: 978-3642084690

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

Course Outcomes:

The student will be able –

1) To formulate computational problems in abstract and mathematically precise manner

2) To design efficient algorithms for computational problems using appropriate algorithmic paradigm

3) To analyze asymptotic complexity of the algorithm for a complex computational problem using suitable mathematical techniques.

4) To establish NP--completeness of some decision problems, grasp the significance of the notion of NP--completeness and its relationship with intractability of the decision problems.

5) To understand significance of randomness, approximability in computation and design randomized algorithms for simple computational problems and design efficient approximation algorithms for standard NP-optimization problems.

6) To incorporate appropriate data structures, algorithmic paradigms to craft innovative scientific solutions for complex computing problems.

CO PO Map:

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 Courses Mapping:

Following courses can be learned after successful completion of this course:

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

Job Mapping:

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.

CS3204::AUTOMATED SOFTWARE ENGINEERING

Course Prerequisites: Data Structures

Course Objectives:

1. To summarize capabilities and impact of Software Development Process Models and justify process maturity through application of Software Engineering principles and practices

2. To discriminate competing and feasible system requirements indicating correct real world problem scope and prepare stepwise system conceptual model using stakeholder analysis and requirement validation.

3. To formulate system specifications by analyzing User-level tasks and compose software artifacts using agile principles, practices and Scrum framework

4. To compose system analysis and design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented analysis and design principles and Model Driven Engineering practices using UML-supported modeling tools.

5. To comprehend the nature of design patterns by understanding a small number of examples from different pattern categories and apply these patterns in creating a correct design using design heuristics

6. To propose multi-faceted defendable solutions demonstrating team-skills accommodating design patterns reducing the potential cost and performance impedance in order to realize system artifacts with the help of Model Driven Development practices using, scheduling, estimation and risk management activities.

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

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: Given that software engineering is built upon the foundations of both computer science and engineering, a software engineering curriculum can be approached from either a computer science-first or software engineering-first perspective; there clearly is merit in both approaches. Software engineering spans the entire software lifecycle - it involves creating high-quality, reliable programs in a systematic, controlled, and efficient manner using formal methods for specification, evaluation, analysis and design, implementation, testing and maintenance. any software products are among the most complex of man-made systems, requiring software development techniques and processes that successfully scale to large applications which satisfy timing, size, and security requirements all within acceptable timeframes and budgets. For these reasons, software engineering requires both the analytical and descriptive tools developed in computer science and the rigor that the engineering disciplines bring to the reliability and trustworthiness of the systems that software developers design and implement while working cohesively in a team environment.

SECTION-1

Software Engineering Paradigms: Overview of Software Engineering, Software Process Framework, Traditional Process Models, Process Models: Code-and-Fix, Waterfall Model, Rapid Application Development, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Cleanroom Methodology, Component-Based Software Engineering, CMMI, Software Engineering Principles and Practices, Requirements Engineering Tasks, Requirement Elicitation Techniques, Software Requirements: Functional, Non-Functional, Domain Engineering activities, Requirements Characteristics and Characterization, Eliminating Requirement Ambiguities, Conflict Identification and Resolution, Requirement Qualities, Requirement Specification, Requirement Traceability, Requirement Prioritization, Relationship of Requirement Engineering to other Framework Activities, System Scope Determination and Feasibility Study, Statement of Work Generation, Requirements Verification and Validation, Requirement Maturity, Technical Reviews, Stakeholder Management

Overview of Agile Methodology: Introducing Agile in Practice, Landscape of Agile and Planned Methods, Agile Challenges in Practice, Composite Agile Method and Strategy (CAMS), Composite Agile and IT: Enablement, Development, and Maintenance, Collaborative-Agile Business Management, Business Analysis and Composite Agile, CAMS Project Management and ICT Governance, Agile Adoption in Organizations. Time-Boxing, Kanban, and Theory of Constraints, Lean IT, Pair Programming, Extreme Programming, DSDM, User Requirements in the context of Agile

The Scrum: Scrum Origins: What Is Scrum? Scrum Origins, Why Scrum? Scrum Framework, Agile Principles, Overview, Variability and Uncertainty, Sprints., Requirements and User Stories, Product Backlog, Estimation and Velocity, Technical Debt, Roles: Product Owner, ScrumMaster, Development Team, Scrum Team Structures, Managers, Planning: Scrum Planning Principles, Portfolio Planning, Envisioning (Product Planning), Release Planning (Longer-Term Planning), Sprinting: Sprint Planning, Sprint Execution, Sprint Review, Sprint Retrospective, Scrum and Service Industry

SECTION-2

System Behavior Specification: Static Behavior: Use Cases, Use Case Diagram Components, Use Case Diagram, Actor Generalization, Include and Extend, Template for Use Case Narrative, Building Domain Model, and capturing system behavior in use cases, Use cases and User Stories, Dynamic Behavior: Sequence diagrams, object lifelines and message types, Modeling collections multiobjects, Refining sequence diagrams, Collaboration diagrams, States, events and actions, Nested machines and concurrency, Modifying the object model to facilitate states, Modeling methods with activity diagrams, Activity Diagrams: Decisions and Merges, Synchronization, Iteration, Partitions, Parameters and Pins, Expansion Regions, Swimlanes, concurrency and synchronization, Communication Diagram, Interaction Overview Diagrams, Timing Diagrams

Software Architecture Design and Configuration Management: Analysis Concepts, Analysis Methods, The Design Model, Design Qualities, Characteristics of Design activities, Design Principles, Cohesion and Coupling, Software Architecture Vs Software Design, Software Reuse, Design Heuristics, User Interface Design: Rules, User Interface Analysis and Steps in Interface Design, Design Evaluation, Source Code Management,

Foundations of Software Architecture, Reference Architectures, Architectural Design: Software Architecture, Data Design and Architectural Design, Views, Viewpoints, Perspectives, Conceptual Architecture View, Module Architecture View, Execution Architecture View, Code Architecture View, Architecture styles: Repository, Layered, Pipe-Filter, Call-Return, Peer-Peer, Publish-Subscribe, Client-Server, Two-Tier, Three-Tier, N-Tier, Heterogeneity in Architecture, Categorizing classes: entity, boundary and control , Modeling associations and collections, Preserving referential integrity, Achieving reusability, Reuse through delegation, Identifying and using service packages, Improving reuse with design Packages and interfaces: Distinguishing between classes/interfaces, Exposing class and package interfaces,

Project Management Principles and Design Patterns:, Design Patterns: Introduction to Design Pattern, Describing Design Patterns, Catalogue of Design Patterns Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Structural Patterns: Adapter, Bridge, Composite, Decorator, Facade, Flyweight, Proxy, Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Antipatterns, Applications of Design Patterns, Project Management Activities, Structures and Frameworks, Teamwork, Leadership, Project Planning, Project Scheduling, Risk Analysis, Introduction to Function Points, Empirical Estimation, COCOMO II model.

List of Tutorials: (Any Four)
1.   Study of Requirement Engineering
2.   Study on preparation of System Requirement Specification
3.   Scrum Artifacts

4.   User Stories and Use Case
5.   Product Backlog Development
6.   Burn-up and Burn-down chart development and management
7.   Software System Analysis and Design: UML
8.   Incorporation of Design patterns

List of Practical's: (Any Eight)
1. A real-world problem issue is required to be identified with manageable scope. The problem scenarios are required to be identified for target system to be developed. The scenarios are stated in the form of Statement-of-Work template. The SOW document shall address the vision, goals, and objectives of the project.
2. The initial requirements and feature set for the target system is required to be identified. The requirements are required to be synthesized with stakeholder participation. The project roles are assigned to the project team with clear indicator of responsibilities. The initial requirements summary document with adequate and minimal infrastructure is required to be developed using multiple iterations.
3. The product backlog for the project aimed at maintaining a prioritized queue of project requirements shall be created.
   a. It should be dynamic and should be continuously groomed as the project progresses. Agile projects generally use an iceberg strategy for grooming the product backlog.
   b. The items that are near the top of the iceberg and are closest to going into development should get the most attention.
   c. There should typically be about two to three sprints worth of stories at the top of the backlog that are well-groomed and ready to go into development in order to avoid a situation where the project team is waiting for work to do.
4. Sprint-level planning activity accommodating story points, planning poker shall be performed. The Sprint-plan and Sprint-design indicating detailed activity planner shall be developed.
5. To decompose and organize the problem domain area into broad subject areas and identify the boundaries of problem/system. Specify the behavior of the target system and map requirements to Use cases.
   a. The System Context Diagram depicts the overall System behavioral trace and Requirement Capture diagram depicts the hierarchical Use case Organization. The Use Case diagram should encompass
   b. Actors (External Users)
   c. Transactions (Use Cases)
   d. Event responses related to transactions with external agents.
   e. Detection of System boundaries indicating scope of system.
6. To depict the dynamic behavior of the target system using sequence diagram. The

Sequence diagram should be based on the Scenarios generated by the inter-object Communication. The model should depict:
   a. Discrete, distinguishable entities (class).
   b. Events (Individual stimulus from one object to another).
   c. Conditional events and relationship representation.
7. To depict the state transition with the life history of objects of a given class model. The model should depict:
   a. Possible ways the object can respond to events from other objects.
   b. Determine of start, end, and transition states.
8. To depict the dynamic behavior using detailed Activity diagram. Activity is a parameterized behavior represented as coordinated flow of actions. The flow of execution is modeled as activity nodes connected by activity edges.
   a. A node can be the execution of a subordinate behavior, such as an arithmetic computation, a call to an operation, or manipulation of object contents.
   b. Activities may form invocation hierarchies invoking other activities, ultimately resolving to individual actions.
9. To develop logical static structure of target system with Software Class diagram. To prepare Class Collaboration-Responsibility (CRC) cards for the Conceptual classes traced from System analysis phase. The design model should depict
   a. Relationship between classes: inheritance, Assertion, Aggregation, Instantiation
   b. Identification of objects and their purpose.
   c. Roles / responsibilities entities that determine system behavior.
10. To enhance Software Class diagram to Architecture diagram with appropriate design patterns. The patterns selected shall be justifiable and applied to individual and distinct hierarchies. Suitable Architectural Styles shall be selected and the structural elements shall be well-documented.

To represent physical module that provides occurrence of classes or other logical elements identified during analysis and design of system using Component diagram. The model should depict allocation of classes to modules. To narrate precise Program Design Language constructs separating computation from interface. To represent deployment view of the system through Architecture Diagram.

List of Projects:
   1. Automated Parking lot identifier
   2. Health Care Softwires
   3. Financial Domain
   4. Appraisal Systems
   5. Automate Project Administration System
   6. Translator for Agriculture System

7. Development of applications manageable by Agile

Development of SMART applications

List of Course Seminar Topics:
1. Agile software development
2. AI and software engineering
3. Apps and app store analysis
4. Automated reasoning techniques
5. Autonomic and (self-)adaptive systems
6. Big data
7. Cloud computing
8. Component-based software engineering
9. Computer-supported cooperative work
10. Configuration management and deployment
11. Crowd sourced software engineering
12. Cyber physical systems
13. Data-driven software engineering
14. Debugging

Dependability, safety, and reliability

List of Course Group Discussion Topics:
1. Distributed and collaborative software engineering
2. Domain modeling and meta-modeling
3. Education
4. Embedded software
5. Emerging domains of software
6. Empirical software engineering
7. End-user software engineering
8. Fault localization
9. Formal methods
10. Green and sustainable technologies
11. Human and social aspects of software engineering
12. Human-computer interaction
13. Knowledge acquisition and management
14. Machine learning for software engineering
15. Middleware, frameworks, and API

List of Home Assignments:
Design:
1. Software visualization
2. Specification and modeling languages
3. Tools and environments
4. Traceability
5. Ubiquitous and pervasive software systems
6. Validation and verification

Case Study:
1. Software economics and metrics
2. Software engineering for machine learning
3. Software evolution and maintenance
4. Software modeling and design
5. Software process
6. Software product lines

Blog
1. Mining software engineering repositories
2. Mobile applications
3. Model-driven engineering
4. Parallel, distributed, and concurrent systems
5. Performance
6. Program analysis
7. Program comprehension
8. Program repair
9. Program synthesis
10. Programming languages
11. Recommendation systems
12. Refactoring

Surveys
1. Requirements engineering
2. Reverse engineering
3. Safety-critical systems
4. Scientific computing
5. Search-based software engineering
6. Security, privacy and trust
7. Software architecture
8. Software reuse
9. Software services
10. Software testing

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.

MSE(15)+ESE(15)+HA(10)+LAB(10)+CP(10)+CVV(20)+SEMINAR(10)+GD(10)

Text Books: *(As per IEEE format)*

1. *Ian Sommerville, 'Software Engineering', Addison-Wesley, 9th Edition, 2010, ISBN-13: 978-0137035151.*
2. *Kenneth S. Rubin, Essential SCRUM: A Practical Guide To The Most Popular Agile Process, Addison-Wesley, ISBN-13: 978-0-13-704329-3, 2012*
3. *Tom Pender, "UML Bible", John Wiley & sons, ISBN – 0764526049*

Reference Books: *(As per IEEE format)*

1. *Soren Lauesen, Software requirements: Styles and techniques, Addison Wesley, ISBN 0201745704, 2002*
2. *Dean Leffingwell, Agile Software Requirements, Addison-Wesley, ISBN-13: 978-0-321-63584-6, 2011*
3. *Charles G. Cobb, The Project Manager's Guide To Mastering Agile: Principles and Practices for an Adaptive Approach, Wiley Publications, ISBN: 978-1-118-99104-6 (paperback), ISBN 978-1-118-99177-0 (epdf), 2015*
4. *Grady Booch, James Rambaugh, Ivar Jacobson, "Unified Modeling Language Users Guide", 2nd Edition, Addison- Wesley, ISBN – 0321267974*
5. *Erich Gamma, Richard Helm, Ralph Johnson, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, ISBN-10: 0201633612 ISBN-13: 978-0201633610*
6. *Paul Clements, Felix Bachmann, Len Bass, David Garlan, Documenting Software Architectures: Views and Beyond Addison-Wesley Professional 2003, ISBN-10:0201703726, ISBN-13: 9780201703726*

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

 www.nptelvideos.in
www.coursera.com

www.udemy.com

Course Outcomes:

1. Summarize capabilities and impact of Software Development Process Models and justify process maturity through application of Software Engineering principles and practices focusing tailored processes that best fit the technical and market demands of a modern software project.
2. Discriminate competing and feasible system requirements indicating correct real world problem scope and prepare stepwise system conceptual model using stakeholder analysis and requirement validation.
3. Formulate system specifications by analyzing User-level tasks and compose software artifacts using agile principles, practices and Scrum framework along with Propose and demonstrate realistic solutions supported by well-formed documentation with application of agile roles, sprint management, and agile architecture focusing project backlogs and velocity monitoring.
4. Compose system analysis and design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented analysis and design principles and Model Driven Engineering practices using UML-supported modeling tools.
5. Comprehend the nature of design patterns by understanding a small number of examples from different pattern categories and apply these patterns in creating a correct design using design heuristics, published guidance, applicability, reasonableness, and relation to other design criteria resulting in well-documented system profiles to the engineering and social community.
6. **Propose multi-faceted defendable solutions demonstrating team-skills accommodating design patterns reducing the potential cost and performance impedance in order to realize system artifacts with the help of Model Driven Development practices using, scheduling, estimation and risk management activities.**

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO3	PO4	PO8	PO11	PSO1
2	3	3	2	1	3

CO attainment levels

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO3	PO4	PO8	PO11	PSO3
1	5	2	3	3	4

Future Courses Mapping:

Software testing and Quality Assurance, Service-oriented Software

Job Mapping:

Application Architect, Project Designer, SCRUM Role Players

CS3206 :: DATA SCIENCE

Course Prerequisites: Data Structures, Mathematics and Statistics

Course Objectives:

1   To learn the concepts of descriptive, prescriptive and predictive data analysis.

2   To apply quantitative modelling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.

3   Apply ethical practices in everyday business activities and make well-reasoned ethical business and data management decisions.

4   Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.

5   Apply principles of Data Science to the analysis of business problems to build machine intelligence.

6   Demonstrate use of teamwork, leadership skills, decision making and organization theory.

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

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance:

The principal purpose of Data Science is to find patterns within data.

It uses various statistical techniques to analyze and draw insights from the data.

From data extraction, wrangling and pre-processing, a Data Scientist must scrutinize the data thoroughly.

Then, he has the responsibility of making predictions from the data.

The goal of a Data Scientist is to derive conclusions from the data.

Through these conclusions, he is able to assist companies in making smarter business decisions.

SECTION-1

Introduction: Data, Big Data, characteristics of Big Data, Data Analytics Lifecycle, structured, unstructured and semi structured data, Data representation, data storage, LaGrange's methods, interpolation, Data Scientist Role, application areas.

Descriptive Statistics: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity, Data Visualization, Prescriptive analysis.
Data Pre-processing: An Overview, Data Cleaning, Data normalization, Data Integration, Data Reduction, Data Transformation and Data Discretization
Predictive Analytics: Linear Regression, Logistic Regression, Association Rules, Optimization Techniques, Hypothesis Testing, confidence interval, Sampling theory and Standard Error.

SECTION-2

Classification: Supervised learning, Bayesian Classification, k-Nearest Neighbours (k-NN), Decision tree, Support Vector Machines, Neural Networks, Overfitting/Underfitting, bagging / boosting and ensemble methods, Classifier performance measures, confusion matrix, Cross validation.
Clustering and Outlier Detection: Unsupervised learning, K-means algorithm, hierarchical clustering, Interpretation of clusters and validation, Introduction to outlier detection. Model Planning, Model Building, Decision Support Systems. Chatbots, Recommender systems.

List of Tutorials: (Any Three)

1.   Preprocessing of data: consider 10 data samples: Calculate Mean, mode, Median, Standard deviation and Normalized Values.

2.   Min Max Normalization: consider 10 data samples: Calculate Normalized Values.

3.   Linear Regression: consider 8 trees with different height and trunk diameter. Calculate correlation coefficient. Build a mathematical model and calculate tree height if the new trunk diameter is known.

4.   Sampling: Consider iris dataset and apply all types of sampling techniques.

5.   Hypothesis testing: apply Null and alternate hypotheses on given statements or problems.

6.   Detection and classification: design one best model for Detection and classification of

fruits.

7.   Clustering: consider 10 persons height and weight and group using K=2 and K=3.

8.   Decision Support Systems

9.   Real time applications: Recommender system

List of Practical's: (Any Six)

1   Getting Started with Python installation and first program
2   Data pre-processing and normalization.
3   Correlation and Linear regression analysis.
4   Data optimizations Using Genetic algorithms.
5   Classification of diabetic Data using SVM
6   K-means clustering on any one type of UCI Machine learning dataset / Kaggle dataset
7   Social media analysis: Twitter/Facebook/WhatsApp: sentiment analysis.

8   Building Hadoop Map Reduce Application for counting frequency of words/phrases in simple text file.

9 Creating List in python: merging two lists, adding matrices in lists, adding vectors in list.

10 Manipulating and Processing Data in Python: merging data sets, sorting data, plotting data, managing data using matrices and data frames

11 Sentiment Analysis of WhatsApp / twitter / facebook data using Python

List of Projects:

1   Visit a nearby retail shop, discuss how they are analyzing data, find out limitations and propose solutions for better profit.

2   IMD Movie Analysis

3   Creditworthiness of Customers

4   Fraud Detection

5   Social Media Listening

6   Telecom Churn

7   Retail-Giant Sales Forecasting

8   Interactive Marketing Campaign Analysis

9   Inventory management E Commerce

10   Stock market price prediction

11   Product Delivery Drones

12   Smart city water / light management system

13   Human Tracking system

14   Automatic Interview Conduction system

15   Sentiment analysis

16   Customer Targeted E-Commerce

17   Spam detection

18   Recommenders systems

List of Course Seminar Topics:

1. Cyber-crime detection from online social media data

2. Text and product label reading for blind persons

3. Network Intrusion Detection

4. Hate speech recognition

5. Time series data analytics

6. Smart voting system support through face recognition

7. Emotion detection system

8. AWS Data analysis

9. Tsunami Warning system

10. Real time speech recognition

11. Data science future

List of Course Group Discussion Topics:

   1. Machine Learning Vs Data science

   2. Management information system and Data science

   3. Artificial Intelligence and Data science

   4. Artificial Intelligence applications

   5. Artificial Intelligence future

   6. Artificial Intelligence after 10 years / 2030

   7. Uninformed searching and Informed searching Techniques

   8. Chatbots and Recommender systems

   9. Will Automation and Data science Reduce or Increase Jobs.

   10. Cashless Economy using Data science

11. Data science in covid-19 situations

12. Image classification vs. video classification

13. Descriptive Prescriptive Analysis

14. Regression and Generalization

List of Home Assignments:

Design:

    1   DS Accessibility Design

    2   Best DS for any one real time application

    3   DS Customer Experience Design

    4   DS Data-Informed Design

    5   DS Decision Architecture

    6   DS Designing for Senior Citizens

    7   DS in ecommerce Design

    8   DS Enterprise UX Design

    9   DS Experience Design

    10   Sentiment analysis design

    11   Fitness prediction

    12   Fake news detection

    13   Credit card fraud detection

    14   Road vehicle traffic analysis

    15   Crime detection

Case Study:

1. ELKAN Medicine

2. How Indian Retail Giant Is Using Data science to Prepare For The 4th Industrial Revolution

3. Rolls-Royce And Google Partner To Create Smarter, Autonomous Ships Based On Data science.

4. The Amazing Ways Tesla Is Using Big Data and Data science

5. The Incredible Ways John Deere Is Using Data science to Transform Farming

6 . RealDirect (online real estate firm)

7.. Voice quality measurement

8. Home security

9. Tracking and positioning of Human

10. Customer retention

Blog

1. DS Trends

2. DS Research

3. DS sentimental analysis / Chatbot

4. Chatbot Magazine

5. AI Medical / Agriculture

6. NLP applications

7. Energy prospecting

8. Weather/climate change monitoring

9. Entertainment pattern identification

10. Agriculture Industry trends

Surveys

1. Adaption of DS in 2020

2. DS in Industry

3. DS in Digital Marketing

4. DS in Gaming

5. DS after Covid-19

6. DS Agriculture

7. IBM Watson

8. Crowd sourced analytics

9. supply chain analytics and issues

10. Data Science for smart cities

11. Data Science in supply chain management

Suggest an assessment Scheme:

HA, PPT, GD, ,MSE, ESE, LAB, CVV

Text Books: (As per IEEE format)

1   Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2 Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufman, ISBN 978-81-312-0535-8, 2nd Edition.

3 David Dietrich, Barry Hiller, "Data Science & Big Data Analytics", EMC education services, Wiley publications, 2012

4 Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.

Reference Books: (As per IEEE format)

1 *Peng, Roger D and Elizabeth Matsui, "The Art of Data Science." A Guide for   Who Works with Data. Skybrude Consulting 200 (2015): 162.*

2   Evans, James R., and Carl H. Lindner, "Business analytics: the next frontier for decision sciences." Decision Line 43.2 (2012): 4-6.

3   James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer, 2013.

4   Albright, Winston "Business Analytics: Data Analysis and decision making" Cengage Learning

5   Sahil Raj, "Business Analytics" , Cengage Learning

6 Camm, Cochran, Fry, Ohlmann, Anderson, Sweeney, Williams, "Essentials of Business Analytics" Cengage Learning

Moocs Links and additional reading material:

https://nptel.ac.in/courses/106/106/106106179/

https://nptel.ac.in/courses/110/106/110106064/

https://www.coursera.org/specializations/jhu-data-science

https://www.coursera.org/professional-certificates/ibm-data-science

Course Outcomes:

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

1   Select appropriate data visualizations to clearly communicate analytic insights to business sponsors and analytic audiences

2   Deploy the Data Analytics Lifecycle to address big data analytics projects

3   Reframe a business challenge as a Data scientist / developer

4   Apply appropriate analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results

5   Use tools such as: R and R Studio, MapReduce/Hadoop, in-database analytics,

6   Explain how advanced analytics can be handled to create competitive applications.

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO3	PO4	PO7	PO11	PSO3
2	3	3	2	1	3

CO attainment levels

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

Future Courses Mapping:

Data Analytics, Business Analytics, Artificial Neural Networks, Machine Learning, Deep Learning.

Job Mapping:

Data Analyst, Data Scientist, Data Designer, Data Developer

CS3207::COMPILER DESIGN

Course Prerequisites: Automata Theory (Grammar)

Course Objectives:

1. Understand the process of program execution cycle.

2. Understand the translation process from High Level Languages to Machine Level Language.

3. Know the syntax and semantic analysis approaches for efficient code/program verification.

4. Learn the methods of code generation which helps for the optimization.

5. Learn code optimization and runtime code synthesis.

6. Know the process of compiler design for emerging programming languages.

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

Tut: Hours/Week

Lab:...2.Hours/Week

Course Relevance:

All high level programming languages are easy for users to understand but not understood by a computing machine. The computing machine knows only binary data.

A translation is required, in this case, to convert higher level language into machine level, so that the intended program could execute.

This translation is done by using a compiler. This course will give you detailed insights of how compilers function internally and design it efficiently.

This gives freedom to design your own programming language with its compiler.

SECTION-1

Compilers: Introduction to compiler phases, introduction to cross compiler, features of machine-dependent and independent compilers, overview of types of compilers. Interpreters: compiler vs. interpreter, phases, and working, Preprocessor: header file and macro expansion.
Assembler: Elements of assembly language programming, design of the assembler, assembler design criteria, types of assemblers, two-pass assemblers, one-pass assemblers, assembler algorithms, multi-pass assemblers, variants of assemblers design of two-pass assembler, machine-dependent and machine-independent assembler features.
Linkers: Relocation and linking concepts, static and dynamic linker, subroutine linkages.
Loaders: Introduction to the loader, loader schemes: compile and go, general loader scheme, absolute loaders, relocating loaders, direct linking loaders, MS DOS linker.
Lexical Analysis and introduction to Syntax Analysis: Introduction to Compiler, Phases and Passes, Bootstrapping, Role of a Lexical Analyzer, Specification and Recognition of Tokens, LEX/FLEX, Expressing Syntax, Top-Down Parsing, Predictive Parsers. Implementing Scanners, operator precedence parsers.
Syntax and Semantic Analysis: Bottom-Up Parsing, LR Parsers: constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, YACC/BISON Type Checking, Type Conversion. Symbol Table Structure.

SECTION-2

Syntax-Directed Translation and Intermediate Code Generation: Syntax-Directed Definitions, Bottom-Up Evaluation, Top-Down Translation, Intermediate Representations, Intermediate Code Generation. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors, semantic errors. More about translation: Array references in arithmetic expressions, case statements, introduction to SSA form
Code Generation: Issues in Code Generation, Basic Blocks and Flow Graphs, Next-use information, A simple Code generator, DAG representation of Basic Blocks, Peephole Optimization. Generating code from dags.
Code Optimization and Run-Time Environments: Introduction, Principle Sources of Optimization, Optimization of basic Blocks, Introduction to Global Data Flow Analysis, Runtime Environments, Source Language issues. Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing
Machine Dependant Optimization: Instruction (Basic-Block) scheduling algorithm, Instruction selection algorithm, Register allocation techniques, peephole optimizations
Introduction to Data flow analysis: Introduction to constant propagation, live range analysis

Case studies: LLVM compiler Infrastructure, Power of SSA, compiling OOP features, Compiling in multicore environment, Deep learning compilation

List of Practical's: (Any Six)

1) LEX/FLEX specification and programming regular expressions

2) Add line numbers to lines of text, printing the new text to the standard output using LEX/FLEX.

3) Implement LEX/FLEX code to select only lines that begin or end with the letter 'a' and delete everything else.

4) Implement LEX/FLEX code to count the number of characters, words and lines in an input file.

5) Implement LR/SLR/LALR Parser.

6) Implement Syntax directed Translator.

5) Convert all uppercase characters to lowercase except inside comments.

6) Change all numbers from decimal to hexadecimal notation, printing a summary

statistic (number of replacements) to stderr.

7) Implement Lexical Analyzer for language C-.

8) YAAC specifications and implement Parser for specified grammar.

9) Implement Parser for language C-.

10) Implement an Intermediate code generator (three address code and Quadruples)

List of Projects:

1. Compiler for subset of C using Lex and YAAC

2. Compiler for Subset of Java programming Language

3. Intermediate Code generator

4. Code Optimizer

5. Develop an Editor for Assembly programming. (Use available Assembler MASM/TASM to compile the code and execute in editor)

6. Design a system to check syntax and semantics of English Language.

7. Design a system to check syntax and semantics of a subset of Logical programming Language.

8. Design a System to check syntax and semantics of a subset of Python programming language.

9. Compiler for subset of C++ programming language

10. Compiler for a subset of Algol programming language

List of Course Seminar Topics:

1. Tools complementary to Lex

2. Tools complementary to YAAC

3. Semantic Analyser

4. Obsolete programming Language compiler advantage and issues

5. Android App program compiler

6. Approaches of Intermediate Code generation

7. Recent Trends in Compiler

8. Recent Trends in Interpreter

9. Decompilation

10. Compilation in multicore machines

List of Course Group Discussion Topics:

1. Compiler Vs Interpreter

2. Multi Language Compiler

3. Tree structure for parsing

4. Decompilers: Good or Bad

5. Universal Compiler

6. Cross compiler

7. Alternate to parsers

8. Compiler challenges in mobile app development.

9. Online Compilers

10. Compilers in field of Game development

List of Home Assignments:

Design:

1. Recent methodologies in Intermediate Code Generator

2. Recent methodologies in Code Optimizer

3. Universal Compiler

4. Compiler for Deep learning

5. Recent trend in parsers

Case Study:

1. Algol Compiler

2. Compilation process(internals) of Functional Programming

3. Compilers for Mobile App development

4. LLVM compiler

5. Cross compiler

Blog

1. Decompilers: Ethical or Unethical?

2. Multiparadigm programming compiler

3. State of the Art tools for rapid compiler development

4. Compiler for parallel machines

5. Compiler for distributed computing

Surveys

1. Obsolete Programming Language Compilers

2. Obsolete Programming Language Interpreter

3. Compilers for various programming paradigms

4. Online compilers

5. Mobile app cross compiler

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.

HA:10 Lab 10 CP 10 PPT 15 GD 15 MSE 10 ESE 10 CVV 20

Text Books: *(As per IEEE format)*

1. *Aho, A.V., Lam, M.S., Sethi, R., & Ullman, J.D. (2006). Compilers: Principles, Techniques, and Tools, Addison Wesley, ISBN 978-81317-2101-8 (2nd Edition).*

2. *Cooper, K., & Torczon, L. (2011). Engineering a compiler. Morgan Kaufmann, ISBN 155860-698-X.*

3. *Appel, A. W. (2004). Modern compiler implementation in C. Cambridge university press.*

4. *Appel, A. W., & Jens, P. (2002). Modern compiler implementation in Java. In ISBN 0–521–58388–8. Cambridge University Press.*

5. *Appel, A. W. (1998). Modern Compiler Implementation in ML, In ISBN 0-521-60764-7. Cambridge University Press.*

6. *Raghavan, V. (2010). Principles of Compiler Design. Tata McGraw-Hill Education.*

Reference Books: *(As per IEEE format)*

1. *Muchnick, S. (1997). Advanced compiler design implementation. Morgan Kaufmann, ISBN 8178672413*

2. *Levine, J. R., Mason, J., Levine, J. R., Mason, T., Brown, D., Levine, J. R., & Levine, P. (1992). Lex & yacc. "O'Reilly Media, Inc".*

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

https://swayam.gov.in/nd1_noc20_cs13/preview

https://www.udacity.com/course/compilers-theory-and-practice--ud168

https://online.stanford.edu/courses/soe-ycscs1-compilers

Course Outcomes:

1) Design basic components of a compiler including scanner, parser, and code generator.

2) Perform semantic analysis in a syntax-directed fashion using attributed definitions.

3) Apply local and global code optimization techniques.

4) Synthesize machine code for the runtime environment.

5) Develop software solutions for the problems related to compiler construction.

6) Adapt themselves to the emerging trends in language processing.

CO PO Map

CO1-PO2 - 2

CO2-PO3 - 3

CO3-PO4 - 3

CO4-PO11 - 3

CO5-PO12 - 1

CO6-PSO3 - 3

CO attainment levels

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

Job Mapping:

Software Engineer, Compiler Developer

CS3211:: ENGINEERING DESIGN-I

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

Tut: 2 Hours/Week

Lab:....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 guidelines 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 à Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

 Topic and Content: Programming Robots and Drones Using C++ and Python

The MODBUS protocol, an industry standard, is used frequently throughout the robot industry. Robot-to-Robot communication method. ROS is an open-source, meta-operating system for your robot. Control logic for robots using infrared and ultrasonic sensors, Proximity sensors and light sensors. Communication architectures and protocols for networking unmanned aerial vehicles (UAV). Protocols - Common Data Link (CDL), Tactical Common Data Link (TCDL), Link-11, Link-14, Link-16, and Link-22, Micro Air Vehicle Communication Protocol (MAVLink) used for bidirectional communications between the drone and the GCS.

 List of Practical's:

Lab can be conducted in real and simulation mode.

Programming a simulated robot is analogous to programming a real robot.

1) Design layout with proximity and define all the states to simulate autonomous mobile robots.

2) Deploy the IR sensors in layout and achieve the communication among them

3) Deploy the Ultrasonic in layout and achieve the communication among them

4) Deploy other required sensors and achieve the communication among them

5) Design layout with proximity and define all the states to simulate autonomous mobile drone (Unmanned Aerial Vehicles-UAV).

6) Deploy the base station and achieve the communication with the sensors of UAV using point to point MAVLink protocol

7) Deploy the base station and achieve the communication with the sensors of UAV using point to multi point link protocol

...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.

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

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, PO5	PO4, PO5, PO8	PO6, PO7, PO9, PO11	PO12, PSO1, PSO2, PSO4
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

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

CS3210::ENGINEERING DESIGN AND INNOVATION-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 world problems using an interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards à Single Board Computers and IoT à Computational Biology (Biomedical and Bioinformatics)à Robotics and Drone à 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 : -

Lab can be conducted in real and simulation mode. Programming a simulated robot is analogous to programming a real robot.

1) Design and deployment of autonomous mobile robot in either real mode or simulation mode.

2) Design and deployment of unmanned aerial vehicles-UAV in either real mode or simulation using point to point protocol.

3) Design and deployment of unmanned aerial vehicles-UAV in either real mode or simulation using point to multipoint protocol.

...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 Blooms 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	PO3	PO4, PO5, PO8	PO6, PO7, PO9, PO11	PO12, PSO2, PSO3, 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

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 "D20"

Effective from Academic Year 2020-21

Prepared by: - Board of Studies in Computer Engineering

Module VII Courses

CS4203:: BUSINESS PROPOSAL WRITING

Course Prerequisites:

Course Objectives:

1. To understand basic bid and proposal management terminologies.

2. They will be able to conceptualize the entire process of bid and proposal management.

3. Know the techniques and tools for customer analysis and competitive intelligence.

4. Create business proposals with basic building blocks.

5. Can create customer centric theme statements.

6. Present a business proposal and defend it.

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

Introduction
The world of B2B Businesses, Pre-Scale Roles and Responsibilities, End to end bid management
Process including costing.
Focus on Customer
Compliance, Responsiveness, Client Analysis and competitive Intelligence, Strategies and win
themes,
Features, Benefits and Discriminators, Teaming/sub-contracting
Manage Processes
Proposal development cycle, Business approvals and reviews, lessons learnt
Elements of persuasive writing

Assertive writing, Headings, graphics and action captions, Page and document design, style
guides

CO-PO MAP:

CO1	CO2	CO3	CO4	CO5	CO6
PO1, PO8	PO2	PO5	PO7, PO8	PO10	PO11, PSO3
3, 1	3	2	2, 1	2	2, 3

CS4217:: HUMAN-COMPUTER INTERACTION

Course Prerequisites: Mathematics

Course Objectives:

1. To differentiate IT applications into categories based on measurable human factors

2. To study ethnographic observations in user community

3. To generate the awareness about usability standards and accessibility guidelines

4. To design user-friendly user interface with due consideration of interface theory and principles

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

6. To integrate web, CSCW and mobile app design approaches as per user requirement

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

Course Relevance:

Human-Computer Interaction (HCI) is a socio-technical course, with a goal of bringing the power of computers and communication systems to users, customers or people.

It aims to make all computing and communications systems more accessible, maintainable and useful in working, learning and recreational lives of users or people.

It helps every computing, web or mobile application to become really user-centric, increasing its users as well as related sales.

SECTION-1

Fundamentals of Human Computer Interaction (HCI): Definition of HCI, Interdisciplinary Nature, Related Disciplines, Goals of System Engineering, Usability, Types of Usability, User Interface (UI), Measurable Human Factors, Accessibility, Differently-abled Users, Accessibility Guidelines.

Interaction Concepts and Models: User Persona, User Categorization, Golden Rules of Interface Design, Miller's Principle, Norman's Action Model, Task Analysis - GOMS, Contextual Inquiry, Work Models, Interaction Styles, Empathy Maps.

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

Observations, Participatory Design, Internationalization, Interaction Design Patterns.

SECTION-2

Usability Evaluation: Expert-based Evaluation, User-based Evaluation, Formative Evaluation, Summative Evaluation, Heuristic Evaluation, Cognitive Walkthrough, Semiotic Analysis, Icon Categorization, User Surveys, Interviews, Usability Testing, Data Analysis, Statistical Methods.

Documentation and Groupware: Classification of Documents, Reading from Displays, Online Help, Tutorials, Error / Warning Messages, Groupware, Computer Supported Cooperative Work (CSCW), Dimensions of Cooperation, Asynchronous Interactions, Synchronous Interactions, Online Communities, Challenges with Online Communications.

Website and Mobile App Design: Content Design, Interaction and Navigation Design, Presentation Design, Differences in design approaches, Design and Evaluation Tools.

List of Course Seminar Topics:

1. Accessibility guidelines

2. Empathy maps

3. Internationalization

4. SIGCHI

5. Ethnography with IT applications

6. Design thinking

7. Participatory design

8. Color schemes in user interfaces

9. Design of home screens

10. Human errors

List of Course Group Discussion Topics:

1. Which is better - human skills or computer abilities?

2. What adds more value - aesthetics or gamification?

3. Are accessibility guidelines affordable?

4. Is multilingual support essential in mobile apps?

5. Should users be involved in the UI design process?

6. Is user-based evaluation better than expert-based evaluation?

7. Is heuristic evaluation more valuable than cognitive walkthrough?

8. Is internationalization essential in IT applications?

9. Are websites easier to design than mobile apps?

10. Are documents designed?

List of Home Assignments:

Design:

1. Social Network for Spiritual Users

2. App for Alzheimer's disease

3. Health Tracking App

4. Ration Card Management App

5. Innovative e-Commerce Platform

Case Study:

1. Chatbot in healthcare domain

2. Best food ordering app in India

3. Online teaching-learning process

4. Use of Twitter with Indian Users

5. User experience with car booking in India

Blog

1. Noise of Notifications

2. Challenges in Food Delivery Service

3. Need for Accessibility Guidelines

4. Usability of Autonomous Vehicles

5. Failure of Usability Testing

Surveys

1. User experience with video-conferencing apps

2. User errors on Social Networking Sites (SNS)

3. Challenges for hearing impaired users with IT applications

4. Most popular Indian mobile apps (Made in/by India)

5. Impact of ban on Chinese apps in India

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.

 MSE 30 ESE 30 CVV 30 HA 10

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 capture the ethnographic observations in user community

3) Students will be able to follow usability standards and accessibility guidelines

4) Students will be able to design user interfaces as per interface theory and user requirements

5) Students will be able to apply a suitable usability evaluation method to identify the usability issues

6) Students will be able to enhance UI designs as per desired web, CSCW or mobile app design approach

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO4	PSO2	PO3	PO8	PO10	PO11
3	3	3	2	2	1

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:

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

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

CS4219::INTERNET OF THINGS

Course Prerequisites: Microprocessor Hardware, Microcontroller

Course Objectives:

1. Learn the terminology, technology and its applications of IoT

2. Analyze Embedded suite widely used in IoT.

3 . Describe the concept of M2M with necessary protocols

4. Understand the cloud storage for IoT applications.

5. Optimize resources for different IoT applications

6. Understand Real world IoT Design constraint.

Credits: 02   **Teaching Scheme Theory: 02** 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-1

Introduction and Application to Internet of Things: Need of IoT, Towards the IoT, 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.

Embedded Suite for IoT: Introduction to Arduino and Raspberry Pi, Understanding the Arduino and Raspberry Pi board and its Components, recognizing the Input/output, GPIO connectivity.

WIRELESS TECHNOLOGIES supporting IoT:

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-2

IoT Networking: Star, Mesh, Tree, and Overview of networking Protocols: TCP/IP, 6LowPan, IoT Devices Application Level Protocol Service parameter in MQTT,

IoT: 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

Cloud Analytics for IoT Application:

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 Tutorials: (Any Three)

1)Introduction to the Internet of Things

2)How IoT works

3) Features of Internet of Things.

4)IoT Applications

5)Advantages of Internet of Things

6)Representative applications of IoT

7)Architectures for the IoT

8) Layered Architectures for the IoT

9)Relevant MAS concepts and techniques

10)Limitations of MAS concepts and techniques and directions for further research

List of Practical's: (Any Six)

1) LED Blinky
2) Switch
3) ADC
4) PIR, Ultrasonic sensor,IR Sensor, Flame Sensor interface with Microcontroller
5) MQ6 Sensor, Humidity sensor, Raindrop Sensor interface
6) Communication over Wifi through Node MCU
7) Voice Controlled Iot application
8) Serial Communication
9) PWM
10) Bluetooth Controlled application(Interfacing Bluetooth Module (HC-05)
11) Control through Android APP
12) RFID Interface
13)Use IOT Comm Protocol (MQTT)

List of Projects:

1.IoT Based Humidity and Temperature Monitoring Using Arduino Uno

2.IoT Weather Reporting system using Raspberry pi.

3.IoT Connected Healthcare Applications.

4.IoT Based Intelligent Traffic Management System

5.IoT Based Smart Parking System Using RFID

6.Smart Irrigation System Using IoT.

7. Waste and water management using IoT

8. Smart Healthcare Solution using IoT

9. Automatic Herbicides Sprayers

10. Fish Feeder

11. Green Corridor

12. Trusted high-quality elderly care

13. Gesture controlled Iot Application

List of Course Seminar Topics:

1.Authentication of Edge-Device in AWS IoT

2.How to Build a Complete IoT Solution with AWS- An Use Case Approach.

3.Exploring IoT Through a Use Case

4.Security Technologies behind SSL

5.A Look at the AWS IoT Ecosystem

6.Wireless Protocols for Internet of Things

7.Sensor Characteristics.

8.Manufacturing Intelligence

9.IoT in the Manufacturing industry

10.IoT and Machine Learning

11. IoT Communication Protocol selection based on application

12. Security and Privacy issue in internet of things

List of Course 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.

13. MQTT vs COAP protocol for IoT applications

List of Home Assignments:

Design:

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

Case Study:

1.IOT Real Time DashBoard

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

Blog

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 frst 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

10. Iot Applications in Logistics and Supply chain managements

11. Data management for IoT applications.

Surveys

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: MSE 30 ESE 30 CVV 30 HA 10

As per Institute directives.

Mid Sem Exam, End Sem Exam, Home Assignment, Course Project,Group Discussion

Seminar

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

3. 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 an additional reading material: <u>www.nptelvideos.in</u>

Course Outcomes:

The student will be able to

1.   Understand the application areas of IOT

2. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

3 . Understand building blocks of Internet of Things and characteristics of Sensors and Communication Devices

4. Implement state of the art architecture in IoT

5. Demonstrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

6. Compare and Contrast the use of Devices, Gateways and Data Management in IoT

7. Design and program IOT Devices

8. Implement Security protocols to prevent internal and External damage.

9. Design an IoT device to work with a Emerging and Adaptive Computing infrastructure.

10. Define the infrastructure for supporting IoT deployments.

11. Lead a team to achieve design goals and contribute significantly in smooth implementation of design

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO3	PO5	PO7	PO9	PO10	PSO3

CO attainment levels

PO3   --3, PO5 ---3, PO7 –2, PO9 ---2, PO10---1, PSO3---3

Future Courses Mapping:

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

Job Mapping:

1) All sectors of business from agriculture, transportation, health, manufacturing, resources, mining and retail to service sector are set to benefit from or at least be impacted by IoT.
2) IOT will offer Local governments   a great opportunity to provide a range of services that will not only improve the quality of life of its citizens but also improve the efficiency and profitability of state services.

CS4222::IMAGE PROCESSING

Course Prerequisites: Digital Signal Processing

Course Objectives:

1. Describe different color models and the need for those

2. Analyze image condition and deduce enhancement algorithms

3. Recognize geometric distortions in image and correct those

4. Learn different compression techniques

5. Understand different mathematical transforms and their properties

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

Course Relevance:

Vision sense is the most powerful human sense organ. In the world where intelligent automation is taking place, image processing is a vital domain for research and development.

In Industry 4.0, image processing systems built around industrial cameras are an essential component in automated production.

Throughout all steps of production, from the inspection of raw materials and production monitoring (i.e. flaw detection) to final inspections and quality assurance, they are an indispensable part of achieving high efficiency and quality standards.

 In the Entertainment Industry, latest trends such as 4K video streaming requires high quality compression that can provide limited/no loss image quality with high fps.

In social networking, sharing images has been a vital part. Creating innovative effects and overall manipulating the images will be explored.

SECTION-1

Topics and Contents

Introduction: Elements of image processing system, Scenes and Images, Vector Algebra, Human Visual System, color vision color model: RGB, HVS, YUV, CMYK, YCbCr and some basic relationships between pixels, linear and nonlinear operations. Image types (optical and microwave), Image file formats (BMP, tiff, jpeg,PIN, GIF,png, raster image format). Image sampling and quantization.

Image Enhancements: Memory-less operations, Convolution, Spatial domain image enhancements: Denoising filters, Smoothing Operation, Sharpening Operation, and Contrast stretching /enhancement, histogram and histogram equalization.

Frequency Domain Processing: 2 dimensional Fourier transform of an image, filtering in Fourier domain.

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

SECTION-2

Topics and Contents

Morphological Operation: Binary Morphology, Erosion Dilation, Opening and Closing.

Object Recognition: Feature points and feature detection (Line, circle and corner). Line detection: RANSAC, Hough Transform. Corner detection: Harris Corner Detector. Feature descriptors, Descriptor matching. SIFT, SURF.

Image compression: Introduction and need, Coding redundancy, classification of compression techniques (Lossy and lossless- JPEG, Run Length Coding, Huffman Coding, Shannon fano coding).

List of Course Seminar Topics:

1.   Challenges in Automated Video Surveillance

2.   Tumor detection in MRI images

3.   Eye gaze tracking for HMI: Pros, cons and implementation

4.   Roll of image processing in Industry 4.0

5.   Parallelism for performance enhancement in image processing

6.   Vision based ADAS

7.   Computational photography

8.   Computational microscopy

9.   Automatic navigation using Visual SLAM

10.   Animoji

List of Course Group Discussion Topics:

1.   Lines Vs. Corners as features

2.   Hough Transform for line detection Vs. RANSAC

3.   Fourier domain denoising Vs. Spetial domain denoising

4.   Kernel size Vs. Speed of operation

5.   Histogram equalization Vs. Gamma correction

6.   OTSU Vs Adaptive thresholding

7.   Compression techniques

8.   Color models

9.   SIFT Vs SURF

10.Roll of image processing in security

List of Home Assignments:

Design:

1. Design an algorithm to identify fault in a "PCB inspection system" as shown below
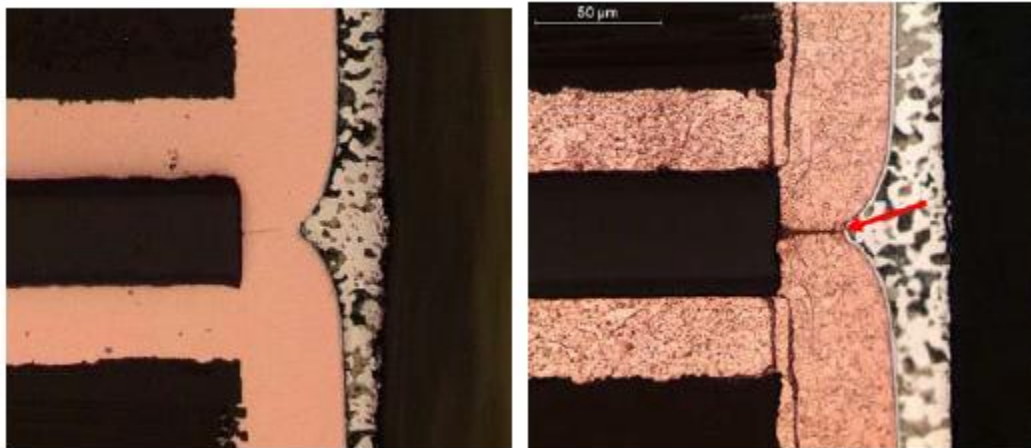
2. Design an algorithm to perform segmentation of the image below to extract the mango from its background
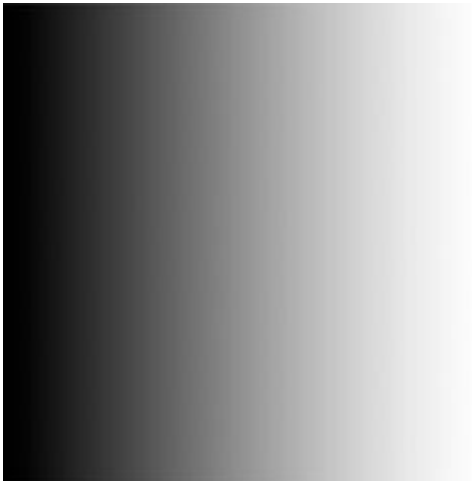

3. Design an algorithm to get from image 1 to image 2

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

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

Case Study:

1.   Cam-scanner: Document scanning app

2.   Tesseract OCR library

3.   Instagram filters

4.   OpenCV

5.   Google Street View

Blog

1.   Image processing on Embedded platforms

2.   Face recognition system security analysis for authentication

3.   Image processing in MSME for effective automation

4.   H.264 codec for image streaming

5.   Role of mathematics in image processing

Surveys

1. Image quality metrics
2. Vision based self driving car safety
3. Compression techniques & codecs
4. State of the art applications such as AR/ XR

Human recognition in social networking apps like Facebook

Suggest an assessment Scheme:

MSE 30 ESE 30 CVV 30 HA 10

Text Books: *(As per IEEE format)*

1. *Rafael Gonzalez & Richard Woods, "Digital Image Processing," 3rd Edition, Pearson publications, ISBN 0132345633.*

2. *Anil K. Jain, "Fundamental of Digital Image Processing," 5th Edition, PHI publication, ISBN 13: 9780133361650.*

Reference Books: *(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.
3.K. D. Soman and K. I. Ramchandran, "Insight into wavelets - From theory to practice," 2nd Edition PHI, 2005.

Moocs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:

The student will be able to

1.Apply various corrective geometric transforms on a distorted image. (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 (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   CO6-5

Future Courses Mapping:

Augmented Reality

Multimedia Processing

Job Mapping:

Augmented Reality Experience Designer

Automation Engineer

Embedded Software Developer

Image Processing Expert

CS4213::NETWORK 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. Formulate mathematical solutions to security problems

6. Articulate the security threats to critical infrastructures

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

Course Relevance: Digitization and widespread use of internet communication, most of the users on the network are vulnerable to the various attacks. It is need of time to know the various types of attack and vulnerabilities which lead to attack. Also it becomes of paramount importance to study the techniques to secure the network and transfer of data through the network. It is very important at this time to know how to secure the transmission of the data.

SECTION-1

Introduction to Attacks and Hacking: Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services. Trustworthiness, Ethical issues and practices, Tradeoffs of balancing key security properties - Confidentiality, Integrity, and Availability. Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks. Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing,

Cryptography:

Private key cryptography: Mathematical background for cryptography: modulo arithmetic,

GCD (Euclids algorithm), algebraic structures (Groups, Rings, Fields, Polynomial Field). Role of random numbers 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.

SECTION-1I

Public key cryptography: RSA: RSA algorithm, Key generation in RSA, attacks on RSA. Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack. Elliptic Curve Cryptography (ECC): Elliptic Curve over real numbers, Elliptic Curve over Zp, Elliptic Curve arithmetic. Diffie-Hellman key exchange using ECC. .

Authentication and Authorization: Network Access Control: Network Access Control, Extensible Authentication Protocol, SHA-512, Kerberos, X.509 authentication service

IP Security, Database Security, File Security, Mobile Security

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

Email security: PGP and SMIME

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. Dark web

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 block chain related issues/ cryptocurrency/ application systems developed using block chain

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:

MSE 30 ESE 30 CVV 30 HA 10

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: <u>www.nptelvideos.in</u>

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 the current environment on a continuous basis for the benefit of society.
6) Analyze various types of threats in the networking attack.

CO attainment levels

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

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

CS4201::CLOUD COMPUTING

Course Prerequisites: Operating Systems, Fundamentals of Computer Networks

Course Objectives:

1. To become familiar with Cloud Computing and its ecosystem

2. To learn basics of virtualization and its importance

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

4. To give a technical overview of Cloud Programming and Services.

5. To understand security issues in cloud computing

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

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

SECTION-1

Introduction to Cloud Computing: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Evolution of cloud computing

Cloud Computing Architecture: Cloud versus traditional architecture, Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), , Public cloud, Private cloud, Hybrid cloud, Community cloud, Google Cloud architecture, The GCP Console, Understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs

Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Storage options in the cloud, Structured and unstructured storage in the cloud, unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a

NoSQL document store, Cloud Bigtable as a NoSQL option

SECTION-2

Platform as a Service (PaaS): Introduction to PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine

Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS,

Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing and accounting, Billing in GCP

Cloud Security: Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM.

Cloud Network : Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, Multiple VPC networks, Building hybrid clouds using VPNs, interconnecting, and direct peering, Different options for load balancing.

List of Course Seminar Topics:

1. Storage Cost Optimization On Cloud

2. Cloud Security And Cryptography

3. Infrastructure As A Code (IAC)

4. Cloud Computing In Healthcare

5. Serverless Architecture

6. Deployment Of Microservices In Kubernetes Engine

7. RPA Using AWS Cloud

8. Cloud Trends In Supporting Ubiquitous Computing

9. Mobile Cloud Computing

10. Modern Data Center Architecture

List of Course Group Discussion Topics:

1. Data Storage Security in Cloud

2. Cloud Services for SMB's

3. Monitoring Services Provided by GCP and AWS

4. Docker and Kubernetes

5. SaaS vs FaaS (Function as a service)

6. Hybrid Cloud

7. GCP Vs AWS Web Service Architecture

8. Cloud based security issues and threats

9. Authentication and identity

10. Future of Cloud-Based Smart Devices

List of Home Assignments:

Design:

1. Serverless Web App to order taxi rides using AWS lambda.

2. Deploying App on Kubernetes

3. Serverless web Application (GCP Cloud Functions)

4. Demonstration of EBS, Snapshot, Volumes

5. Single Node Cluster Implementation (Hadoop)

Case Study:

1. PayU Migration to AWS

2. Cloud object storage

3. Deployment and Configuration options in AWS

4. Deployment and Configuration options in Microsoft Azure

5. Deployment and Configuration options in GCP

Blog

1. Comparing design of various cloud computing platforms

2. AWS EKS and Google Cloud Functions

3. App Engine

4. Cloud Endpoints

5. Cloud Pub/Sub

Surveys

1. Disaster Recovery in Cloud Computing

2. Cloud Economics

3. Data archiving solutions

4. Salesforce

5. Dropbox

Suggest an assessment Scheme:

MSE 30 ESE 30 CVV 30 HA 10

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:

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

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO3	PO7	PO10	PO11	PSO4
3	3	2	2	1	3

CO attainment levels

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

Future Courses Mapping:

After completing this course different certifications courses in cloud be taken such as AWS, Azure, Google cloud certifications. One can go for higher studies in specialization of cloud computing and allied subjects.

Job Mapping:

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

Module VIII courses

CS4206::DATA MINING AND DATA WAREHOUSING

Course Prerequisites: Database Management Systems

Course Objectives:

1. To understand the principles of Data warehousing and Data Mining.

2. To be familiar with the Data warehouse architecture and its Implementation.

3. To know the Architecture of a Data Mining system.

4. To understand the various Data preprocessing Methods.

5. The key steps involved well enough to lead/manage a real-life data mining project

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

Course Relevance: Course focuses on the fundamentals of data warehousing and their associated problem areas. Data pre-processing and preparation, outlier detection, data warehouse design, On-line analytical processing are the major areas of coverage of this course. This course also deals with the fundamentals of data mining and algorithms associated with the same.

SECTION-I

Introduction to DWH and OLAP: Decision Support System: Introduction to Decision Support System (DSS), DSS Components, Decision Types; Data warehouse (DWH): Need, Definition, Advantages of DWH, OLTP Vs DWH, 3-tier Architecture, DWH Design Process, ETL Process, DWH Back-end Tools and Utilities, Metadata Repository, Models of DWH: Enterprise Warehouse, Data Mart, Virtual Warehouse, Comparison; OLAP: Data Cube and OLAP, Concept Hierarchies, OLAP Operations: Drill-Down, Roll-Up and Extreme Roll-Up, Slice-Dice and Pivot, OLAP Types, OLAP Query Processing, Computation of Data Cube.

Dimensional Modeling : Dimensional Model Vs ER Model, DWH Schemas: Star, Snowflake, Fact Constellation, their Comparison, Techniques to Handle Changing Dimensions, Aggregation, Families of Fact Tables, Fact Less Fact Tables; Data Warehouse Indexing: Factors used to select an Indexing Technique, Properties of a Good Indexing Technique for DWH, Indexing Techniques: Projection Index, Bitmap Index (Pure and Encoded), Join Index and their Comparison.

SECTION-2

Data Mining and Functionalities: Introduction: Need of Data Mining, Knowledge Discovery in Database (KDD), Architecture of Data Mining System, Data Mining on Different kind of Data, Data Mining Functionalities; Data Preprocessing: Need, Cleaning, Integration, Transformation, Reduction, Discretization, Concept Hierarchy Generation; Cluster Analysis: Categories of Clustering methods, Partitioning methods: k-Means, k-Medoids ; Prediction: Numerical Prediction, Linear, Non-Linear Regression; Outlier Analysis: Applications, Techniques. Classification: Decision Tree Classifier, Rule Based Classification, Bayesian Classification, Lazy Learner: kNN Classifier, Case-Based Reasoning, Other: Fuzzy Set Approach, Classifier Accuracy Measures, Techniques for Evaluating Classifier Accuracy; Frequent Itemset Mining: Interesting Item Set Mining: Market Basket Analysis, APriori Algorithm, Generating Association Rules, Types of Association Rules, Correlation Analysis.

List of Course Seminar Topics:

1. Mining web graphs for recommendations

2. Educational Data Mining

3. Multimedia Data Mining

4. Text Mining

5. Spatial Data Mining

6. Mining on Social Networks

7. Multirelational Data Mining

8. Data Mining Tools

9. Data Mining applications

10. Outlier Mining

List of Course Group Discussion Topics:

1. Relational modeling vs. Dimensional modeling

2. OLTP vs. OLAP

3. Challenges of Data Mining

4. Business Intelligence versus Data Warehouse

5. Business Intelligence versus Data Mining

6. Data Mining Versus Database Management System

7. ROLAP Versus MOLAP

8. MOLAP Versus HOLAP

9. Hypercube & Multicubes

10. Cross Industry Standard Process for Data Mining

List of Home Assignments:

Design:

1. Suppose that a data warehouse consists of the three dimensions *time, doctor*, and *patient*, and the two measures *count* and *charge*, where *charge* is the fee that a doctor charges a patient for a visit. Draw a star schema diagram.

2. Suppose your task as a software engineer at *Big University* is to design a data mining system to examine the university course database, which contains the following information: the name, address, and status (e.g., undergraduate or graduate) of each student, the courses taken, and the cumulative grade point average (GPA). Describe the *architecture* you would choose.

3. Use a flowchart to summarize the following procedures for *attribute subset selection*:(a) stepwise forward selection (b) stepwise backward elimination

4. Take the IRIS data set, obtained from*http://www.ics.uci.edu/_mlearn/MLRepository.html* (UC-IrvineMachine Learning Data Repository), as a data set to be discretized. Perform data discretization for each of the four numerical attributes using the ChiMerge method.

5. Propose an algorithm, in pseudo-code for the automatic generation of a concept hierarchy for

categorical data based on the number of distinct values of attributes in the given schema

Case Study:

1. OLAP tools

2. Data mining query languages

3. Genetic algorithms

4. Rough set approach for classification

5. Fuzzy set approach for classification

Blog

1. Managing data warehouse metadata

2. Associative classification

3. Class imbalance problem

4. Classifier Accuracy and Error Measures

5. Clustering high-dimensional data

Surveys

1. Desktop OLAP

2. methods for handling missing values

3. Methods to compute the *dissimilarity* between different types of objects

4. Distance-based outlier detection techniques

5. Data Mining for Financial Data Analysis

Suggest an assessment Scheme:

MSE 30 ESE 30 CVV 30 HA 10

Text Books: *(As per IEEE format)*

1. Jiawei Han and Micheline Kamber "Data mining: concepts and techniques", Morghan Kaufman, 2001.

2. Kimball, "Data warehouse lifecycle toolkit", John Wiley,1998

Reference Books: *(As per IEEE format)*

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database Systems Concepts", 5th edition, 2005.

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

3. Hand, Smyth, Mannila "Principles of Data mining", MIT press,2001.

4. Gagendra Sharma, "Data mining, Data warehousing and OLAP", S.K. Kataria and sons, First edition,2007-08.

5 M. Dash and H. Liu. "Feature selection for classification" Intelligent Data Analysis, 1(3):131-156, 1997.

Moocs Links and additional reading material:

https://nptel.ac.in/courses/106/105/106105174/

https://swayam.gov.in/nd1_noc20_cs12/preview

https://www.sas.com/en_in/insights/data-management/what-is-etl.html

https://www.talend.com/resources/what-is-etl/

Course Outcomes:

1) Construct an end-to-end data warehousing solution.

2) Evaluate various data processing algorithms in their applicability to different problems

3) Display the process of converting data into a user defined format required for

particular analysis

4) Utilize statistical tools in deriving insights from data

5) Describe various techniques for clustering and classification

6) Apply various techniques to solve real world data analysis problems

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO5	PO9	PO11	PO12	PSO4
3	3	2	2	1	3

CO attainment levels

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

Future Courses Mapping:

Cloud Computing ,Machine Learning, Data Science,Big Data Management Systems

Job Mapping:

Data Warehouse Architect ,Backend Engineer- Data Warehousing Engineer /ETL

ETL Engineer -Data Warehousing & Modeling ,Data Warehouse Manager

CS4208 :: ALGORITHMIC NUMBER THEORY

Course Prerequisites: Basic courses on Algebra, Algorithms

Course Objectives:

1. Students will gain understanding of basic number theory

2. Students will develop familiarity with different algebraic structures

3. Students will gain understanding of basic abstract algebra

4. Student will gain understanding of different algorithms for computational problems in algebra and Number theory

5. Students will develop understanding of various polynomial factorization algorithms

6. Students will develop understanding of various primality testing algorithms

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

Course Relevance:

This is an advanced course for Computer science and Engineering.

This course gives introduction to basic abstract algebra and number theory, followed by different algorithms for Number Theoretic/Algebraic Problems.

The security of several existing crypto-systems relies upon computational hardness of certain number theoretic problems.

Therefore this course is relevant to the current cryptosystems and security applications.

Along with this practical aspect, the course builds good enough background in Algebra and Number theory which is useful in several domains of Computer Science.

This course is also relevant for the students who want to pursue research career in computational complexity theory, number theory, advanced algorithmic research.

SECTION-1

Basic Number Theory

Infinitely many primes in Z(some proofs), greatest common divisor, unique factorization of integers, modular arithmetic, (some results on modular arithmetic: Fermat's little theorem, Euler's theorem, Wilson's theorem,… etc), linear congruences and Chinese Remaindering Theorem, some arithmetic multiplicative functions (e.g. Euler's phi function, Mobius function, divisor function). Distribution of primes, Prime number theorem.

Basic abstract Algebra

Groups, subgroups, Lagrange's theorem, group homomorphism, cyclic groups, Abelian groups and their decomposition, rings, ideals, some examples of rings (e.g. polynomial ring F[x], ring of integers modulo n), units and zero devisors in the ring, fields, Unique factorization in ring k[x] where k is a field, Basics of finite fields

Number theoretic algorithms

(Review of the Euclid's algorithm for GCD, Extended Euclid's algorithm, fast integer arithmetic, algorithms for modular arithmetic, fast exponentiation), finding modular inverse, finding order of element in a group, finding quadratic non-residues, algorithm for modular square-root, algorithms for discrete-log problem. Chinese Remaindering and computing determinant of integer matrix, algorithmic questions over finite fields.

Univariate polynomial arithmetic (multiplication, gcd, etc), irreducibility testing for polynomials in F[x] where F is finite field, ring F[x]/(f), modular inverse computation.

SECTION-2

Polynomial Factorization

Univariate polynomial factorization over finite fields: revisit unique factorization, Randomized polynomial time algorithms. Berlekamp's algorithm: linear algebra preliminaries for Berlekamp's algorithm, Frobenius map, the algorithm, resultants and some implications of Berlekamp's algorithm, parallel algorithm for computing gcd of polynomials. Cantor-Zassenhaus algorithm: distinct degree and equal degree factorization, CRT and Cantor-Zassenhaus algorithm.

Primality

Pratt's result: PRIMES in NP intersection coNP, randomized polynomial time algorithms for primality testing. Miller-Rabin primality test: Carmichael numbers, derandomizing Miller-Rabin

test using Riemann Hypothesis. Prime number theorem and generating large primes (application to RSA crypto system). High level overview of Agarwal-Kayal-Saxena (deterministic polynomial time) primality test.

List of projects:

 1.   Implementation of RSA crypto-system

2.   Implementing AKS primality test

3.   Implementing Miller-Rabin Primality test

4.   Implementing Solovay Strassen Primality test

5.   Attacks on crypto-system based on number theoretic algorithms

6.   Lattice based crypto-systems

7.   Algorithmic toolkit for abstract algebra

8.   Algorithmic toolkit for Linear Algebra

9.   Implementing Berlekamp's factoring algorithm

10. Implementing Cantor-Zassenhaus algorithm

 List of Course Seminar Topics:

 1.   Primality testing algorithms

2.   Solovay-Strassen primality test

3.   Integer Factoring Algorithms

4.   Application of number theory in cryptography

5.   Proof of Prime Number theorem

6.   Generating large primes and applications

7.   RSA crypto-system

8.   Polynomial factorization over rationals

9. Deterministic algorithms for polynomial factorization

10. Gauss law of quadratic reciprocity

List of Course Group Discussion Topics:

1. Application of Number theory in cryptography

2. Prime Number Theorem and applications

3. Security of RSA cryptosystem

4. Discrete Log problem and applications in cryptography

5. Algorithms for integer factoring

6. Evdokimov's deterministic algorithm for polynomial factorization over finite fields

7. Quadratic sieve algorithm

8. Gauss law of quadratic reciprocity and applications

9. Euler's phi function: some interesting applications

10. Implications of Berlekamp's algorithm

11. Parallel algorithm for gcd of polynomials

12. Role of randomness in Number theory

List of Home Assignments:

Design:

1. Problem solving based on Basic Number Theory

2. Advanced problem solving based on Number Theory

3. Algorithmic problems in Number theory

4. Problem solving based on Abstract Algebra

5. Advanced problem solving based on Abstract Algebra

6. Algorithmic problems in Abstract Algebra

7. Problem solving on prime numbers

Case Study:

1. AKS primality test

2. Quadratic sieve factoring algorithm

3. Evdokimov's polynomial factorization algorithm

4. Gauss's law of quadratic reciprocity

5. Miller Rabin primality test derandomization

6. RSA crypto-system

7. Diffie-Hellman cryptosystem

Blog:

1. Role of randomness in number theory

2. Number Theoretic Algorithms

3. Accessible open problems in number theory

CS4212::BUSINESS INTELLIGENCE

Course Prerequisites: Database Management Systems, Basic probability and statistics

Course Objectives:

1. Be exposed with the basic rudiments of business intelligence system

2.Understand the modeling aspects behind Business Intelligence

3.Understand of the business intelligence life cycle and the techniques used in it

4. Be exposed with different data analysis tools and techniques

5. Learn different reporting tools

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

Course Relevance:

The course aims at examining Business Intelligence (BI) as a broad category of applications and technologies for gathering, storing, analyzing, sharing and providing access to data to help enterprise users make better managerial decisions.

You will learn the principles and best practices for how to use data in order to support fact-based decision making.

Emphasis will be given to applications in marketing, where BI helps in, e.g., analyzing campaign returns, promotional yields, or tracking social media marketing; in sales, where BI helps performing for sales analysis; and in application domains such as Customer Relationship Management and e-Commerce.

Practical experience will be gained by developing a BI project (case-study) with leading BI software.

SECTION-1

Introduction: What is business intelligence and analytics (BIA)? Evolution of BIA, Interplay among Business Intelligence, Business Analytics, Data Science, Data Mining, Data Analytics, Data Warehousing, Statistics and Machine Learning. Drawing insights from data: DIKW pyramid Business Analytics project methodology - detailed description of each phase, Data exploration and data preparation.

Decision Management Systems : Study of Information Technology resources such as database systems, enterprise systems, and networks explained in their role of supporting decision makers, Decision Taxonomy Principles of Decision Management Systems, Building Decision Management Systems, Characteristics of Suitable Decisions, Prioritizing Decisions, Decision Analysis, Monitor Decisions, Fact-Based Decisions - The OODA Loop - Technology Enablers, Business Rules Management Systems

Data Preprocessing: mechanisms of data collection and challenges involved therein. Notion of data quality. Typical preprocessing operations: combining values into one, handling incomplete or incorrect data, handling missing values, recoding values, sub setting, sorting, transforming scale, determining percentiles, data manipulation, removing noise, removing inconsistencies, transformations, standardizing, normalizing - min-max normalization, z-score standardization, rules of standardizing data

Enterprise Reporting: Metrics, Measurement, Measures, KPIs, Dashboards, Reports, Scorecards

SECTION-2

Architecting the Data: Introduction, Types of Data, Enterprise Data Model, Enterprise Subject Area Model, Enterprise Conceptual Model, Enterprise Conceptual Entity Model, Granularity of the Data, Data Reporting and Query Tools, Data Partitioning, Metadata, Total Data Quality Management (TDQM).

Data Warehousing: What is a data warehouse, need for a data warehouse, architecture, data marts, OLTP vs OLAP, Multidimensional Modeling: Star and snow flake schema, Data cubes, Enterprise Reporting OLAP operations, Data Cube Computation and Data Generalization, Data lake

Descriptive statistics, Inferential statistics

Data visualization: Role of visualization in analytics, different techniques for visualizing data

based on the nature of data and what kind of insights need to be drawn

List of Course Seminar Topics:

1. Embedded BI

2. Mobile analytics and Mobile BI

3. Business Intelligence Value Chain

4. Real time Business Intelligence

5. Challenges of BI

6. Modern Business Intelligence

7. Enterprise Performance Life Cycle (EPLC)Framework

8. Multiplicity of Business Intelligence Tools

9. Managing Total Cost of Ownership for Business Intelligence

10. Microsoft Power BI

List of Course Group Discussion Topics:

1. Human Factors in BI Implementation

2. Ethics and business intelligence

3. Dynamic roles in Business Intelligence

4. OLAP and OLTP

5. Factors that Affect Total Cost of Ownership

6. Competitive intelligence and Business intelligence

7. Operational intelligence and Business intelligence

8. Business Analytics vs. Business intelligence

9. Traditional BI and modern BI

10. Self-Service Business Intelligence

List of Home Assignments:

Design:

List and Identify KPIs (key performance indicators) for given systems

1. HR dashboard

2. Marketing Lead dashboard

3. Sales Geography dashboard

4. Financial dashboard

5. Disease tracker

Case Study:

1. SaaS Business intelligence

2.   MySQL Business intelligence

3. Tableau

4. BI users

5.   IBM Cognos

Blog

1.   BI DASHBOARD BEST PRACTICES

2.   Trends in Business intelligence

3. Advantages and disadvantages of BI

4. How to develop a successful BI strategy

5.   SAS BI

Surveys

1. ETL tools

2.   BI for on-time delivery

3. BI research

4. AI applications for BI

5.   BI through Data Visualization

Suggest an assessment Scheme:

MSE 30 ESE 30 CVV 30 HA 10

Text Books: *(As per IEEE format)*

1. James R Evans ,Business Analytics , Pearson

2. Jiawei Han and Micheline Kamber ,"Data Mining: Concepts and Techniques", Morgan Kaufman, ISBN 978-81-312-0535-8, 2nd Edition

3. R. N. Prasad, SeemaAcharya , "Fundamentals of Business Analytics",ISBN: 978-81-256-3203-2, Wiley-India – Types of Digital Data, OLTP-OLAP, Introduction to BI (ch 4 and 5), data integration (ch 6), MDDM (ch 7), Reporting (ch 8, 9)

4. Handbook of Data Mining – for data collection, preparation, quality and visualizing (ch 14)

5. Wolfgang Jank , Business Analytics for managers, exploring and discovering data (ch 2), Data Modeling (ch 3, 4, 5, 6)

6. Camm, Cochran, Fry, Ohlmann, Anderson, Sweeney, Williams , Essentials of Business Analytics by, Cengage Learning

7. Ralph Kimball, Margy Ross , The Kimball Group Reader: Relentlessly Practical Tools for Data Warehousing and Business Intelligence 2010, Wiley Publications

8. Ralph Kimball, Margy Ross ,"The Data Warehouse Toolkit – Complete Guide to Dimensional Modeling", Wiley Computer Publishing

Reference Books: *(As per IEEE format)*

1. Business Intelligence for Dummies

2. Erwin Kreyszig ,"Advanced Engineering Mathematics", John Wiley & Sons Inc., 10th Edition

3. Ken Black , Applied Business Statistics: Making Better Business Decisions (English) 7th Edition , Wiley India

4. Rob J Hyndman, George Athanasopoulos ,Forecasting: Principles and Practices, OTexts

5. Stephen Few, Information Dashboard Design: The effective visual communication of data, O'Reilly

Moocs Links and additional reading material:

https://nptel.ac.in/courses/110/105/110105089/

 https://www.inetsoft.com/info/list_of_business_intelligence/

https://www.board.com/en/resources/case-studies#gref

https://www.coursera.org/specializations/data-warehousing

https://www.edx.org/learn/business-intelligence

Course Outcomes:

Students will be able to

1. Construct an end-to-end data warehousing solution for business intelligence involving

various data sources, ETL, multi -dimensional modeling, OLAP, reporting and analytics

2. Evaluate various data processing algorithms in their applicability to different problems

3. Display the process of converting data into a user defined format required for

particular analysis

4. Utilize statistical tools in deriving insights from data

5. Describe various techniques for descriptive, predictive and prescriptive analytics

6. Apply various techniques to solve real-world data analysis problems

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- 3   CO4- 2   CO5-1   CO6-5

Future Courses Mapping:

Big data and the Internet of Things (IoT)

Data Science

Job Mapping:

BI Analyst

BI Manager

BI Developer

CS4214::GENETIC ALGORITHMS

Course Prerequisites: Design and Analysis of Algorithm

Course Objectives:

1. Explain the principles underlying Evolutionary Computation in general and Genetic Algorithms in particular.
2. Apply Evolutionary Computation Methods to find solutions to complex problems
3. Analyze and experiment with parameter choices in the use of Evolutionary Computation
4. Summarize current research in Genetic Algorithms and Evolutionary Computing

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

Course Relevance:.........

SECTION-1

Gentle Introduction To Genetic Algorithms : What Are Genetic Algorithms? ,Robustness of Traditional Optimization and Search Methods. The Goals of Optimization, How Are Genetic Algorithms Different from Traditional Methods?

A Simple Genetic Algorithm. Genetic Algorithms at Work—a Simulation by hand. Grist for the Search Mill—Important Similarities 18 Similarity Templates (Schemata) 19 Learning the Lingo.

Genetic Algorithms Revisited: Mathematical Foundations: Who Shall Live and Who Shall Die? The Fundamental Theorem, Schema Processing at Work: An Example by Hand Revisited. The Two-armed and й-armed Bandit Problem, How Many Schemata Are Processed Usefully. The Building Block Hypothesis, Another Perspective: The Minimal Deceptive Problem, Schemata Revisited: Similarity Templates as Hyper planes.

Computer Implementation Of A Genetic Algorithm: Data Structures, Reproduction, Crossover, and Mutation, A Time to Reproduce, a Time to Cross, Get with the Main Program, How Well Does it Work?, Mapping Objective Functions to Fitness Form, Fitness Scaling, Coding, A Multiparameter, Mapped, Fixed-Point Coding, Discretization , Constraints.

SECTION-2

Some Applications Of Genetic Algorithms: The Rise of Genetic Algorithms , Genetic Algorithm Applications of Historical Interest , De Jong and Function Optimization, Improvements in Basic Technique , Current Applications of Genetic Algorithms.

Advanced Operators And Techniques In Genetic Search : Dominance, Diploidy, and Abeyance . Inversion and Other Reordering Operators .Other Micro-operators, Niche and Speciation, Multiobjective Optimization, Knowledge-Based Techniques, Genetic Algorithms and Parallel Processors .

Introduction To Genetics-Based Machine Learning : Genetics-Based Machine Learning: Whence It Came 218 What is a Classifier System? Rule and Message System. Apportionment of Credit: The Bucket Brigade , Genetic Algorithm . A Simple Classifier System in Pascal, Results Using the Simple Classifier System .

Applications Of Genetics-Based Machine Learning: The Rise of GBML, Development of CS-1, the First Classifier System , Smith's Poker Player , Other Early GBML Efforts , A Potpourri of Current Applications .

List of Course Seminar Topics:

1.Genetic Algorithm for Combinatorial Optimization Problems

2.Genetic Algorithm for Image Processing Problems

- Pattern recognition

- Image Classification

3.Genetic Algorithm for Business Problems

- Economic Forecasting

- Evaluating credit risks

- Detecting stolen credit cards before customer reports it is stolen

4.Genetic Algorithm for Medical Problems

- Studying health risks for a population exposed to toxins

● Feature Selection

5. Genetic Algorithm for Optimization problems

6. Genetic algorithm to solve Security issues

7. Genetic Algorithm for Mobile Computing

8. Genetic Algorithm for Dynamic Problems

9. Applications of genetic algorithm in evolutionary methods

10. Application of genetic algorithm in deep learning techniques

List of Course Group Discussion Topics:

1. Use of genetic algorithm to find the vulnerability in the protocol header

2. Use of genetic algorithm to check infections in the fruits

3. Use of genetic algorithm to check the cancer cell

4. Use of genetic algorithms for time table management

5. Use of genetic algorithm for channel assignment in wireless network

6. Use of Single point or multipoint crossover

7. Decidability factors for mutation

8. Use of genetic algorithm to decide fitness of individuals in Covid-19

9. Use of genetic algorithm to check the probability of admission in dream Institutes

10. Use of genetic algorithm for language grammar prediction

List of Home Assignments:

Design:

1. Design Genetic Algorithm for following basic applications like Locating an Emergency Response Unit

2. Design a system using genetic algorithm to solve the time table problems of autonomous Institute

3. Design a system using Genetic algorithm for Channel assignment in wireless network

4. Design a system using genetic algorithm for share market prediction

5. Design a system using GA for evolutionary methods

Case Study:

1. A system for medical diagnosis

2. A system for agriculture applications

3. A system to solve smart city problems

4. A system to solve problem in educational institutes

5. A system to solve bank loan prediction

Blog

1. Genetic algorithm for parallel processors

2. Genetic algorithm for diagnosis of crop diseases

3. Genetic algorithms for prediction of abnormality in human life

4. Genetic algorithm for selection of virus databases

5. Genetic algorithm for Covid -19

Surveys

1. Use of genetic algorithms to predict various cancer cells in the human body.

2. Genetic algorithm for optimization of space structure

3. Genetic algorithm for Iris detection

4. Genetic algorithm for feature selection

5. Genetic algorithm for classification.

Suggest an assessment Scheme:

MSE 30 ESE 30 CVV 30 HA 10

Text Books: *(As per IEEE format)*

1. David E. Goldberg, " Gentic Algorithms in Search, Optimization & Machine Learning" Pearson Education.

2. John R. Koza, "Genetic Programming", MIT Press, 1992

Reference Books: *(As per IEEE format)*

1. Lawrence Davis, "Handbook of Genetic Algorithms", Editor, Van Nostrand Reinhold, 1991.

2. John H. Holland, "Adaptation in Natural and Artificial Systems", MIT Press, 1992

Moocs Links and additional reading material: <u>www.nptelvideos.in</u>

Course Outcomes:

1)Identify various problems which can be solved by Genetic Algorithms.

2) Model problems in the space of genetic algorithms.

3) Understand mathematical foundation of Genetic Algorithms.

4) Explore the concepts, operators and technology for Genetic Algorithms to solve various problems of different domains.

5) Apply Genetic Algorithm based Machine Learning approaches.

6) Analyze difference in performance of Machine Learning approaches and Genetic Algorithm based Machine Learning.

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO4	PO6	PO8	PO12	PSO3
3	3	2	2	1	3

CO attainment levels

CO	Attainment level
1	4
2	5
3	3

4	2
5	1
6	3

Future Courses Mapping:

 Distribute algorithms,

Randomization and Approximation algorithms

Job Mapping:

Software engineer, System analyst, Complex problem solver

CS4209::PARALLEL COMPUTING

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

Course Objectives: Students will be able to

1. Understand the basic concepts of parallel computing
2. Learn various GPU Architecture
3. Learn to write CUDA programs
4. Learn the memory management in GPU
5. Learn to optimize parallel programs on GPU using CUDA
6. Learn to solve the scientific problems using GPUs

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

Course Relevance: This course is required in the industry & csn be used to set up data centers.

SECTION-1

Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Parallelism vs Concurrency, Types and levels of parallelism, Flynn's classification, Amdhal's law; Parallel computer architectures : PRAM, Distributed memory systems ,Shared memory systems and cache coherence, Concept of thread and process, programming parallel computers, Parallel computing architectures, interconnection networks, Modern GPU architecture (in brief), Performance comparison: Speedup, Gain time and scalability.

Parallel Programming Model: Common Unified Device Architecture (CUDA), CUDA programming model, Concept of grid, block and thread, thread index generation, warp, kernel & kernel launch. Programming for GPU's in C/C++ using CUDA API: Memory transfers, Writing and executing kernel functions, Writing device functions, Thread synchronization, Data Dependences and Race Conditions, Organizing Parallel Threads.

SECTION-2

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

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, Sparse matrix representations, Fast Fourier transforms, Binomial coefficients, light weight scientific computing exercises, Matrices etc .

List of Course Group Discussion Topics:

1.Kepler and Maxwell Gpus

2. Volta & Pascal GPUs

3. GPU profiling

4. Unified Memory & Virtual memory of GPU

5. Ampere GPUs & DGX

6. AI & DL on GPUs

7. Global & Shared Memories of GPUs

8. Texture & Constant Memories of GPUs

9. Memory & code optimization in CUDA

10. Control flow & instruction optimization of CUDA

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 CVV 30 HA 10

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 Hwu CUDA: Programming Massively Parallel Processors: A Hands-On Approach. © ELSEVIER Inc.*

3 *Jason Sanders and Edward Kandrot CUDA 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 McKercher Professional CUDA C Programming,*

3. *CUDA C PROGRAMMING GUIDE by NVIDIA*

Moocs Links and additional reading material:

https://nptel.ac.in/courses/106/105/106105220/#

 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	CO2	CO3	CO4	CO5	CO6
PO3	PO5	PO7	PO11	PO12	PSO3
3	3	2	1	1	3

CO attainment levels

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

Future Courses Mapping:

 High Performance Computing

Distributed Computing

Job Mapping:

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

CS4211::SOFTWARE TESTING AND QUALITY ASSURANCE

Course Prerequisites: Software Engineering

Course Objectives:
1. To classify measurement scales and models, software metrics and measures addressing software quality and reliability.
2. To conduct unit and integration tests by determining test design, test automation, test coverage criteria using testing frameworks and test adequacy assessment using control flow, data flow, and program mutations.
3. To recognize suitable higher order testing techniques and methods in order to achieve verified and validated software by following testing best practices.
4. To establish the skill set as a tester to neutralize the consequences of wicked problems by narrating effective test cases and test procedures.
5. To be familiarized to various test processes, types of errors and fault models and methods of test generation from requirements for continuous quality improvement of the software system along with Software Quality best practices usage.
6. To run software testing cycle in relation to software development and project management focusing incidents and risks management within a project towards efficient delivery of software solutions and implement improvements in the software development processes by making use of standards and baselines.

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

Course Relevance:
The course organizes the complex and confusing landscape of test coverage criteria with a novel and extremely simple structure.
At a technical level, software testing is based on satisfying coverage criteria. It is central observation is that there are few truly different coverage's criteria, each of which fits easily into one of four categories: graphs, logical expressions, input space, and syntax structures.
This not only simplifies testing, but it also allows a convenient and direct theoretical treatment of each category.
This approach contrasts strongly with the traditional view of testing, which treats testing at each phase in the higher-quality software.
Testing is not an anti-engineering activity, and it is not an inherently destructive process.
Neither is it only for testing specialists or domain experts who know little about programming or math.
Not very long ago, software development companies could afford to employ programmers who could not test and testers who could not program.
For most of the industry, it was not necessary for either group to know the technical principles behind software testing or even software development.
Software testing in industry historically has been a nontechnical activity.

SECTION-1

Software Measurement: Measurement Theory, Software Measurement and Models, Measurement Scales, Classification of Software Measures, Measurement Framework, Theory of Program Testing, Graph Theory for Testers, Software Complexity, Measuring Internal Product Attributes: Size, Measuring Internal Product Attributes : Structure, Halstead's Software Science, Product Quality Metrics, In-Process Quality Metrics, Software Reliability: Measurement and Prediction, The Rayleigh Model, SRE process, Reliability Concepts: Hardware and Software, Deploying SRE

Principles of Testing: Testing Concepts: Purpose of Software Testing, Testing Principles, Goals of Testing, Testing aspects: Requirements, Test Scenarios, Test cases, Test scripts/procedures, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Planning for Verification and Validation, Software Inspections, Automated Static Analysis, Verification and Formal Methods, Levels of Testing

White-Box Testing: Test Adequacy Criteria, Static Testing, Structural Testing, Code Complexity Testing, Mutation Testing, Data Flow Testing

Black-Box Testing: Test Case Design Criteria, Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Equivalence Partitioning State Based Testing, Domain Testing

Functional Testing: Test Plan, Test Management, Test Execution and Reporting, Test Specialist Skills, Tester's Workbench and Tool Categories, Test Maturity Model and Test Process Assessment, Debugging & Root Cause Analysis, Software Items, Component & Units, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Types of Testing Documentation, Verification Testing, Validation Testing, Integration Testing, System and Acceptance Testing, GUI Testing, Regression Testing, Selection, Minimization and Prioritization of Test Cases for Regression Testing, Creating Test Cases from Requirements and Use cases, Software Defects: Origins of Defects, Defect Classes, Defect Repository / Test Design, Defect Repository

SECTION-2

Higher Order Testing: Object Oriented Testing, Specification Based Testing, Performance Testing, Ad-hoc Testing, Usability and Accessibility Testing, Risk-based Testing, Exploratory Testing, Scenario-based Testing, Random Testing Compatibility Testing, User Documentation Testing, Client–Server System Testing, RAD Testing, Configuration Testing, Testing internal Controls, Multiplatform Environment Testing, Security Testing, Web-based System Testing, Reliability Testing, Efficiency Testing, Maintainability Testing, Portability Testing, Introduction to Performance Testing, Application Performance Testing, Process of Performance Testing, Effective Root-Cause analysis, Testing VS Test Automation, Tool evaluation and selection, Automation team roles, Architectures, Planning and implementing test automation process

Introduction to Software Quality Assurance: The software quality challenge, Meaning of software quality, Software quality factors , Software Quality Lessons Learned, The components of the software quality assurance system, Pre-project software quality components: Contract Review, Development and quality plans, SQA components in the project life cycle: Integrating quality activities in the project life cycle, Assuring the quality of

software maintenance components, Assuring the quality of external participants' contributions, CASE tools, Software quality infrastructure components, Pareto Principles, Total Quality Management, Ishikawa's Seven Basic Tools

Software Quality Assurance Management: Management components of software quality: Project progress control, Software quality metrics, Costs of software quality, Standards, certification and assessment: Quality management standards, SQA project process standards – IEEE software engineering standards, Management and its role in software quality assurance, The SQA unit and other actors in the SQA system, Inspection as an Up-Front Quality Technique, Software Audit Methods, Software Safety and Its Relation to Software Quality Assurance, SQA for Small Projects, Development Quality Assurance, Quality Management in IT, Introduction to ITIL, Software Quality Assurance Metrics, Software Benchmarks and Baselines

List of Tutorials: (Any Four)
1. Study of Requirement Engineering
2. Study on preparation of System Requirement Specification
3. Scrum Artifacts
4. User Stories and Use Case
5. Product Backlog Development
6. Burn-up and Burn-down chart development and management
7. Software System Analysis and Design: UML
8. Incorporation of Design patterns

List of Practical's: (Any Eight)
1. To Prepare Test Plan for the implemented system under test. The Test Plan shall be based on System Requirement Specification. The Test plan consists of following issues.
   a. Purpose of the test. / Location and schedule of the test.
   b. Test descriptions. / Pass and Fail Criteria.
2. To identify and narrate Test cases, Test scripts/procedures and Test incident Report identifier for the system under test. Refer Use case analysis document to prepare mentioned/ identified test documents. The expected specifications/ behaviors can be stated with the help of Test Oracle.
3. To perform Unit testing especially indicating the traced Independent data paths, Control paths and Error handling paths. Prepare control flow graphs for the unit under test. Compute the Cyclomatic complexity of the unit.
4. To perform Data Flow testing for the Program Segments by identifying the Definition-Use chain and type of data flow anomaly.
5. To perform Mutation Analysis of the Program Segments along with mutant history, mutation score and type of mutation by using any Code analysis Tool / Mutation Testing Tool (JUNIT, MuJava).
6. To perform Black-Box Testing for all the units contained in the architectural segments using Equivalence Partitioning, Boundary Value Analysis and Orthogonal Array testing methods. To study exploratory Testing for the Module under Test and merits/demerits of this technique.
7. To perform Regression Testing / GUI Testing of the System under construction with Unit and Integration profiles by using any Functional Testing Tool.
8. To perform Automated Testing using suitable CASE tool addressing Higher-Order testing strategies.
9. To perform Web Based Testing for Web Application incorporating any Open Source Tool. To study Performance Testing, Load Testing, Security Testing, Stress Testing, Demonstrate on link Test expectation.
10. To perform Software Audit (Checklist and Template-based) for the software developed and improve the Code Quality.

List of Projects:
1. Software Code Analyzer
2. Software Configuration Profiles
3. Black-box test systems
4. White-box test systems

List of Course Seminar Topics:
1. Acceptance Testing
2. Agile Testing
3. Android Arquillian Behavior-Driven Development (BDD)
4. Code Analysis
5. Continuous Deployment
6. Continuous Integration
7. Cucumber Database
8. Devops Exploratory Testing
9. Functional Testing
10. Integration Testing

List of Course Group Discussion Topics:
1. Java JavascriptJmeter Junit
2. Load Testing
3. Mobile Testing
4. Mocking Open Source People Performance Testing
5. Refactoring
6. Regression Testing
7. Ruby Selenium Software Quality Assurance
8. TDD Team Test Automation
9. Test Case Test Coverage Test Management
10. Test Plan Unit Testing
11. User Interface Visual Studio Web Testing

List of Home Assignments:
Design:
1. Java Javascript Jmeter Junit
2. Load Testing
3. Mobile Testing
4. Mocking Open Source People Performance Testing
5. Refactoring
6. Regression Testing
7. Ruby Selenium Software Quality Assurance
8. TDD Team Test Automation
9. Test Case Test Coverage Test Management
10. Test Plan Unit Testing
11. User Interface Visual Studio Web Testing
Case Study:
1. Capacity Testing
2. Concurrency Testing
3. Continuous Integration
4. End-To-End Testing
5. Load Generator
6. Test-First Approach

7. Checklist-Based Review
8. The Verb Reviewing
9. Computer Aided Software Testing (CAST)
10. Software Audit

Blog
1. Compliance with Complies
2. Cause-Effect Graphing
3. Condition Coverage
4. Directed Graph Coverage
5. Multiple Condition Coverage
6. Operational Environment Testing
7. Pair Testing
8. Path Testing
9. Portability Testing
10. Quality Control

Surveys
1. Partition Coverage
2. Horizontal Traceability
3. Interface Testing
4. Negative Testing Software services
5. Software testing

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 30 ESE 30 CVV 30 HA 10

Text Books: *(As per IEEE format)*

1. *Burnstein, "Practical Software Testing", Springer International Edition, ISBN 81-8128-089-X*
2. *William E. Perry, " Effective Methods for Software Testing", John Wiley and Sons, ISBN 9971-51-345-5*
3. *Daniel Galin, Software Quality Assurance: From theory to implementation, Pearson Education Limited, 2004, ISBN 0201 70945 7*

Reference Books: *(As per IEEE format)*

1. *Kshirasagar Naik, PriyadarshiTripathy, Software Testing and Quality Assurance-Theory and Practice, John Wiley & Sons, Inc., 2008, ISBN 978-0-471-78911-6*
2. *Fenton, Pfleeger, "Software Metrics: A Rigourous and practical Approach", Thomson Brooks/Cole, ISBN 981-240-385-X.*
3. *Desikan, Ramesh, "Software Testing: principles and Practices", Pearson Education, ISBN 81-7758-121-X.*
4. *Anne Mette Jonassen Hass, Guide to Advanced Software Testing, ARTECH HOUSE, INC., 2008, ISBN-13: 978-1-59693-285-2*
5. *Ian Molyneaux, The Art of Application Performance Testing, O'Reilly Media, Inc., 2009, ISBN: 978-0-596-52066-3*

6. *Jamie L. Mitchell, Rex Black, Advanced Software Testing—Vol. 3, 2nd Edition, Rocky Nook, 2015, ISBN: 978-1-937538-64-4*
7. *G. Gordon Schulmeyer, Handbook of Software Quality Assurance Fourth Edition, ARTECH HOUSE, INC., 2008, ISBN-13: 978-1-59693-186-2*

Moocs Links and additional reading material:
www.nptelvideos.in
www.coursera.com
www.udemy.com

Course Outcomes:
1. Select and classify measurement scales and models, software metrics and measures addressing software quality and reliability.
2. Conduct unit and integration tests by determining test design, test automation, test coverage criteria using testing frameworks and test adequacy assessment using control flow, data flow, and program mutations.
3. Apply suitable higher order testing techniques and methods in order to achieve verified and validated software by following testing best practices.
4. Demonstrate the skillset as a tester to neutralize the consequences of wicked problems by narrating effective test cases and test procedures.
5. Adapt to various test processes, types of errors and fault models and methods of test generation from requirements for continuous quality improvement of the software system along with Software Quality best practices usage.
6. Apply software testing cycle in relation to software development and project management focusing incidents and risks management within a project towards efficient delivery of software solutions and implement improvements in the software development processes by making use of standards and baselines.

Future Courses Mapping:
Quality Analysis, Standardization and control, Software Reliability

Job Mapping:
What are the Job opportunities that one can get after learning this course
Application Tester, QA Analysts, QA Team Lead, Auditor

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO5	PO6	PO8	PO12	PSO4
3	3	2	1	2	3

CO attainment levels

PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO5	PO6	PO8	PO12	PSO4
4	4	3	2	3	5

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 30 ESE 30 CVV 30 HA 10

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

CS4203::MOBILE COMPUTING

Prerequisites: Data Communication and Networking

Course Objectives:

1. Study mobile generations to maintain legacy standards and networking components required to set-up mobile wireless networks.

2. Learn to set mobile network performance parameters depending on requirement of users.

3. Carryout calculations for system capacity for given city, state or country in accordance with the requirements.

4. Understand design of mobile networks with appropriate technologies available in the market.

5. Use mobile network for smart city applications of future generations

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

Course Relevance: Mobile computing refers to technology to support voice and/or data network connectivity using wireless radio transmission. The most familiar application of mobile networking is the mobile phone. Recently both voice and data are being transmitted over both circuit-switched and packet-switched networks. Nowadays each network application is extended to mobile phones in the form of mobile apps. Extension of each and every application of IT as well as non-IT industries makes it essential to learn this subject.

SECTION-1

Topics and Contents

Introduction to Cellular Networks: Personal Communication System (PCS), PCS Architecture, Cell phone generation-1G to 5G Mobile Station (UE), SIM, Base Station (enodeB), Base Station Controller, Mobile Switching Center, MSC Gateways, HLR and VLR, AuC/EIR/OSS, Radio Spectrum, Free Space Path Loss, S/N Ratio, Line of sight transmission, Length of Antenna, Fading in Mobile Environment. Cellular Network Design: Performance Criterion, Frequency Reuse, Co-channel Interference and System Capacity, Channel Planning, Cell Splitting, Mobility Management in GSM and CDMA. Medium Access Control: Specialized MAC, SDMA, FDMA, TDMA, CDMA, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), GMSK Modulation, 8PSK, 64 QAM, 128 QAM, OFDM

and Multicarrier Modulation.

SECTION-2

Overview of GSM and CDMA as legacy standards : D-AMPS, GSM – Architecture, GSM Identifiers, Spectrum allocation, Physical and Logical Traffic and Control channels, GSM Bursts, GSM Frame, GSM Speech Encoding and decoding, Location Update, Incoming and Outgoing Call setup GPRS, EDGE, cdmaOne (IS-95: CDMA95), 3G and 4G Technologies for GSM and CDMA:, W-CDMA, UMTS, HSPA (High Speed Packet Access), HSDPA, HSUPA, HSPA+, TD-SCDMA, LTE (E-UTRA) 3GPP2 family CDMA2000 1x, 1xRTT, EV-DO (Evolution-Data Optimized), Long Term Evolution (LTE) in 4G. Architecture of 5G. Role of 5G in IoT.

List of Course Seminar Topics:

1. Modulation Techniques in 3G

2. Modulation Techniques in 4G

3. Higher Data Rates in 5G

4. Reduced Latency in 5G

5. Energy Saving in 5G

6. W-CDMA-UMTS 3gpp

7. HSPA and HSPA+ (High Speed Packet Access)

8. TD-SCDMA,

9. 3GPP2 family CDMA2000 1x,

10. 3GPP2 family CDMA2000 1xRTT

11. 3GPP2 family CDMA2000 EV-DO

12. 4G LTE and LTE Advanced

List of Course Group Discussion Topics:

1. Comparison between 2G and 3G Architecture

2. Comparison between 3G and 4G Architecture

3 Comparison between 4G and 5G Architecture

4. Advances in Antenna Techniques in Mobile Networks

5. Utilization of Carrier Aggregation in Mobile Networks

6. Evolution of Multiple Access Schemes in Mobile Networks

7. Improved Spectral Efficiency in Mobile Networks

8. Role of Mobile networks in Smart City

9. Role of Mobile networks in IoT

10. Mobile Databases

List of Home Assignments:

Design:

1. Design a mobile app system for sending live locations of working women to their parents while travelling using UML and develop the mobile app for the same to validate it.

2. Caring Old Age People: Design a mobile app system for creating alarms for walking, eating, medicine etc for old age people using UML and develop the mobile app for the same to validate it.

3. Design of online app using RESTAPI

4. Design of offline app for saint literature

5. Design of mobile app for SUDOKU game

 Case Study:

1. Prepare a case study on TRAI Acts 1997, 2012 and 2014, Telecom Regulatory Authority of India, Government of India, GOI

2. Prepare a case study on 3gpp 3G architecture, it functions and interactions including authentication, security, session management etc with the help of white papers and presentations.

3. Prepare a case study on 3gpp2 3G architecture, it functions and interactions including authentication, security, session management etc with the help of white papers and presentations.

 4. Prepare a case study on 4G architecture, it functions and interactions including authentication, security, session management etc with the help of white papers and presentations.

 5. Prepare a case study on 3gpp 5G architecture, it functions and interactions including authentication, security, session management etc with the help of white papers and presentations.

Blog

1. Create and write a blog for Mobile Application Development

2. Create and write a blog for Mobile Advertising.

3. Create and write a blog for gradual increments in Mobile Technologies.

4. Create and write a blog for access schemes in Mobile Networks.

5. Create and write a blog for routing in Mobile Networks.

Surveys

1. Carry out the survey on 3G technologies and their usage at international level

2. Carry out the survey on 4G technologies and their usage at international level.

3. Carry out the survey on 5G technologies and their usage at international level.

4. Carry out the survey on wired networks and their usage at international level.

5. Carry out the survey on wireless networks and their usage at international level.

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, HA,,CVV,SEMINAR, GD

Text Books: *(As per IEEE format)*

1. Jochen Schiller, "Mobile Communications ",Pearson Education,Second Edition, 2004, ISBN: 13: 978-8131724262

2. Smith Collins, "3G Wireless Networks" McGraw Hill Communications, Second Edition , Indian Print, 2016, ISBN-13 978-0-07-063692-7

3. Martin Sauter, "3G, 4G and Beyond: Bringing Networks, Devices and the Web Together", 2012, ISBN-13: 978-1118341483

Reference Books: *(As per IEEE format)*

1. Wireless Communications – Principles and Practice by Theodore S Rappaport, Pearson Education.

2. Wireless Communication and Networks by William Stallings, Second Edition, Prentice Hall

Moocs Links and additional reading material:

www.nptelvideos.in

android.developer.com

Course Outcomes:

The student will be able to –

 1) Select components and radio spectrum for PCS based on bandwidth requirement.

2) Justify the Mobile Network performance parameters and design decisions.

3) Choose the modulation technique for setting up mobile network.

4) Formulate GSM/CDMA mobile network layout considering futuristic requirements which conforms to the technology.

5) Deploy the 3G/4G technology based network with bandwidth capacity planning.

6) Adapt to the requirements of next generation mobile network and mobile applications.

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

Future Courses Mapping:

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

IoT, Unmanned Aerial Vehicles, Drone Control Systems

Job Mapping:

Mobile Application Developer, Telecom Engineer, IT Engineer

CS4225 and CS4226::MAJOR PROJECT

Course Prerequisites: Project Based Learning

Credits:.10.......   **Teaching Scheme Theory: …20... 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 statement	10
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