



**Bansilal Ramnath Agarwal Charitable Trust's**

# **Vishwakarma Institute of Technology**

*(An Autonomous Institute affiliated to Savitribai Phule Pune University)*

**Structure & Syllabus of**

## **B. Tech.**

## **(Information Technology)**

**Effective from Academic Year 2024-25**

**Prepared by: Board of Studies in Information Technology**

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

**Signed by**

**Chairman–BOS**

**Chairman–Academic Board**

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### **Institute Vision**

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

### **Institute Mission**

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

## **Department Vision**

“To provide student-centered state-of-the art academically enriched environment for productive careers in the world of computing through creativity and innovation art”

## **Department Mission**

- To promote aspiring ethically conscious engineers demonstrating sustainable employability and entrepreneurship.
- To impart quality education with the focus on analytical and problem-solving skill development.
- To foster inspired scholarly environment through active student faculty participation in research and development resulting in new knowledge-base or insights.
- To prepare students to shoulder social responsibilities by application of their skill set for betterment of society.

**Program Education Objectives(PEO)**

PEO	PEO Focus	PEO Statement
PEO1	Preparation	To prepare the students with a commitment towards meeting the needs of users within an organizational and societal context through the selection, creation, application, integration and administration of InformationTechnology projects.
PEO2	Core competence	To facilitate students with foundation of mathematical & engineering fundamentals along with knowledge of Information Technology principles and applications and be able to integrate this knowledge in a variety of business and inter-disciplinary setting.
PEO3	Breadth	To enable student to exercise problem solving capacity with effective use of analysis, design, development that address idea realization.
PEO4	Professionalism	To inculcate students with professional and ethical values with effective skills leading to participative team work having multidisciplinary knowledge useful to the society.
PEO5	Learning Environment	To provide students an academic environment that develops leadership qualities, excellence in subject areas of Information Technology and lifelong learning in every sphere of their life.

**List of Programme Outcomes[PO]**

Graduates will be able

PO	PO Statement
<b>PO1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO2</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO3</b>	<b>Design/development of solutions:</b> 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.
<b>PO4</b>	<b>Conduct investigations of complex problems:</b> 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.

<b>PO5</b>	<b>Modern tool usage:</b> 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.
<b>PO6</b>	<b>The engineer and society:</b> 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.
<b>PO7</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO8</b>	<b>Ethics:</b> Apply ethical principles and commit professional ethics and responsibilities and norms of the engineering practice.
<b>PO9</b>	<b>Individual and team work:</b> Function effectively as an individual ,and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO10</b>	<b>Communication:</b> 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.
<b>PO11</b>	<b>Project management and finance:</b> 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.
<b>PO12</b>	<b>Life-long learning:</b> 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.
<b>PSO1</b>	Apply information science theory, algorithmic and programming principles for comprehending technological trade-off in order to determine conceptual aspects of real world problems in information technology.
<b>PSO2</b>	Analyze and create problem frames in order to formulated composition structure of Information technology problem with correct resources, infrastructure and technology requirements determination for solution realization.
<b>PSO3</b>	Compose technical design specifications using template based approaches for formally expressing the solution implementation by applying techniques and methods to create, enhance, and deliver IT tools with appropriate CASE tools selection.
<b>PSO4</b>	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.

**B. Tech. Information Technology Structure(Applicable w.e.f.AY-2024-25)****SY IT Module-III**

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme									Total	Credits
			Theory	Lab	Tut	CA			MSA	ESA						
						Lab	Seminar	GD		CP	HA	ESE	CVV			
S1	MD2201	Data Science	2	2	1	10	20	-	-	20	-	30	20	100	4	
S2	CS2221	Internet of Things	2	2	1	10	-	20	-	20	-	30	20	100	4	
S3	CS2218	Object Oriented Programming	2	2	1	10	-	-	-	20	-	50	20	100	4	
S4	CS2227	Database Management Systems	2	2	1	10	20	-	-	20	-	30	20	100	4	
S5	IT2273	Probability and Calculus	2	-	-	-	-	-	-	-	-	100	-	100	2	
S6	IT2268	Design Thinking- III	-	-	1	-	-	-	-	-	-	-	-	-	1	
S7	IT2272	Engineering Design & Innovation – III	-	2	-	-	-	-	30	-	-	70	-	100	4	
Total															23	

**SY IT Module-IV**

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme									Total	Credits
			Theory	Lab	Tut	CA			ESA							
						Lab	Seminar	GD	MCQ	CP	HA	ESE	CVV			
S1	IT2250	Data Structure	2	2	1	10	-	-	-	20	-	50	20	100	4	
S2	IT2274	Web Technology	2	2	1	10	-	-	30	20	20	-	20	100	4	
S3	IT2266	Computer Network	2	2	1	10	20	-	-	20	-	30	20	100	4	
S4	IT2004	Automata Theory	2	-	-	-	-	-	-	-	-	100	-	100	2	
S5	IT2275	Digital Electronics and Microprocessor	2	2	1	10	20	-	-	20	-	30	20	100	4	
S6	IT2268	Design Thinking- IV	-	-	1	-	-	-	-	-	-	-	-	-	1	
S7	IT2272	Engineering Design & Innovation – IV	-	-	-	30	-	-	-	-	-	70	-	100	4	
Total															23	

**MD2201: DATA SCIENCE****Course Prerequisites:**

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

**Course Objectives:**

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

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

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

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

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

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

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

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

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

Vector norms, Unconstrained Optimization (4 Hours)

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

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

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

#### List of Tutorials:

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

**List of Practical's: (Any Six)**

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

**List of Course Projects:**

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

**List of Course Seminar Topics:**

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

12. LASSO

**List of Course Group Discussion Topics:**

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

**List of Home Assignments:**

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

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

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

1. 'A Beginner's Guide to R' – Zuur, Leno, Meesters; Springer, 2009
2. 'Introduction to Data Science' – Iguar, Segui; Springer, 2017
3. 'Mathematics for Machine Learning' – Diesenothe, 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](http://www.nptelvideos.in)

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



**Course Outcomes:**

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

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

**Future Courses Mapping:**

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

**Job Mapping:**

*Job opportunities that one can get after learning this course*

1. Data Scientist
2. Data Analyst

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

**CS2221: INTERNET OF THINGS****Course Prerequisites:**

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

**Course Objectives:**

The student will be able to

1. Understand IoT Architecture and framework.
2. Recognize and differentiate between the various use cases of different sensors, actuators, solenoid valve etc
3. Learn about fundamental concepts of networking and protocols.
4. Understand IoT Physical, Data link and Higher layer Protocols.
5. Apply theoretical knowledge for Cloud computing.
6. Implement an IoT solution practically

**Credits: 4**

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

**Tut: 1 Hours/Week**

**Lab: 2 Hours/Week**

**Course Relevance:**

The Internet of Things is transforming our physical world into a complex and dynamic system of connected devices on an unprecedented scale. Internet of Things is a system of interrelated computing and sensing devices and has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.

IoT is highly relevant in this growing ecosystem of internet-enabled devices. IoT offers increasing opportunities to collect, exchange, analyse and interpret data in real-time. This robust access to data will result in opportunities to further enhance and improve operations. In a world which is moving towards an increasingly connected future, Internet of Things (IoT) is the next big thing. Right from our homes to our cars to our cities, everything is being connected and the technology of IoT is right in the middle of it.

**Introduction to IoT**

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

**IOT Platform Design Methodology**

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

**IoT Devices**

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

**Introduction to Wireless Sensor Network**

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

**Connectivity Technologies**

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

**Case Studies (Any Two from following List to be covered)**

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

**List of Practical's: (Minimum Six)**

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

**List of Course Projects:**

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

**List of Course Seminar Topics:**

1. IoT Architecture
2. Sensor Characteristics
3. IoT for supply chain management and inventory systems
4. IoT Ethics
5. Security in IoT
6. Cloud Computing Platform
7. IoT Best Practices
8. 5GinIoT
9. Middleware Technology
10. M2M energy efficiency routing protocol
11. IoT based Biometric Implementation
12. Complete IoT solution using AWS
13. A smart patient health monitoring system
14. IoT for intelligent traffic monitoring
15. Home automation of lights and fan using IoT

**List of Group Discussion Topics:**

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

**List of Home Assignments:****Design:**

1. Smart City
2. Smart Transportation
3. Smart Healthcare
4. Smart Industry using IoT

5. Design of IoT framework



**Case Study:**

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

**Blog:**

1. Network Selection for IoT
2. Need of secure protocols
3. Future of IoT
4. IIoT
5. IoT and Industry4.0

**Surveys:**

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

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

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

**Reference Books:**

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

**MOOCs Links and additional reading material:**

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

[arduino-ide-28184f](#)**Course Outcomes**

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

**Future Courses Mapping:**

*Other courses that can be taken after completion of this course*

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

**Job Mapping:**

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

**CS2218: OBJECT ORIENTED PROGRAMMING**

**Course Prerequisites:**

Basic course on programming

**Course Objectives:**

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

**Credits: 4**

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

**Tut: 1Hours/Week**

**Lab: 2 Hours/Week**

**Course Relevance:**

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

**Introduction:**

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

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

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

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

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

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

**Inheritance:** Inheritance in Java, Types, Constructor in Inheritance, Using final with Inheritance, Accessing superclass member, Parent and Child classes having same data member, Base vs derived class

reference. Polymorphism: Method Overloading, Overloading main(), Static vs Dynamic Binding, Method Hiding. Private and final methods, Passing and Returning Objects in Java

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

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

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

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

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

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

#### **List of Course Seminar Topics:**

1. Introduction of Arrays and 1D Array programming examples
2. Multidimensional arrays
3. Variants of main() and command line arguments
4. Input and Output stream classes
5. String concepts and various methods of comparing strings
6. Methods in Java
7. Java String Methods
8. Passing array to a function and Jagged array examples
9. Reading input using Scanner and Buffer Reader Class
10. String, String buffer and String builder
11. Types of Inheritance in Java
12. Implementation of Types using Constructor in Inheritance
13. Using final with Inheritance
14. Base vs derived class reference in Inheritance
15. Using final with Inheritance, Accessing superclass member
16. Parent and Child classes having same data member
17. Overriding, Hiding Fields & Methods
18. Static vs Dynamic Binding & Hiding Methods
19. Private and final methods
20. Passing and Returning Objects in Java
21. Java Memory Management
22. File handling in Java vs C++
23. Data types used in Java vs C++

24. Java Object Serialization and Deserialization
25. Operator precedence
26. Use of Object Class Methods
27. Garbage collection in JAVA

28. Use of Static Blocks in various applications
29. Keywords used in JAVA
30. Types of Variables In JAVA

**List of Course Seminar Topics:**

31. Introduction of Arrays and 1D Array programming examples
32. Multidimensional arrays
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**List of Group Discussion Topics:**

1. Introduction of Arrays and 1D Array programming examples
2. Multidimensional arrays
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23. Data types used in Java vs C++
24. Java Object Serialization and Deserialization
25. Operator precedence
26. Use of Object Class Methods
27. Garbage collection in JAVA
28. Use of Static Blocks in various applications
29. Keywords used in JAVA
30. Types of Variables In JAVA
31. Data types used in java and Wrapper classes in java
32. Checked and unchecked exception, user defined and standard exception
33. Abstraction in Java and different ways to achieve Abstraction
34. Packages in Java – Types, Advantages & Techniques to Access Packages
35. Inner classes, nested interfaces in Java
36. Difference between Interfaces and abstract classes in Java
37. Exception Handling in Java Vs CPP
38. Difference between 1) throw and throws. 2) Final, finally and finalize in Java
39. Discuss Exception propagation and Discuss Exception handling with method overriding in Java
40. Discuss Packages, Access specifiers and Encapsulation in java.
41. Difference between abstraction and encapsulation in Java.
42. Daemon Threads Vs user threads
43. Preemptive scheduling Vs slicing
44. Is it possible to call the run() method directly to start a new thread? please comment
45. Arraylist Vs Vector
46. Arrays Vs Collections
47. is Iterator a class or an Interface? What is its use?
48. List Vs Set
49. BufferedWriter and BufferedReader classes in java
50. BufferedReader Vs Scanner class in java
51. Buffered Reader Vs FileReader in java

52. Instanceofjava

53. Difference between CPP and JAVA

54. Difference between JDBC and ODBC connectivity

55. file processing in java

56. Difference between primitive data processing and object data processing
57. Creating GUI using swing
58. comparison between Swing, SWT, AWT, SwingX, JGoodies, JavaFX, Apache Pivot
59. Introduction To JFC And GUI Programming In Java
60. Introduction to wrapper classes
61. Why java uses Unicode System?
62. Checked and unchecked exception, user defined and standard exception
63. Abstraction in Java and different ways to achieve Abstraction
64. Packages in Java – Types, Advantages & Techniques to Access Packages
65. Inner classes, nested interfaces in Java
66. Difference between Interfaces and abstract classes in Java
67. Exception Handling in Java Vs CPP
68. Difference between 1) throw and throws. 2) Final, finally and finalize in Java
69. Discuss Exception propagation and Discuss Exception handling with method overriding in Java
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78. List Vs Set
79. BufferedWriter and BufferedReader classes in java
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87. Creating GUI using swing
88. comparison between Swing, SWT, AWT, SwingX, JGoodies, JavaFX, Apache Pivot
89. Introduction To JFC And GUI Programming In Java
90. Introduction to wrapper classes
91. Why java uses Unicode System?

**List of Practical's:**

1. Implement Student class using following Concepts
  - All types of Constructors
  - Static variables and instance variables
  - Static blocks and instance blocks
  - Static methods and instance methods

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

Input:

Array=[3,5,-4,8,11,1,-1,7] targetsum=15

Output: [8,7]

Input:

Array=[3,5,-4,8,11,1,-1,6] targetsum=15

Output: []

3. Write Java program to calculate area of triangle, square & circle using function overloading. Function parameter accept from user (Use function Overloading concepts and Inheritance).
4. Write a program for following exception, develop a suitable scenario in which the following exceptions occur:
  - a. divide by zero
  - b. Array index out of bounds exception
  - c. Null pointer Exception
5. Write a java program to solve producer-consumer problem where there are two producer threads and one consumer thread.
6. Implement various operations using JDBC Connectivity.
7. Display bank account information ( Use interface and inheritance using java)
8. Develop a GUI in java which reads, update the file.

#### List of Course Projects:

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

12. Online Survey System
13. RSS feed reader
14. Smart city project
15. Stock management system
16. Supply chain management system

17. Virtual private network
18. Pocket Tanks Game Java Project
19. Internet Banking
20. Hospital Management Java Project
21. Teachers Feedback Form Java Project
22. Online Job Portal Java Project
23. Online Examination Java Project
24. Alumini Database Java Project
25. Virtual Classroom Java Project
26. Lan Chat and File Sharing Java Project
27. Payroll System Java Project
28. Online Exam Java Project
29. Java Game mini Project
30. Online Shopping Java Project
31. Online Library Management System
32. Feedback Collection System java project
33. Text Editor in Java Project
34. Moving Balls using Java Applet
35. Online Reservation System Project
36. Web skeletonizer service
37. Web Enabled Manufacturing Process Project
38. Album Manager Project
39. Global Communication Network
40. Library System project
41. Link Handler System Project
42. Crypto system Project
43. Scheduling and Dispatching project
44. Intranet Mailing System
45. Online Examination System Project
46. Business to Customer System Project
47. University Admission & Maintenance System
48. Campaign Management System Project
49. Content Management System Project
50. Digital Library System Project
51. Contract Labour Management System Project
52. Pay Roll System Project using Java
53. Revenue Recovery System Project
54. Online medical Booking Store Project
55. Client Management System Project
56. Tele Dormitory System Project
57. Reusable CAPTCHA security engine Project
58. Mobile Service Provider System
59. Forestry Management System



60. Distributed Channel management System

61. Online Tenders Management System

62. Noble Job Portal System

63. Energy Audit Processing System
64. Collector Monthly Review System
65. Grievance Handling System
66. Student Project Allocation and Management Project
67. Web Based Reporting System
68. Vehicle Identification System
69. Diamond Shipping System
70. Visa Processing System
71. Enterprise Fleet Management System
72. Global Communication Media
73. HR Help Desk System
74. SQL Workbench Project
75. Remarketing System project
76. Cargo Express Courier project
77. Automated Sports Club Project
78. Multi Banking System Project
79. Java Application World
80. Cricket Game Java Project
81. Email Program System
82. Employee Information and Payroll System
83. Complete Mailing System
84. Complete Banking System
85. College Library Application System
86. Colleges Enrollment System
87. Car Sales System
88. Bus Booking System
89. Bug Tracking System
90. University Admission Management System Java Project
91. Beat It Game in Java
92. Civilization Game Project
93. Airways Reservation System
94. Airstrike System Game
95. Pong Game Java Project
96. Faculty Book System
97. Bank Application System
98. ATM Database System
99. Advanced Payroll System
100. Virtual Private Network Java Project
101. ISP Automation System
102. Life Insurance Management System
103. Help Desk Management System
104. Datamart Management System
105. Automated Sports Club System

106. University Search Engine Project

107. Online Exam Suite Project

108. Forensic Management System

109. Student Registration System
110. E Mail Scanning Project
111. Criminal Face Detection System
112. Web Server Management System Java Project
113. Stores Management System
114. Bug Tracking System Java Project
115. Career Information Management System Java Project
116. Course Management System Java Project
117. Data Visualization Software Java Project
118. Digital Steganography Java Project
119. E Health Care Management System Java Project
120. Electricity Billing System Java Project
121. Email Client Software Java Project
122. Event Management System Java Project
123. Farmers Buddy Java Project Java Project
124. File Transfer and Chat Java Project
125. Knowledge Evaluator Software Java Project
126. Library Management System Java Project
127. Mail Server Java Project
128. Network Packet Sniffer Java Project
129. Number Guessing Game Java Project
130. Online Attendance Management System Java Project
131. Online Bank Management System Java Project
132. Online Book Store
133. Online Customer Care and Service Center Java Project
134. Online Document Management System Java Project
135. Online Examination Management System Java Project
136. Online Medical Management System Java Project
137. Online Quiz System Java Project
138. Online Survey System Java Project
139. Photo Lab Management System Java Project
140. RSS Feed Reader Java Project
141. Smart City Project Java Project
142. Stock Management System Java Project
143. Student Result Processing System Java Project
144. Supply Chain Management System Java Project
145. Telephone Billing System Java Project
146. Travel Management System Java Project
147. Currency Converter
148. Career Information Management System
149. Digital Steganography
150. Event Management System
151. Farmers Buddy

152. File Transfer and Chat

153. Knowledge Evaluator Software

154. Mail Server

155. Number Guessing Game
156. Online Attendance Management System
157. Online Customer Care and Service Center
158. Online Document Management System
159. Online Examination Management System
160. Online Quiz System
161. Photo Lab Management System
162. Student Result Processing System
163. Travel Management System
164. University Admission Management System
165. Web Server Management System
166. Address Book Management System
167. Affiliate Manager
168. Ajax Browser
169. Application Installer Software
170. Application Re-installer Software
171. ATM Simulator System
172. Automatic File Update
173. Bookmark Sync
174. Bus Ticket Reservation System
175. Calendar Icon Maker Application
176. CSS Color and Image Annotator
177. Cyber cafe Management System
178. Data Encryption
179. Database Explorer
180. Directory and File Explorer
181. Domain Search Engine
182. E-Acquisition
183. E-Advertisement
184. E-Learning
185. Enterprise Scheme Planner
186. Face Identification
187. File and Folder Explorer
188. Font Detector/Finder
189. HTML Color Code Finder
190. HTML Spell Checker
191. Image Compressor Application
192. Image to Text Converter
193. Internet Credit Card System
194. Internet Usage Monitoring System
195. Intrusion Detection in Wireless Sensor Network
196. Keyword Finder and Number Calculator
197. Language Emulator

198. Mac Ethernet Address

199. Malware Scanner

200. MP4 Video Converter

201. Online Auction
202. Online Magazine
203. Password Protector and Reminder
204. PDF Converter
205. Pharmacy Management System
206. Port Scanner
207. Process Analysis in Asynchronous System
208. Remote Desktop Administrator
209. Resource Planner and Organizer
210. Search Engine
211. Security System for DNS using Cryptography
212. Smart FTP Uploads
213. Synchronous Conferencing System
214. Text to HTML Converter
215. Unicode Font
216. Voice Chatting and Video Conferencing
217. Voice Compressor Software
218. Windows Fixer
219. XML Compactor



**List of Home Assignments:****Blog:**

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

**Survey:**

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

**Design:**

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

**Case Study:**

1. Java development milestones from 1.0 to 16.0
2. Implementation of Different Methods in Polymorphism
3. Real world systems which use java for its implementation

4. Drawing a flag using java
5. Use of different methods of Class object
6. Drawing a flag using java

**Text Books:**

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

**Reference Books:**

1. *Bruce Eckel, "Thinking In Java – The Definitive Introduction to Object-Oriented Programming in the Language of the World-Wide Web", Fourth Edition, Pearson Education, Inc.*
2. *R. Morelli and R. Walde, "Java, java, Java – Object-Oriented Problem Solving", 3<sup>rd</sup> edition, Pearson Education, Inc.*

**Moocs Links and additional reading material:**

1. Programming using Java| Java Tutorial | By Infosys Technology  
[https://infyspringboard.onwingspan.com/en/app/toc/lex\\_auth\\_01304972186110361645\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01304972186110361645_shared/overview)
2. An Introduction to Programming through C++ – Prof A.G. Ranade- NPTEL- computer science and engineering – NOC <https://nptel.ac.in/courses/106/101/106101208/#>

**Course Outcomes:**

The student will be able to –

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

**Future Courses Mapping:**

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

**Job Mapping:**

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

**CS2227: DATABASE MANAGEMENT SYSTEMS**

**Course Prerequisites:** Data structures, Discrete Mathematics

**Course Objectives:**

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

**Credits: 4**

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

**Tut: NA**

**Lab: 2 Hours/Week**

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

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

**Storage and Querying:** Storage and File structures, Indexed Files, Single Level and Multi Level Indexes; Query Processing, Query Optimization

**Transaction Management:** Basic concept of a Transaction, ACID Properties, State diagram, Concept of Schedule, Serializability – Conflict and View, Concurrency Control Protocols, Recovery techniques

**Parallel and Distributed Databases:** Architecture, I/O Parallelism, Interquery, Intraquery, Intraoperation and Interoperation Parallelism, Types of **Distributed** Database Systems, Distributed Data Storage, Distributed Query Processing

**NOSQL Databases and Big Data Storage Systems:** Introduction to NOSQL Databases, Types of NOSQL Databases, BASE properties, CAP theorem, MapReduce.

**Data Warehousing:** Architecture and Components of Data Warehouse, OLAP

**List of Practical: (Any Six)**

- 1) Choose a database application; you propose to work on throughout the course. Perform requirement analysis in detail for the same. Draw an entity-relationship diagram for the proposed database.
- 2) Create a database with appropriate constraints using DDL and populate/modify it with the help of DML.
- 3) Design and Execute "SELECT" queries using conditional, logical, like/not like, in/not in, between...and, is null/is not null operators in where clause, order by, group by, aggregate functions, having clause, and set operators. Use SQL single row functions for date, time, string etc.
- 4) Write equijoin, non equijoin, self join and outer join queries. Write queries containing single row / multiple row / correlated sub queries using operators like =, in, any, all, exists etc. Write DML queries containing sub queries. Study a set of query processing strategies.
- 5) Write PL/SQL blocks to implement all types of cursor.
- 6) Write useful stored procedures and functions in PL/SQL to perform complex computation.
- 7) Write and execute all types of database triggers in PL/SQL.
- 8) Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

- 9) Create a database with suitable example using MongoDB and implement Inserting and saving document, Removing document, Updating document
- 10) Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques: find and findOne, Query criteria, Type-specific queries
- 11) Implement Map Reduce operation with suitable example using MongoDB.

**List of indicative project areas: (Any 1)**

Following is the indicative list of projects but is not limited to. Student and teacher can also jointly decide project area other than specified in the list.

1. University/Educational institute database
2. Railway reservation/Show booking system
3. Finance management system
4. Travel/Tours management system
5. Blood bank management system
7. Sales management
8. Online retailer/payment systems
9. Hospital management system
10. Human resource management
11. Manufacturing/production management
12. Matrimonial databases for finding matches.
13. Online appointment booking

**List of Course Seminar Topics:**

1. Object and Object-Relational Databases
2. XML data model, XML documents and associated languages
3. Database Security
4. Modern Storage Architectures
5. Google Cloud- SQL Databases
6. Google Cloud- NOSQL Databases
7. Amazon Databases
8. Oracle NoSQL Database
9. Cassandra DB

10. Data Center Engineering



## 11. Google File System (GFS)

**List of Home Assignments:****Design:**

1. Suppose you want to build a video site similar to YouTube. Identify disadvantages of keeping data in a file-processing system. Discuss the relevance of each of these points to the storage of actual video data, and to metadata about the video, such as title, the user who uploaded it, tags, and which users viewed it.
2. Illustrate data model that might be used to store information in a social-networking system such as Facebook
3. Describe the circumstances in which you would choose to use embedded SQL rather than SQL alone or only a general-purpose programming language.
4. Give the DTD and XML Schema for Library Management System. Give a small example of data corresponding to this DTD and XML. Write ten queries in Xpath and XQuery
5. If you were designing a Web-based system to make airline reservations and sell airline tickets, which DBMS architecture would you choose? Why? Why would the other architectures not be a good choice? Design a schema and show a sample database for that application. What types of additional information and constraints would you like to represent in the schema? Think of several users of your database, and design a view for each.

**Case Study:**

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

**Blog**

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

**Surveys**

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

**Suggest an assessment Scheme:**

MSE:10 ESE:20 HA:10 CP:10 Lab:10 Seminar:20 CVV:20

**Text Books:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan; “Database System Concepts”; 6<sup>th</sup> Edition, McGraw-Hill Education
2. RamezElmasri, Shamkant B. Navathe; “Fundamentals of Database Systems”;7<sup>th</sup> Edition, Pearson

**Reference Books:**

1. Thomas M. Connolly, Carolyn E. Begg,” Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition ;Pearson
2. Raghu Ramakrishnan, Johannes Gehrke; “Database Management Systems”, 3rd Edition; McGraw Hill Education
3. Kristina Chodorow, MongoDB The definitive guide, O’Reilly Publications, ISBN: 978-93-5110-269-4, 2nd Edition.
4. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
5. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication. 6. Reese G., Yarger R., King T., Williams H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.
7. Dalton Patrik, SQL Server – Black Book, DreamTech Press.

8. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.

9. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

**Moocs Links and additional reading material:**

<https://nptel.ac.in/courses/106/105/106105175/>

[https://onlinecourses.nptel.ac.in/noc21\\_cs04/preview](https://onlinecourses.nptel.ac.in/noc21_cs04/preview)

<https://www.datacamp.com/courses/introduction-to-sql>

[Oracle MOOC: PL/SQL Fundamentals - Oracle APEX](#)

**Course Outcomes:**

The student will be able to –

1. Design data models as per data requirements of an organization
2. Synthesize a relational data model up to a suitable normal form
3. Develop a database system using relational queries and PL/SQL objects
4. Apply indexing techniques and query optimization strategies
5. Understand importance of concurrency control and recovery techniques
6. Adapt to emerging trends considering societal requirements

**Future Courses Mapping:**

Advanced databases

Big Data Management

Cloud Databases

Database Administrator

**Job Mapping:**

Database Engineer

SQL developer

PL/SQL developer

**IT2273 : PROBABILITY AND CALCULUS**

**Course Prerequisites:**

Basics of Mathematics

**Course Objectives:**

1. To facilitate the students with a concrete foundation of probability and calculus
2. To analyze problems in Science and Engineering applications through probability and calculus methods.

**Credits: 4**

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

**Course Relevance:**

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

The course is relevant to all branches of Engineering. Its an important foundation for computer science fields such as machine learning, artificial intelligence, computer graphics, randomized algorithms, image processing, and scientific simulations.

<b>SECTION I</b>
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**UNIT 1: Probability Theory****5 Hours**

Definition of probability: classical, empirical and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Baye's theorem of inverse probability and examples

**UNIT II: Random Variables and Mathematical expectation****4 Hours**

Random variable, Discrete Random Variable, Continuous Random Variable, Mathematical Expectation, Addition theorem of Expectation, Multiplication theorem of Expectation, Chebychev's Inequality

**UNIT III: Probability distributions****6 Hours**

Distribution Function, Probability Mass Function, Probability density function, Continuous Distributions: Normal Distribution, joint probability distribution, Discrete Distributions: Binomial distribution, Poisson's distribution-Illustrative examples.

**UNIT IV: Probability Densities****4 Hours**

The Uniform Distribution, Log-normal distribution, Beta distribution, Gamma distribution, joint probability distribution: Discrete and Continuous distribution

**UNIT V: Multivariable Calculus****6 Hours**

Partial Differentiation and Its Applications: Functions of two or more variables, partial

derivative, euler theorem, total derivative, Jacobian, Maxima and Minima of functions of two variables and problems

**UNIT VI: Fourier Series and Fourier Transforms****4 Hours**

Definition of periodic function, Fourier expansion of periodic functions in a given interval of length 2, Determination of Fourier coefficients – Fourier series of even and odd functions, Fourier integral theorem

**TEXT BOOKS:**

1. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7th Revised and Enlarged Edition, 2016.
2. MILLER & FREUND'S PROBABILITY AND STATISTICS FOR ENGINEERS NINTH EDITION Global Edition by Richard A. Johnson Pearson Publication
3. Higher Engineering Mathematics B. S. Grewal Khanna Publishers 44th Edition, 2017
4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

**REFERENCE BOOKS:**

- 1) Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6 th Edition 1995
- 2) G. V. Kumbhojkar, Probability and Random Processes, C. Jamnadas and Co., 14th Edition, 2010.
- 3) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
- 4) Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010 4 A Text Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014

**COURSE OUTCOMES:**

1. Understand basics of probability and Bayes rule
2. Solve problems related to random variables and mathematical expectation
3. Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
4. Understand and analyze various probability densities
5. Apply partial differentiation for two or more variables
6. Identify Fourier concepts and techniques to provide mathematical models of real-world situations

**IT2268: DESIGN THINKING-III****Credits: 1****Teaching Scheme Tut: 1 Hour/Week****Course Objectives:**

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

**Contents for Design Thinking 2 to Design Thinking 8:**

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

**Suggest an assessment Scheme:**

Publication of paper or patent

**Course Outcomes:**

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



**IT2272: ENGINEERING DESIGN AND INNOVATION III**

Course Prerequisites: Problem Based Learning

**Credits: 4**

**Teaching Scheme Theory: 1 Hour/Week**

**Lab: 6 Hours/Week**

**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.

**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.

**SECTION-1**

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of “Trends in Engineering Technology” 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 Securityetc).

**Suggest an assessment Scheme:**

MSE and ESE

**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 RobartCapraro, 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](http://www.nptelvideos.in)

**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

**IT2250: 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:4**

Teaching Scheme Theory: 2 Hours/Week

Tut: 1 Hour/Week

Lab: 2 Hours/Week

**SECTION-1****UNIT 1****3 Hours**

Introduction: Data and Information, Data Structure, Classification of Data Structures, Primitive Data Types, Abstract Data Types, Data structure vs. File Organization, Operations on Data Structure, Algorithm, Importance of Algorithm Analysis, Complexity of an Algorithm, Asymptotic Analysis and Notations, Big O Notation, Big Omega Notation, Big Theta Notation

Array: Introduction, One Dimensional Array, Various Operations on Array, Multidimensional Arrays, Advantages and Limitations of Arrays.

**Unit II****5 Hours**

Sorting Techniques:

Bubble, Selection, Insertion, Merge, Quick, Heap sort with Analysis.

Searching techniques:

Linear Search, Binary search with Analysis.

**UNIT II****6 Hours**

Stack: Introduction, Operations on the Stack Memory Representation of Stack, Array Representation of Stack, Applications of Stack, Evaluation of Arithmetic Expression, Matching Parenthesis, infix and postfix operations, Recursion.

Queue: Introduction, Queue, Operations on the Queue, Memory Representation of Queue, Array representation of queue, Linked List Representation of Queue, Circular Queue, Deque, Priority Queue, Application of Priority Queue, Applications of Queues.

Linked List : Dynamic memory allocation, Singly Linked Lists, Doubly linked Lists, Circular linked lists, Applications of Linked list

## SECTION-II

### Unit IV

6 Hours

Tree: Tree, Binary Tree, Properties of Binary Tree, representation using array and linked lists. Tree Traversals: Recursive and Non recursive, Operations Performed on Binary Tree, Reconstruction of Binary Tree from its Traversals, Binary Search Tree, Operations on Binary Search Tree  
Advanced Tree Structures: AVL Tree, Operations performed on AVL Tree, Red Black Tree, Operations Performed on Red Black Tree, B-Tree

### Unit V

4 Hours

Graph: Introduction, Graph, Graph Terminology, Memory Representation of Graph, Adjacency Matrix Representation of Graph, Adjacency List or Linked Representation of Graph, Operations Performed on Graph, Graph Traversal, Applications of the Graph, Reachability, Shortest Path Problems

### Unit VI

4 Hours

Hashing Techniques Hash function, Address calculation techniques, Common hashing functions Collision resolution, Linear probing, Quadratic, Double hashing, Bucket hashing

#### List of Practicals:

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

#### 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.

3. Narasimha karumanchi, “Data Structures and Algorithm Made Easy”, Fifth Edition, CareerMonk publication.

**Reference Books:**

1. G. A.V, PAI , “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6

Reference Books:

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

**Virtual Labs:**

1. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>

2. <https://cse01-iiith.vlabs.ac.in/List%20of%20experiments.html>

Assessment Scheme: CVV, Lab Assignment, Lab exam, Course Project

**Course Outcomes:**

The student will be able –

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)

**IT2274: WEB TECHNOLOGY**

**Course Prerequisites:** Computer Programming, Database Management Systems, Computer Network

**Course Objectives:**

1. To learn the fundamental tags of HTML5 and CSS.
2. To obtain knowledge of JavaScript as client-side technology in web development.
3. To understand use of jQuery in dynamic website designing.
4. To acquire skills of server-side technologies such as PHP in web development.
5. To build user interface or front end of complex websites using react.
6. To study building the backend of web application using NodeJS framework.

**Credits: 4**

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

**Tut:** 1Hours/Week

**Lab:** 2 Hours/Week

**Course Relevance:** Web development is the work involved in developing a website for the Internet or an intranet . Web development can range from developing a simple single static page of plain text to complex web-based internet applications (web apps), businesses, social network services and enterprise application development. Apparently in today's technology-driven society, knowing the foundations of the website design is useful. Actually, it has grown into the world's most important site for research, education, networking, as well as entertainment. Most of the jobs available in the IT industries are web technology related.

**SECTION-1**

**Introduction:** Introduction to web technology, Internet and WWW, web site planning and design issues, HTML5: structure of html document, commenting, formatting tags,list tags, hyperlink tags, image, table tags, frame tags, form tags, CSS, Bootstrap, JSON(6Hrs)

**Client Side Technologies:** JavaScript: Overview of JavaScript, Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS, Form validation, DOM: Introduction, DOMlevels, DOM Objects, their properties and methods, Manipulating DOM (6 Mrs)

**JQuery:** Introduction, Loading JQuery, selecting elements, changing styles, creating elements, appending elements, removing elements, handling events.(2 Hrs)





**ServerSide Technologies:** Introduction, Features, PHP syntax, Control structures, Functions, Arrays, String, Form Handling, File Handling, Session and Cookies, Error Handling, MySQL with PHP (6 Hrs)

**React:** Introduction, Architecture, Components, JSX, Class, State, Props, Events, Render function, Forms, Lists, Router, Flux. (4 Hrs)

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

**List of Tutorials: (Any Three)**

- 1) Learn various HTML tags
- 2) Use of Bootstrap to design a web page
- 3) Understand use of JavaScript in form validation
- 4) Study of Cookies in PHP
- 5) Study of Session in PHP
- 6) Study of different ways of working with PHP and MySQL
- 7) Express Framework
- 8) Laravel Framework
- 9) RESTful API
- 10) React Hooks
- 11) Node JS and relational databases
- 12) Node JS and NoSQL databases

**List of Practicals: (Any Six)**

- 1) Installation, configuration and understanding working of XAMPP server for local host.
- 2) Design and implement a web page to demonstrate the use of different HTML tags.
- 3) Design and develop a web page demonstrating the use of CSS tags.
- 4) Design and develop a HTML form for student registration.
- 5) Write a code for validation of student registration form using JavaScript.
- 6) Design and develop a web page to demonstrate various methods of objects in JavaScript like Array, String, Math, Date.
- 7) Design and develop a web page demonstrating various effects using jQuery.
- 8) Write a PHP program to create a simple calculator that can accept two numbers and perform operations like add, subtract, multiplication and divide. Validate input values and prompt/alerts for invalid values.
- 9) Design a dynamic web application using PHP and MYSQL as back-end to perform insert, delete, view and update operation.
- 10) Design a web page demonstrating file handling operations like open, read, write, append copy, move, delete and rename using nodeJS.
- 11) Design and implement simple website using React.

**List of Projects:**

1. Student Registration System
2. Tours and Travel System
3. Canteen Food Ordering and Management System.
4. Online Personal Counseling
5. Online Recruitment System
6. Farming Assistant System
7. Hospital management System
8. Hostel Management System

9. Online Event Management
10. Online Bus/Railway/Airways Booking System
11. Online Banking System

**List of Course Seminar Topics:**

1. Bootstrap
2. Spring Framework
3. Joomla
4. Sass
5. Java Servlets
6. Object Oriented PHP
7. Angular JS
8. VueJS
9. Django
10. Laravel

**List of Course Group Discussion Topics:**

1. Web Services
2. Client Side Frameworks
3. Server Side Frameworks
4. Relational and NoSQL Databases
5. AJAX
6. Client Side Technologies
7. Server Side Technologies

8. Template Engine

9. Progressive Web Apps
10. Markup Languages

**List of Home Assignments:****Design:**

1. Design, Develop and Deploy social web applications using Bootstrap.
2. Design, Develop and Deploy web applications using CMS.
3. Design, Develop and Deploy web application for Electricity Billing System
4. Design, Develop and Deploy web application for department
5. Design, Develop and Deploy web application for Medical Shop

**Case Study:**

1. Angular JS
2. VueJS
3. Django
4. Flask
5. Wordpress

**Blog:**

1. Recent Web Development Trends
2. Databases for Web Developers
3. Web Services
4. Web Security
5. Web Evolution

**Surveys:**

1. Comparison of Web Services



2. Frameworks for Web Development
3. Scripting languages for Web Designing
4. Web Server Vs Application Server
5. Current Technologies for Web Development

**Suggest an assessment Scheme:**

1. Home Assignment
2. ESE
3. CVV
4. Seminar
5. Group Discussion
6. LAB-Course Assignment and Project Evaluation

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

1. *Thomas A. Powell; "Complete reference HTML"; 4<sup>th</sup> edition, Tata McGraw-Hill Publications*
2. *Black book; "Web Technologies:HTML,JS,PHP,Java,JSP,ASP.NET,XML and AJAX" ; Dreamtech Press, 2016.*
3. *Dave Mercer, Allan Ken; "Beginning PHP 5"; Dreamtech Publications.*
4. *Martin, M.G., "Programming for Beginners: 6 Books in 1 – Swift+PHP+Java+Javascript+Html+CSS: Basic Fundamental Guide for Beginners", independently published, 2018*
5. *Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS and HTML 5",5<sup>th</sup> Edition, O'Reilly publication.*

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

1. *Jeremy McPeak & Paul Wilton, "Beginning JavaScript", 5<sup>th</sup> Edition, Wrox Publication.*
2. *Adam Bretz & Colin J Ihrig, "Full Stack Javascript Development with MEAN", SPD, ISBN-13: 978-0992461256*
3. *Shama Hoque "Full-Stack React Projects", 1<sup>st</sup> Edition, Packt Publishing, ISBN-13 978-1788835534*
4. *Frank Zammetti, "Modern Full-Stack Development", 1<sup>st</sup> Edition, Apress, ISBN-13 978-1484257371*

**MOOCs Links and additional reading material:**

1. <https://www.w3schools.com>
2. <https://www.udemy.com/course/ultimate-web/>
3. <https://www.coursera.org>
4. <https://nptel.ac.in/courses/106106222>
5. <https://nptel.ac.in/courses/106106156>
6. <https://www.udemy.com/course/full-stack-web-development-2021-guide-with-nodejs-mongodb/>

**Course Outcomes:**

The student will be able to –

- 1) Design reliable, efficient, scalable front-end view of web pages using HTML5, CSS with Bootstrap framework.
- 2) Perform client-side web page validation and event handling using JavaScript.
- 3) Develop the web pages more dynamic and interactive using jQuery.
- 4) Deliver realistic and extensible lightweight web application using suitable server side web technology like PHP
- 5) Design and implement User Interface for complex web applications using React
- 6) Build server-side applications, real time applications, and cross platform applications using NodeJS framework

**IT2266: COMPUTER NETWORK**

**Course Prerequisites:** Fundamentals of Computer, C/C++ programming.

**Course Objectives:**

1. Understand the importance of Computer Network and its usage.
2. Study error control and flow control techniques.
3. Solve real-world problems in the context of today's internet (TCP/IP and UDP/IP).
4. Distinguish and relate various physical Medias, interfacing standards and adapters.
5. Implement mathematically and logically the working of computer protocols in abstract.

**Credits:**4

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

**Tut:** 1 Hours/Week

**Lab:** 2 Hours/Week

**Course Relevance:**

A system of interconnected computers and computerized peripherals such as printers is called computer network. This interconnection among computers facilitates information sharing among them by using data communication. The main objective of computer network is to enable seamless exchange of data between any two points in the world. This course will explore common network services and protocols such as email, web services etc Networking is an ever growing domain in which there is a constant need of support. Networks are becoming progressively more and more convoluted as the technology is advancing and flourishing.

**Section 1**

Introduction: Introduction to computer network, LAN, MAN, WAN, PAN, Ad-hoc Networks, Network Architectures- Client-Server, Peer To Peer, Network Topologies- Bus, ring, tree, star, mesh, hybrid. Communication Models- OSI Model, TCP/IP Model, Design issues for layers.

Physical Layer: Transmission media- Guided media, unguided media. Transmission Modes- Simplex, Half-Duplex and Full-Duplex. Network Devices- Hub, Repeater, Bridge, Switch, Router, Gateways and router. Spread spectrum signal, FHSS, DSSS.

Data Link Layer : Logical Link Layer- Services to Network Layer, Framing, Error Control and Flow Control. Framing in LLC- framing challenges, types of framing. Error Control in LLC- error detection, error correction, Parity Bits, Hamming Codes (11/12-bits) 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 Standards and Frame Formats, CSMA/CD.

**Section 2**

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Network Layer: Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols- Distance Vector, Link State, Path Vector, Routing in Internet- RIP, OSPF, BGP, Congestion control and QoS,

Transport Layer: Services, Berkeley Sockets, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, TCP, TCP Timer management, Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless.

Application Layer: Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP).

### List of Tutorials: (Any Three)

1. Identification of various networks components
2. Establishing LAN
3. Installation of network device drivers
4. Use/installation of proxy server
5. Configuration of network devices in CISCO packet tracer (Windows/Linux)
6. Implement communication between various network devices using CISCO packet tracer (Windows/Linux)
7. Network traffic monitoring using Wireshark/Ethereal (Windows/Linux)

### List of Practical's: (Any Six)

1. Study and implement various networking commands on terminal.
2. Use Socket programming to create Client and Server to send Hello message.
3. Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC. Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer-to-peer mode. (50% students will perform Hamming Code and others will perform CRC)
4. Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in peer-to-peer mode
5. Write a program to find class and type of a given IP address.
6. Write a program to demonstrate sub netting and find the subnet masks.
7. Write a program using TCP socket for wired network for following: a. Say Hello to Each other (For all students) b. File transfer (For all students) c. Calculator (Arithmetic) (50% students) d. Calculator (Trigonometry) (50% students)
8. Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.
9. Write a program to implement: a. Network Routing: Shortest path routing, AODV. b. Analysis of congestion control (TCP and UDP).
10. Write a program to analyse following packet formats captured through Wireshark for wired networks. 1. Ethernet 2. IP 3. TCP 4. UDP

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**List of Course Projects:**

1. Write a program using TCP sockets for wired networks to implement a. Peer to Peer Chat b. Multi User Chat Demonstrate the packets captured traces using Wireshark Packet AnalyzerTool for peer-to-peer mode.
2. Implementation of shortest path protocol
3. Implementation of string encryption and decryption
4. Implementation of character stuffing and destuffing
5. Execution and analysis of Network commands
6. To find out details of network from IP addressing scheme using 'C' code
7. Implement real time Internet route optimization.
8. Implement Broadcast Server System.
9. Implement a real time voting System.
10. Real time packet capture and analysis for malwares in wireless networks.

**List of Course Seminar Topics:**

1. Asynchronous Transfer Mode
2. Need Of Multiplexing for Signal Modulation
3. TDM with PAM a case study
4. Noise signal
5. Basic Network Protocols
6. Manchester Vs Differential Manchester coding technique
7. Amplitude Shift Keying: Working and Applications
8. Nyquist Sampling Theorem
9. CDMA
10. Line coding Techniques with example

**List of Course Group Discussion Topics:**

1. TCP/IP Model
2. Mobile IP
3. Congestion Control and QoS
4. Wireless Technology for Short range and long range
5. Application Protocols and its security
6. IP Protocols
7. Data Communication Issues in IP Networks and Solutions to it
8. Congestion control in hybrid networks
9. Issues in Real time Audio and video transmission protocol.
10. IPV6

**List of Home Assignments:**

**Design:**

1. Enumerate the challenges in Line coding. Draw the line code for the sequence 010011110 using Polar NRZ-L and NRZ-1 schemes.
2. Design the procedure to configure TCP/IP network layer services.
3. Simulation of Routing Protocols using NS2
4. Simulation of FTP based Protocols using CISCO packet Tracer/ NS2
5. Simulation of Congestion Control Protocols Using NS2

**Case Study:**

1. Amplitude and Frequency Modulation Technique
2. Digital to Analog and Analog to Digital converters
3. Study of Various VPNs
4. IoT Solutions to Current Network Requirement
5. Unix Solutions for Broadcast System

**Blog:**

1. Communication Protocol
2. Emerging Trends in Computer Networks
3. Use of IOT in Networks
4. Cloud based Network Solutions for real world problems
5. Recent Trends in Computer Security

**Surveys:**

1. Survey of wireless Technologies
2. Survey of Congestion control methodologies
3. Survey of Bluetooth Technology
4. Survey of Virtual Private Networks
5. Survey of ADHOC Networks

**Assessment Scheme:**

PPT/GD  
HA  
ESE  
Course Project  
CVV

**Text Books:**

1. James F. Kurose, and Keith W. Ross, "A Top-Down Approach", 4th edition, Publisher: Addison-Wesley ISBN: 0-321-49770-8
2. Behrouz A. Forouzan, "Data Communication and Networking", 4th edition, Tata McGraw Hill
3. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education



**Reference Books:**

1. Kurose, Ross, "Computer Networking a Top Down Approach Featuring the Internet", Pearson; 6th edition (March 5, 2012), ISBN-10: 0132856204
2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", Wiley, ISBN: 0-470-09510-5
3. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall, 2004

**Moocs Links and additional reading material:**

1. [www.nptelvideos.in](http://www.nptelvideos.in)
2. <https://www.my-mooc.com/en/categorie/computer-networking>

**COURSE OUTCOMES**

3. Select network architecture, topology and essential components to design computer networks.
4. Estimate reliability issues based on error control, flow control and pipelining by using bandwidth, latency, throughput and efficiency.
5. Design mechanisms to demonstrate server channel allocation in wired and wireless computer networks
6. Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols
7. Demonstrate Network Connections Strategies ,Protocols and Technologies
8. Develop Client-Server architectures and prototypes by the means of correct standards, protocols and technologies

**IT2004: AUTOMATA THEORY**

**Course Prerequisites:** Basic mathematics and programming

**Course Objectives:**

To design suitable computational model/for accepting / recognizing a given formal language

To compare computational models with respect to their power in recognizing different types of languages

To understand notion of un/decidability of problems

**Credits:** 2

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

**Course Relevance:** This course lays a strong foundation for higher studies as well as research. For higher studies, there are different courses such as 'Program Analysis and Verification' which are based on the concepts of computation theory. For Research scholars, it would help in understanding the type and class of problems, and to solve and prove certainty of the provided solution. It would also help software developers in building the logic of programs, exploring its mathematical proofs, generating hypothetical scenarios, designing various computing machines.

**Finite Automata:** (05 hrs)

Automaton as a model of computation, Alphabets, Strings, Languages, Deterministic Finite Automata (DFA), Nondeterministic finite Automata (NFA), State Minimization algorithm, NFA with epsilon transition, pumping lemma

**Regular Expression:** (05 hrs)

Regular expression (RE) Definition, Applications, Kleene's Theorem: Equivalence of RE and DFA, Closure properties of Regular Languages, Myhill- Nerode theorem and its applications

**Grammar:** (04 hrs)

Chomsky hierarchy, Context Free Grammars (CFG), Derivation, Languages of CFG, Constructing CFG, Derivation trees, Ambiguity in CFGs, Removing ambiguity, CNF, GNF, Chomsky hierarchy, Applications of CFG

**Pushdown Automata:** (05 hrs)

Pushdown Automata (PDA), Acceptance by final state /empty stack, Deterministic and Non-deterministic PDAs, Equivalence of PDA and CFG, Context Sensitive Languages, Context Sensitive Grammars, Linear Bounded Automata

**Turing Machine:** (05 hrs)

(TM) definition, Instantaneous Description, Language acceptance, Robustness of TM, equivalence of TM variants, Universal Turing Machine. TM as enumerator, Recursive and Recursively Enumerable languages and their closure properties, Church-Turing thesis

**Undecidability:** (04hrs)

Complexity classes, decidability, undecidability of halting problem, post correspondence problem

**Text Books:**

1. Hopcroft J, Motwani R, Ullman, Addison-Wesley, "Introduction to Automata Theory, Languages and Computation", Second Edition, ISBN 81-7808-347-7
2. Michael Sipser, "Introduction to Theory of Computation", Third Edition, Course Technology, ISBN 10: 053494728X

**Reference Books:**

1. Mishra K.L.P, N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", Third Edition, PHI, ISBN 978-8120329683

2. John C. Martin," Introduction to Languages and The Theory of Computation", Fourth Edition, McGraw Hill,ISBN 978-0-07-319146-1

**Moocs Links and additional reading material:**

[www.nptelvideos.in](http://www.nptelvideos.in)

**Course Outcomes:**

1. Students should be able to design Automata / Regular expression for given computational problems
2. Students should be able to correlate given computational model with its Formal Language
3. Students should be able to understand Chomsky hierarchy and write grammar for languages
4. Students should be able to design PDA / TMfor given computational problem
5. Students should be able to analyse power of different computational models
6. Students should be able to understand complexity classes and un / decidability of problems

**IT2275: DIGITAL ELECTRONICS AND MICROPROCESSOR****Course Prerequisites:** Basic electronics system**Course Objectives**

1. To understand all the concepts of Logic Gates and Boolean Functions.
2. To learn about Combinational Logic and Sequential Logic Circuits.
3. To design Combinational Logic and Sequential Logic Circuits
4. To understand basics of 8086 Microprocessor architecture

**Credits: 4****Teaching Scheme: 2 Hours / Week****Lab: 2 Hours / Week****Tut: 1 Hours / Week****SECTION I****Digital Fundamentals**

Number Systems – Decimal, Binary, Octal, Hexadecimal, Codes – Binary, BCD, Excess 3, Gray, Sum of products and product of sums, Minterms and Maxterms, Standard representation for logic functions, simplification of logic functions using K-map, minimization of logical functions. Dont care conditions.

**Combinational Digital Circuits:**

Adders, Subtractors Multiplexers & De-multiplexers, Encoder: Priority encoders, Decoders: 74138, ALU: 74181, Parity generator and checker. BCD adder and subtractor.

**Sequential Circuit:**

Introduction of flip-flop (F.F), 1 bit memory cell, clocked S-R F.F., J-K F.F. race around condition, M/S J-K F.F, flip-flop truth table, excitation table, flip-flop conversion, flip-flop characteristics. T and D F.F, Design of 4 – bit UP-Down ripple counter using J-K flip-flop, Design of Synchronous 3 bit up/down counter, mod-n counters (IC - 7490, 7493),.

**SECTION II**

**Introduction to 8086 microprocessor:**

Internal Architecture, Generation of physical address 8086,

8086 memory segmentation, Register Organization, Addressing modes: Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

**8086 Instructions types**

Instruction types, formats, timings, Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. 8086 pin functions: Minimum & Maximum Mode System.

**Interrupt Structure and Programmable Interval Timer:**

Interrupt Structure, Interrupt service Routine, Interrupt Vector Table, Hardware and Software Interrupts, INTR,NMI

Interrupt Response, Execution of an ISR, Priority of Interrupts.8259 control word

**List of Practicals:**

1. Verification of Logical Gates and Boolean Algebra.
2. Code converters e.g. Excess-3 to BCD and vice versa using logical gates.
3. Multiplexer - e.g. 16:1 Mux using 4:1 Mux (IC 74153).
4. Decoder – e.g. 2 bit comparator (IC 74138).
5. Synchronous Up /down counter using JK flip-flop.
6. Sequences detector using JK flip flop.
7. Study of 8086 Architecture and Execution of sample programs.
8. Write 8086 ALP to find and count negative and positive number from signed array stored in memory and display magnitude of negative numbers.
9. Write 8086 ALP to access marks of 5 subjects stored in array and find overall percentage and display grade according to it.
10. Write 8086 ALP to perform block transfer operation. (Don't use string operations) .Data bytes in a block stored in one array transfer to another array.
11. Write 8086 ALP for following operations on the string entered by the user.(Use Extern Far Procedure).
  - a. String length
  - b. Reverse of the String
  - c. Palindrome

**Text Books:**

1. Douglas Hall, "Microprocessors and Interfacing", 2<sup>nd</sup> Edition, Tata McGraw Hill Publications, ISBN 0-07-025742-6.
2. "Advanced 80386, programming techniques " , James Turley , Tata McGraw Hill Publications, ISBN – 0-07-881342-5
3. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630- 011, December 1995.
4. R.P. Jain, "Modern Digital Electronics," 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2003, ISBN 0 - 07 - 049492 – 4.

**Reference Books:**

1. Ray Duncan, “Advanced MS DOS Programming,” 2<sup>nd</sup> Edition BPB Publications ISBN 0 – 07 – 048677 – 8.
2. M. Mano, “Digital Design”, 3<sup>rd</sup> Edition, Pearson Education, 2002, ISBN - 81 - 7808 – 555 – 0.
3. A. Malvino, D. Leach, “Digital Principles and Applications”, 5<sup>th</sup> Edition, Tata McGraw Hill, 2003, ISBN 0 - 07 - 047258 – 05.

**Course Outcomes:**

The student will be able to –

1. Learn and illustrate the standard representation for logical functions
2. Explore the knowledge of Digital logic circuits.
3. Design applications based on combinational and sequential circuits.
4. Demonstrate the concepts of microprocessor systems
5. Adapt the knowledge based on microprocessor instructions.
6. Understand the concept of interrupts and its service routine..

**IT2268: DESIGN THINKING-IV****Credits: 1****Teaching Scheme Tut: 1 Hour/Week****Course Objectives:**

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

**Contents for Design Thinking 2 to Design Thinking 8:**

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

**Suggest an assessment Scheme:**

Publication of paper or patent

**Course Outcomes:**

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

Course Prerequisites: Problem Based Learning

**Credits: 4**

**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.

**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.



**SECTION-1**

**Preamble** - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all

courses of ED, laboratory course contents of “Trends in Engineering Technology” 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).

**Suggest an assessment Scheme:**

MSE and ESE

**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.*

Moocs Links and additional reading material: [www.nptelvideos.in](http://www.nptelvideos.in)

**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

**TY IT Module-V**

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme								Total	Credits
			Theory	Lab	Tut	CA			MSA	ESA					
						Lab	Seminar	GD		CP	HA	ESE	CVV		
S1	IT3221	Operating System	2	2	1	10	-	-		20	-	50	20	100	4
S2	IT3203	Image Processing and Computer Vision	2	2	1	10				20	20	30	20	100	4
S3	IT3209	Software Design and Methodologies	2	2	1	-	-	20		20	20	20	20	100	4
S4	IT3218	Artificial Intelligence	2	2	1	10	20	-		20	-	30	20	100	4
S5	IT3212	Engineering Design & Innovation – V	-	2	-	-	-	-	30			70	-	100	6
S6	IT3222	Design Thinking- V	-	-	1	-	-	-	-			-	-		1
Total															23

**TY IT Module-VI**

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme								Total	Credits
			Theory	Lab	Tut	CA			MSA	ESA					
						Lab	Seminar	GD		CP	HA	ESE	CVV		
S1	IT3207	Cloud Computing	2	2	1	10-	20	-		20		30	20	100	4
S2	IT3216	Machine Learning and Deep learning	2	2	1	10	-	-		20	20	30	20	100	4
S3	IT3202	System Programming	2	2	1	10	20	-		20	-	30	20	100	4
S4	IT3215	Design and Analysis of Algorithms	2	2	1	10	-	-		20	20	30	20	100	4
S5	IT3214	Engineering Design & Innovation –VI	-	2	-	-	-	-	30			70	-	100	6
S6	IT3223	Design Thinking- VI	-	-	1	-	-	-	-			-	-		1

Total												23
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## IT3221: Operating System

**Course Prerequisites:**

1. Basics of Computer System
2. Computer Organization
3. Data Structures
4. Any Programming Language.

**Course Objectives:**

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

**Credits: 4**

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

**Tut: 1 Hours/Week**

**Lab: 2 Hours/Week**

**Course Relevance:**

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

<b>SECTION-1</b>
<p><b>Introduction:</b> 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 &amp; Real-time OS. <b>Process management:</b> Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control, 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. <b>Uniprocessor Scheduling:</b> Scheduling Criteria, Types of Scheduling: Preemptive, Non-preemptive, Long-term, Medium-term, Short-term, Algorithms: FCFS, SJF, RR, Priority</p>
<b>SECTION-2</b>

**Deadlock:** Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery, **Memory Management:** Memory Management requirements, Memory Partitioning, Paging, Segmentation, Address translation, Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit. Virtual Memory, VM with Paging, VM with Segmentation, Page Replacement Policies: FIFO, LRU, Optimal, **File and I/O management:** File Organization, File Directories, File Sharing. Record Blocking, I/O Buffering, Disk Scheduling: FCFS, SSTF, SCAN, C-SCAN

**List of Tutorials:**

1. Linux commands
2. Evolution of OS
3. Comparison of different OS
4. OS structures
5. Inter Process Communication
6. Symmetric Multiprocessor
7. Thread Scheduling
8. Translation Lookaside buffer
9. Secondary storage management
10. Linux Memory management
11. File System in Windows and Linux

**List of Practicals: (Any Six)**

11. Execution of Basic Linux commands.
12. Execution of Advanced Linux commands.
13. Write shell scripts which covers basic arithmetic, control structures, command line arguments, functions and arrays.
14. Write a program demonstrating use of different system calls.
15. Implement multithreading for Matrix Operations using Pthreads.
16. Implementation of Classical problems using Threads and Mutex.
17. Implementation of Classical problems using Threads and Semaphore.
18. 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
19. Write a program to check whether given system is in safe state or not using Banker's Deadlock Avoidance algorithm.
20. 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 Course Projects:**

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

**List of Course Seminar Topics:**

1. Different File Systems in Windows and Linux OS
2. Operating System generations
3. OS Structures
4. HDFS
5. Process Vs Threads
6. Virtual Machines
7. Real Time Scheduling
8. Booting Process of different Operating Systems.
9. RAID
10. Protection and Security in Operating System

**List of Course Group Discussion Topics:**

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



**List of Home Assignments:**

**Design:**

1. Report Generation using Shell Script 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

**Case Study:**

1. Distributed Operating System
2. Microsoft Windows 11
3. VMware
4. Linux
5. Android

**Surveys:**

1. A survey of Desktop OS
2. Analysis and Comparison of CPU Scheduling Algorithms
3. Device Drivers for various devices
4. Parallel Computing
5. Malware Analysis, Tools and Techniques

**Blog**

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

**Assessment Scheme:**

1. Home Assignment: Design, Case Study, Blog and Survey
2. ESE
3. CVV
4. Seminar
5. Group Discussion

6. LAB-Course Assignment and Project Evaluation

**Text Books:**

5. *Stalling William; "Operating Systems"; 6<sup>th</sup> Edition, Pearson Education;*
6. *Silberschatz A., Galvin P., Gagne G.; "Operating System Concepts" ; 9<sup>th</sup> Edition; John Wiley and Sons;*
7. *Yashavant Kanetkar; "Unix Shell Programming"; 2<sup>nd</sup> Edition, BPB Publications*
8. *Sumitabha Das; "Unix Concepts and Applications"; 4<sup>th</sup> Edition, TMH.*
9. *D M Dhamdhere; "Systems Programming & Operating Systems"; Tata McGraw Hill Publications, ISBN – 0074635794*
10. *John J Donovan; "Systems Programming"; Tata Mc-Graw Hill Edition, ISBN-13978-0-07-460482-3*

**Reference Books:**

5. *Silberschatz A., Galvin P., Gagne G; "Operating System Principles"; 7<sup>th</sup> Edition, John Wiley and Sons.*
6. *Forouzan B. A., Gilberg R. F.; "Unix And Shell Programming"; 1<sup>st</sup> Edition, Australia Thomson Brooks Cole.*
7. *Achyut S. Godbole , Atul Kahate; "Operating Systems"; 3<sup>rd</sup> Edition, McGraw Hill.*

**Moocs Links and additional reading material:**

5. [www.nptelvideos.in/](http://www.nptelvideos.in/)
6. <https://www.udemy.com/>
7. <https://learn.saylor.org/>
8. <https://www.coursera.org/>
9. <https://swayam.gov.in/>

**Course Outcomes:**

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

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

**IT3203: IMAGE PROCESSING AND COMPUTER VISION**

**Course Prerequisites:** Knowledge of Different types of Signals, Linear Algebra, Probability and Statistics.

**Course Objectives:**

1. To learn Image Processing fundamentals.
2. To study Image preprocessing methods.
3. To understand image lossless and lossy compression techniques.
4. To introduce the major ideas, methods, and techniques of computer vision and pattern recognition.
5. To acquaint with Image segmentation and shape representation.
6. To explore object recognition and its application

**Credits: 5**

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

**Tut:** 1 Hours/Week

**Lab:** 2 Hours/Week

**Course Relevance:** Image processing and computer vision are of fundamental importance to any field in which images must be enhanced, manipulated, and analyzed. They play a key role in remote sensing, medical imaging, inspection, surveillance, autonomous vehicle guidance, and more. Students of this course will benefit from the direct visual realization of mathematical abstractions and concepts, and learn how to implement efficient algorithms to perform these tasks.

**SECTION-1**

Introduction: Elements of image processing system, Scenes and Images, Vector Algebra, Human Visual System, color vision color model: RGB, HVS, YUV, CMYK,  $YCbCr$ . Spatial domain techniques {Image Negative, Contrast stretching, gray level slicing, bit plane slicing, histogram and histogram equalization, local enhancement technique, image subtraction and image average. Image Statistical and Geometrical properties. Image Smoothing: low-pass spatial filters, median filtering. Image Sharpening: high-pass spatial filter, derivative filter. Introduction to Image compression and its need: Coding redundancy, classification of compression techniques (Lossy and lossless- JPEG, RLE, Huffman). Sub band coding, multi resolution expansions, Wavelet Transform in one dimensions; Wavelet transforms in two dimensions.

**SECTION-1I**

Human Vision System, Computer Vision System, Camera Geometry Fundamentals, Camera Calibration.Construction of 3D Model from images.

Image Segmentation techniques: Image Segmentation: Edge Based approaches to segmentation, Gradient using Masks, LOG,DOG, Canny, Edge Linking, Line detectors (Hough Transform), Corners – Harris, RegionGrowing, Region Splitting.

Object recognition:Object Recognition, Feature Detectors, Supervised and Unsupervised Machine Learning for Image Classification, Stereo Vision.

Applications of Image Processing and Computer Vision.

**List of Tutorials: (Any Six)**

- 1) Implement Image preprocessing and Edge detection
- 2) Image Arithmetic Operations
- 3) Image quality Enhancement by using following techniques-Logarithmic transformation, Histogram Equalization, Gray level slicing with and without background, Inverse transformation.
- 4) Image Compression
- 5) Implement Segmentation methods
- 6) Implement camera calibration methods
- 7) Determine depth map from Stereo pair
- 8) Construct 3D model from defocus image
- 9) Construct 3D model from Images
- 10) Implement object detection and tracking from video
- 11) Face detection and Recognition
- 12) Object detection from dynamic Background for Surveillance
- 13) Content based video retrieval
- 14) Construct 3D model from single image

**List of Practicals: (Any Six)**

- 1) A. Write matlab code to display following binary images  
Square, Triangle,Circle  
B. Write MATLAB code to perform following operations on images  
Flip Image along horizontal and vertical direction, Enhance quality of a given image by changing brightness of image, Image negation operation, change contrast of a given Image.
- 2) Pseudo coloring operation of a given image using Intensity slicing technique and Gray to Colour transform
- 3) Study of different file formats e.g. BMP, TIFF and extraction of attributes ofBMP.
- 4) Write C-language code to read and Display BMP image. Perform following operations on the given image 1. Flip Image along horizontal and vertical direction 2. Crop the image 3. Convert gray scale image into Binary image
- 5) Write matlab code to find following statistical properties of an image- Mean, Median, Variance, Standard deviation, Covariance.



- 6) Write matlab code to enhance image quality by using following techniques-Low pass and weighted low pass filter, Median filter, Laplacian mask.
- 7) Write matlab code for edge detection using Sobel, Prewitt and Roberts operators.
- 8) Write C-language code to find out Huffman code for the following word - COMMITTEE.
- 9) Write matlab code to design encoder and decoder by using Arithmetic coding for the following word MUMMY. (Probabilities of symbols M-0.4, U-0.2, X-0.3, Y- 0.1 ).
- 10) Develop an algorithm for pre-processing of an input image for geometric transformation of image.
- 11) Develop an algorithm for pre-processing of an input image for enhancement of image.
- 12) Develop an algorithm for feature extraction of an input image using point detector
- 13) Develop an algorithm for segmentation of an input image
- 14) Develop an algorithm for recognition of an object from input image
- 15) Develop an algorithm for motion estimation from a given video sequence.
- 16) Design an algorithm for SVM classifier
- 17) Design an algorithm for adaboost classifier
- 18) Line detection using Hough transform
- 19) To design and develop optical flow algorithm for Motion Estimation
  
- 20) Write matlab code to apply second level of DWT decomposition on the given image and display your result.

**List of Projects:**

1. Lossless and Lossy Compression Techniques
2. Pseudo Colour Image Processing Model
3. Image and Video Enhancement models
4. Human Motion Detection
5. Object Detection Model
6. Face Recognition Model
7. Dynamic Texture Synthesis
8. Image and Video Editing
9. Develop an application for a vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.
10. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Automobile tracking/ face tracking/ human tracking).
11. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Space vehicle tracking/ solar energy tracking/ crowd pattern tracking).

**List of Course Seminar Topics:**

1. Linear Algebra used for Image Processing
2. Image File format-TIFF
3. Color Model
4. Pseudo Colour Image Processing

5. Image Enhancement-Spatial Domain
6. Image Smoothing
7. Image Enhancement-Frequency Domain
8. Image Sharpening
9. Image Segmentation
10. Watershed Transformation
11. 3-D model
12. Face Detection
13. Object Recognition

**List of Course Group Discussion Topics:**

1. Lossy Compression Techniques
2. Loss less Compression Techniques
3. Fourier Transform
4. Set Partitioning in Hierarchical Trees-SPIHT Wavelet Transform
5. Image Understanding-Pattern Recognition Models
6. Object Recognitions
7. 3-D models and its applications
8. Wavelet Transform
9. Face detection models etc.

**List of Home Assignments:****Design:**

1. Human Motion Detection
2. Object Detection Model
3. Face Recognition Model
4. Dynamic Texture Synthesis
5. Image and Video Editing
6. Design 3-D models
7. Face Detection Models
8. Develop an application for a vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.
9. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Automobile tracking/ face tracking/ human tracking).
10. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Space vehicle tracking/ solar energy tracking/ crowd pattern tracking).

**Case Study:**

1. Image Processing for Smart City
2. Computer Vision for AR AVR

3. Research Areas in Image Processing & Computer Vision
4. Image Processing for Swastha Bharat
5. Image Processing in IoT
6. Computer Vision in Health Analytics
7. Computer Vision in wearable computing

**Blog:**

1. Computer Vision for Data Science
2. Image Processing for Smart Agriculture
3. Image Processing in Medical Field
4. Usage of AI for Computer Vision
5. Job Opportunities in Image Processing and Computer Vision
6. Usage of Image Processing in Computer Vision, Machine Learning, Deep Learning, and AI

**Surveys:**

1. Steganography and Cryptography
2. Image Processing for Educations
3. Dynamic Texture Synthesis
4. Classifications and Recognitions
5. Image & Video Compression
6. Drone based Surveillance
7. Video Editing
8. Human Motion/Object tracking and detections
9. Image Processing using High-Performance Computing-Computational
10. Complexity/Time Complexity and Execution time
11. Recent Trends in Image and Video Processing

**Suggest an assessment Scheme:**

1. MSE
2. ESE
3. LAB+Course Project
4. GD
5. PPT
6. VIVA

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

1. Rafael Gonzalez & Richard Woods, "Digital Image Processing," 3<sup>rd</sup> Edition, Pearson publications, ISBN 0132345633.
2. S. Jayaraman, S Esakkirajan, & T Veerakumar, "Digital Image Processing," Tata McGraw Hill Education, ISBN(13) 9780070144798.
3. Anil K. Jain, "Fundamentals of Digital Image Processing," 5<sup>th</sup> Edition, PHI publication, ISBN 13: 9780133361650.
4. Richard Szeliski, "Computer Vision: Algorithms and Applications (CVAA)", Springer, 2010.

5. E. R. Davies, "Computer & Machine Vision," 4<sup>th</sup> Edition, Academic Press, 2012.
6. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge
- 7.
8. University Press, 2012.

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

1. Pratt, "Digital Image Processing," Wiley Publication, 3<sup>rd</sup> Edition, ISBN 0-471-37407-5.
2. K.R. Castleman, "Digital Image Processing," 3<sup>rd</sup> 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," 2<sup>nd</sup> Edition PHI, 2005.
4. D. Forsyth and J. Ponce, "Computer Vision - A modern approach," Prentice Hall
5. E. Trucco and A. Verri, "Introductory Techniques for 3D Computer Vision," Publisher: Prentice Hall.
6. D. H. Ballard, C. M. Brown, "Computer Vision", Prentice-Hall, Englewood Cliffs, 1982.

**Moocs Links and additional reading material:** [www.nptelvideos.in](http://www.nptelvideos.in)

**Course Outcomes:**

The student will be able to-

1. Apply lossless and Lossy compression techniques for image compression.
2. Explore pre-processing algorithms to acquire images
3. Use Wavelet transforms to analyze and modify image
4. Extract features from Images and do analysis of Images
5. Apply Supervised and Unsupervised Machine Learning for Image Classification
6. Make use of Computer Vision algorithms to solve real-world problems.

**IT3209: SOFTWARE DESIGN AND METHODOLOGIES**

**Course Prerequisites:** Mastery of programming in a high-level, object-oriented language, Familiarity with data structures and algorithms.

Course Objectives:

1. Understanding object-oriented analysis and design.
2. Learn different software process models and principles and practices
3. Practicing UML to model OO systems
4. Familiarity with current models and standards for design.
5. Exposure to organizational issues in software design.
6. An ability to analyze and evaluate problems and draw on the theoretical and technical knowledge to develop solutions and systems

**Credits :4**

Course Relevance: Software Architecture

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

**Lab:** 2 Hours/Week

**SECTION I**

**Overview of Software Engineering:** Software Process Framework, Process Patterns, Process Models: Code-and-Fix, Waterfall Model, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Agile process, Software Engineering Principles and Practices.

**Software Modeling:** Introduction to Software Modeling, Advantages of modeling, Principles of modeling.

**Evolution of Software Modeling and Design Methods:** Object oriented analysis and design methods, Concurrent, Distributed Design Methods and Real-Time Design Methods, Model Driven Architecture (MDA), 4+1 Architecture, Introduction to UML, UML building Blocks, COMET Use Case-Based Software Life Cycle.

**Requirement Study:** Requirement Analysis, SRS design, Requirements Modeling. **Use Case:** Actor and Use case identification, Use case relationship (Include, Extend, Use case Generalization, Actor Generalization), Use case template.

Study of classes (analysis level and design level classes).

**Methods for identification of classes:** RUP (Rational Unified Process), CRC (Class, Responsibilities and Collaboration), Use of Noun Verb analysis (for identifying entity classes, controller classes and boundary classes).

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**SECTION  
II**

**Class Diagram:** Relationship between classes, Generalization/Specialization Hierarchy, Composition and Aggregation Hierarchies, Associations Classes, Constraints. Object diagram, Package diagram, Component diagram, Composite Structure diagram, Deployment Diagram.

**Activity diagram:** Different Types of nodes, Control flow, Activity Partition, Exception handler, Interruptible activity region, Input and output parameters, Pins.

**Interaction diagram:** Sequence diagram, Interaction Overview diagram, State machine diagram, Advanced State Machine diagram, Communication diagram, Timing diagram.

**Architecture in the Life Cycle:** Architectural styles, Architecture in Agile Projects, Architecture and Requirements, Designing an Architecture.

**Design Patterns:** Introduction, Different approaches to select Design Patterns. **Creational patterns:** Singleton, Factory, Structural pattern: Adapter, Proxy. **Behavioral Patterns:** Iterator, Observer Pattern with applications.



**List of Tutorials: (Any Three)**

- 1) Goals of software engineering
- 2) Software process models, life cycle models
- 3) Process improvement, Capability Maturity Model
- 4) Unified Modeling Language (UML)
- 5) Design patterns
- 6) Frameworks, software product lines
- 7) Software architecture
- 8) Software measurements and metrics
- 9) Software estimation methods
- 10) Static and dynamic analysis
- 11) Version control, configuration management
- 12) Software quality, verification and validation, software testing

**List of Practicals: (Any Six - Any 3 out of 1 to 5 and any 3 out of 6 to 10)**

1. To study modeling methodologies and identify their applicability to various categories of projects.
2. To understand Requirement Elicitation Techniques and recognize types of requirement while preparing System Requirement Specification.
3. To study MDD/MDA and identify the importance of Model Transformation.
4. To study types of MOF and metamodel concepts for various diagrams in UML 2.0.
5. To identify System Scope, Actors, Use Cases, Use Case structuring for a given problem and perform Use Case narration in template form with normal/alternate flows.
6. To identify Entity, Control, Boundary objects and trace object interactions for scenarios from use cases.

prepare a state chart diagram for given object scenario.

8. To prepare detailed Activity diagram with notational compliance to UML 2.0 indicating clear use of pins, fork-join, synchronization, data stores.

9. To prepare Class diagram for a defined problem with relationships, associations, hierarchies, interfaces, roles and multiplicity indicators.

10) To prepare Component and Deployment diagram for a defined problem.

**List of Projects:**

1. ERP system
2. Hospital Management
3. Railway Reservation
4. Stock market management
5. Parking automation
6. Library Management
7. Online shopping

Content management

**List of Course Seminar Topics:**

1. CMMI
2. Process Models
3. Agile Methodology
4. Modelling using UML
5. Analysis and Design in OO systems
6. Requirement Engineering
7. Principles and Practices of good Software Design
8. Collaborative software development
9. Component diagram
10. Deployment diagram

**List of Course Group Discussion Topics:**

1. Traditional Vs Agile
2. Phases of SDLC. Which is more important?
3. UML modeling
4. Analysis Vs Design
5. Design Patterns
6. Design Vs Architecture
7. Architecture style
8. Design Vs Framework

- 9. Framework Vs Architecture
- 10. Archetype patterns

List of Home Assignments:

Design:

- 1. Requirement Engg steps
- 2. Analysis modeling
- 3. design modeling
- 4. Architectural styles
- 5. design patterns

Case Study:

- 1. Imaging Software architecture
- 2. Banking Software architecture
- 3. ERP Software architecture
- 4. Online Shopping Software architecture
- 5. AI Software architecture

Blog:

- 1 Software Engg Do's and Don'ts
- 2. Which Process Model?
- 3. Scrum
- 4. Devops
- 5. Data ops

Surveys:

- 1. Software Design
- 2. Software Methodologies
- 3. Software Architectures
- 4. Design Patterns
- 5. Architectural Patterns

Suggest an assessment Scheme:

*MSE PPT Presentation ESE*  
*GD Riva Lab assignments*  
 + *Course Project*

*Text Books*

1. Roger S Pressman, “Software Engineering: A Practitioner’s Approach”, 6th edition. McGraw Hill International Edition, 2005
2. Jim Arlow, Ila Neustadt, “UML 2 and the unified process – practical object-oriented analysis and design”, Addison Wesley, Second edition, ISBN 978-0201770605.
3. Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Second Edition, Pearson, ISBN 978-81-775-8996-2

*Reference Books*

1. Hassan Gomaa, “Software Modeling and Design- UML, Use cases, Patterns and Software Architectures”, Cambridge University Press, 2011, ISBN 978-0-521-76414-8
2. Gardy Booch, James Rumbaugh, Ivar Jacobson, “The unified modeling language user guide”, Pearson Education, Second edition, 2008, ISBN 0-321-24562
3. Ian Sommerville, “Software Engineering”, Addison and Wesley, ISBN 0-13-703515-2

**Moocs Links and additional reading material:**

[www.nptelvideos.in](http://www.nptelvideos.in)

**Course Outcomes:**

The student will be able to —

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.
4. 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.
5. Conform to Configuration Management principles and demonstrate cohesive teamwork skills avoiding classic mistakes and emphasizing on software safety adhering to relevant standards.

Analyze the target system properties and recommend solution alternatives by practicing project planning, scheduling, estimation and risk management activities

**IT3218: ARTIFICIAL INTELLIGENCE****Course Prerequisites:**Data structures, Computer programming**Course Objectives:****To make students**

1. familiar with basic principles of AI
2. capable of using heuristic searches
3. aware of knowledge based systems
4. able to use fuzzy logic and neural networks
5. Learn various applications domains AI

**Credits: 4****Teaching Scheme Theory: 2 Hours/Week****Tut: 1 Hour/Week****Lab: 2 Hours/Week****Course Relevance:**This course is highly applied in many scientific and engineering disciplines**SECTION I****Topics and Contents****Fundamentals of Artificial Intelligence**

Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, KnowledgeBase Systems, State Space Search, Production Systems, ProblemCharacteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation

**Uninformed Search Strategies**

Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, and Comparison of Uninformed search Strategies.

**Informed Search Strategies**

Generate& test, Hill Climbing, Best First Search, A\*, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence

**Knowledge Representation**

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

*Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.*

**Introduction to PROLOG and ANN**

*AI Programming Language (PROLOG): Introduction, How Prolog works? Some hands on PROLOG examples.*

*Introduction to Neural networks:- basics, comparison of human brain and machine, biological neuron, general neuron model, activation functions, Perceptron learning rule, applications and advantages of neural networks. Brief introduction to single layer and multilayer networks.*

**Handling Uncertainty**

*Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function, designing a fuzzy set for a given application.*

**List of Practical's: (Any Six)**

1. Implement Non-AI and AI Techniques
2. Implement any one Technique from the following
  - a. Best First Search OR A\* algorithm
  - b. Hill Climbing
3. Implement Perceptron learning algorithm
4. Implement a real life application in Prolog.
5. Expert System in Prolog-new application
6. Implement any two Player game using min-max search algorithm.
7. Design a fuzzy set for shape matching of handwritten character
8. Conducting Turing test of an online chat robot
9. Any real application of AI in gaming
10. Spam email detection and classification using any simple classifier

**List of course Projects: (Any project within following domain but not limited to)**

1. Pattern recognition – Classification, Clustering, hybrid-classification clustering
2. Prediction using -Regression – Linear or nonlinear
3. Game playing- single player/2-player/multi-player
4. Use of Knowledge based system for generating inferences
5. Deep Learning
6. Neural network training and using for a real application
7. Use of fuzzy sets for human like reasoning
8. Use of any ML algorithm for solving real world problem
9. Deep Learning framework-PyTorch
10. Expert system applications in medicine suggestions
11. Some other projects mutually decided by instructor and students

**Suggest an assessment Scheme:**

Lab work	CP	ESE written	CVV	Practical exam
10	10	20	20	40

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

1. Elaine Rich and Kevin Knight, *Artificial Intelligence*, 2nd, Ed., Tata McGraw Hill, 1991
2. Stuart Russell & Peter Norvig, *Artificial Intelligence : A Modern Approach*, 2nd, Ed., Pearson Education, 2003

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

1. Ivan Bratko, *Prolog Programming For Artificial Intelligence*, 2nd Ed. Addison Wesley, 1986.
2. Eugene Charniak, Drew McDermott, *Introduction to Artificial Intelligence*, Addison Wesley, 1985
3. Dan W Patterson, *Introduction to AI and Expert Systems*, PHI, 1990
4. Nils J. Nilsson, *Principles of Artificial Intelligence*, 1st Ed., Morgan Kaufmann, 1982
5. Carl Townsend, *Introduction to turbo Prolog*, Paperback, 1987
6. Jacek M. Zurada, *Introduction to artificial neural systems*, Jaico Publication, 1994

**Moocs Links and additional reading material:**

1. <http://www.eecs.qmul.ac.uk/~mmh/AINotes/AINotes4.pdf>
2. <https://www.slideshare.net/JismyKJose/conceptual-dependency-70129647>
3. <https://web.archive.org/web/20150813153834/http://www.cs.berkeley.edu/~zadeh/papers/Fuzzy%20Sets-Information%20and%20Control-1965.pdf>
4. <https://www.youtube.com/watch?v=aircAruvnKk>
5. <https://www.youtube.com/watch?v=IHZwWFHwa-w>
6. <https://silp.iiita.ac.in/wp-content/uploads/PROLOG.pdf>
7. Others suggested by instructor

**Course Outcomes:**

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

1. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.
2. Evaluation of different uninformed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.
3. Design and Analysis of informed search algorithms on well formulated problems.
4. Formulate and solve given problem using Propositional and First order logic.
5. Apply neural network learning for solving AI problems
6. Apply reasoning for non-monotonic AI problems.

**IT3213: ENGINEERING DESIGN AND INNOVATION V**

Course Prerequisites: Problem Based Learning

**Credits: 4****Teaching Scheme Theory: 1 Hour/Week****Lab: 6 Hours/Week****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.

**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.

**SECTION-1**

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students;rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of “Trends in Engineering Technology” 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 Securityetc).

**Suggest an assessment Scheme:**

MSE and ESE

**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 RobartCapraro, 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-basedlearning 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](http://www.nptelvideos.in)

**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

**IT3222: Design and Thinking V****Credits: 1****Teaching Scheme Tut: 1 Hour/Week****Course Objectives:**

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

**Contents for Design Thinking 2 to Design Thinking 8:**

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

**Suggest an assessment Scheme:**

Publication of paper or patent

**Course Outcomes:**

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

## IT3207: CLOUD COMPUTING

**Course Prerequisites:** Computer Programming, Database Management Systems, -Operating System, Computer Network

### Course Objectives:

1. To provide students with the fundamentals and essentials of cloud computing
2. To learn basics of virtualization and its importance .
3. To provide students a sound foundation of the cloud computing so that they are able to start using and adopting cloud computing services and tools in their real life scenarios
4. To enable students exploring some important cloud computing driven commercial systems and applications
5. To understand cloud storage technologies and relevant file systems.
6. To be exposed to Ubiquitous Cloud and Internet of Things

**Credits: 4**

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

**Tut:** 1Hours/Week

**Lab:** 2 Hours/Week

**Course Relevance:** The course is important in all domains to implement simulation or prototype of different systems

<b>SECTION-1</b>
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**UNIT I: Fundamentals of Cloud Computing [5 Hrs.]**

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Inter-cloud, Types of Clouds.

**UNIT II: Cloud Enabling technology and Virtualization [5 Hrs.]**

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

Virtualization: Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

**UNIT III: Common Standards and Cloud Platforms [5 Hrs.]**

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application

Amazon web services: Compute services Storage Services Communication Services Additional services

Google AppEngine: Architecture and core concepts, Application life cycle, Cost model

Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance

**SECTION-II****UNIT IV: Data Storage and Security in Cloud [5 Hrs.]**

Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB Gautam Shrauf, Cloud Storage-Overview, Cloud Storage Providers.

Securing the Cloud: General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.

**UNIT V: Ubiquitous Clouds and the Internet of Things [4 Hrs.]**

Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things

**UNIT VI: Future of Cloud Computing [4 Hrs.]**

How the Cloud Will Change Operating Systems, Location-Aware Applications, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing. Docker at a Glance

**List of Practicals: (Any Six)**

1. Install Google App Engine. Create hello world app and other simple web applications using python/java.
2. Use GAE launcher to launch the web applications.
3. Find a procedure to transfer the files from one virtual machine to another virtual machine.
4. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
5. Design and deploy a web application in a PaaS environment.
6. Design and develop custom Application (Mini Project) using Salesforce Cloud.
7. Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.

**Text Books:**

1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, 2010, The McGraw-Hill
3. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128

**Reference Books:**

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. GautamShrof, “ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
5. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
6. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
7. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.

**Course Outcomes: The student will be able to –**

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

1. Articulate the main concepts, key technologies and fundamentals of cloud computing
2. Understand cloud enabling technologies and virtualization
3. Analyze various cloud programming models and apply them to solve problems on the cloud
4. Explain data storage and major security issues in the cloud
5. Understand trends in ubiquitous cloud and internet of things
6. Explore future trends of cloud computing



**IT3216: MACHINE LEARNING AND DEEP LEARNING**

**Credits: 4**

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

**Tut: 1 Hours/Week**

**Lab: 2 Hours/Week**

**Course Prerequisites:** Linear Algebra, Statistics, Calculus, and Probability Basics

**Course Objectives:**

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

**Course Relevance:** Machine Learning and Deep Learning are disruptive technologies. Powered by data science, machine learning and Deep Learning makes our lives easier. When properly trained, they can complete tasks more efficiently than a human. Understanding the possibilities and recent innovations of ML technology and Deep Learning are important for businesses so that they can plot a course for the most efficient ways of conducting their business. It is also important to stay up to date to maintain competitiveness in the industry.

**SECTION-I**

**Topics and Contents**

**Introduction:** What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Cross-validation, Mathematical models.

**Types of Learning:** Supervised, Unsupervised and Semi-Supervised Learning. Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.

**Regression and Generalization:** Regression: Linear and Logistic Regressions, Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting.

**Classification:** Binary and Multiclass Classification: Support Vector Machines (SVM), Soft Margin SVM, KNN Algorithm, Naïve Bayes Classifier, Decision Tree and Random Forest.

**Clustering:** Distance Based Models: Distance based clustering algorithms - K-means and C-means, Hierarchical clustering, Association rules mining – Apriori Algorithm, Confidence and Support

parameters.

**SECTION-II****Topics and Contents**

**Trends in Machine Learning:** Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties.

**Deep Learning:** Introduction to deep learning, Neural Network Basics, Batch Normalization, The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons. Shallow Neural Network and Deep Neural Networks. Attacking neural networks with Adversarial Examples and Generative Adversarial Networks, Practical aspects of deep learning, Optimization algorithms, Hyperparameters Tuning, Batch Normalization.

**Deep Learning Strategy:** A guide to convolution arithmetic for deep learning, Is the deconvolution layer the same as a convolutional layer?, Visualizing and Understanding Convolutional Networks, Deep Inside Convolutional Networks: Types of CNN, Visualizing Image Classification Models and Saliency Maps.

**List of Course Seminar Topics:**

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

10. Probabilistic Model
11. Dropout: a simple way to prevent neural networks from overfitting
12. Deep Residual Learning for Image Recognition
13. Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shift
14. Large-Scale Video Classification with Convolutional Neural Networks
15. Generative adversarial nets
16. High-Speed Tracking with Kernelized Correlation Filters
17. Do we need hundreds of classifiers to solve real world classification problems Scalable Nearest Neighbor Algorithms for High Dimensional Data
18. A survey on concept drift adaptation 10. Simultaneous Detection and Segmentation

**List of Course Group Discussion Topics:**

1. Supervised Vs Unsupervised
2. Univariate Vs Multivariate analysis
3. Accuracy measuring methods
4. Bias Vs Variance Tradeoff
5. Data Reduction Vs Dimensionality reduction
6. Continuous Vs Discrete variables
7. Feature Extraction Vs Automatic Feature detection
8. RNN Vs LSTM
9. Sentence Classification using Convolutional Neural Networks
10. Dog-breed Classifier
11. Generate TV Scripts

12. Generate Faces
13. Factoid Question Answering
14. Neural Summarization
15. Dialogue Generation with LSTMs

**List of Home Assignments:****Design:**

1. Propensity to Foreclose: Predicting propensity of the customer to foreclose their loans. The objective is to retain the customer for the maximum tenure.
2. Portfolio & Price Prediction for Intra-day trades: Price movement prediction using a masked set of features - This involves predicting short-term to mid-term price movements using a combination of multiple features.
3. Smart Building Energy Management System using Machine Learning
4. Quick analysis of quality of cereals, oilseeds and pulses using ML
5. Video Library Management System using Machine Learning
6. Building a Recurrent Neural Network
7. Character level Dinosaur Name generation
8. Music Generation
9. Operations on Word vectors
10. Neural Machine translation with attention

**Case Study:**

1. Product Recommendation: Given a purchase history for a customer and a large inventory of products, identify those products in which that customer will be interested and likely to purchase. A model of this decision process would allow a program to make recommendations to a customer and motivate product purchases. Amazon has this capability. Also think of Facebook, GooglePlus and LinkedIn that recommend users to connect with you after you sign- up.
2. Medical Diagnosis: Given the symptoms exhibited in a patient and a database of anonymized patient records, predict whether the patient is likely to have an illness. A model of this decision problem could be used by a program to provide decision support to medical professionals.
3. Stock Trading: Given the current and past price movements for a stock, determine whether the stock should be bought, held or sold. A model of this decision problem could provide decision support to financial analysts.
4. Customer Segmentation: Given the pattern of behaviour by a user during a trial period and the past behaviors of all users, identify those users that will convert to the paid version of the product and those that will not. A model of this decision problem would allow a program to trigger customer interventions to persuade the customer to covert early or better engage in the trial.
5. Shape Detection: Given a user hand drawing a shape on a touch screen and a database of known shapes, determine which shape the user was trying to draw. A model of this decision would allow a program to show the platonic version of that shape the user drew to make crisp diagrams. The Instaviz iPhone app does this.
6. AlexNet
7. VGG
8. Inception
9. ResNet
10. YOLO

**List of Home Assignments:****Design:**

1. Propensity to Foreclose: Predicting propensity of the customer to foreclose their loans. The objective is to retain the customer for the maximum tenure.
2. Portfolio & Price Prediction for Intra-day trades: Price movement prediction using a masked set of features - This involves predicting short-term to mid-term price movements using a combination of multiple features.
3. Smart Building Energy Management System using Machine Learning
4. Quick analysis of quality of cereals, oilseeds and pulses using ML
5. Video Library Management System using Machine Learning
6. Building a Recurrent Neural Network
7. Character level Dinosaur Name generation
8. Music Generation
9. Operations on Word vectors
10. Neural Machine translation with attention

**Case Study:**

1. Product Recommendation: Given a purchase history for a customer and a large inventory of products, identify those products in which that customer will be interested and likely to purchase. A model of this decision process would allow a program to make recommendations to a customer and motivate product purchases. Amazon has this capability. Also think of Facebook, GooglePlus and LinkedIn that recommend users to connect with you after you sign- up.
2. Medical Diagnosis: Given the symptoms exhibited in a patient and a database of anonymized patient records, predict whether the patient is likely to have an illness. A model of this decision problem could be used by a program to provide decision support to medical professionals.
3. Stock Trading: Given the current and past price movements for a stock, determine whether the stock should be bought, held or sold. A model of this decision problem could provide decision support to financial analysts.
4. Customer Segmentation: Given the pattern of behaviour by a user during a trial period and the past

behaviors of all users, identify those users that will convert to the paid version of the product and those that will not. A model of this decision problem would allow a program to trigger customer



interventions to persuade the customer to convert early or better engage in the trial.

5. Shape Detection: Given a user hand drawing a shape on a touch screen and a database of known shapes, determine which shape the user was trying to draw. A model of this decision would allow a program to show the platonic version of that shape the user drew to make crisp diagrams. The Instaviz iPhone app does this.
6. AlexNet
7. VGG
8. Inception
9. ResNet
10. YOLO

### **Blog**

1. Focusing Too Much on Algorithms and Theories.
2. Mastering ALL of ML.
3. Having Algorithms Become Obs mgolete as Soon as Data Grows.
4. Getting Bad Predictions to Come Together With Biases.
5. Making the Wrong Assumptions.
6. Receiving Bad Recommendations.
7. Having Bad Data Convert to Bad Results.
8. Open AI
9. Computer Vision
10. Google Brain
11. Deep Learning and Natural Language Processing
12. Multi-task Learning and Transfer Learning

### **Surveys**

1. Concept learning
2. Reinforcement learning
3. Semi supervised learning
4. Deep learning
5. Transfer learning
6. Deep Neural Networks in Speech and Vision Systems
7. GANs
8. Deep Learning for big data
9. Deep Learning for NLP

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

1. T. Mitchell, "Machine Learning", McGraw-Hill, 1997.
2. Anup Kumar Srivastava, *Soft Computing*, Alpha Science International limited. 2009.
3. *Deep Learning with Python* by François Chollet, Manning Publications Co, ISBN: 9781617294433
4. *Deep Learning - A Practical Approach* by Rajiv Chopra, Khana Publications, ISBN: 9789386173416

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

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT press, 2004.
2. Jacek M. Zurada, "Introduction to Artificial neural System", JAICO publishing house, 2002,.
3. *Deep Learning* by Ian Goodfellow and Yoshua Bengio and Aaron Courville Published by An MIT Press book.

**Suggest an assessment Scheme:**

MSE PPT Presentation    ESE    GD    Tut    Viva    Lab assigts. + Course Project

**Course Outcomes:**

1. Explore Different Machine Learning Techniques.
2. Evaluate Regression and Classifier Algorithms.
3. Use different Clustering Algorithms to different objects.
4. Acquaint with Trends in Machine Learning
5. Build and train a Deep Neural Network.
6. Understand functionality of all layers in a Convolutional Neural Network.

**IT3202: SYSTEM PROGRAMMING**

**Course Prerequisites:** Data structures, programming in C/C++/Java

**Course Objectives:**

1. To introduce students the concepts and principles of system programming and to enable them to understand the duties and scope of a system programmer.
2. To provide students the knowledge about both theoretical and practical aspects of system programming, teaching them the methods and techniques for designing and implementing system-level programs.
3. To train students in developing skills for writing system software with the aid of sophisticated OS services, programming languages and utility tools.
4. To train students in developing skills for writing compiler from scratch
5. To understand encoding-decoding of instruction set for a new machine.

**Credits:5****Teaching Scheme Theory:** 3Hours/Week**Tut:** 1Hours/Week**Lab:** 2 Hours/Week

**Course Relevance:** This course is helpful in designing different system softwares like operating systems, compilers and device drivers etc.

**SECTION-1**

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.

Macroprocessor: Introduction, macro definition and call, macro expansion, nested macro calls, design of macroprocessor, design issues of macroprocessors, two-pass macroprocessors, one-pass macroprocessors. 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. Allocation, relocation, linker v/s loader.

Linkers and Loaders: relocation and linking concepts, static and dynamic linker, subroutine linkages, Linking of Overlay Structured Programs, dynamic linking libraries, MSDOS linker. Loaders: Introduction to Loader, Sequential and Direct Loaders, loader Schemes compile and go loader, general loader scheme, absolute loader, relocating loader, dynamic linking loader.

### SECTION-II

Systems Programming for Linux as Open Source OS: Essential concepts of linux system programming, APIs and ABIs, standards, program segments/sections, the elf format, linking and loading, linux dynamic libraries (shared objects), dynamic linking, API compatibility, dynamically linked libraries.

Advanced system programming concepts: Operating system interfaces, stack smashing. Multitasking and paging, address translation, memory protection, comparison with windows.

Compilers: Introduction to Compiler phases, Introduction to cross compiler, Features of machine dependent and independent compilers, types of compilers.

Interpreters: Compiler Vs. Interpreter, phases and working. Debuggers: Types of errors, debugging procedures, classification of debuggers, dynamic/interactive Debugger. Lexical Analyzer, Specification and Recognition of Tokens, LEX, Expressing Syntax, Top-Down Parsing, Predictive Parsers. Bottom-Up Parsing, LR Parsers: constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, YACC. Encoding and decoding schemes for the X-86 processor.

#### List of Tutorials: (Any Three)

1. File handling basics
2. Debugging concepts
3. logic development for implementing assignments
4. Booting process and system files
5. Inbuilt drivers structure of Linux
6. Study of Linkers
7. Study of Loaders
8. Different DLL
9. Paging
10. Segmentation

**List of Practicals: (Any Six)**

- 1) Design and implementation of a symbol Table
- 2) Simulation of linkers.
- 3) Simulation of loaders.
- 4) Implementation of 2 Pass Assembler
- 5) Design and implementation of an Editor: Design of a Line or Screen Editor using C Language.
- 6) Implementation of Macro processor
- 7) Write a TSR program in 8086 ALP to implement Real Time Clock (RTC). Read the Real Time from CMOS chip by suitable INT and FUNCTION and display the RTC at the bottom right corner on the screen. Access the video RAM directly in your routine.
- 8) Write a TSR program in 8086 ALP to implement Screen Saver. Screen Saver should get activated if the keyboard is idle for 7 seconds. Access the video RAM directly in your routine.
- 9) Write a TSR program in 8086 ALP to handle the "Divide by zero" interrupt. Test your program with a small code, which causes the divide by zero interrupt.

Write a TSR program in 'C' that would change the color of the screen every 10 seconds

**List of Projects:**

1. Design Macro processor
2. Design One pass Assembler
3. Design Two pass Assembler
4. Design direct linking loader
5. Mouse driver for Linux
6. USB driver for Linux
7. Keyboard driver for Linux
8. Implement a Lexical Analyzer using LEX for a subset of C.
9. Design and implementation of DLL on Linux shared library
10. Design a device driver on Linux system

**List of Course Seminar Topics:**

1. Macro processor design
2. Assembler design
3. machine dependent and machine independent assembler features
4. linker v/s loader
5. Structured Programs
6. MSDOS linker
7. dynamic linking loader.
8. dynamic linking libraries
9. static and dynamic linker with subroutine linkages Linux linking schemes

**List of Course Group Discussion Topics:**

1. Windows Vs Linux OS
2. Application Programming Vs System Programming
3. Carrier in Application Programming Vs System Programming
4. API Vs ABI
5. Single pass Vs multi pass strategyCompiler Vs Interpret

**List of Home Assignments:****Design:**

1. Design and implementation of 2 Pass Macro processor.
2. Design and implementation of 2 Pass Assembler.
3. Simulation of linker & loader.
4. Implement a Lexical Analyzer using LEX for a subset of C.
5. Design and implementation of DLL on Linux shared library.
6. Design a device driver on Linux system.

**Case Study:**

1. Linux OS system architecture
2. Windows OS system architecture
3. Android OS system architecture
4. MAC OS system architecture
5. New trends in linker and loaders

**Blog:**

1. PASS-I Assembler
2. PASS-II Assembler
3. Macro expansion Algorithm
4. Macro Definition Algorithm
5. Machine Language Instruction Generation from Assembly LanguageInstruction
6. Language Processor Pass
7. Procedure vs Problem Oriented Languages
8. Macro Expansion and Macro definition
9. Linux File System
10. Device Drivers
11. Dynamic Link Library
12. BIOS
13. DOS
14. LINKER

15. LOADER

**Surveys:**

1. Display drivers
2. Network drivers
3. Printer drivers
4. New trends in device drivers design
5. Driver adaptability

**Suggest an assessment Scheme:**

1. Home Assignment
2. MSE &ESE
3. Quiz
4. Seminar
5. Group Discussion

LAB-Course Assignment and Project Evaluation

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

1. D M Dhamdhare, "Systems Programming & Operating Systems", Tata McGrawHill Publications, ISBN – 0074635794
- John J Donovan, "Systems Programming", ISBN -0070176035

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

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

**Moocs Links and additional reading material:**

1. [www.nptelvideos.in](http://www.nptelvideos.in)

**Course Outcomes:**

The student will be able to –

1. Discriminate among different System software and their functionalities.
2. Design language translators like Macro processor and Assembler.
3. Develop approaches and methods for implementing linker and loader.
4. Identify and interpret the different phases of a compiler and their functioning.
5. Design a well-structured system to ensure the syntactic and semantic correctness of a program.
6. Interpret the methods and techniques about instructions Encoding and Decoding for implementing system-level programs and Device Drivers.



**IT3215: DESIGN AND ANALYSIS OF ALGORITHMS**

**Course Prerequisites:** Basic programming Skills, Data structures, Discrete Structures.

**Course Objectives:**

1. To understand asymptotic notations and apply suitable mathematical techniques to find asymptotic time and space complexities of algorithms.
2. To provide students with foundations to deal with a variety of computational problems using different design strategies.
3. To select appropriate algorithm design strategies to solve real world problems.
4. To understand notions of NP-hardness and NP-completeness and their relationship with the intractability of decision problems.
5. To understand randomized approximation algorithms for given computational problems.

**Credits:5****Teaching Scheme Theory:3 Hours/Week****Tut: 1 Hour/Week****Lab:2 Hours/Week**

**Course Relevance:** This is an important course for Information Technology Engineering. It develops algorithmic thinking capability of students. Designing algorithms using suitable paradigms and analyzing the algorithms for computational problems has a high relevance in all domains of IT (equally in Industry as well as research). Once the student gains expertise in Algorithm design and in general gains the ability of Algorithmic thinking, it facilitates systematic study of any other domain (in IT or otherwise) which demands logical thinking. This course is also relevant for students who want to pursue research careers in theory of computing, computational complexity theory, and advanced algorithmic research.

**SECTION-1**

**Basic introduction to 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. 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, Josephus problem using recurrence, Efficient algorithms for Integer arithmetic (Euclid's algorithm, Karatsuba's

algorithm for integer multiplication, fast exponentiation).

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

**Dynamic Programming:** General strategy, Principle of Optimality, 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, Bellman Ford shortest path algorithm, longest increasing subsequence problem, Largest independent set for trees.

## SECTION-II

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

**Branch and Bound strategy:** Control abstraction for LIFO, Least Cost Search and FIFO branch and bound, 0-1 knapsack problem using LC branch and bound

**Computational Complexity classes:** Complexity classes P, NP, NP complete, NP Hard and their interrelation, Notion of polynomial time reduction, Cook-Levin theorem and implication to P versus NP question, Satisfiability Problem, NP-hardness of halting problem, NP-Complete problems (some selected examples).

**Introduction to Randomized and Approximation algorithms:** Introduction to randomness in computation, Las-Vegas and Monte-Carlo algorithms, Abundance of witnesses/solutions and application of randomization, randomized quick sort, Introduction to Approximation algorithms for NP-optimization problems (like Vertex Cover).

### List of Practical: (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, fractional knapsack problem)
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. Creation / Solution of Maze (comparing the backtracking-based solution and Dijkstra's algorithm)
4. Different exact and approximation algorithms for Travelling-Sales-Person Problem
5. Knight tour algorithms
6. Network flow optimization and maximum matching
7. AI for different games such as minesweeper, shooting games, Hex, connect-4, sokobanetc
7. SUDOKU solver
8. Algorithms for factoring large integers
10. Randomized algorithms for primality testing (Miller-Rabin, Solovay-Strassen)
11. Slider puzzle game

**List of Course Seminar Topics:**

1. Complexity classes
2. Space complexity
3. Divide and Conquer Vs Dynamic Programming
4. Greedy strategy Vs Backtracking strategy
5. Dynamic Programming Vs Greedy
6. Computational Complexity
7. Comparison of P Vs NP problems
8. Compression Techniques
9. Approximation algorithms
10. Pseudorandom number generators

**List of Home Assignments:****Design:**

1. Divide and Conquer strategy for real world problem solving
2. Dynamic Programming strategy for real world problem solving
3. Problems on Randomized Algorithms
4. Problems on Approximation Algorithms
5. Problems on NP completeness

**Case Study:**

1. Encoding techniques
2. Network flow optimization algorithms
3. Approximation algorithms for TSP
4. Sorting techniques

5. AKS primality test



**Blog:**

1. How to decide suitability of Approximation Algorithms
2. When do Randomized Algorithms perform best
3. Applications of Computational Geometry Algorithms
4. Role of number-theoretic algorithms in cryptography
5. Performance analysis of Graph Theoretic Algorithms

**Surveys:**

1. Primality Testing Algorithms
2. Integer Factoring Algorithms
3. Shortest Path Algorithms
4. Algorithms for finding Minimum Weight Spanning Tree
5. SAT solvers

**Suggest an assessment Scheme:**

1. Home Assignment
2. MSE & ESE
3. Seminar
4. LAB-Course Assignment and Project Evaluation

**Text Books:**

1. *Cormen, Leiserson, Rivest and Stein "Introduction to Algorithms", 3rd edition, 2009. ISBN 81-203-2141-3, PHI*
2. *Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9*
3. *Jon Kleinberg, Eva Tardos "Algorithm Design", 1st edition, 2005. ISBN 978-81-317-0310-6, Pearson*

*4.Dasgupta, Papadimitriu, Vazirani "Algorithms", 1st edition (September 13, 2006), ISBN-*

10:9780073523408, ISBN-13: 978-0073523408, McGraw-Hill Education

**Reference Books:**

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithm", Pearson, ISBN 81- 7758-835-4.
2. Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244-3.
3. Motwani, Raghavan "Randomized Algorithms", 1st edition (August 25, 1995), ISBN-10:0521474655, ISBN-13: 978-0521474658, Cambridge University Press
4. Vazirani, "Approximation Algorithms", ISBN-10: 3642084699, ISBN-13: 978-3642084690, Springer (December 8, 2010)

**Moocs Links and additional reading material:**

1. <https://nptel.ac.in>
2. <https://www.udemy.com>
3. <https://www.coursera.org>
4. <https://www.geeksforgeeks.org>

**Course Outcome:**

The student will be able –

1. To formulate computational problems mathematically.
2. To apply appropriate algorithmic paradigm to design efficient algorithms for computational problems.
3. To apply suitable mathematical techniques to analyze asymptotic complexity of the algorithm for a complex computational problem.
4. To understand the significance of NP-completeness of some decision problems and its relationship with intractability of the decision problems.
5. To understand significance of randomness, approximability in computation and design randomized and approximation algorithms for suitable problems.
6. To incorporate appropriate data structures, algorithmic paradigms to craft innovative scientific solutions for complex computing problems.

**IT3213: ENGINEERING DESIGN AND INNOVATION VI**

Course Prerequisites: Problem Based Learning

**Credits: 4****Teaching Scheme Theory: 1 Hour/Week****Lab: 6 Hours/Week****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.

**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 nalyze, design and apply categories of

Bloom's Taxonomy.

**SECTION-1**

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of “Trends in Engineering Technology” 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).

**Suggest an assessment Scheme:**

MSE and ESE

**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.*

Moocs Links and additional reading material: [www.nptelvideos.in](http://www.nptelvideos.in)

**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

**IT3222: Design and Thinking VI****Credits: 1****Teaching Scheme Tut: 1 Hour/Week****Course Objectives:**

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

**Contents for Design Thinking 2 to Design Thinking 8:**

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

**Suggest an assessment Scheme:**

Publication of paper or patent

**Course Outcomes:**

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



**Structure Module VII**

Course code	Course name	Total number of Contact hours				Credits
		Theory	Lab	Tut	Total Hrs	
MD4201/MD4206/IT4214	OE1:Project Management/Financial Management and Costing/ From Campus to Corporate	2	-	-	2	2
IT4210	OE2: Machine Learning	2	-	-	2	2
IT4212	OE2:Advanced Communication Engineering					
IT4216	OE3 : Data management , Protection and Governance	2	-	-	2	2
IT4213	OE3:Deep Learning					
IT4214	OE3: Nptel Course: Cyber Security and Privacy					
IT4215	Distributed Computing	2	-	-	2	2
IT4218	Network Security	2	-	-	2	2
IT4205	Major Project	-	20	-	20	10
	<b>Total</b>	<b>8</b>	<b>20</b>	<b>-</b>	<b>20</b>	<b>18</b>

**Structure Module VIII**

Subject	BTech Sem1/Sem2 (Internship Module)	Theory	Lab	Tut	Credits
IT4251	Industry Internship	-	40	-	16
<b>OR</b>					
IT4252	International Internship	-	40	-	16
<b>OR</b>					
IT4253	Research Internship	-	40	-	16
<b>OR</b>					
IT4254	Project Internship	-	40	-	16
<b>Total Credits-16</b>					

**MD4206: FINANCIAL MANAGEMENT AND  
COSTING****Course Prerequisites:**

Basic concepts of cost, profit, loss, debit and credit.

**Course Objectives:**

Students will be able to:

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

**Credits: 2****Teaching Scheme Theory: 2 Hours/Week****Course Relevance:** Basic knowledge of Finance for working in a industry**SECTION-1**

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

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

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

## SECTION-1I

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

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

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

### List of Tutorials: (Any Three)

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

### List of Practicals: (Any Six)

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

**List of Projects:**

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

**List of Course Seminar Topics:**

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

**List of Course Group Discussion Topics:**

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

**Text Books:**

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

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

**Reference Books:**

1. Paresh P. Shah, Financial Management, Reprint No. 2 2011, Biztantra, New Delhi,
  2. S. N. Maheshwari, Introduction to Accountancy, Edition 11, 2013, Vikas Publishing House
- M. Y. Khan, P. K. Jain, Management Accounting –Text, Problems, Cases, Edition No. Tata McGraw Hill Publishers, 2013

**Course Outcomes:**

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

**IT4219 : FROM CAMPUS TO CORPORATE**

**Course Prerequisites:**

5. Fundamental knowledge about Engineering
6. Basic knowledge about business concept
7. Management Knowledge

**Course Objectives:**

1. Understanding the evolution of technology
2. Understanding Innovation
3. Types of companies and typical organization - Who does What
4. Understanding companies - Domain, Offering, Customers, Strategy, Company Culture & Professionalism
5. Understanding companies financially

**Credits: 4**

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

**Course Relevance:**

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

The course is relevant to all branches of Engineering and beyond, since students work in different companies after graduation. So understanding the way different types of companies work is essential for students in final year.

Planning and Execution : Product Development - Understanding beyond the theory, Quality - Understanding beyond the theory, Product Management, Solutioning and Design - A key step between requirements and delivery, Site Reliability , Devops, Support - Understanding beyond the theory, Common metrics and measurements in a software delivery organization  
**( 6 Hours)**

Key Tool types and processes - End to End product lifecycle management, Issues Management and Lifecycle - A key aspect of customer Satisfaction, Software delivery models and Release cycles - how they work in the real world, Usability by end user - UI/UX and other key concepts and its importance  
**(6 Hours)**

Useful Skills : Continuous learning and improvement - An essential skill, Ownership and Leadership, Analyzing ones career path and making educated judgments, Time management

and multi tasking model, Being a effective Mentee and Mentor, Being Inquisitive: Why asking questions is more difficult than giving answers? Hands on exercise  
**(6 Hours)**

Effective Articulation and Collaboration, Introducing yourself & Making Effective Presentations, Problem breakdown and resolving model, Effective project and program management, Mind Mapping - A powerful technique to learn, Must have tips to succeed in any career  
**(8 Hours)**

**List of Home Assignments:**

**Case Study:** Unique Home assignments will be set up for all groups

**Additional reading material:**

10. [https://drive.google.com/drive/folders/1RmffPScbEnKLdz0\\_LhWJxoAYZL9mWiGs?usp=sharing](https://drive.google.com/drive/folders/1RmffPScbEnKLdz0_LhWJxoAYZL9mWiGs?usp=sharing)

**Course Outcomes:**

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

7. Understand essential skills to develop and thus the experience to look forward to for students joining the Industry
8. Demystify the gap between theory and practice and learn via case studies on application of knowledge
9. Understand Key concepts about the area .Implement supervised algorithms for classification and prediction
10. Understand and learn techniques and methods to imbibe and use

**Job Mapping:**

*Job opportunities that one can get after learning this course*

14. Business Analyst
15. Infrastructure Architect
16. Enterprise Architect
17. Project Manager
18. Design Engineer



**IT4210: MACHINE LEARNING****Course Objectives:**

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

**Credits: 2****Teaching Scheme:-Theory: 2 Hours / Week****Prerequisite-Linear Algebra, Statistics, Probability, Calculus, and Programming Languages**

**Course Relevance-**Machine Learning is the applicable science of making computers work without being explicitly programmed. It is mainly an application of Artificial Intelligence (AI) that allows systems to learn and improve from experience, without any human intervention or assistance. Machine Learning keeps on innovating every aspect of the business and has been shaping up the futures even more powerfully now. Machine learning is the fuel we need to power robots, alongside AI. With ML, we can power programs that can be easily updated and modified to adapt to new environments and tasks- to get things done quickly and efficiently. Machine learning skills help you expand avenues in your career.

**Section 1:**

**Introduction:** What is Machine Learning, Examples of Machine Learning applications in various domains, Introduction to Data Science, Training versus Testing, Positive and Negative Class, Cross validation. Framework of ML Model development.

**Types of Learning:** Supervised, Unsupervised and Semi-Supervised Learning.

**Regression and Generalization:** Regression: Linear and Logistic Regressions, Asses performance of Regression – Error measures, Over fitting and Under fitting, Catalysts for Overfitting. Univariate Regression, Multivariate Linear Regression.

**Classification:** Binary and Multiclass Classification: Handling more than two classes, Multi Classification-One vs One, One vs Rest Linear Models: Perceptrons, KNN, Decision Tree, Random Forest, Assessing Classification Performance.

**Section2:**

**Dimensionality Reduction:** Introduction to Dimensionality Reduction, Subset Sele Introduction to Principal Component Analysis and Singular Value Decomposition.

**Logic Based and Algebraic Models:** Support Vector Machines (SVM), Distance Based Mo Distance based clustering algorithms - K-means and C-means, Hierarchical clustering, Association rules mining – Apriori Algorithm, Confidence and Support parameters.

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

**Trends in Machine Learning:** Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning.

**Introduction to Deep Learning:** The Neuron, Expressing Linear Perceptrons as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons, reinforcement learning.

#### ***Text Books***

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

#### ***Reference Books***

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

#### **Course Outcomes:**

The student will be able to –

1. Understand Different Machine Learning Techniques (1)
2. Evaluate Regression Algorithms (2)
3. Apply different Classifiers to Classify different objects (3)
4. Explore Different Clustering Algorithms(4)
5. Acquaint with Trends in Machine Learning(4)
6. Analyze research based problems using Machine Learning Techniques (5)

**IT4212: ADVANCED COMMUNICATION ENGINEERING****Course Prerequisites:**

Communication Engineering, Digital Signal Processing, Wireless Communication

**Course Objectives:**

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

**Credits:02****Teaching Scheme Theory: 02****hours/Week****Course Relevance:**

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

**SECTION-I**

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

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

**SECTION-II**

Orthogonal Frequency Division Multiplexing Multicarrier modulation, Introduction to Orthogonal Frequency Division Multiplexing (OFDM), OFDM system model, IFFT/ FFT

Transceiver Model, OFDM -BER and SNR performance, multiuser OFDM.

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

**List of Course Seminar Topics:**

1. Performance analysis of multiple-input multiple-output singular value decomposition 29 transceivers.
2. Modeling the Indoor MIMO Wireless Channel
3. Channel Modeling for 5G mobile Communication
4. Comparison of Indoor Geo location methods in DSSS and OFDM Wireless Lan Systems
5. Analysis of MIMO system through Zero Forcing and MMSE detection scheme
6. SVD for Engine design of High Throughput MIMO OFDM system
7. Measured capacity gain using water filling in frequency selective MIMO Channels
8. MIMO channel capacity in Co-channel interference.
9. OFDM Channel estimation using Singular value decomposition
10. Increase in capacity of Multiuser OFDM system

**List of Course Group Discussion Topics:**

1. Fading Environment
2. Deep Fade Phenomenon in Wireless Communication
3. OFDM versus CDMA
4. Filtered -OFDM & OFDM modulation
5. OFDM vs MIMO-OFDM
6. OFDM for Optical Communication
7. MIMO -opportunities and challenges
8. MIMO Radar
9. Massive MIMO for next generation wireless systems
10. 5G - Spectrum, Deployment & Customer Trends

**List of Home Assignments:**

Design:

1. Design of OFDM for UWB environment

2. Design of 4G MIMO OFDM wireless system
3. OFDM for underwater Acoustic communication
4. Design LMSE algorithm for equalization

5. Design Zero forcing Algorithm

Case Study:

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

Blog

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

Surveys

1. Diversity techniques in Wireless Communication
2. Space time coding scheme for MIMO 31
3. Survey on resource allocation techniques in OFDM (A) networks
4. Survey on Mobile WiMax
5. Performance Analysis in MIMO OFDM system

Suggest an assessment Scheme:

1. Seminar
2. Group Discussion
3. Home Assignment
4. Course Viva
5. MSE
6. ESE

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

1. Principles of Modern wireless communication systems. Theory and practice , Aditya K. Jagannatham ,McGraw –Hill publication.
2. Wireless Communications-Andrea Goldsmith –Cambridge university press.
3. Wireless Communications- Principle and practice- Theodore S, Rappaport, Pearson.
4. Digital communications -Fundamentals and applications –Bernard Sklar, Prentice Hall

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

1. Baseband Receiver Design for wireless MIMO-OFDM communications, Tzi-Dar Chiueh, Pei-Yun Tsai, I-Wei Lai, Wiley-IEEE Press, 2012.
2. Theory and applications of OFDM and CDMA : Wideband Wireless Communications , Henrik Schulze, Christian Lueders, Wiley, 2005.
3. Radio Propagation and Adaptive Antennas for Wireless Communication Networks, Nathan Blaunstein, Christos G. Christodoulou, Wiley , 2014.
4. Fundamentals of Wireless Communication

**Moocs Links and additional reading material:**

[www.nptelvideos.in](http://www.nptelvideos.in)

Advanced 3G, 4G Wireless Mobile Communications

<https://nptel.ac.in/courses/117/104/117104099/#>

**Course Outcomes:**

The student will be able to –

- 1) Calculate received power by system and keep required margin
- 2) Differentiate between diversity techniques
- 3) Understand channel modeling
- 4) Illustrate OFDM System
- 5) Discuss performance behavior of MIMO systems
- 6) Differentiate between ZF & MMSE receivers



**IT4216: DATA MANAGEMENT, PROTECTION AND GOVERNANCE****Course Prerequisites:** Database Management System, Operating System**Course Objectives:****To facilitate the learner to –**

1. Get acquainted with the high-level phases of data life cycle management.
2. Acquire knowledge about the various aspects of data storage, data availability, data protection.
3. Gain exposure to various solutions/reference architectures for various use-cases.
4. Understand the technical capabilities and business benefits of data protection.

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

**Course Relevance:** Since technology trends such as Machine Learning , Data science and AI rely on data quality, and with the push of digital transformation initiatives across the globe, data management, governance and security is very much important.

**SECTION-I****Data Storage, Availability and Security**

**Introduction to data life cycle management (DLM):** - Goals of data life cycle management, Challenges involved: Volume of data source, Ubiquity of data locations, User demand for access; Stages of data life cycle - creation, storage, usage, archival, destruction; Risks involved without DLM, benefits, best practices.

**Data storage and data availability :- Storage technology:** Hard Disk Device (HDD), Solid State Devices (SSD), memory devices, Data access - block, files, object ; Data center End to End View – overview of complete stack including storage, network, host, cluster, applications, virtual machines, cloud storage ; Storage virtualization technologies - RAID level, storage pooling, storage provisioning ; Advance topics in storage virtualization – storage provisioning, thin provisioning; Cloud storage – S3, glacier, storage tiering; **High Availability:** Introduction to high availability, clustering, failover, parallel access

**Data Threats and Data center security: - Type of Threats:** Denial of Service (DoS), man in the middle attacks, Unintentional data loss, Repudiation, Malicious attacks to steal data; **Introduction to Ransomware; Understanding, Identification and Threat modeling tools ;Security:** Authorization and authentication - access control, Transport Layer

Security (TLS), key management, security in cloud, Design and architecture considerations for

security

## SECTION-II

### Data Protection, Regulation and Governance

**Introduction to data protection:** - Introduction- Need for data protection, basic of back-up/restore;Snapshots for data protection, copy-data management (cloning, DevOps);De-duplication;Replication; Long Term Retention – LTR; Archival; Design considerations: System recovery, Solution architecture, Backup v/s Archival,media considerations and management (tapes, disks, cloud), challenges with new edge technology (cloud, containers)

**Data regulation, compliance and governance:** - Regulations requirements and Privacy Regulations: The Health Insurance Portability and Privacy Act of 1996 (HIPPA), PII (Personally Identifiable Information), General Data Protection Regulation (GDPR) ;Information Governance : Auditing, Legal Hold, Data classification and tagging (Natural Language Processing); India’s Personal Data Protection bill

**Applications uninterrupted:** - Understand data management aspects of traditional and new edge applications;Reference architecture/best practices (*pick 2-3 case studies from below topics*): Transactional Databases (Oracle, MySQL, DB2), NoSQL Databases (MongoDB, Cassandra),Distributed applications (micro service architectures),Cloud applications – Platform as Service (PaaS), Software as Service (SaaS), Kubernetes, Multi-Tiered applications, ETL workloads, Data analytics (AI/ML)

#### List of Home Assignments:

##### Design:

1. Design data management aspects for cloud applications.
2. Design data management aspect for MongoDB/Cassandra.
3. Design data management aspect Distributed applications.
4. Design data life cycle management for any application.
5. Design data management for any Multi-Tiered application.

##### Case Study:

1. Consider different Transactional and NoSQL Data bases. Comparative study.
2. Compare various cloud applications based on Platform as service and Software as service.
3. Data Analytics based study for data management.
4. Study of Multi-Tiered Applications
5. Study data management in DevOps

**Blog:**

1. Comparative study of data protection schemes.
2. study of The Health Insurance Portability and Privacy Act of 1996 (HIPPA)
3. Need of data management, protection and governance
4. How Threat modelling tools are useful? Consider any application related to it.
5. Role of storage Technology for cloud storage.

**Surveys:**

1. Survey on data protection challenges with new edge technology like cloud
2. Survey on General Data Protection Regulation (GDPR)
3. Survey on Data classification and tagging in Natural Language Processing
4. Survey on Ransomware data security.
5. Survey on Kubernetes.

**Suggest an assessment Scheme:**

MSE, ESE, HA

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

1. Robert Spalding, 'Storage Networks: The complete Reference'.
2. Vic (J.R.) Winkler, 'Securing The Cloud: Cloud Computing Security Techniques and Tactics', Syngress/Elsevier - 978-1-59749-592-9

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

1. Martin Kleppmann, 'Designing Data-Intensive Applications' , O'Reilly

**Web References:**

1. <https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html>
2. <https://searchstorage.techtarget.com/definition/data-life-cycle-management>
3. <https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/>
4. <https://www.bmc.com/blogs/data-lifecycle-management/>
5. <https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/>
6. <https://medium.com/jagoanhosting/what-is-data-lifecycle-management-and-what-phaseswould-it-pass-through-94dbd207ff54>
7. <https://www.spirion.com/data-lifecycle-management/>
8. <https://www.bloomberg.com/professional/blog/7-phases-of-a-data-life-cycle/>
9. <https://www.datacore.com/storage-virtualization/>
10. <https://www.veritas.com/content/dam/Veritas/docs/solutionoverviews/>
11. V0907\_SB\_InfoScale-Software-Defined-Infrastructure.pdf
12. <https://www.veritas.com/solution/digital-compliance>
13. <https://www.veritas.com/solution/data-protection>
14. <https://www.veritas.com/gdpr>

**Course Outcome:**

**By taking this course, the learner will be able to –**

1. Understand the data management world, challenges and best practices.
2. Compare various concepts and technologies for enabling data storage and high availability.
3. Illustrate various types of data threats and approaches to ensure data center security.
4. Explain the various concepts related to data protection.
5. Outline different standards for compliance and governance of data.
6. Understand various approaches for designing data intensive enterprise applications and industry standard solutions in data management.

**IT4213: DEEP LEARNING**

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

**Course Objectives:**

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

**Credits: 2**

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

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

**Section-I**

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

**Section-II**

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

**List of Course Seminar Topics:**

1. Deep learning for Stock Market Clustering
2. Application of Deep Networks in health care
3. Credit card fraud detection

4. Classification of skin cancer with deep neural networks
5. ALEXNET
6. VCGNET
7. Accelerating Deep Network Training by Reducing Internal Covariate Shift
8. Deep learning applications for predicting pharmacological properties of drugs
9. GAN (Generalized Adversarial network)
10. Auto encoders
11. LSTM

**List of Course Group Discussion Topics:**

1. Recurrent or Recursive Networks for sequential Modeling?
2. Initializing network weights vs performance
3. Difficulty of training deep feed forward neural networks
4. Hyper parameter tuning: Is there a rule of thumb?
5. Problem of over fitting: How to handle?
- 6 Which cost function: Least squared error or binary cross entropy?
7. How to tackle with loss of corner information in CNN
8. Need of hundred classifiers to solve real world classification problem
9. Which optimization: Batch gradient descent or stochastic gradient descent
10. Activation functions: Comparison of trends
11. Remedy of problem of vanishing gradient and exploding gradient in RNN

**List of Home Assignments:****Design:**

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

**Case Study:**

1. Deep learning for security
2. Bag of tricks for efficient text classification



3. Convolutional Neural Networks for Visual Recognition

4. Deep Learning for Natural Language Processing
5. Scalable object detection using deep neural networks

**Blog**

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

**Surveys:**

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

**Suggest an assessment Scheme:**

1. Seminar – 10 Marks
2. Group Discussion – 10 Marks
3. Home Assignment – 10 Marks
4. Course Viva – 20 Marks
5. MSE – 25 Marks
6. ESE –25Marks

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

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

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

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

**Moocs Links and additional reading material:**

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

**Course Outcomes:**

Students will be able to

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

**IT4215: DISTRIBUTED COMPUTING****Course Pre requisites:** Operating System, Data Structures and Programming languages**Course Objectives:**

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

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

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

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

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

issues of DSM

**List of Home Assignments:****Design:**

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

**Case Study:**

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

**Blog:**

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

**Surveys:**

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

**Suggest an assessment Scheme:**

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

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

1. Andrew S. Tanenbaum & Maarten Van Steen; “Distributed Systems Principles and Paradigms”;5<sup>th</sup> Edition, Prentice Hall India.
- 2.Pradeep K. Sinha; “Distributed Operating Systems Concepts and Design;1997, Prentice Hall India.

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

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

**Moocs Links and additional reading material:**

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

**Course Outcomes:**

The student will be able to –

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

**IT4218: NETWORK SECURITY****Credits: 2****Teaching Scheme: 2 Hours/Week****Prerequisites:** Computer Networks.

<b>Unit 1:</b>	<b>(5 Hours)</b>
<b>Introduction</b>	
Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services. key security properties - Confidentiality, Integrity, Availability. Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks. Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing	
<b>Unit 2:</b>	<b>(4 Hours)</b>
<b>Private key cryptography</b>	
Mathematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm), Role of random numbers in security, Importance of prime number, DES, AES. Chinese remainder theorem	
<b>Unit 3:</b>	<b>(5 Hours)</b>
<b>Public key cryptography</b>	
RSA: RSA algorithm, Key generation in RSA, attacks on RSA. Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack. Elliptic Curve Cryptography (ECC), Elliptic Curve arithmetic. Diffie-Hellman key exchange	
<b>Unit 4:</b>	<b>(5 Hours)</b>
<b>Authentication and access control</b>	
Message authentication and Hash Function. Authentication: One-Way Authentication, Mutual Authentication, SHA-512, The Needham-Schroeder Protocol. Kerberos, X.509 authentication service, public key infrastructure. Access Control in Operating Systems: Discretionary Access Control, Mandatory Access Control, Role Based Access Control.	
<b>Unit 5:</b>	<b>(5 Hours)</b>
<b>Security application and design</b>	
<b>Part A:</b> Network layer security: IPSec for IPV4 and IPV6. Transport layer security: SSL and TLS. Application layer security: Security services, S/MIME, PGP, Https, Honey pots. Security design: End-to-end security, Security composability, Open design, Cost and tradeoffs	



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**Unit 6:****(4 Hours)****Cyber Security:**

Cyber Attack, Cyber Reconnaissance, Crimes in Cyber Space-Global Trends & classification, e-commerce security, Computer forensics, facebook forensic, mobile forensic, cyber forensic, digital forensic

**Text Books**

1. *“Cryptography and Network Security-Principles and Practices”* by William Stallings, Pearson Education, 2006, ISBN 81-7758-774-9, 4th Edition.
2. *“Network Security and Cryptography”*, by Bernard Menezes, Cengage Learning, 2010, ISBN 81-315-1349-1, 1st Edition.

**Reference Books**

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

**Additional Reading**

1. *“Security architecture, design deployment and operations”*, by Christopher M. King, Curtis Patton and RSA press, McGraw-Hill, 2001, ISBN 0072133856, 1st Edition.
- 2 *“Inside Network Perimeter Security”* by Stephen Northcott, Leny Zeltser, et al, Pearson Education Asia, ISBN 8178087618, 1st Edition.

**Course Outcomes**

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

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

**IT4205: MAJOR PROJECT****Credits: 10****Teaching Scheme Lab: 20 hours/week****Course Relevance:**

This is a culmination of four years of learning into Practical. This course is essential for Graduate Engineers to practice the successful management of a software development project. The course emphasizes on project life cycle phases requirement engineering, system analysis and system design and gives them the exposure to research in any area of their interest. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and It is a way of increasing the student's maturity and preparing him/her for their future career. The students carry out cutting edge projects with a flexibility to balance between research- and application-oriented work as per their interest. The program enables the students to find opportunities for higher studies in top ranking universities abroad, and to find jobs in dream companies.

The Motivation for this Major Project is

- a. Synthesis of knowledge
- b. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
- c. To mature the knowledge.
- d. Preparation for joining the working world.

The Project Work can lead to:

- a. Novice algorithm development
- b. Optimization of existing system/method
- c. New state of the art application
- d. Some incremental work in any existing field of their choice

**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 open-ended – meaning that there is not a known correct answer to the design problem. Students are expected to apply their creativity (simply copying or re-creating something that already exists is not acceptable).
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 Requirement Definition Document, Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.
6. The Project Work will be assessed jointly by a panel of examiners having more than Five Years experience. The Project Groups will deliver the presentation of the Project Work which will be assessed by the panel.
7. 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, understanding of the Project, analysis and design performed for the project.
8. The Student Project Groups are expected to work on the recommendations given by the panel of examiners. In no case any variation in Project Theme will be permitted.
9. The outcome of the project should be tangible in terms of paper publication/patent/SOP/prototype
10. The Project should justify the work worth 10 credits.

### Assessment Scheme

Sr. No.	Content	Marks
1	Development of Prototype/ Model	20
2	Innovativeness and intellectual input	20
3	evaluation of literature review	10
4	Individual contribution	10
5	Usage of Modern Tool/ Technology and experimental competency	10
6	Presentation of the Project Work	10
7	Results and analysis	10
8	Quality Publication and Project Report	10

### Note:

The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice like signal processing, computer vision, machine learning and artificial intelligence, control systems, game theory, and communication

networks and address the problem by formulating a solution for the identified problem. 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 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.

Following is the list of recommended domains for Project Work:

signal processing, computer vision, machine learning and artificial intelligence, IoT, Block Chain, Image Processing, data Science etc.

**Course Outcomes:**

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

1. Model the Real World Problem
2. Identify the Design within Specification and Available Resources
3. Realize the Solution within Defined references
4. Defend his Design with Technical and Ethical reasoning
5. Adapt to changing Technological and Human resource advances
6. Use the gained knowledge for other Real-World Problems
7. Project will involve development of a compact solution to current problem/s in chosen field.

**IT4251: INDUSTRY INTERNSHIP**

**Credit: 16**

**Course Relevance:** Implementation of technical knowledge acquired during previous three years of Internship and to get acquainted with Industry culture.

**SECTION-1**

Get used to corporate culture

Realization of Internship as per problem statement  
Design, Testing / Experimentation, Analysis / Validation  
Documentation and Report Writing  
Quality of Work

Performance in Question & Answers Session  
Regular interaction with guide

**SECTION-2**

Problem Statement  
Literature Review  
Clarity about the objectives of Internship activity  
Requirement Analysis, Internship Planning  
Knowledge of domain, Latest technology, and modern tools used /to be used  
  
Neat project documentation

**Suggest an assessment Scheme:**

MSE review for 50 marks converted to 30  
ESE review for 100 marks converted to 70

**Course Outcomes:**

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

CO1: Explore career alternatives prior to graduation.

CO2: Integrate theory and practice.

CO3: Develop work habits and attitudes necessary for job success.

CO4: Develop communication, interpersonal and other critical skills in the job interview process.

CO5: Acquire employment contacts leading directly to a full-time job following graduation from college.

CO6: Practice Project Management and learn team dynamics



**IT4252: INTERNATIONAL INTERNSHIP****Credit: 16**

**Course Relevance:** Implementation of technical knowledge acquired during previous three years of Internship and to inculcate research culture.

**SECTION-1**

Realization of Internship as per problem statement  
Design, Testing / Experimentation, Analysis / Validation  
Documentation and Report Writing  
Quality of Work

Performance in Question & Answers Session  
Regular interaction with guide

**SECTION-2**

Problem Statement  
Literature Review  
Clarity about the objectives of Internship activity  
Requirement Analysis, Internship Planning  
Knowledge of domain, Latest technology, and modern tools used /to be used

Research Paper should be published in Peer Reviewed Journal/Conference or Patent should be published.

**Suggest an assessment Scheme:**

MSE review for 50 marks converted to 30  
ESE review for 100 marks converted to 70

**Course Outcomes:**

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

CO1: Explore career alternatives prior to graduation.

CO2: Integrate theory and practice.

CO3: Develop work habits and attitudes necessary for job success.

CO4: Develop communication, interpersonal and other critical skills in the job interview process.

CO5: Acquire employment contacts leading directly to a full-time job following graduation from college.

CO6: Practice Project Management and learn team dynamics

**IT4253: RESEARCH INTERNSHIP**

**Credit: 16**

**Course Relevance:** Implementation of technical knowledge acquired during previous three yearsof Internship and to inculcate Industry culture.

**SECTION-1**

Realization of Internship as per problem statement  
Design, Testing / Experimentation, Analysis / Validation  
Documentation and Report Writing  
Quality of Work

Performance in Question & Answers Session  
Regular interaction with guide

**SECTION-2**

Problem Statement  
Literature Review  
Clarity about the objectives of Internship activity  
Requirement Analysis, Internship Planning  
Knowledge of domain, Latest technology, and modern tools used /to be used

**Suggest an assessment Scheme:**

MSE review for 50 marks converted to 30  
ESE review for 100 marks converted to 70

**IT4254: PROJECT INTERNSHIP****Credit: 16**

**Course Relevance:** Implementation of technical knowledge acquired during previous three years of Internship and to get acquainted with Industry culture.

**SECTION-1**

Get used to corporate culture and get sponsorship from the company

Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

**SECTION-2**

Problem Statement

Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

Knowledge of domain, Latest technology, and modern tools used /to be used

Neat project documentation

**Suggest an assessment Scheme:**

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

**Course Outcomes:**

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

CO1: Explore career alternatives prior to graduation.

CO2: Integrate theory and practice.

CO3: Develop work habits and attitudes necessary for job success.

CO4: Develop communication, interpersonal and other critical skills in the job interview process.

CO5: Acquire employment contacts leading directly to a full-time job following graduation from college.

CO6: Practice Project Management and learn team dynamics.

