Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

B.Tech.

(AI & DS)

Effective from Academic Year 2023-24

Prepared by: Board of Studies in AI & DS

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 offer quality academic environment with the modern infrastructure to cater the demand of AI and DS careers with the research aptitude"

Department Mission

- To promote employability and entrepreneurship skills among students in the AI-DS and IT domains.
- To impart quality education with the focus on design, development and analysis using Interdisciplinary approach.
- To encourage students-faculty participation in research and development in collaboration with industry.
- To prepare students for solving problems of societal benefits and make them responsible citizens

Program Educational 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 Information Technology 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	Toenablestudenttoexerciseproblemsolvingcapacitywitheffectiveuseofanalysis,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]

Graduateswillbeable

PO	PO Statement
PO1	**Engineering knowledge:**Apply the knowledge of mathematics,science,engineering fundamentals,and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:**Identify,formulate,review research literature,and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety,and the cultural,societal,and environmental considerations.
PO4	**Conduct investigations of complex problems:**Use research-based knowledge and Research methods including design of experiments, analysis and interpretation of data,and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:**Create, select, and apply appropriate techniques, resources,and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:**Apply reasoning informed by the contextual knowledge to

	assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:**Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:**Apply ethical principles And commit to professional ethics and responsibilities And norms of the engineering practice.
PO9	**Individual and teamwork:**Function effectively as an individual, and as a member or Leader in diverse teams,and in multidisciplinary settings.
PO10	**Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as,being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clea rinstructions.
PO11	**Project management and finance:**Demonstrate knowledge and understanding of the engineering and management principles and apply the setoone's own work, as a member and leader in a team,to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:**Recognize the need for,and have the preparation and ability to Engage in independent and life-long learning in the broad estcontext of technological change**.**
PSO	**PSO Statement**
PSO1	Solving the real-world problems with the application of Artificial Intelligence and Data Science concepts, theory and algorithms that adequately meet the challenges of present and future.
PSO2	Ability to develop advanced knowledge and skill-sets to innovate technological tools and techniques with optimal use of resources and infrastructure in a competitive environment.
PSO3	Exhibit proficiency in computational knowledge and project development using Artificial Intelligence and data science techniques and tools for effective use in analysis, design and development in a multidisciplinary set-up.
PSO4	Develop high quality research and development aptitude for generation of knowledge and innovative business solutions which are socially and ethically acceptable and recognized by the industry and academia.

B.Tech.AI&DS Structure

(Applicablew.e.f.AY23-24)

SY AI&DS 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	20	30	20	100	4
S2	CS2221	Internet of Things	2	2	1	10	-	20		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	20	30	20	100	4
S5	AI2018	Probability and Calculus	2			-	-	-		-		100	-	100	2
S6	AI2010	Design Thinking- III	-	-	1	-	-	-	-	-		-	-		1
S7	AI2018	Engineering Design & Innovation – I	-	2	-	-	-	-	30	-		70	-	100	4
Total															23

SY AI&DS Module-IV

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	AI2001	Advanced Data Structure	2	2	1	10	-	-	-	20	-	50	20	100	4
S2	AI2014	Web Technology	2	2	1	10	-	-	30	20	20	-	20	100	4
S3	AI2003	Computer Network	2	2	1	10	-	-	-	20	-	50	20	100	4
S4	AI2015	Digital Electronics and Microprocessor	2	2	1	10	20	-	-	20	-	30	20	100	4
S5	AI2017	Automata Theory	2									100		100	2
S6	AI2012	Design Thinking- IV	-	-	1	-	-	-	-			-	-		1
S7	AI2020	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. Overfitting and underfitting in the context of classification
6. Linear and Quadratic discriminant analysis
7. Regression v/s classification
8. Classifier performance measures
9. Supervised and unsupervised learning
10. Various clustering approaches
11. Classifiers and classifier combinations
12. Balancing errors in hypothesis testing
13. Standard sampling practices for a successful survey for reliable sample data

List of Home Assignments:

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

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

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

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

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

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

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

Course Outcomes:

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

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

Future Courses Mapping:

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

Job Mapping:

Job opportunities that one can get after learning this course

1. Data Scientist
2. Data Analyst

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

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, Datalink and Higherlayer 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. Interne of Things is a system ofinterrelated 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. ListofIndiancompanieswhichofferIoTsolutionsforagricultureandfarming.Describethepro blem they are addressing and their solution.
3. Make a list of Indian companies which offer IoT solutions for healthcare. Describe the problem they are addressing and their solution.
4. Makeanexhaustivelistofeverythinginside,justoutside(immediatesurroundings)andon the auto body which must be "observed" for safe and comfortable driving using autonomous vehicles.
5. Compare different Cloud Service providers in the market.

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

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

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

Reference Books:

1. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", Wiley
2. OvidiuVermesan&PeterFriess"InternetofThingsApplications-FromResearchandInnovationtoMarket Deployment", ISBN:987-87-93102-94-1,RiverPublishers
3. Joe Biron and Jonathan Follett, "Foundational Elements of an IoT Solution," by Joe Biron

MOOCs Links and additional reading material:

1. https://proed.stanford.edu/course/view.php?id=191
2. https://nptel.ac.in/courses/106/105/106105166/

3. https://create.arduino.cc/projecthub/electropeak/getting-started-w-nodemcu-esp8266-on-arduino-ide-28184f

Course Outcomes

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

Future Courses Mapping:

Other courses that can be taken after completion of this course

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

Job Mapping:

The Internet of Things (IoT) is the most emerging field in today's world. It is revolutionizing every industry, from home appliances to agriculture to space exploration. Since the advent of cloud computing, there has been an exponential growth in the number of sensor-enabled devices connected to the internet and expecting further growth accelerating in the coming years. There are diversified career opportunities in this field. The various career positionsavailableasIoTResearchDeveloper,IoTDesignEngineer,IoTProductManager,IoTSoftwareDeveloper, 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
33. Variants of main() and command line arguments
34. Input and Output stream classes
35. String concepts and various methods of comparing strings
36. Methods in Java
37. Java String Methods
38. Passing array to a function and Jagged array examples
39. Reading input using Scanner and Buffer Reader Class
40. String, String buffer and String builder
41. Types of Inheritance in Java
42. Implementation of Types using Constructor in Inheritance
43. Using final with Inheritance
44. Base vs derived class reference in Inheritance
45. Using final with Inheritance, Accessing superclass member
46. Parent and Child classes having same data member
47. Overriding, Hiding Fields & Methods
48. Static vs Dynamic Binding & Hiding Methods
49. Private and final methods
50. Passing and Returning Objects in Java
51. Java Memory Management
52. File handling in Java vs C++
53. Data types used in Java vs C++
54. Java Object Serialization and Deserialization
55. Operator precedence
56. Use of Object Class Methods
57. Garbage collection in JAVA
58. Use of Static Blocks in various applications
59. Keywords used in JAVA
60. Types of Variables In JAVA

List of Group Discussion Topics:

1. Introduction of Arrays and 1D Array programming examples
2. Multidimensional arrays
3. Variants of main () and command line arguments
4. Input and Output stream classes
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
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? pls 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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84. Difference between JDBC and ODBC connectivity
85. file processing in java
86. Difference between premitive data processing and object data processing
87. Creating GUI using swing
88. comparision 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. Cybercafe 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. SmartFTP 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 aArrayList be synchronised without using vector?

Design:

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

Case Study:

1. Java development milestones from 1.0 to 16.0

2. Implementation of Different Methods in Polymorphism
3. Real world systems which use java for its implementation
4. Drawing a flag using java
5. Use of different methods of Class object
6. Drawing a flag using java

Text Books:

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

Reference Books:

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

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

Moocs Links and additional reading material:

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

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

Course Outcomes:

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

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

FF No.: 654

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 modelling and design, the languages and models provided by the database management systems, and database system implementation techniques. The goal is to provide an in-depth and up-to-date presentation of the most important aspects of database systems and applications, and related technologies.

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

SECTION-II

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"; 6th Edition, McGraw-Hill Education
2. RamezElmasri, Shamkant B. Navathe; "Fundamentals of Database Systems";7th Edition, Pearson

Reference Books:

1. Thomas M. Connolly, Carolyn E. Begg," Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition ;Pearson
2. Raghu Ramakrishnan, Johannes Gehrke; "Database Management Systems", 3rd Edition; McGraw Hill Education
3. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN: 978-93-5110-

269-4, 2nd Edition.
4. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
5. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication. 6. Reese G., Yarger R., King T., Williums H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.
7. Dalton Patrik, SQL Server – Black Book, DreamTech Press.
8. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.
9. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

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

Course Outcomes:
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

AI2018 : PROBABILITY AND CALCULUS

Course Prerequisites:

Basics of Mathematics

Course Objectives:

9. To facilitate the students with a concrete foundation of probability and calculus
10. 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.

SECTION I

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 deriative, 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

AI2010: 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

FFNo.:654

AI2018: 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 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 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-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

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

AI2001: ADVANCED DATA STRUCTURES

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

Course Objectives:

1. To impart the basic concepts tree data structures and algorithms.
2. To understand tree usage in different applications.
3. To construct and implement applications using Graphs
4. To understand Hashing and its applications
5. To emphasize the importance of Heap data structures in developing and implementing efficient algorithms.

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

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

SECTION-1

Trees

Arrays, Stack, Queue, Linked List:-Concepts,Applications.

Trees: - Basic terminology, representation using array and linked lists.
Tree Traversals: Recursive and Non recursive, Operations on binary tree: Finding Height, Leaf nodes, counting no of Nodes etc,Construction of binary tree from traversals, Binary Search trees (BST):Insertion, deletion of a node from BST. Threaded Binary tree (TBT): Creation and traversals on TBT,AVL tree.

AdvancedTrees: Red-BlackTrees,B-TreesandB+Trees,Splaytrees, Tries and compressed tries, Suffix Trees.

Randomized Data Structures: Skip Lists and Treaps.

SECTION-II

Graph, Hashing and Heap

Graphs: Terminology and representation using Adjacency Matrix and Adjacency Lists, Graph Traversals and Application: BFS and DFS. Minimum Spanning tree: Prims and Kruskal's Algorithm, Shortest Path Algorithms: Single Source All destinations, all pair shortest path algorithm, Topological Sort.

Hashing: Hashing techniques, Hash table, Hash functions. Collision handling and Collision resolution techniques, Cuckoo Hashing.Dynamic Hashing: Motivation for Dynamic Hashing, Dynamic Hashing using Directories, directory less Dynamic Hashing. Bloom Filters Bloom Filter Design

Heap: Amortized Analysis, Double Ended Priority queues, Leftist Trees, Binomial Heaps, Fibonacci Heaps, skew heaps, pairing heaps.

List of Tutorials: (Any six)

1. Sorting Techniques: Quick, bucket sort etc.
2. Searching Techniques: Ternary Search, Fibonacci Search.
3. Problem solving using stack (Maze problem, Tower of Hanoi).
4. Expression conversion like infix to prefix and postfix and vice versa.
5. Priority Queues Job Scheduling Algorithms.
6. Generalized Linked Lists.
7. AVL tree.
8. Routing network problems.
9. Design of Hashing Functions and Collision Resolution techniques.
10. Cuckoo Hashing**.**

List of Practicals: (Any Six)

1. Assignment based on Stack Application (Expression conversion etc.)
2. Assignment based on BST operations(Create, Insert, Delete and Traversals)
3. Assignment based on various operations on Binary Tree (Mirror image, Height, Leaf node display, Level wise display etc.)
4. Assignment based on AVL (insert, delete, display)
5. Assignment based on Red black tree (insert, delete, display)
6. Assignment based on B tree (insert, delete, display)
7. Assignment based on tries (insert, delete, display)
8. Assignment based on DFS and BFS
9. Assignment based on MST using Prim's and Kruskals Algorithm.
10. Assignment based on Finding shortest path in given Graph.
11. Assignment based on Hashing.
12. Assignment based on Directory based dynamic hashing
13. Assignment based on Directory less dynamic hashing
14. Assignment based on Binomial heap (insert, delete, display)

List of Projects:

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

Suggest an assessment Scheme:

ESE, CVV, Lab Assignment, Lab exam, Course Project.

Text Books:

1. E. Horwitz , S. Sahani, Anderson-Freed, " Fundamentals of Data Structures in C",Second Edition, Universities Press.

2. Y. Langsam, M.J. Augenstein, A.M.Tenenbaum, "Data structures using C and C++",Pearson Education, Second Edition.

3. Narasimhakarumanchi, "Data Structures and Algorithm Made Easy", Fifth Edition, CareerMonk publication.

Reference Books:

1. *J. Tremblay, P. soresan, "An Introduction to data Structures with applications", TMHPublication, 2nd Edition.*
2. *G. A.V, PAI , "Data Structures and Algorithms ", McGraw Hill, ISBN -13: 978-0-07-066726-6*

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

The student will be able –

1) To demonstrate the use of binary tree traversals. (2)
2) To interpret the tree data structures with their memory representations and time complexity analysis. (3)
3) To use advanced trees for solving real-world problems (4)
4) To analyze the Graph data structure with respect to Graph applications.(3)
5) To design the appropriate data structure by applying various hashing Techniques.(4)
6) To select heap data structure to characterize real data.(5)

FFNo.:654

AI2014: 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 jQueryin 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 HTM"; 4th edition, Tata McGraw-Hill Publications*
2. *Black book; "Web Technologies:HTML,JS,PHP,Java,JSP,ASP.NET,XML and AJAX" ; Dreamtech Press, 2016.*
3. *Dave Mercer, Allan Ken; "Beginning PHP 5"; Dreamtech Publications.*
4. *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",5th Edition, O'Reilly publication.*

Reference Books: (As per IEEE format)

1. *Jeremy McPeak& Paul Wilton, "Beginning JavaScript", 5th 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", 1st Edition,Packt Publishing, ISBN-13 978-1788835534*
4. *Frank Zammetti ,"Modern Full-Stack Development",1st 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, andcross platform applications using NodeJS framework

FF No.: 654

AI2003: 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 Brouter. Spread spectrum signal, FHSS, DSSS. Data Link Layer:Logical Link Layer- Services to Network Layer, Framing, Error Control and FlowControl. 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- PPPand HDLC. Medium Access Control: Channel Allocation-Static and Dynamic, Multiple Access Protocols- Pureand Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, CSMA/CD.
Section 2

Network Layer: Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols- Distance Vector, Link State, Path Vector, Routing inInternet- RIP,OSPF, BGP, Congestion control and QoS,
Transport Layer: Services, Berkley 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 HammingCodes or CRC. Demonstrate the packets captured traces using Wireshark Packet AnalyzerTool for peer-to-peermode. (50% students will perform Hamming Code and others willperform CRC)
4. Write a program to simulate Go back N and Selective Repeat Modes of Sliding WindowProtocol 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 subnetting and find the subnet masks.
7. Write a program using TCP socket for wired network for following: a. Say Hello to Eachother (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 Videoone 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 wirednetworks. 1.Ethernet 2. IP 3.TCP 4. UDP

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 010011110using Polar NRZ-L and NRZ-1 schemes. 2. 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 Approacht," 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
2. https://www.my-mooc.com/en/categorie/computer-networking

COURSE OUTCOMES

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

FFNo.:654

AI2015: 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, Code converter, Characteristics of Digital IC's

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 and Interrupt Structure

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

Multiprocessor Architecture

UMA, NUMA, COMA MPP Processor. Loosely and Tightly coupled multiprocessors, characteristics of multiprocessors & multiprocessing, Inter Processor communication network, Time shared bus, Crossbar switch, Interleaved memories S access, C access. Cache coherency and bus snooping and

directory based protocols. Massively Parallel Processors (MPP), Inter Processor Communication and Synchronization.

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 arraystored 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",2nd 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.*

R.P. Jain, "Modern Digital Electronics,"3rdEdition, Tata McGraw-Hill, 2003, ISBN 0 - 07 - 049492 – 4

Reference Books:

1. *Ray Duncan, "Advanced MS DOS Programming," 2nd Edition BPB Publications ISBN 0 – 07 – 048677 – 8.*
2. *M. Mano, "Digital Design", 3rd Edition, Pearson Education, 2002, ISBN - 81 - 7808 – 555 – 0.*
3. *A. Malvino, D. Leach, "Digital Principles and Applications", 5th 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 and interrupts
6. Understand concept of multitasking and multi-core processors.

FFNo.:654

AI2017: AUTOMATA THEORY

Course Prerequisites: Basic mathematics and programming

Course Objectives:

To design suitable computational model/sfor 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

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 inunderstanding the type and class of problems,and to solve and prove certainty of the provided solution. It would also help software developersin 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 FiniteAutomata (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 RegularLanguages, Myhill-Nerode theoremand its applications
Grammar: (04 hrs)
Chomsky hierarchy, Context Free Grammars (CFG), Derivation, Languages of CFG, Constructing CFG, Derivationtrees, 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 ofTM variants, UniversalTuring 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

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

AI2012: 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

AI2020: ENGINEERING DESIGN AND INNOVATION IV

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 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

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 AI&DS 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	AI3001	Artificial Intelligence	2	2	1	10	20	-		20	-	30	20	100	4
S2	AI3002	Operating System	2	2	1	10	-	-		20	-	50	20	100	4
S3	AI3003	Statistical Inference	2	2	1	10	-	-		20	20	30	20	100	4
S4	AI3004	Machine Learning	2	2	1	10	20	-		20	-	30	20	100	4
S5	AI3014	Engineering Design & Innovation – V	-	2	-	-	-	-	30			70	-	100	6
S6	AI3013	Design Thinking- V	-	-	1	-	-	-	-			-	-		1
Total															23

TY AI&DS 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	AI3009	Cloud Computing	2	2	1	10	-	-		20	-	50	20	100	4
S2	AI3010	Deep learning	2	2	1	10	20	-		20	-	30	20	100	4
S3	AI3011	Complexity Algorithm	2	2	1	10	-	-		20	20	30	20	100	4
S4	AI3012	Software Design and Methodologies	2	2	1	10	20	-		20	-	30	20	100	4
S5	AI3016	Engineering Design & Innovation –VI	-	2	-	-	-	-	30			70	-	100	6
S6	AI3015	Design Thinking- VI	-	-	1	-	-	-	-			-	-		1
Total															23

FFNo. : 654

AI3001: Artificial Intelligence

Course Prerequisites:

- A course on "Computer Programming and Data Structures"
- A course on "Mathematical Foundations of Computer Science"
- Some background in linear algebra, data structures and algorithms, and probability will be helpful

Course Objectives:

1. To learn the distinction between optimal reasoning Vs. human like reasoning
2. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Credits: 4.....

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

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

SECTION-I

Topics and Contents:

Unit-I Title: Fundamentals of Artificial Intelligence

Introduction: A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, Types of production systems, Turing Test. **Intelligent Agents**: Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. **Formulation of problems**: Vacuum world, 8 queens, Route finding, robot navigation.[CO1, CO2] [PO1, PO2]

Unit-II Title: UninformedSearch Strategies

Uninformed Search Methods: Depth First Search, Breadth First Search, Depth Limited Search,Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search

Strategies.[CO3] [PO3, PSO1]

Unit-III Title: Informed Search Methods:

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

SECTION-II

Topics and Contents:

Unit-IV Title: Logical Agents:

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

Unit-V Title: Basics of PROLOG:

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

Unit-VI Title: Planning:

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

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

Tutorials:

List of Tutorials

[CO1] [PO1]

1. AI problem formulation [CO1] [PO1]
2. Task Environment [CO1] [PO1]
3. AI Problem Characteristics [CO1] [PO1]
4. Missionaries and Cannibals Problem [CO2] [PO2]
5. Water Jug Problem [CO2] [PO2]

6. Monkey Banana problem [CO2] [PO2]
7. 8 Puzzle Problem [CO2] [PO2]
8. Magic Square problem [CO2] [PO2]
9. Tic-Tac Toe Problem [CO3] [PO3]
10. Robot Navigation [CO5] [PO4]
11. Propositional Logic Examples [CO5] [PO4]
12. Predicate Logic Examples [CO5] [PO4]
13. Mini Expert system examples [CO5] [PO4]

Practicals:

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

Course Projects:

List of Course Project Topics (Sample topics)
Course Project 01 Statement: ---------- [CO's Mapped] [PO Mapped] 1. Inventory management E Commerce [CO1] [PO1] 2. stock market price prediction [CO1] [PO1] 3. Object Identification / detection [CO2] [PO2] 4. Product Delivery Drones [CO3] [PO3]

5. Pick and drop robotic arm [CO4] [PO2]
6. Arrangement of blocks [CO2] [PO2]
7. Smart city water / light management system [CO2] [PO2]
8. Human Tracking system [CO2] [PO2]
9. Automatic Interview Conduction system [CO3] [PO3]
10. Student Information Chatbot Project. [CO3] [PO3]
11. Product Review Analysis For Genuine Rating. [CO3] [PO3]
12. Customer Targeted E-Commerce [CO4] [PO2]
13. College Enquiry Chat Bot [CO2] [PO2]
14. Artificial Intelligence HealthCare Chatbot System [CO3] [PO3]
15. Intelligent Tourist System Project [CO3] [PO3]

Seminars:

List of Course Seminar Topics

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

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

List of Home Assignments:

List of Design Based Home Assignments

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

List of Case Study Based Home Assignments

HA_CS[CO's Mapped] [PO Mapped]

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

List of Blog Based Home Assignment

1. AI Trends [CO3] [PO3]
2. AI Research [CO3] [PO3]
3. AI Chatbot [CO3] [PO3]
4. Chatbot Magazine [CO3] [PO3]

5. AI Medical / Agriculture [CO3] [PO3]
6. AI Challenges [CO3] [PO3]
7. Knowledge based Inference Engine [CO3] [PO3]
8. Rule based inference Engine [CO3] [PO3]
9. Truth maintenance system[CO3] [PO3]
10. AI in CSP problems [CO3] [PO3]

List of Survey Based Home Assignments

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

Suggest an assessment Scheme:

HA, Seminar, MSE, ESE, Lab, CVV

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

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

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

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

MOOCs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:

On the completion of course, student will able to

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

AI3002: 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.

SECTION-1
Introduction: What is OS?, Interaction of OS and hardware, Goals of OS, Basic functions of OS, OS Services, System Calls, Types of System calls, Types of OS: Batch, Multiprogramming, Time Sharing, Parallel, Distributed & Real-time OS. **Process management:** Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control, Thread implementations – User level and Kernel level threads, Concurrency: Issues with concurrency, Principles of Concurrency, Mutual Exclusion: OS/Programming Language Support: Semaphores, Mutex,Classical Process Synchronization problems.**Uniprocessor Scheduling:** Scheduling Criteria, Types of Scheduling: Preemptive, Non-preemptive, Long-term, Medium-term, Short-term, Algorithms: FCFS, SJF, RR, Priority
SECTION-2

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 andI/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"; 6th Edition,Pearson Education;*
6. *Silberschatz A., Galvin P., Gagne G.;"Operating System Concepts" ; 9th Edition; John Wiley and Sons;*
7. *Yashavant Kanetkar; "Unix Shell Programming"; 2nd Edition, BPB Publications*
8. *Sumitabha Das; "Unix Concepts and Applications"; 4th 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"; 7th Edition, John*

Wiley and Sons.

6. *Forouzan B. A., Gilberg R. F.; "Unix And Shell Programming"; 1st Edition, Australia*

Thomson Brooks Cole.

7. *Achyut S. Godbole , Atul Kahate; "Operating Systems"; 3rd Edition, McGraw Hill.*

Moocs Links and additional reading material:

5. 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/Obuffering techniques and disk scheduling algorithms.

AI3003 : STATISTICAL INFERENCE

Course Prerequisites:

Basic knowledge of Statistics and Probability, Python

Course Objectives:

1. Get basic understanding about statistical models and their use.
2. Apply linear and regression models depending upon the problem context.
3. Get a better understanding of probabilistic models.
4. Derive inference from different statistical datasets

Credits: 4

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

Course Relevance: Machine learning, DataScience

SECTION-I
Topicsand Contents (4Hrs): Introduction, Basic concepts from statistics, definition and uses of models, how models are used in practice, key steps in the modeling process. Linear models and optimization, least square estimation,linear discriminant analysis, Factor analysis, principal component analysis, Concept of Outliers **Correlation, Regression and Generalization(4Hrs):**Correlation and its type, Assessing performance of Regression – Error measures,Overfitting and Underfitting, **Regression Types(6hrs)**:Univariate Regression ,Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves CaseStudy of Polynomial Curve Fitting
Topicsand Contents(4hrs): Introduction to probabilistic models, some examples of probabilistic models, noisy channel model, source channel model, joint source channel models, Monte Carlo Simulation **Building blocks of probability models (5hrs)**, various distributions (Bernoulli, Binomial, Normal distribution), mixture models, bootstrap maximum likelihood methods, Bayesian method, expectation maximization, **Markov-chain models(5Hrs)**, Hidden Markov model, Conditional random fields, Latent variable probability models
List of Tutorials:(Any Three) 1. Consider the following set of points:{(-2,-1),(1,1),(3,2)} a. Find the least square regression line

For the given data points.
b. Plot the given points and the regression line in the same rectangular system of axes.
2. Find the Standard Deviation,Variance,Mean,Median,Modeforthefollowingdata7,11,1
1,15,20,20,28.
3. A2-Ddatasetisgivenbelow.
4. C1=X1={(4,1),(2,4),(2,3),(3,6),(4,4)}
5. C2=X2={(9,10),(6,8),(9,5),(8,7),(10,8)}
6. Calculate the dimensionality reduction using linear discriminant analysis.
1. Find the coefficient of Regression for the following
dataX12 3 4 5 6 7 8 9
Y9 8 10 12 11 13 14 16 15
2. Find whether Null-Hypothesis is correct or not using One-Way ANNOVAAB
C
23 4
45 6
67 8
6. SolvePoissonRegressionmodelproblemusingaworkableexample.
7. FindthePrincipalComponentsforZ1,Z2forthefollowingmatrixA
T
=
2 1 0 -1
4 3 1 0.5
8. ADieisthrown6-times.If getting an odd number is a success what is the probability of
i. 5-Success
ii. Atleast5-Success
iii. Atmost5-Success
9. If a fair coin istossed10timesthen find the probability of
i. Exactly6heads
ii. Atleast6heads
iii. Atmost6heads
10. In a bolt factory, Machines A, B and C manufacture respectively 25%, 35% and 40% of the total bolts. Out of their total output 5, 4 and 2 percentage are respectively defective bolts. A bolt is drawn at random from the product. If the bolt is defective, what is the probability that the Bolt is manufactured by Machine B.

List of Practicals: (Any Six)
1. Least square estimate
2. Ridge and Lasso
3. Cross Validation
4. Factor analysis
5. Principal component analysis
6. Noisy channel model
7. Source channel model
8. Maximum likelihood method
9. Expectation maximization
10. Markov chains
11. Hidden Markov model

List of Projects:
1. Implement linear regression to predict housing price using the Housing dataset of Boston.
2. Implement Logistic regression to do credit score prediction using German credits score dataset.

3. Implement factoranalysis to find the important features out of all features present in the Student Per Formance Dataset.
4. Implement Principal Component analysis to identify the crucial features out
Of all features present in the Breast cancer dataset.
5. Implement Logistic regression model for the prediction of Lung cancer disease using UCI Lung ca Ncer dataset.
6. Compare Average Global Temperatures and Levels of Pollution (linear regression)
7. Compare Budgets of National Film Awards-nominated Movies with the number Movies Winning These Awards (linear regression)
8. Implement different feature selection techniques on any data set.

List of Course Seminar Topics:

1. Least square estimation
2. Linear discriminantanalysis
3. Linear Regression
4. Logistic Regression
5. Anova
6. Ancova
7. Root mean square error
8. Poisson Regression
9. Principal Component analysis
10. Entropy estimation
11. Biased sample
12. Kappa statistics

List of Course Group DiscussionTopics:

1. Noisy channel model
2. Source channel model
3. Monte carlo simulation
4. Binomial Distribution
5. Normal Distribution
6. Markov chain model
7. Bootstrap maximum likelihood methods
8. Bayesian Method
9. Performance Evaluation Metrics for Regression problems
10. Measures of central tendency vs measures of variability
11. Avoiding overfitting and underfitting in classifiers

List of Home Assignments:

Design:

1. Heart disease prediction
2. Customer Review classification
3. Sensorless drive diagnosis
4. Default creditcard client classification
5. Devnagri handwritten character classification

Case Study:

1. Classification models
2. Regression models
3. Maximum likelihood
4. Generalized linear discriminantanalysis.
5. Conditional Randomfields

Blog

1. Logistic regression
2. Support vector machine
3. Types of error
4. Markov chain model
5. Latent variable probability model

Surveys

1. Random forest vs Decision tree
2. Principal Component analysis
3. Bayesian method
4. Types of distribution
5. Different variance models

Text Books:*(As per IEEE format)*

1.The Elements of Statistical Learning: Data Mining, Inference, and Prediction. By Trevor Hastie, Robert Tibshirani, Jerome Friedman, Hardcover: 745 pages, Publisher: Springer; 2nded.2009,ISBN-10:0387848576

2. Statistical Models by A.C.Davison Paperback:738pages,Publisher:Cambridge University Press;1edition(30June2008)ISBN-10:0521734495CambridgeUniversityPress

Reference Books:*(As per IEEE format)*

1. S.C.Gupta;"Fundamentals of Statistics 7th Edition"; Himalaya Publishing House Pvt.Ltd.

2. Abdul Hamid Khan, MANOJ KUMAR SRIVASTAVA, and NAMITA SRIVASTAVA;"STATISTICAL INFE RENCE:THEORYOF ESTIMATION";PhiLearning

MOOCs Links and additional reading material:

1. Statistics tutorial-https://www.youtube.com/channel/UCQKwruq0LY3cjvSx7_M5JAg
2. Inferential Statistics- https://www.youtube.com/watch?v=-FtlH4svqx4&list=PLSQl0a2vh4HDl0hgK8nIBgBjLji5Eu9ar

Course Outcomes:

1. Demonstrate various statistical methods used for modeling purpose
2. Analyze various correlation methods that provides insights of the real world problem
3. Apply suitable linear and regression models to evaluate the performance of models
4. Formulate given problem using probabilistic models for concise representation
5. Demonstrate various distribution methods beneficial for model building
6. Apply Markov modeling to compute functions efficiently

Future Courses Mapping:

Machine learning, Deep Learning

Job Mapping:

For all jobs in the domain of AI&DS knowledge of statistical inference is prerequisite. To name a few Big Data Engineer, Business Intelligence Developer, Data Scientist, Machine Learning Engineer, Research Scientist, AI Data Analyst, Product Manager, AI Engineer, Robotics Scientist, Machine Learning Architect etc.

AI3004 : MACHINE LEARNING

Course Prerequisites:

Linear Algebra, Statistics, Probability, Calculus, and Programming Languages

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

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-I
Types of Learning: Supervised, Unsupervised, Reinforcement**. Concept Learning:** Concept Learning, General-to-Specific Ordering: Task, search, Find S algorithm, Version space and the candidate elimination algorithm, inductive bias, Bias, Variance, Underfitting, Overfitting. **Decision Tree Learning:** Representation, Basic decision tree learning algorithm, Issues in decision tree learning, and Random Forest Model. Validation: Cross validation, Confusion matrix. **Bayesian Learning:** Probability, Bayesian Learning: Bayes theorem,Naïve Bayes algorithm, Maximum likelihood hypothesis. **Ensemble Learning:** Bagging and boosting. **SVM:** Kernel functions, Linear SVM, Nonlinear SVM, Hyper parameter tuning, Handling Imbalanced Data set. KNN Model.
SECTION-II
Clustering Algorithms- Unsupervised learning, clustering. Partition based clustering, K-means and K-medoid, Hierarchical clustering, Density based clustering algorithms. **Association rules mining** – Apriori Algorithm, Confidence and Support parameters. Introduction to Hidden Markov model, Genetic algorithm. **Dimensionality Reduction Techniques:** PCA, SVD etc. **Reinforcement learning:** Exploration, Exploitation, Rewards, Penalties, Markov Decision Process, Q-Learning and Bellman Equation.

Artificial Neural Networks: Basics of ANN, Feed Forward Neural Networks, Deep neural networks etc.

List of Tutorials: (any six)

1. Feature Selection Techniques
2. Supervised Learning
3. Unsupervised Learning
4. Reinforcement Learning
5. SVM
7. Item based Recommender system
8. Shallow Neural Networks
10. Key concepts on Deep Neural Networks
11. Practical aspects of deep learning ,Optimization Algorithms
12. Hyperparameter tuning, Batch Normalization, Programming Frameworks
13. Bird recognition in the city of Peacetopia (case study)
14. Autonomous driving (case study)
15. The basics of ConvNets
16. Detection Algorithms
19. Special Applications: Face Recognition & Neural Style Transfer
20. Natural Language Processing and Word Embeddings
21. Sequence Models and Attention Mechanism

List of Practical:

1. Apply data preprocessing techniques to make data suitable for machine learning.
2. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Decision Tree.
3. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Random Forest.
4. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Naïve Bayes.
5. Implement Find-S algorithm.
6. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using SVM
7. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using KNN classifier.
8. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Kmeans clustering

9. Implement the ANN algorithm on a data set obtained from UCI ML repository
10. Apply PCA and SVD on a data set obtained from UCI ML repository
11. Implement basic Natural Language Processing techniques.
12. Implement word2Vec Model for the problem of your choice.

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

18. A survey on concept drift adaptation

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

List of course Projects:

Following types of problem statements can be taken for course project.

- Sentiment analysis of movie /restaurant dataset
- Possibility of heart attack based on text data.
- Market basket analysis
- Credit Card Fraud Detection
- Handwritten Digit Recognition
- Image Caption Generator
- Movie Recommendation System
- Cancer Classification
- Traffic Signs Recognition
- Customer Segmentation using Machine Learning
- Uber Data analysis
- Loan prediction
- HVAC needs forecasting
- Customer relationship management
- Clinical decision support systems
- Fraud detection
- Portfolio & Price Prediction
- Smart Building Energy Management System

- Quick analysis of quality of cereals, oilseeds and pulses
- Building a Recurrent Neural Network
- Operations on Word vectors
- Neural Machine translation with attention

Textbooks

1. T. Mitchell, ― Machine Learning, McGraw-Hill, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012

Reference Books

1. EthemAlpaydin, "Introduction to Machine Learning", MIT press, 2004.
2. "Data mining: concepts and techniques", Jiawei Han and Micheline Kamber the Morghan Kaufman, 2001.
3. *J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016*

Course Outcomes:

The student will be able to –

1. Demonstrate knowledge learning algorithms and concept learning.
2. Evaluate Decision tree learning algorithm.
3. Formulate a given problem within the Bayesian learning framework and SVM.
4. Apply different clustering algorithms used in machine learning.
5. Explore Association rule mining and dimensionality reduction.
6. Analyze research-based problems using Machine learning techniques like Reinforcement Learning and ANN.

AI3014: 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 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 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

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

AI3013: 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

AI3009: CLOUD COMPUTING

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

Course Objectives:

1. To study fundamental concepts of Cloud Computing.
2. To understand the basics of virtualization in Cloud Computing.
3. To learn security management in Cloud Computing.

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

Course Relevance: Cloud Computing is the on-demand solution for storing and retrieving data globally.cloud computing has become a very integral part of the entire infrastructure of theIT industry.

SECTION-1

UNIT 1: Introduction to Cloud Computing (4 Hours)
Definition, Characteristics, Components, Cloud Types – Private, Public and Hybrid, when to avoid public cloud,Cloud Service Models: SaaS, PaaS, IaaS, Cloud provider, benefits and limitations, Cloud computing vs. Cluster computing vs. Grid computing.

UNIT 2: Virtualization Technology (5 Hours)
Introduction & benefit of Virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM).Virtualization: Server, Storage, Network. Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service),
Multitenant software: Multi-entity support, Multi-schema approach, Multitenance using cloud data stores, Data access control for enterprise applications

UNIT 3: Overview of Cloud file-systems (5 Hours)

GFS and HDFS, BigTable, Features and comparisons among GFS, HDFS. Databases on Cloud: NoSQL, MogoDB, HBase, Hive, Dynamo, Graph databases

SECTION-1I

UNIT 4: Cloud Platforms and Cloud Applications (6 Hours)

Amazon Web Services (AWS), Microsoft Azure, Cloud Computing Applications, Google App Engine. Map-Reduce and extensions: The map-Reduce model, Example/Application of Map-reduce Service Oriented Architecture (SOA), Web services, Web 2.0, Web OS

UNIT 5: Service Management in Cloud Computing (4 Hours)

Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data - Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing

Unit 6: Cloud Security (4 Hours)

Infrastructure Security - Network level security, Host level security, Application level security. Data security and Storage - Data privacy and security Issues.Jurisdictional issues raised by Data location: Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Text Books:

1. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Cloud Computing for Dummies", Wiley India.
2. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India

Reference Books:

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley India
2. Antohy T Velte, et.al, "Cloud Computing : A Practical Approach", McGraw Hill.
3. McGraw Hill, "Cloud Computing", Que Publishing.

Course Outcomes: The student will be able to –

1. Illustrate the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud.
2. Investigate the resource virtualization technique for a given business case.
3. Choose the appropriate file system and database for a given business case.
4. Develop an application for a given business case using various cloud platforms.
5. Understand service management of cloud services.
6. Identify the challenges in Cloud Management and Cloud Security.

FFNo.:654

AI3010: DEEP LEARNING

Course Pre-requisities:

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 networkperformance
3. To introduce Convolutionalnetworks
4. To introduce Sequential models of NN
5. To build deep nets with applications to solve real world problem

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

Course Relevance:

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

SECTION-1
Topics and Contents Machine Learning Vs Deep Learning, 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. Convolutional Neural Networks, padding, strided convolution, pooling layers, convolutional implementation of sliding windows,
SECTION-1I
Deep Learning Basics, Deep Feed forward Networks, Regularization of deep learning, Transfer

Learning,Applications. Implementation of Long-Short Term Memory (LSTMs) with keras and tensor flow in python. Over fitting concepts, Stochastic gradient descent optimizer, encoders decoders, Generative network GANs, Memory nets, Attention models.
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.

Lab Assignments

1. Write Python/R code to implement Neural Network.
2. Write Python/R code to implement Convolutional Neural Network.
3. Write Python/R code to implement Recurrent Neural Network.
4. Write Python/R code to perform Data Augmentation.
5. Write Python/R code to implement LSTM.
6. Write Python/R code to implement GAN.
7. Write Python/R code to implement Sequence Modelling.
8. Write Python/R code to implement Transfer Learning.
9. Write Python/R code to implement Deep Learning model for text analysis.
10. Write Python/R code to implement Deep learning model for Time Series analysis.

List of Course Seminar Topics:

1. Deep learning for Stock Market Clustering
2. Application of Deep Networks in healthcare
3. Credit card frauddetection
4. Classification of skin cancer with deep neuralnetworks
5. ALEXNET
6. VCGNET
7. Accelerating Deep Network Training by Reducing Internal CovariateShift
8. Deep learning applications for predicting pharmacological properties ofdrugs
9. GAN (GeneralisedAdversialnetwork
10. Auto encoders
11. LSTM

List of Course Group Discussion Topics:

1. Recurrent or Recursive Networks for sequentialModelling?
2. Initializing network weights vsperformance
3. Difficulty of training deep feedforward neuralnetworks
4. Hyperparameter tuning: Is there a rule ofthumb?
5. Problem of overfitting: How tohandle?
6 Which cost function: Least squared error or binary cross entropy?
7. How to tackle with loss of corner information inCNN
8. Need of hundred classifiers to solve real world classificationproblem
9. Which optimization: Batch gradient descent of stochastic gradientdescent
10. Activation functions: Comparison of trends
11. Remedy of problem of vanishing gradient and exploding gradient inRNN

List of Home Assignments:

Design:

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

Case Study:

1. Deep learning forsecurity
2. Bag of tricks for efficient text classification
3. Convolutional Neural Networks for VisualRecognition

4. Deep Learning for Natural LanguageProcessing
5. Scalable object detection using deep neuralnetworks

Blog

1. Brain tumor segmentation with deep neuralnetworks
2. Region-based convolutional networks for accurate object detection andsegmentation
3. Human pose estimation via deep neuralnetworks
4. Content Based ImageRetrieval
5. Visual Perception with DeepLearning
6. Music genre classificationsystem

Surveys:

1. Machine translation using deep learning -survey
2. Shaping future of radiology using deeplearning
3. Training Recurrent NeuralNetworks
4. Text generation withLSTM
5. Deep learning applications inBiomedicine

Suggest an assessment Scheme:

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

Text Books: (As per IEEE format)

1. Goodfellow, I., Bengio, Y., and Courville, A., Deeep Learning, MIT Press,2016.
2. Nikhil Buduma, Fundamentals of Deep Learning, O'Reilly, First Edition, ISBN No. 978-14-9192561-4

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. SatishKumar,NeuralNetworks:AClassroomApproach,TataMcGraw-HillEducation, 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

AI3010: COMPLEXITY & ALGORITHMS

Course Prerequisites:

Basic course on programming,Data structures, Discrete structures

Course Objectives:

1. Formulate a givencomputational problem in an abstract and mathematically precise manner.
2. Choose a suitable paradigm to design algorithmsfor given computational problems.
3. Understand asymptotic notations and apply suitable mathematical techniques to find asymptotictime and spacecomplexities of algorithms.
4. Understand notion so fNP-hardness and NP-completenessandtheirrelationshipwiththeintractabilityofdecisionpro blems.
5. Apply randomized,approximation algorithmsfor given computational problems.

Credits:5 **TeachingSchemeTheory:3**Hours/Week

Tut:1 Hours/Week

Lab:**2**Hours/Week

CourseRelevance:

ThisisanimportantcourseforAI-DSEngineering.Itdevelopsalgorithmic thinking capability of students. Designing algorithms using suitable paradigms andanalyzing 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 designAndin general gains the ability of Algorithmic thinking, it facilitates in systematic study of anyother domain (in IT or otherwise) which demands logical thinking. This course is also relevantforstudentswhowanttopursueresearchcareersintheoryofcomputing,computationalc omplexity theory, advanced algorithmic research.

SECTION-I

Basic introductiontotime and space complexity analysis:

Asymptotic notations (Big Oh, small oh, Big Omega, Theta notations). Best case, average case,andworst-casetimeandspacecomplexityofalgorithms.Overviewofsearching,sorting algorithms. Adversary lower bounds (for the comparison-based sorting algorithms, forfinding secondminima).

Divide and Conquer: General strategy**,** Binary search and applications, Analyzing Quicksort,Mergesort,CountingInversions,findingamajorityelement,Orderstatistics(randomized anddeterministicalgorithms, simple dynamic programming based algorithmsto computeFibonaccinumbers, Optimal binarysearchtree(OBST)construction, 0-

1Knapsack,Traveling Sales person Problem, All pair shortest path algorithm ,Longest increasing subsequence problem

SECTION-II

Greedy strategy: General strategy, Analysis and correctness proof of minimum spanningtree andshortestpathalgorithms,fractionalknapsackproblem,Huffmancoding,conflictfree scheduling.Backtrackingstrategy:Generalstrategy,n-queenproblem,backtrackingstrategyforsome NP-completeproblems(e.g. graph coloring, subset sumproblem, SUDOKU)

Introduction to complexity classes and NP-completeness:
Complexity classes P, NP and their interrelation, Notion of NP-hardness and NP-completeness, Introduction to Randomized and Approximation algorithms:
Introduction to randomness in computation, Las-Vegas and Monte-Carlo algorithms,

Abundanceofwitnesses/solutionsandapplicationofrandomization,solvingSATforformulas with"many"satisfyingassignments,randomizedquicksort,majoritysearch, coupon collector problem, randomized data structures (randomized BST,skip lists)

List of Tutorials:(Any Three)

1. Complexity analysis based on asymptotic notations,solution recurrences**.**
2. Complexity analysis based on Divide and Conquer strategy.
3. Complexity analysis based on Divide and Conquer strategy.
4. Complexity analysisbased on Dynamic Programming strategy.
5. Complexity analysisbased on Dynamic Programming strategy.
6. Complexity analysis basedon Greedy strategy.
7. Complexity analysisbased on Backtracking strategy.

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 Conquerstrategy(e.g. majority element search, finding k^{th} rank element in an array).
4. Assignment based on Divide and Conquer strategy (e.g. efficient algorithm forJosephus problem using recurrencerelations, fast modular exponentiation).
5. Assignment based on Dynamic Programming strategy(eg, All pair shortest path, Traveling Sales Person problem).
6. Assignment based on Greedy strategy(e.g.Huffman encoding).
7. Assignment based on Backtracking(e.g. graph coloring,n-queen problem).
8. Assignment based on Las-Vegas and Monte-Carlo algorithm for majority element search.
9. Assignment based on factor-2 approximation algorithm formetric-TSP.

List of Projects:

1. Applications of A* algorithmin gaming.
2. Pac-Man game.

3. Creation /Solution of Maze (comparing the backtracking-based solution and Dijkstra's algorithm).
4. Differentexactand approximation algorithms for Travelling-Sales-Person Problem.
5. Knight tour algorithms.
6. Network flowoptimizationand maximum matching.
7. AI for different games such asmine sweeper ,shooting games, Hex,connect-4,sokoban,etc.
8. SUDOKU solver.
9. Algorithms for factoringlargeintegers.
10. Randomized algorithms for primality testing(Miller-Rabin, Solovay-Strassen).

Listof Course Seminar Topics:

1. Complexity classes
2. Space complexity
3. Divide and Conquer Vs Dynamic Programming
4. Greedy strategy Vs Backtracking strategy
5. Dynamic ProgrammingVs Greedy
6. Computational Complexity
7. Comparison of P Vs NPproblems
8. Compression Techniques

List of Course Group Discussion Topics:

1. Greedy Algorithms Vs. Dynamic Programming strategy
2. Dynamic ProgrammingVs Greedy
3. NP-completeness
4. P Vs NP problems
5. Paradigmsforalgorithm design
6. Different Searching techniques
7. Relevance of Cook-Levin theorem
8. Randomness in computation

List of Home Assignments:

Design:

1. Divide andConquerstrategyforreal world problem solving
2. Dynamic Programming strategy forreal world problem solving
3. Problems on Randomized Algorithms
4. Problems on NP completeness

CaseStudy:

1. Encoding techniques
2. Network flow optimization algorithms
3. Approximation algorithmsfor TSP

4. Sorting techniques

Blog

1. When do Randomized Algorithms perform best
2. Applications of Computational Geometry Algorithms
3. Role of number-theoretic algorithmsin cryptography
4. 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:
Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.

MSE ESE Tutorial Lab HA Seminar GD

TextBooks:(As per IEEE format)

1. *Cormen,Leiserson,RivestandStein"IntroductiontoAlgorithms",3nd edition,2009.ISBN81-203-2141- 3,PHI*
2. *JonKleinberg,EvaTardos"AlgorithmDesign",1st edition,2005.ISBN978-81-317-0310-6,Pearson*
3. *Dasgupta,Papadimitriu,Vazirani"Algorithms",1edition(September13,2006),ISBN-10:9780073523408,ISBN-13:978-0073523408,McGraw-HillEducation*

Reference Books:(As per IEEE format)

1. *Motwani,Raghavan"RandomizedAlgorithms",CambridgeUniversityPress;1edition(August25,1995),ISBN-10:0521474655,ISBN-13:978-0521474658*
2. *Vazirani,"ApproximationAlgorithms",Springer(December8,2010),ISBN-10:3642084699,ISBN-13:978-3642084690*

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

Course Outcomes:

On completion of course, students will beable–

1. To formulate computational problems mathematically
2. To apply appropriate algorithmic paradigm to designefficient algorithms for computational problems
3. To apply suitable mathematical techniques toanalyze asymptotic complexity of the algorithm mora complex computational problem.
4. TounderstandthesignificanceofNP-completenessofsomedecisionproblemsanditsrelationship within tractabilityofthedecision problems.
5. Tounderstandsignificanceofrandomness,approximabilityincomputation anddesignrandomizedand approximationalgorithms forsuitableproblems
6. Toincorporateappropriatedata structures, algorithmicparadigmstocraftinnovativescientificsolutionsforcomplexcomputingproblems

FFNo.:654

AI3012: 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 anddesign.
2. Learn different software process models and principles andpractices
3. Practicing UML to model OOsystems
4. Familiarity with current models and standards fordesign.
5. Exposure to organizational issues in softwaredesign.
6. Anabilitytoanalyzeandevaluateproblemsanddrawonthetheoreticalandtechnical knowledge to develop solutions andsystems

Credits :4

Course Relevance: Software Architecture

Teaching Scheme **Theory:2**Hours/Week
Lab: 2Hours/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).

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 softwareengineering
2) Software process models, life cyclemodels
3) Process improvement, Capability MaturityModel
4) Unified Modeling Language(UML)
5) Designpatterns
6) Frameworks, software productlines
7) Softwarearchitecture
8) Software measurements andmetrics
9) Software estimationmethods
10) Static and dynamicanalysis
11) Version control, configurationmanagement
12) Software quality, verification and validation, softwaretesting

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 projects2.TounderstandRequirementElicitationTechniquesandrecognizetypesofrequirement while preparing System RequirementSpecification.
3. TostudyMDD/MDAandidentifytheimportanceofModelTransformation.
4. TostudytypesofMOFandmetamodelconceptsforvariousdiagramsinUML2.0.
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/alternateflows.
6. ToidentifyEntity,Control,Boundaryobjectsandtraceobjectinteractionsforscenariosfrom use cases.

prepare a state chart diagram for given object scenario.

8. TopreparedetailedActivitydiagramwithnotationalcompliancetoUML2.0indicatingclearuse of

pins, fork-join, synchronization,datastores.

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

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

List of Projects:

1. ERPsystem
2. HospitalManagement
3. RailwayReservation
4. Stock marketmanagement
5. Parkingautomation
6. LibraryManagement
7. Onlineshopping
8. Contentmanagement

List of Course **Seminar Topics:**

1. CMMI
2. ProcessModels
3. AgileMethodology
4. Modelling usingUML
5. Analysis and Design in OOsystems
6. RequirementEngineering
7. Principles and Practices of good SoftwareDesign
8. Collaborative softwaredevelopment
9. Componentdiagram
10. Deploymentdiagram

List of Course Group Discussion Topics:

1. Traditional VsAgile
2. Phases of SDLC.Which is moreimportant?
3. UMLmodeling
4. Analysis VsDesign
S. Design Patterns
6. Design VsArchitecture
7. Architecturestyle
8. Design VsFramework
9. Framework VsArchitecture
10. Archetypepatterns

List of Home Assignments:

Design:

1.Requirement Engg steps
2.Analysis modeling
3.design modeling
4.Architechtura1 styles

3.5.design patterns

Case Study:

1.Imaging Softwarearchitecture

2.Banking Softwarearchitecture 3.ERP Softwarearchitecture

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.Architechtura1 Patterns

Suggest an assessment Scheme:

MSE PPTPresentation ESE GD Riva Lab assignments +CourseProject

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 Rambaugh, 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

Course Outcomes:

The student will be able to —

1. SummarizecapabilitiesandimpactofSoftwareDevelopmentProcessModelsandjustifyprocess maturity through application of Software Engineering principles and practices focusing tailored processesthatbestfitthetechnicalandmarketdemandsofamodernsoftwareproject.

2. Discriminatecompetingandfeasiblesystemrequirementsindicatingcorrectrealworldproblem scopeandpreparestepwisesystemconceptualmodelusingstakeholderanalysisandrequirement validation.

3. FormulatesystemspecificationsbyanalyzingUser-leveltasksandcomposesoftwareartifacts using agile principles, practices and Scrumframework.
4. Propose and demonstrate realistic solutions supported by well-formed documentation with applicationofagileroles,sprintmanagement,andagilearchitecturefocusingprojectbacklogsand velocitymonitoring.
5. Conform to Configuration Management principles and demonstrate cohesive teamworkskills avoidingclassicmistakesandemphasizingonsoftwaresafetyadheringtorelevantstandards.
6. Analyzethetargetsystempropertiesandrecommendsolutionalternativesbypracticingproject planning, scheduling, estimation and risk managementactivities

AI3016: 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 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

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

AI3015: 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(BTech AI&DS)

Subjecthead	Coursecode	Coursename	Contacthoursperweek			Credits
			Theory	Lab	Tut	
S1(OE1)	MD4206	Financial Management & Costing	2	0	0	2
S2(OE2)	AI4012	Augmented RealityandVirtualReality	2	0	0	2
	AI4015	Network Security		0	0	
	ET4230	Natural Language Processing		0	0	
	IT4216	Data Management, Protection and Governance		0	0	
	CS4217	Human Computer Interaction		0	0	
S3(OE3)	AI4006	Cyber Security & Privacy	2	0	0	2
	AI4007/AI4022	Reinforcement Learning/Business Intelligence and Analytics	2	0	0	
	AI4005	Major Project	-	20	0	10
		Total	8	20	0	16

BTech AI&DS Module-VIII

Subject head	Course code	Course name	Contact hours per week			Credits
			Theory	Lab	Tut	
S1	**AI4008**	**Industry Internship**				**16**
		OR				
S2	**AI4011**	**International Internship**				**16**
		OR				
S3	**AI4010**	**Research Internship**				**16**
		OR				
S4	**AI4009**	**Project Internship**				**16**

AI4001: BLOCKCHAIN &CYBER SECURITY

Course Prerequisites:

Computer Networks, knowledge of any programming Language(C/C++/Java/Python)

Course Objectives:

1.To study basics of Blockchain Technology, its applications and different typesofusecases2.ToacquireknowledgeofsmartcontractsinethereumBlockchainandHyperledgerfabric.

3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
4. To deploy encryption techniques to ensure data in transit across data networks.
5. To enhance awareness about Personally Identifiable Information (PII),Information Management, cyberforensics

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

Course Relevance:

Duringthecourse,studentswilllearnmoreaboutthehistory,themostimportantblockchain concepts,thephilosophyofdecentralizationbehindblockchain,andthemaindiscussionshappeningwithintheblockchainenvironment.Inaddition,youwilllearnabout(potential)applications ofblockchainandtheimpactitcouldhaveonthebusinessworld.ThiscourseProvidesanin-depthstudyoftherapidlychangingandfascinatingfieldofcomputerforensics.Combinesboththetechnicalexpertiseandtheknowledgerequiredtoinvestigate,detectandpreventdigitalcrimes.Knowledge on digital forensics legislations, digitalcrime,forensicsprocessesandprocedures,dataacquisitionandvalidation,e-discoverytoolsE-evidencecollection and preservation, investigating operating systems and file systems,networkforensics,artofsteganographyandmobiledeviceforensics.

SECTION-I

Topicsand Contents

Introductionto Blockchain: Features&Industry Applications ofBlockchain,Centralized&DecentralizedSystemwithExamples,DecentralizedSystem&DistributedLedgerTechnology

BlockchainComputingPower,Hash&MerkleTreewithHandsonExamples,MultipleUse-CasesofBlockchainasperdifferentindustriesandgovernment,BlockchainforTechnology:

BlockchaininTechnology,BusinessandManagement,DifferentTypesofBlockchain,PublicBlockchain,PrivateBlockchain,FederatedBlockchainwithExamplesandDifference,DigitalSignaturesandDemoofBlockchainTools,BlockchainApplicationsandusecasesinGovernment,RealTimeUseCaseApplicationsinBlockchain:ConsensusandTypesofConsensuswithexamplesSmartContractsin Blockchain,NeedofSmartContractswithExamplesPracticalHands-OnwithSmart Contracts, Developing Smart Contracts,IndustryusecasesofSmartContracts,SmartContractsforBusinessand Professionals:SmartContractsinDetailDevelopingown SmartContracts,Programmingbasicsof Solidity(DataTypes)andAdvancedSolidity,EVMinrelationwithSmartContractsandGasPrice,RunningandDebuggingSmartContractsinRemix(Detailed),DeployandDebugSmartContractwithTruffle

SmartContractsinEthereumBlockchain,Crypto-EconomicsandCryptocurrency,TypesofCryptocurrency andCryptography,Cryptonomics and CryptocurrencyTransactions,ValidandInvalidTransactions,PrevioususecasesofCryptocurrency,Bitcoinindetail:HowBitcoinSystemworks,DecentralizedCryptocurrencyanditsusecases,MakingyourownCryptocurrencywithDevelopmentanddeployment,PermissionedBlockchain(RAFTConsensus, ByzantineGeneral Problem, Practical Byzantine Fault Tolerance), BlockchainforEnterprise– Overview,BlockchainComponentsandConcepts,HyperledgerFabric–TransactionFlow

HyperledgerFabricDetails,Fabric– MembershipandIdentityManagement,HyperledgerFabricNetworkSetup,FabricDemoonIBMBlockchainCloud,FabricDemoonIBMBlo

ckchainCloudcontinued.,FabricDemo,deployfromscratch,HyperledgerComposer–ApplicationDevelopment,HyperledgerComposer–NetworkAdministration,BlockchainUseCases.

SECTION-II

Topicsand Contents

IntroductionandOverviewofCyberCrime,NatureandScopeofCyberCrime,TypesofCyberCrime:SocialEngineering,CategoriesofCyberCrime,PropertyCyberCrime.

CYBERCRIMEISSUES: UnauthorizedAccesstoComputers,ComputerIntrusions,WhitecollarCrimes,VirusesandMaliciousCode,InternetHackingandCracking,VirusAttacks,Pornography, Software Piracy, Intellectual Property, Mail Bombs,Exploitation,StalkingandObscenityinInternet,Digitallawsandlegislation,LawEnforcementRolesandResponses**.**

INVESTIGATION: IntroductiontoCyberCrimeInvestigation,InvestigationTools,eDiscovery,Digital Evidence Collection, Evidence Preservation, EMail Investigation,EMailTracking,IPTracking,EMailRecovery,HandsonCaseStudies.EncryptionandDecryptionMethods,SearchandSeizureofComputers,RecoveringDeletedEvidences,PasswordCracking.

DIGITALFORENSICS: IntroductiontoDigitalForensics,ForensicSoftwareandHardware,AnalysisandAdvancedTools,ForensicTechnologyandPractices,ForensicBallisticsandPhotography,Face,IrisandFingerprintRecognition,AudioVideoAnalysis,WindowsSystemForensics,LinuxSystemForensics,Network Forensics.

ListofCourseSeminarTopics:

1. DifferentIntroductiontoBlockchain
2. TypesofBlockchain
3. BlockchainApplicationsandusecasesinGovernment
4. RealTimeUseCaseApplicationsinBlockchain
5. IndustryusecasesofSmartContracts
6. SmartContractsinEthereumBlockchain
7. Bitcoin
8. BlockchainforEnterprise
9. HyperledgerFabric
10. HyperledgerComposer

ListofCourseGroupDiscussionTopics:

1. IntroductiontoCyberSpace
2. ClassificationofMalware,Threats
3. VulnerabilityAssessment
4. BiometricAuthenticationMethods
5. OperatingSystemSecurity
6. WebSecurity
7. EmailSecurity
8. MobileDeviceSecurity
9. CloudSecurity
10. DifferentTypesofCyberCrimes,ScamsandFrauds
11. Stylometry,IncidentHandling
12. DigitalForensicInvestigationMethods
13. DigitalForensicInvestigationMethods
14. EvidentiaryvalueofEmail/SMS,CybercrimesandOffensesdealtwithIPC
15. RBIActandIPRActinIndia
16. JurisdictionofCyberCrime,CyberSecurityAwarenessTips

ListofHomeAssignments:
Design:

1. TCPScanningUsingNMAP.
2. PortscanningUsingNMAP.
3. TCP/UDPConnectivityusingNetcat
4. Creatingwalletsandsendingcryptocurrency
5. StartingaWordpresswebsite

CaseStudy:

1. NetworkVulnerabilityusingOpenVAS
2. ThePracticeofWebApplicationPenetrationTesting
3. ToimplementSQLinjectionmanuallyusingDamnVulnerableWebApp
4. Crypto-anarchismandCypherpunks
5. Hashcryptography,miningandconsensus

Blog

1. PracticalIdentificationofSQL-InjectionVulnerabilities
2. Stylometry,IncidentHandling
3. InvestigationMethods
4. Tokenizationandtradingcryptocurrencies
5. SmartcontractsanddApps

Surveys

1. DigitalForensicInvestigationMethods

2. DigitalForensics
3. VirtualCurrency
4. IoTSecurity
5. ThecurrentstateoftheBlockchainlandscape

SuggestanassessmentScheme:SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentand checkifitcoversallaspectsofBloom'sTaxonomy.
MSE ESE PPT GD VIVAHA

TextBooks:(AsperIEEEformat)

1. *NelsonPhillipsandEnfingerSteuart,"ComputerForensicsandnvestigations",Cengageearning,NewDelhi,2009.*
2. *NihadHassan,RamiHijazi,Apress,"DigitalPrivacyandSecurityUsingWindows:APracticalGuide".*
3. *"DigitalForensics",DSCI-Nasscom,2012.*
4. *"CyberCrimeInvestigation",DSCI-Nasscom,2013*
5. *KevinMandia,ChrisProsise,MattPepe,"IncidentResponseandComputerForensics",TataMcGraw-Hill,NewDelhi,2006.*

***ReferenceBooks*:(AsperIEEEformat)**

1. RobertMSlade,"SoftwareForensics",TataMcGraw-Hill,NewDelhi,2005.
2. BernadetteHSchell,ClemensMartin,"Cybercrime",ABC–CLIOInc,California,2004.3."UnderstandingForensicsinIT",NIITLtd,2005.

MoocsLinksandadditionalreadingmaterial:
www.nptelvideos.in

CourseOutcomes:
1. Identifythreadsincybersecurity.
2. Usetoolsfordigitalforensics.
3. InvestigateandAnalyzedataofcybersecurity.
4. Usetheblockchaintechnologyforsecurityinreallifeapplication.
5. Studyandunderstandtheblockchainconceptsandtoolsrequiredforitsimplementation.
6. Developtheapplicationsofblockchainforsolvingsocialproblems.

AI4002: OPTIMIZATION TECHNIQUES

CoursePrerequisites:

Datastructure,computerprogramming**CourseObjectives:**

1. Toformulatemathematicalmodelsofbusinessproblems.
2. Tolearneffectiveprojectmanagementandplanningofresources.
3. Tomakeoptimalutilizationofresources.
4. Toreducelogisticcostsofthesupplychain.
5. Tounderstandformulationofoptimalstrategiesinaconflictandcompetitiveenvironment.
6. Tounderstandthesignificanceandmethodsofinventorymanagement.

Credits:2 **TeachingSchemeTheory:2Hours/Week**

CourseRelevance: Thiscourseiswidelyapplicableinsoftwareandmanufacturingindustriestoimprove productivityandquality.

SECTION-I

Topicsand Contents

LinearProgramming:EssentialsofLinearProgrammingModel,PropertiesofLinearProgramming Model, Formulation of Linear Programming, General LinearProgrammingModel,Maximization&MinimizationModels,GraphicalMethodforSolvingLinearProgrammingproblems,UnboundedLPProblem,AdditionalVariablesUsedInSolvingLPP,MaximizationCase,MinimizationProblems,BigMMethod,DegeneracyinLPProblems,UnboundedSolutionsinLPP,MultipleSolutions inLPP.

CPM/PERT:PERT/CPMNetworkComponents,RulesinConstructingaNetwork,Scheduling ofActivities: Earliest Time and Latest Time, Determination of Float and SlackTimes,CriticalPathmethodforprojectmanagement,ProjectEvaluation ReviewTechnique

–PERT,Ganttchart(timechart).Terminology.

Sequencing:TypesofSequencingProblems,AlgorithmforSolvingSequencingProblems,Processingn jobsthrough 2,3,mmachines.Processing2jobsthroughmachines.

SECTION-II

Topicsand Contents

Transportation:GeneralMathematicalmodeloftransportationproblem,Thetransportationalgorithm,Methodoffindinginitialsolution:Northwestcornermethod,Leastcostmethod,Vogel's Approximation method, Test for optimality: MODImethod,Variationintransportationproblems.

Game Theory: Terminologies of game theory,Two-person-zero-sum-game, Game withpurestrategy,Methodsofsolvinggamewithmixedstrategy,DominanceProperty,Graphical methodfor2xnandmx2games.LinearProgrammingapproachforgamestheory,

InventoryManagement:InventoryControlModels:Purchasemodelwithinstantaneousreplenishment with and without shortages, calculate EOQ, classification ofinventorylikeABC-Always,Better,Control,FSN–Fast,Slowandnon-Moving,VED-Vital,Essential,Desirableetc

ListofCourseSeminarTopics:

1. FormulationofLinearProgramming
2. SimplexMethodofsolvingLPPproblem.
3. PrimalToduelwithexampleandsolutionofproblem
4. DegeneracyinLPProblems
5. BigMmethod
6. CPM/PERT
7. Sequencing-Processingnjobsthrough2,3machines
8. Processing2jobsthroughmmachines
9. Queuing10.SequencingVsQueuin gtechniques

ListofCourseGroupDiscussionTopics:

1. ComparisonofTransportation-N-WCornermethodandLeastcostcellmethod.
2. Transportation-VAMmethod.
3. Two-person-zero-sum-game,Gamewithpurestrategy.
4. Methodsofsolvinggamewithmixedstrategy.
5. Inventory-Purchasemodelwithinstantaneousreplenishmentwithshortagesand withoutshortages.
6. Discussinventoryclassificationtechniques
7. Comparativeanalysesofpurchasemodels
8. EOQ
9. Inventorycontrolmodels
10. Transportation-MODImethod

ListofHomeAssignments:

Design:

1. DesignnetworkactivitydiagramusingCPMforconstructionworkofbuilding.
2. DesignnetworkactivitydiagramusingCPMforaresearchwork.
3. DesignatransportationmodelusingVAM–Vogel'sApproximationmethod.
4. Designoptimalstrategiesfortwoplayers-Zerosumgame.
5. Designmathematicalmodelforabusinessproblem.

CaseStudy:

1. WriteacasestudyongoalprogrammingforanITstartupcompany.
2. Casestudyonprojectcrashingofasoftwaredevelopmentcompany.
3. Writeacasestudyonspecialcasesinlinearprogramming.
4. Writeacasestudyonprojectmanagement.
5. Writeacasestudytoimproveasalesofamanufacturingcompany.
6. Writeacasestudyonclassificationofinventory.

Blog

1. OptimizationTechniques-Aquantitativeperspectivetodecisionmaking.
2. Themethodologytosolveoptimizationproblems.
3. Writeablogonnon-linearingprogramming
4. WriteablogonapplicationsofOptimizationTechniques.
5. WriteablogonLinearProgrammingapproachforgamestheory.

Surveys:

1. Takethesurveyofapplicationsoflinearprogramming.
2. Takethesurveyofdifferenttransportationmodels.
3. Takesurveyinventoryclassificationmodels.
4. Takethesurveyofoptimizationtechniquesindatascience
5. Takethesurveyofoptimizationtechniquesinshortestpathfinding
6.

SuggestanassessmentScheme:

SuggestanAssessmentschemethatisbestsuited for thecourse.Ensure360degreeassessmentandcheckifitcovers allaspects ofBloomsTaxonomy.MSE ESE PPT GD VIVAHA

TextBooks:(AsperIEEEformat)

1. KantiSwarup,GuptaP.K.,ManMohan,"OperationsResearch",12thEdition; SultanChand&Sons,NewDehli.
2.R.Panneerselvam,"OperationsResearch",2ndEdition, PHILearningPrivateLtdNewDehli.
3. TahaHAOperationResearchandIntroduction9thEditionPearsonEducation2014
4. Gupta&HiraOperationsResearchRevisedEditionChand&Co.2007

ReferenceBooks:(AsperIEEEformat)

1. BillyE.Gillett,"AComputer–OrientedAlgorithmicApproach",1979Edition,TataMcGraw-HillPublicationsCompanyLtd.,NewDehli.
2. HillerLieberman,"IntroductiontoOperationsResearch",7thEdition;TataMcGrew-hillpublishingCompanyLtd.,NewDehli
3. S.D.SharmaOperationsResearch15thEditionKedarnath,Ramnath&Co
4. JKSharmaOperationsResearch3rdeditionLaxmiPublications2009

MoocsLinksandadditionalreadingmaterial:

1. https://www.youtube.com/watch?v=Q2dewZweAtU
2. https://www.youtube.com/watch?v=h0bdo06qNVw

CourseOutcomes:

Thestudentwillbeableto–

1. Developlinearprogrammingmodelstosolvereallifebusinessproblems.(3)
2. AnalyzeCriticalpathusingCPMandPERT(3)
3. Usesequencingtechniquesforeffectiveschedulingofjobs(4)
4. Solvetransportationproblemsusingvariousmethods.(4)
5. Computethevalueofthegameusingpure/mixedstrategiesandaccordingly deviceoptimalstrategiestowinthegame(5)
6. Learnvariousmodelsandtechniquesofinventorymanagement.(5)

CS4217: HUMAN COMPUTER INTERACTION

Course Prerequisites:

Computer Programming,Web Technology

CourseObjectives:

1. Understandthetheoreticaldimensionsofhumanfacto rsinvolvedintheacceptanceofcomputerinterfaces.
2. DescribeanduseHCIdesignprinciples,standardsandguidelines.
3. Identifythevarioustoolsandtechniquesforinterfaceanalysis,design,andevaluation.
4. DiscusstasksanddialogsofrelevantHCIsystemsbasedontaskanalysisanddialogdesign.
5. AnalyzeanddiscussHCIissuesingroupware,ubiquitouscomputingand WorldWide Web-relatedenvironments.

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

Course Relevance: This course provides an introduction to and overview of the field of human-computerinteraction(HCI).HCIisaninterdisciplinaryfieldthatintegratestheriesandmethodologiesfro mcomputerscience,cognitivepsychology,design,andmanyotherareas.Students will work on bothindividualandteamprojectstodesign,implementandevaluatecomputerinterfaces.Thecourseisop entostudentsfromalldisciplines,providingthemwithexperienceworkingininterdisciplinarydesignte ams.

SECTION-I

Topics and Contents

Introduction to Human-Computer Interaction (HCI)

Human,DefinitionofHumanComputerInteraction,InterdisciplinaryNature,Goals,HumanFactors, MeasurableFactors– Learnability,Speed,Efficiency,Satisfaction.EarlyFocusonUsers,Ergonomics,Usability,Typesof Usability,UserInterface(UI),Contexts- Web,Business,Mobile,GamingApplications,CategorizationofApplicationsbasedonHumanFactors,AccessibilityandSecurity.

PrinciplesandModels

EightGoldenRulesofInterfaceDesign,PrinciplesofGoodDesign,FaultyDesigns,Miller's

Principle,Norman'sActionModel,GulfofExecutionandEvaluation,Errors–Mistakes,Slips,LapsesandViolations,GuidelinesforDataDisplay,GuidelinesforDataEntry,Conceptual,Semantic, Syntactic and Lexical Model, Task Analysis, GOMS, Keystroke-LevelModel,UserPersona,UIStandards andGUILibraries.

DesignProcessandInteractionStyles

Design, Three Pillars of Design, Process of Design, Ethnographic Observations,ContextualInquiry, Iterative Design, Participatory Design, Navigation Design, Visual Design, -Layout,Color,Fonts,Labeling,LUCID,Scenarios,InteractionStyles–DirectManipulation,MenuSelection,Form-Filling,Commands,NaturalLanguage,Internationalization,InteractionDesignPatterns.s-Apexprofessionalbodies,Industries,international curriculum, curriculumofIITand otherprominentUniversities,etc. Makethecoursein 2 sections-SectionIandSectionII.

SECTION-II

Topicsand Contents

EvaluationTechniquesandInterfaceCategories

Expert-basedEvaluation,User-basedEvaluation,HeuristicEvaluation,CognitiveWalkthrough,SemioticAnalysis,ExpertReviews,UsabilityTesting,UserSurveys,Interviews,ThinkAloud,Acceptance Tests, Statistical Methods, Touch Interfaces, Public PlaceInterfaces,WearableInterfaces,TangibleInterfaces,IntelligentInterfaces,UbiquitousandContext-Aware Interaction.**DocumentationandGroupware**

ClassificationofDocuments,PrintedManuals,ReadingfromDisplays,OnlineHelp,Tutorial,Error/WarningMessages,Groupware,Goals/DimensionsofCooperation,AsynchronousInteractions,SynchronousInteractions,OnlineCommunities,Communityware

Miscellaneous

CaseStudies:WebUsability,MobileUsability,EmbeddedSystems,SocialNetworkingSites,Messengers,E-GovernanceSites,SecurityTools,e-Healthapplications

ListofCourseSeminarTopics:
1. TheFutureofSmartEverydayObjects
2. CooperativeArtifacts
3. IntelligentKitchenUtilities
4. InteractingwithSmartProducts
5. IntimateInterfaces
6. MultitouchInterfaces
7. InteractiveTables
8. Microsoft Surface
Technology9.SenseCam
10.SpokenDialogueSystems

ListofCourseGroupDiscussionTopics:1.
W3CMultimodalInteractionActivity
2. MultimodalDialogueSystems
3. TangibleInteractionwithIntelligentVirtualAgents
4. MixedandAugmentedReality
5. MultimodalGenerationforVirtualCharacters
6. ExpressiveVirtualCharacters
7. Recognizing and Expressing
Affect8.EmotionalInterfacesandInputD
evices9.NaturalMachines10.DataEntry
Interfaces

ListofHomeAssignments:
Design:
1. ApplyNorman'sactionmodelonthetask–'Tomakeonlinepayment'.
2. Illustratemajormodelsevolvedincontextualenquirywithanexample.
3. Designaccommodationforvisuallyimpairedusersinmobileapplications
4. DesignUIforInformationKioskforaMetroTerminusRelatedUIsketches
5. FormulateauserpersonasofIndianUserforITproduct.

CaseStudy:
1. HCIguidelines/principlesfordesigninghomepageformuseumwebsite.
2. VitalethnographicobservationsinITproducts.
3. Gulfofexecutionwithrespecttoleft-handedusers.
4. User-basedandexpert-basedusabilityevaluationmethods.
5. Anymobileapphighlightingitsethno-culturalandaccessibilityfeatures.

Blog
1. HeuristicEvaluationusingaLikert'sscale.
2. Goldenrulesofinterface
3. Effectsofmetaphorsindesignofsocialnetworkingsites.
4. LUICD
5. Semioticanalysis.

Surveys
1. Investigatepopularityofremotesynchronouscommunicationamongusergroups.
2. e-governancewebsite
3. UbiquitousandContext-AwareInteraction
4. IterativeDesign,ParticipatoryDesign,NavigationDesign,VisualDesign
5. CognitiveWalkthroughevaluationtechnique

SuggestanassessmentScheme:SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentand checkifitcoversallaspectsofBloomsTaxonomy.
MSE ESE PPT GD VIVAHALAB

TextBooks:(AsperIEEEformat)

1. "Human-Computer Interaction", AlanDix, JanetFinlay, GregoryD.Abowd,RussellBeale,PearsonEducation,ISBN81-297-0409-9,3rdEdition.
2. "DesigningtheUserInterface",BenShneiderman,PearsonEducation,ISBN81-7808-262-4,3rdEdition

ReferenceBooks:(AsperIEEEformat)

1. TheDesignofEverydayThings",DonaldNorman,BasicBooks,ISBN100-465-06710-7,2002Edition
2. "TheEssentialGuidetoUserInterfaceDesign",WilbertO.Galitz,Wiley-dreamtechIndia (P)Ltd.,ISBN81-265-0280-0,2ndEdition.
3. "Human-ComputerInteractionintheNewMillennium",JohnM.Carroll,PearsonEducation,ISBN 81-7808-549-6

MoocsLinksandadditionalreadingmaterial:
www.nptelvideos.in

CourseOutcomes:
1. Identifyhumanfactorsandusabilityissuesrelatedwithcomputingapplications
2. Differentiatecomputingapplicationsintocategoriesbasedonhumanfactors
3. Designanuserinterfacebyapplyingsuitabledesignprinciples,modelsandusabilityguidelines
4. Integrateethno-culturalandaccessibilitycomputingaspectsintotheuserinterfacedesign
5. Displaytheimpactofusabilityevaluationandtestingincomputingapplications
6. Followrequiredprocessesandstandardswhiledesigninguserinterfaces

FF No.: 654

AI4004: PATTERN RECOGNITION USING FUZZY NEURAL NETWORKS

CoursePrerequisites:

Datastructure,computerprogramming,Linearalgebra

CourseObjectives:

1. Tounderstandfundamentalsofpatternrecognition.
2. Tounderstandthefuzzysetdesign
3. Tolearnfundamentalsoffuzzysetsandtheiruseinpractice.
4. Tolearntrainingofhybridsystem-fuzzyneuralnetworks(FNN)
5. Toapplytrainedfuzzyneuralnetworks(FNN)forinferences.
6. TounderstandevaluatingperformanceofFNNs.

Credits:2 **TeachingSchemeTheory:2**Hours/Week

CourseRelevance: Thiscourseapplicableforcomplexpatternrecognitiontasks

SECTION-I

Topicsand Contents

Patternrecognitionfundamentals:-

Definitionofapattern,statisticalandsyntacticpatterns,featurevector,featuredimensionality,pattern class,definitionofclassification,clustering,hybridclassification-clustering

Introductiontofuzzysettheory:-

Definitionoffuzzyset,membershipfunction,typesoffuzzysets,operationsonfuzzysetslikeunion, intersection, compliment, plot of fuzzy membership function, core and supportparts offuzzysets

IntroductiontoArtificialNeuralnetworks:-

Biologicalneuron,McCullochPittsmodel,generalneuronmodel,perceptron,activationfunctiontypes,perceptronlearningalgorithmfor2-classclassification,singlelayerperceptronclassifiersandlearningalgorithms,briefintroto multilayersperceptrons

SECTION-II

Topicsand Contents

Fuzzymin-maxneuralnetwork(FMN)architectureforclassification-

Conceptofhyper-box,hyper-boxasafuzzyset,hyperboxmembershipfunction-definition,interpretationanduse,FMNlearningalgorithm-hyper-boxexpansion,overlaptestandhyperboxcontraction,FMNrecall/testingalgorithm,commentsonhyperbox size, sensitivityparameterandperformanceevaluation.

Fuzzy min-max neuralnetwork (FMN) architecture for clustering- architecture,trainingalgorithmandrecallphase

FuzzyHyperlineSegmentNeuralNetwork(FHLSNN)classifier:-

Conceptofhyperline,hyperlineasafuzzyset,fuzzymembershipfunctiondesign,FHLSNNtrainingandtestingalgorithm,

ComparisonofFMNandFHLSNNarchitectures.

ModifiedFuzzyHyperlineSegmentNeuralNetwork(MFHLSNN)classifier:-

Modifiedfuzzymembershipfunctiondesign,convexityandnormalityroperties,trainingandtestingalgorithms,comparisonofFHLSNNandMFHLSNN

ListofCourseSeminarTopics:
1. DrawbacksinthemembershipfunctiondesignofFMN.
2. FHLSNNmembershipfunctiondesign
3. FMNclusteringalgorithm
4. FMNclassificationalgorithm
5. Fuzzysetsandapplications
6. Fuzzyneuralnetworksashybridsystem
7. Softcomputing
8. Someothertopicsdecidedbyinstructor

ListofCourseGroupDiscussionTopics:
1. FHLSNNclassifierdrawbacksinmembershipfunction
2. FMNapplicationinHCR
3. FHLSNNforheartdiseasedetection
4. Fuzzyclusteringtechnique
5. ComparisonofK-NNclassifierandFMNclassifier
6. Someothertopicsdecidedbyinstructor

ListofHomeAssignments:
Design:
1. DesignafuzzymembershipfunctionforFMNforefficiency
2. DesignafuzzymembershipfunctionforFHLSNNwithlesscostlyoperations
3. DesignFMNarchitecturefor8-Dinputpatternsfor4classes
4. DesignafuzzymembershipfunctionforFHLSNNwithoutusingsquarerootoperationsinceitis costly
5. Someothertopicsdecidedbyinstructor

CaseStudy:
1. HCRusingFHLSNN
2. FourierFuzzyneuralnetworkforpatternrecognition
3. FuzzyneuralnetworkbyKawnandKai
4. UFHLSNNforpatternrecognition
5. Someothertopicsdecidedbyinstructor

Blog
1. Fuzzyneuralnetworksashybridsystem
2. FMNforhybridclassificationandclusteringbyBargiala
3. FHLSNNmembershipfunctiondesign
4. FlawsinthecontractionofhyperboxesinFMN
5. Someothertopicsdecidedbyinstructor

Surveys
1. EvolutionofFuzzyneuralnetworks
2. Fuzzyneuralnetworksapplicationsinhealthcare/medicaldiagnosis
3. DevelopmentsinFuzzysystems

4. Backpropagationtrainingalgorithm
5. Someothertopicsdecidedbyinstructor

SuggestanassessmentScheme:SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentand checkifitcoversallaspectsofBloomsTaxonomy.
MSE PPTPresentation ESE GD Viva LAB

TextBooks:(AsperIEEEformat)

1. *TimothyJRoss,Fuzzylogicwithengineeringapplications,3rdeditiion,Wiley,2010*
2. *JacekM.Zurada,Introductiontoartificialneuralsystems,Jaicopublishinghouse,1992*

ReferenceBooks/Papers(AsperIEEEformat)

1. *P. K. Simpson, Fuzzy min-max neural networks Part-1. classification, IEEETransactionsonNeuralNetworks,Vol.3(5),1992,https://doi.org/10.1109/72.159066.*
2. *P.K.Simpson,Fuzzymin-maxneuralnetworksPart-2.clustering,IEEETransactionsonFuzzySystems,Vol.1(1),1993*
3. *U.V.Kulkarni,T.R.SontakkeandG.D.Randale,Fuzzyhyperlinesegmentneuralnetworkforrotationin variant andwrittencharacterrecognition,inProc.Jointconf.onNeuralNetworks:IJCNN01,WashingtonDC,USA,pp .2918-2923,July2001.*
4. *Pradeep M Patil, P S Dhabe, Uday V Kulkarni, TR Sontakke, Recognition ofhandwrittencharactersusingmodifiedfuzzyhyperlinesegmentneuralnetwork,The12thIEEEInternationalConferenceonFuzzy Systems,2003.FUZZ'03.*5. *PriyadarshanDhabe,PrashantVyas,DevratGaneriwal,AdityaPathak,Patternclassification usingupdatedfuzzy hyper-line segment neural network and it's GPUparallelimplementationforlargedatasetsusingCUDA,InternationalConferenceonComputing,AnalyticsandSecurityTrends(CAST),2016*
6. *PriyadarshanSDhabe,SanmanDSabane,ImprovedUFHLSNN(IUFHLSNN)forGeneralizedRepresentationofKnowledgeandItsCPUParallelImplementationUsingOpenMP,SpringersEAIInternationalConference on Big DataInnovationforSustainableCognitiveComputing,2020*

MoocsLinksandadditionalreadingmaterial:
1.https://www.youtube.com/watch?v=ZBCg_nH1hVQ

(VideolectureonFMNbyProf. Biswas,IITKGP)2.https://www.youtube.com/watch?v=0e0z28wAWfg(Backpropagationalgorithm)

CourseOutcomes:

Thestudentwillbeableto–

1. Designfuzzysetforagivenapplication
2. DecidearchitectureofFNNforagivenrealproblem
3. ApplyFMNforsolvingrealworldproblems
4. TrainFNNforpatternrecognition
5. TestFNNfortheirrecallinpatternrecognition
6. Evaluateperformanceof FNN

AI4012: AUGMENTED REALITY AND VIRTUALREALITY

Course Prerequisites: Computer Graphics

Course Objectives:

1. Learning different components of Augmented and Virtual Reality Systems
2. Understanding VRmodel development
3. Understanding ARmodel development
4. Integrating different sensors with AR-VR systems
5. Understanding different applications of AR-VR

Credits:2 **Teaching Scheme Theory: 3**Hours/Week

Lab: 2 Hours/Week

CourseRelevance:
Thissubjectisimportantinalldomainstoimplementsimulationorprototypeofdifferentsystems.

SECTION-I
Topicsand Contents *Computer mediated reality: Augmented reality, Virtual reality, Mixed reality, Augmented Virtuality, Diminished reality. Comparative study with use-cases. Software and Hardware requirements.* *3D Graphics and 3D modeling: Terminology and examples, Pixel, voxel, Colors and interpolation, Light, fog, opacity, projection, view volume, frustum, culling, texture mapping, bump mapping, ray tracing, path tracing, photon mapping.* *Geometric transforms: Chain of Viewing transforms.* *Introduction to Unity: Creating environment, manipulating camera, colliders, physics engine, standard assets and asset store. Creating solar system-Basic game objects, texture mapping, lighting effects and types.* *C# scripting language and examples.*
SECTION-II

TopicsandContents

Visual perception: Depth, motion and color perception, Display properties: Minimum spatial resolution, minimum frame rate, LCD vs OLED for VR.
Visual rendering: Object order rendering, Image order rendering, Rasterization, pixel shading, distortion shading.
Elements of image processing required for AR, Object recognition: SIFT, Object tracking.
Vuforia for marker based AR, Pose Estimation for marker based AR, Designing marker.
Case study and sample applications.

Lab Assignments

1. 3D objects display
2. Solar Model
3. Home interior
4. Vehicle Model
5. Hand-watch making and test on Hand
6. 2D Game
7. 3D Maze Game
8. 3D vehicle racing game
9. Ray tracing simulation
10. Photon mapping simulation

List ofCourseSeminarTopics:

1. 3Dobjectcreation
2. Cameraprojections
3. Geometrictransformations
4. Viewingtransformations
5. C#scriptgraphicsrendering
6. C#scriptinterfaceforUnitysoftware
7. ObjectorderrenderinginUnitysoftware
8. Object tracking
9. Motionperception
10. Rasterizationandpixelshading

ListofCourseGroupDiscussionTopics:

1. VirtualVsAugmentedreality
2. VirtualVsAugmented Vs.Mixedreality
3. Diminishedreality
4. Mediatedreality
5. Vuforia
6. Markerbased AR
7. Markerlesstracking
8. Euler rotationtheoremand axis-anglerotation
9. Quaternion
10. Visualanddepthperception

ListofHomeAssignments:D
esign:

1. Solarmodel
2. Librarymodel
3. Classroommodel
4. Carshowroommodel
5. Livingroommodel

Case Study:

1. RaytracinginUnity
2. PixelshadinginUnity
3. DistortionshadinginUnity
4. ImageorderrenderinginUnity
5. PoseestimationinAR

Blog

1. AR/VRmodelsforKids
2. AR/VRmodelstostudymachinedesign
3. AR/VR modelstostudynetworking
4. AR/VRmodelsforspaceresearch
5. AR/VRmodelsforwearingdevices

Surveys

1. Imageprocessing forVR/AR
2. ProjectionsinVR/AR
3. LighteffectinVR/AR
4. TexturemappinginAR/VR
5. ShadowingtechniqueinAR/VR

SuggestanassessmentScheme:
SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentandcheckifitcovers allaspectsofBloomsTaxonomy.
HA Seminar GD MSE ESE LAB VIVA

Text Books:*(AsperIEEEformat)*

1. AlanBCraig,WilliamRShermanandJeffreyDWill,DevelopingVirtualRealityApplications:FoundationsofEffective Design, MorganKaufmann,2009.
2. GerardJounghyunKim, DesigningVirtualSystems:TheStructuredApproach, 2005.

ReferenceBooks:*(AsperIEEEformat)*

1. GrigoreC.Burdea,PhilippeCoiffet,VirtualRealityTechnology, Wiley2016
2. DieterSchmalstiegandTobiasHöllerer,AugmentedReality:Principles&Practice,PearsonEducationIndia,2016
3. KentNorman(Ed),WileyHandbookofHumanComputerInteraction,Wiley2017
4. AndyField, "DiscoveringStatisticsUsingSPSS",SAGE PublicationsLtd.,2009

MoocsLinksandadditionalreadingmaterial:
www.nptelvideos.in

CourseOutcomes:
1. LearnAR-VRgraphicsobjectcreation
2. DesignobjectsinAR-VRenvironment
3. Developrenderingalgorithms
4. Understandmodellingandviewingtransformations
5. Applyvariousrealityeffectslikelighting, texturemappingetc.
6. Developdifferent modelling,gamingapplications

AI4015: NETWORK SECURITY

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

Prerequisites: Computer Networks.

Unit 1:	**(5 Hours)**
Introduction	
Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services. key security properties - Confidentiality, Integrity, Availability. Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks. Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing	
Unit 2:	**(4 Hours)**
Private key cryptography	
lathematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm), Role of random numbers in security, Importance of prime number, DES, AES.	
Chinese remainder theorem	
Unit 3:	**(5 Hours)**
Public key cryptography	
RSA: RSA algorithm, Key generation in RSA, attacks on RSA. Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack. Elliptic Curve Cryptography (ECC), Elliptic Curve arithmetic. Diffie-Hellman key exchange	
Unit 4:	**(5 Hours)**
Authentication and access control	
Message authentication and Hash Function. Authentication: One-Way Authentication, Mutual Authentication, SHA-512, The Needham-Schroeder Protocol. Kerberos, X.509 authentication service, public key infrastructure. Access Control in Operating Systems: Discretionary Access Control, Mandatory Access Control, Role Based Access Control.	
Unit 5:	**(5 Hours)**
Security application and design	
Part A: Network layer security: IPSec for IPV4 and IPV6. Transport layer security: SSL and TLS. Application layer security: Security services, S/MIME, PGP, Https, Honey pots. Security design: End-to-end security, Security composability, Open design, Cost and tradeoffs	
Unit 6: **Cyber Security:**	**(4 Hours)**

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

AI4007:REINFORCEMENT LEARNING

CoursePrerequisites: ProficiencyinPython,Calculus,LinearAlgebra,BasicProbabilityandStatistics,Foundations of MachineLearning

CourseObjectives:

1. Topursuebasicknowledgeofreinforcementlearningtechniques.
2. TounderstandfoundationTechniquesofDeepReinforcement Learning.
3. Toinculcatedynamicprogrammingtechniques.
4. Toprovideaclearandsimpleaccountofthekeyideasandalgorithmsofreinforcementlearning.
5. Toexplorehow thelearningis valuabletoachieve goalsin therealworld.
6. To explore about how Reinforcement learning algorithms perform better and better in moreambiguous,real-life environmentswhile choosingfromanarbitrary number of possibleactions.

Credits:2 **TeachingSchemeTheory:2**Hours/Week

CourseRelevance: Reinforcementlearning(RL)referstoacollectionofmachinelearningtechniqueswhich solve sequential decision-making problems using a process of trial-and-error. It is a core areaofresearchinartificialintelligenceandmachinelearning,andtodayprovidesoneofthemostpowerfulapproachesto solvingdecision problems.

SECTION-1
TheReinforcementLearningProblem:ReinforcementLearning,Examples,ElementsofReinforcement Learning,Limitations and Scope FiniteMarkovDecisionProcesses:TheAgent–EnvironmentInterface,GoalsandRewards,Returns,Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov DecisionProcesses,ValueFunctions, Optimal Value Functions, Optimalityand Approximation Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration,AsynchronousDynamicProgramming,GeneralizedPolicyIteration,EfficiencyofDynamicProgramming Model-free solution techniques: Temporal difference learning, Monte Carlo Methods, EfficientExplorationand value updating

SECTION-1I

Topicsand Contents

BatchReinforcementLearning:Introduction,BatchReinforcementLearningProblem,FoundationsofBatch RLAlgorithms, Batch RLAlgorithms, Batch RLin Practice
Learning and Using Model: What is Model, Planning: Monte Carlo Methods, Combining ModelsandPlanning,SampleComplexity,FactoredDomains,Exploration,ContinuousDomains,EmpiricalComparisons, ScalingUp
Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting,andLearning,WhentheModelIsWrong,PrioritizedSweeping,Fullvs.SampleBackups,TrajectorySampling, HeuristicSearch, MonteCarlo TreeSearch

Listof CourseSeminar Topics:
1. Naive REINFORCE algorithm2.TD Control methods - SARSA3.ProbabilityPrimer
4.Bellman Optimality5.Imitation learning
6.Sequential Decision-Making7.MichaelLittman:TheRewardHypothesis8.multi-agentlearning
9.An n-Armed Bandit Problem10.Q-Learning

List of Course Group Discussion Topics:1.HumanIntelligenceversusmachineintelligence2.Securityand PrivacyinPervasiveNetwork
3. Security of Smart devices4.FutureofUbiquitousComputing
5.OnlineLeast-SquarePolicyIteration
6. Gradient-DescentMethods
7. BellmanOptimality
8. RewardShaping
9. HierarchicalRL
10. AtariReinforcementLearningAgent

Listof HomeAssignments:
Design:
1. Smartpersonalhealth assistant
2. Human activities
sensor3.Intelligentbuildin
gs
4. Datastoragesearchingin IOT
5. Protocolsin IOT

CaseStudy:
1. ChallengesinageofUbiquitouscomputing
2. Ethnography in Ubiquitous
computing3.CyberPhysical System
4.ApproachestoDeterminingLocationUbiquitouscomputing5.
Q-LearningforAutonomous Taxi Environment

Blog
1. Smart Devices for smart
life2.Mobileaffectivecomputin
g
3. IOT and Cloud
Computing4.DeepQ-
LearningforFlappyBird
5.Q-Learning foranygame

Surveys
1. DataCollectionforUbiquitouscomputingField
2. Usageofsmartdevicesindailylifestyle3.V
ideoSummarization
4.Behaviour Suite for Reinforcement
Learning5.CausalDiscoverywithReinforcementL
earning

SuggestanassessmentScheme:
SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360-degreeassessmentandcheck ifit coversall aspects of Blooms Taxonomy.

MSE ESE PPT GD VIVAHA

TextBooks:(AsperIEEEformat)

1. Ed.JohnKrumm;UbiquitousComputingFundamentals; Chapman&Hall/CRC2009
2. RichardS.SuttonandAndrewG.Barto,Reinforcementlearning:Anintroduction,SecondEdition,MITPress,2019

ReferenceBooks:(AsperIEEEformat)

1. Wiering,Marco,andMartijnVanOtterlo.Reinforcementlearning.Adaptation,learning,andoptimization12 (2012)
2. MohammadS.Obaidatandet al;PervasiveComputingandNetworking,Wiley

MoocsLinksandadditionalreadingmaterial:www.nptelvideos.in

CourseOutcomes:
Thestudentsshould beableto
1) Definethekeyfeaturesofreinforcementlearningthatdistinguishesitfrom AIandnon-interactivemachinelearning
2) FormalizeproblemsasMarkovDecisionProcesses
3) Understandbasicexplorationmethodsandthe exploration/exploitationtrade-off
4) Understandvaluefunctions, asageneral-purposetool foroptimal decision-making
5) Implementdynamicprogrammingasanefficientsolutionapproachtoareal-worldproblem
6) Explain varioustabular solution methods.

AI4017: INTERNET OF THINGS

CoursePrerequisites:

ComputerNetworks,ComputerProgramming

CourseObjectives:

1. UnderstandtheIOTTerminologyandTechnology
2. DescribeintelligentIOTsystems.
3. AnalyzeProtocolstandardizationforIOT
4. PerformananalysisofIOTsecurityissuesusingAItechnology.
5. Identifytheroleofcloudcomputinginlot.

Credits:4

TeachingScheme

Theory:3 Hours/Week**Lab:2**Hours/Week

CourseRelevance: IoTorInternetofThingsisprimarilyafullsystemofalltheinterconnectedcomputing devices, havingall themechanical and digital machines.TheInternet ofThingsisgettingsmarter.Companiesareincorporatingartificialintelligenceinparticular,machinelearningintotheirIoTapplications.VendorsofIoTplatforms— Amazon,GE,IBM,Microsoft,Oracle,PTC,andSalesforceareintegratingAIcapabilitiesIoTisbeneficialbecauseitmakesourworkeasyandisverylesstime-consuming.IoThasgotalotmorescopeintermsofmakingacareerandevenexploringmoreopportunitiesifstartingupwiththeirownbusiness.

SECTION-I
Topicsand Contents **IntroductiontoInternetofThings–** Definition&Characteristics,ImportanceofIoT,PhysicalDesignofIOT,LogicalDesignofIOT,IOTEnablingtechnologies,IOTLevels&DeploymentTemplates,IoTandM2M,TheroleofArtificialIntelligenceinIOT,IntroductiontoAIOT,ApplicationsofArtificialIntelligenceinInternetofThings:CollaborativeRobots,DigitalTwins,Drones,SmartRetailing,SmartCities,SmartHealth,etc.

AI and the Internet of Thing: Real World Use-Cases: Automated vacuum cleaners, like thatoftheiRobotRoomba,Smartthermostatsolutions,likethatofNestLabs
DesignMethodology–
Purpose&RequirementsSpecification,ProcessSpecification,DomainModelSpecification,InformationmodelSpecification,Servicespecification,IOTlevelSpecifications,FunctionalViewSpecifications,OperationalViewSpecification,deviceandcomponentintegration,applicationdevelopment,EmbeddedsuiteforIoTPhysicaldevice–
Arduino/RaspberryPiInterfaces

SECTION-II

Topicsand Contents

ConnectivityTechnologiesandCommunicationProtocolsinIOT:RFID:Introduction,PrincipleofRFID,Components ofanRFIDsystem,RFIDProtocols&NFC protocols,WirelessSensorNetworks:WSNArchitecture,thenode,connectingnodes,NetworkingNodes,SecuringCommunicationWSNspecificIoTapplications,**ProtocolsinIOT:**CoAP,XMPP,AMQP,MQTT,**InternetofthingsChallenges:**VulnerabilitiesofIoT,Security,Privacy&TrustforIoT,Securityrequirements Threat analysis, Use cases and misuse cases, Introduction tocloudcomputing,RoleofCloudComputinginIoT,Cloud-to-DeviceConnectivity,Clouddatamanagement,clouddatamonitoring,ClouddataExchange,ENHANCINGRISKMANAGEMENTbypairingIoTwithAI

ListofCourseSeminarTopics:
1. Self-drivingvehicles
2. Securityandaccessdevices
3. AI-poweredIoT
4. RoleofAIandIOTinHealthandMedicine
5. RPioperatingsystemfeaturesoverArduino
6. Arduinoarchitectureanditsinterfacingtechniques
7. IPv6technologiesfortheIoT.
8. SensorsinIOT
9. IoTSystemManagement

AutomatedCommuteandTransport

ListofCourseGroupDiscussionTopics:
1. FutureofIOT:AI
2. THEAIKEYTOUNLOCKIoTPOTENTIAL
3. IOTProtocols
4. WSNarchitecture
5. RoleofcloudcomputinginIOT
6. ChallengeinintegrationofIoTwithCloud.
7. RFIDVsNFCwithrealworldexample
8. VulnerabilitiesofIoT
9. Cloudtypes;IaaS,PaaS,SaaSwithrealworldexample

ResourceManagementInTheInternetOfThings

ListofHomeAssignments:

Design:

1. DesignacompleteIOTarchitectureforSmartofficebasedonAItechnique
2. DesignacompleteIOTarchitectureforSmartgardenbasedonAItechnique
3. DesignacompleteIOTarchitectureforSmartindustrybasedonAItechnique
4. ProvideacompletelayeredarchitectureforWeathermonitoringsystemandexplainthesame
5. DeveloptheIOTsecuritysystemfortheapplications,justtomakesurethatthedataiscollectedsafely andsound

CaseStudy:

1. SmartRetail
2. FleetManagementandAutonomousVehicles
3. SmartEnergy
4. SmartCampus
5. ClassroomMonitoringSystem

Blog

1. DroneTrafficMonitoring
2. IntelligentRouting
3. RevolutionizingIoTThroughAI
4. InternetofBusiness
5. AIinIOTforHealthcare

Surveys

1. PredictiveEquipmentMaintenanceinIndustries
2. SmartAgriculture
3. RuralDevelopmentusingIOT
4. Tesla’sAutopilot
5. SmartTransportation

SuggestanassessmentScheme:SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentand checkifitcoversallaspectsofBloomsTaxonomy.
MSE ESE CourseProject GD/PPT

TextBooks:(AsperIEEEformat)

1.ArshdeepBahga,VijayMadisetti,"Internetof Things–Ahands-onapproach",UniversitiesPress,2015
2 Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging TechnologiesforSmartEnvironmentsandIntegratedEcosystems",RiverPublishers,ISBN-10:87929827353JanHoller,VlasiosTsiatsis,CatherineMulligan,StefanAvesand,StamatisKarnouskos,
DavidBoyle,"FromMachine-to-MachinetotheInternetofThings:Introductionto aNewAgeofIntelligence",1stEdition,AcademicPress,2014.
4FrancisdaCosta,"RethinkingtheInternetofThings:AScalableApproachtoConnectingEverything", 1stEdition,ApressPublications,2013

ReferenceBooks:(AsperIEEEformat)

1. PethuruRaj,AnupamaC.Raman,TheInternetofThingsEnablingTechnologies,Platforms,and Use Cases, CRC Press Taylor & Francis Group, International Standard BookNumber-13:978-1-4987-6128-4
2. RajkumarBuyya,AmirVahidDastjerdiInternetofThings–PrincipalsandParadigms,MorganKaufmannisanimprintofElsevier,ISBN:978-0-12-805395-9HakimaChaouchi, "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7,WillyPublications
3. OlivierHersent,DavidBoswarthick,OmarElloumi,TheInternetofThings:KeyApplicationsand Protocols,ISBN:978-1-119-99435-0,2ndEdition,WillyPublications
4. DanielKellmereit,DanielObodovski,"TheSilentIntelligence:TheInternetofThings",.Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700,ISBN-13:978-0989973700.

MoocsLinksandadditionalreadingmaterial:1.https://nptel.ac.in/courses/106/105/106105166/2.https://swayam.gov.in/nd1_noc19_cs65/preview

CourseOutcomes:
Uponthecompletionofthecourse,studentwillbeableto

1. DesignanapplicationbasedonIOTTerminologyandTechnology
2. DifferentiatetheroleofAIinIOTintermsofAIOT.
3. Implementtheconnectivitytechnologiesandprotocolsin IOT
4. ProduceasolutionforIOTsecuritychallengesusingtheconceptofAI.
5. ApplyCloudtechnologyconceptsfordevelopingIOTbasedprototype
6. Performprogramminganddataanalysistobuildandtestacompleteworking IntelligenceIoTsys tem.

AI4016:PREDICTIVE ANALYTICS

CoursePrerequisites:

Descriptivestatistics,ProbabilityDistribution,Hypothesistesting

CourseObjectives:

1. Tolearn,howtodevelopmodelstopredictcategoricaland continuousoutcomes.
2. Usageoftechniquessuchasneuralnetworks,decisiontrees,logisticregression,supportvectormachinesandBayesian networkmodels.
3. Toknowthe useof thebinaryclassifierand numericpredictornodes.
4. Togetfamiliarityonautomationofmodelselection.
5. Toadviceon when andhow to useeach model.
6. Tolearnhowtocombine two ormoremodelstoimproveprediction performance.

Credits:2 **TeachingSchemeTheory:2Hours/Week**

CourseRelevance:

Thiscourseiswidelyapplicableto all types ofindustriesfor improvingproductivityandquality.

SECTION-I
Topicsand Contents Introduction to Data Mining Introduction, what is Data Mining? Concepts of Data mining,Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining onvariouskinds ofdata, Applicationsof DataMining, Challenges ofData Mining. Data Understanding and Preparation Introduction, Reading data from various sources,Datavisualization,Distributionsandsummarystatistics,Relationshipsamongvariables, ExtentofMissingData.Segmentation,Outlierdetection,AutomatedData Preparation, Combiningdatafiles,AggregateData,DuplicateRemoval,SamplingDATA,DataCaching,Partitioningdata, MissingValues.

SECTION-II

Topicsand Contents

Modeldevelopment&techniquesDataPartitioning, Modelselection,Model DevelopmentTechniques,Neuralnetworks,Decisiontrees,Logisticregression,Discriminantanalysis, Support vector machine, Bayesian Networks, Linear Regression, CoxRegression,Associationrules.

ModelEvaluationandDeployment Introduction, ModelValidation,RuleInduction UsingCHAID,AutomatingModelsforCategoricalandContinuoustargets,ComparingandCombining Models, Evaluation Charts for Model Comparison, MetaLevel Modeling,DeployingModel, AssessingModel Performance,UpdatingaModel.

ListofCourseSeminarTopics:

1. Handlingmissingvalues
2. Handlingoutliersindata.
3. PrincipleComponentAnalysis.
4. CrossValidation.
5. VariableImportance.
6. DealingwithNominalPredictors
7. SamplingTechniques.
8. ConfusionMatrix
9. Predictiveinference
10. Timeseriesforcasting

ListofCourseGroupDiscussionTopics:

1. BiasVarianceTradeoff
2. Explainvs Predict
3. ClassificationvsRegression
4. SinglemodelvsEnsemblemodel
5. SupervisedvsUnsupervisedapproaches.
6. Accuracyvs explainability
7. PerformanceevaluationofclassifiervsPerformanceevaluationofRegressor
8. Auto-regressiveandmovingaveragemodels.
9. Additive&Multiplicativemodels.
10. SEMMA(SAS)andCRISP(IBM)

ListofHomeAssignments:

Design:

1. Design aclassifierfor realworldapplication.
2. Designaregressionmodelforrealworldapplication.
3. Designsvoting-basedensemblemodelforrealworldapplication.
4. Design atimeseriesforecastingmodel.
5. Designsstackedensemblemodelforrealworldapplication.

CaseStudy:

1. Writeacasestudyongoalprogrammingforan ITstartupcompanyusingpredictiveanalyticstools.
2. Casestudyonprojectcrashingofasoftwaredevelopmentcompany usingpredictivemaintenancetools.
3. Writeacasestudyonefficientprojectmanagementbyutilizingpredictivemaintenancetools.
4. Writeacasestudytoimproveasaleof amanufacturingcompanyusingpredictiveanalytics.
5. Writeacasestudyonclassificationofinventory.

Blog

1. Writeablogon data summaries.
2. Writeablogon data visualization.
3. Writeablogon datapreprocessing.
4. Writeablogon modelevaluation andcomparisonofmodels.
5. Writeablogon dimensionalityreduction techniques.

Surveys:

1. Takethesurveyofapplicationsofpredictiveanalyticsinbankingsector.
2. Takethesurveyofdifferentmodeldeploymenttechniques.
3. Takesurveyinventoryclassificationmodelsusingdataminingtechniques.
4. Takethesurveyofoptimizationtechniquesindatascience.
5. Takeasurveyontime seriesforecasting.

SuggestanassessmentScheme:

SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentandcheckifitcoversallaspects ofBloomsTaxonomy.
MSE ESE PPT GD VIVAHA

TextBooks:(AsperIEEEformat)

1. *"AnIntroductiontoStatisticalLearning:withApplicationsinR"byJames,Witten,HastieandTibshirani,Springer,1st.Edition, 2013.*
2. *RegressionModelingwithActuarialandFinancialApplications,EdwardW.Frees,2010,NewYork:Cambridge.ISBN: 978-0521135962.*
3. *E.Alpaydin,IntroductiontoMachineLearning,PrenticeHall OfIndia,2010*

ReferenceBooks:(AsperIEEEformat)

1. *ASMStudyManualforSRM-StatisticsforRiskModeling|2ndEdition,Weishaus|ASM.ISBN:978-1-64756-065-2*
2. *TrevorHastie,RobertTibshirani,JeromeFriedman,TheElementsofStatisticalLearning-DataMining,Inference,and Prediction,Second Edition ,Springer Verlag,2009.*

MoocsLinksandadditionalreadingmaterial:

1. http://faculty.smu.edu/tfomby/
2. http://www-bcf.usc.edu/~gareth/ISL/

CourseOutcomes:
Thestudentwillbeableto–

1. Understandtheprocessofformulatingbusinessobjectives
2. Studydataselection/collection,preparationandprocess.
3. Tosuccessfullydesign,build,evaluateandimplementpredictivemodelsforavariousbusinessapplication.
4. Comparetheunderlyingpredictivemodelingtechniques.
5. Selectappropriatepredictivemodelingapproachesto identifycasesto progresswith.
6. Applypredictive modelingapproaches usinga suitable packages.

IT4216: DATAMANAGEMENT,PROTECTIONAND GOVERNANCE

CoursePrerequisites:

DatabaseManagementSystem,OperatingSystem

CourseObjectives:

Tofacilitatethelearner to–

2. Getacquaintedwiththehigh-levelphasesofdatalifecyclemanagement.
3. Acquireknowledgeaboutthevariousaspectsofdatastorage,dataavailability,datap rotection.
4. Gainexposureto various solutions/referencearchitectures forvarious use-cases.AI
5. Understandthetechnicalcapabilitiesandbusinessbenefitsofdata protection.

Credits:2 **TeachingScheme** **Theory:2Hours/Week**

Course Relevance: Since technology trends such as Machine Learning , Data science and AI rely ondataquality,andwiththepushofdigitaltransformationinitiativesacrosstheglobe,datamanagement,gove rnanceand securityis verymuch important.

SECTION-I
DataStorage,AvailabilityandSecurity : Introductiontodatalifecyclemanagement(DLM):- Goalsofdatalifecyclemanagement,Challenges involved: Volume of data source, Ubiquity of data locations, Userdemandforaccess;Stagesofdatalifecycle- creation,storage,usage,archival,destruction;Risksinvolvedwithout DLM,benefits, best practices. Data storage and data availability :- Storage technology: Hard Disk Device (HDD), Solid StateDevices (SSD), memory devices, Data access - block, files, object ; Data center End to EndView – overview of complete stack including storage, network, host, cluster, applications,virtual machines, cloud storage ; Storage virtualization technologies - RAID level, storagepooling, storage provisioning ; Advance topics in storage virtualization – storage provisioning,thin provisioning; Cloud storage – S3, glacier, storage tiering; High Availability: Introductiontohigh availability,clustering,failover, parallel access DataThreatsandDatacentersecurity:-TypeofThreats:DenialofService(DoS),maninthemiddle attacks, Unintentional data loss,Repudiation,Malicious attacks to steal data;IntroductiontoRansomware;Understanding,Identificationand Threatmodellingtools ;Security:Authorizationandauthentication-accesscontrol,Transport Layer.

Security(TLS),keymanagement,securityincloud,Designandarchitecture considerationsforsecurity

SECTION-II

DataProtection,RegulationandGovernance : Introductiontodataprotection:-Introduction-Needfordataprotection,basicofback-up/restore;Snapshotsfordataprotection,copy-datamanagement(cloning,DevOps);De-duplication;Replication;Long Term Retention – LTR;Archival;Design considerations: Systemrecovery, Solution architecture,Backup v/s Archival,media considerations and management(tapes, disks,cloud), challenges with newedgetechnology(cloud, containers)

Dataregulation,complianceandgovernance:-RegulationsrequirementsandPrivacyRegulations:TheHealthInsurancePortabilityandPrivacyAct of1996(HIPPA),PII(PersonallyIdentifiableInformation),GeneralDataProtectionRegulation(GDPR);InformationGovernance:Auditing,LegalHold,Dataclassificationandtagging(NaturalLanguageProcessing); India'sPersonal DataProtection bill

Applications uninterrupted: - Understand data management aspects of traditional and new edgeapplications;Reference architecture/best practices (pick 2-3 case studies from below topics):TransactionalDatabases(Oracle,MySQL,DB2),NoSQLDatabases(MongoDB,Cassandra),Distributedapplications(microservicearchitectures),Cloudapplications–PlatformasService(PaaS),SoftwareasService(SaaS),Kubernetes,Multi-Tieredapplications,ETLworkloads,Data analytics(AI/ML)

Listof HomeAssignments:

Design:

1. Designdatamanagementaspectsforcloud applications.
2. DesigndatamanagementaspectforMongoDB/Cassandra.
3. DesigndatamanagementaspectDistributedapplications.
4. Designdatalifecycle managementforanyapplication.

5.Design datamanagement foranyMulti-Tieredapplication.

CaseStudy:

1. ConsiderdifferentTransactionalandNoSQLDatabases.Comparativestudy.
2. ComparevariouscloudapplicationsbasedonPlatform asserviceandSoftwareasservice.
3. DataAnalytics based studyfordata management.
4. Studyof Multi-TieredApplications
5. Studydata management in DevOps

Blog:

1. Comparativestudyofdataprotectionschemes.
2. studyofTheHealthInsurancePortabilityand PrivacyAct of1996 (HIPPA)
3. Needofdatamanagement,protectionandgovernance
4. HowThreatmodellingtoolsareuseful?Consideranyapplicationrelatedtoit.
5. RoleofstorageTechnologyfor cloudstorage.

Surveys:

1. Surveyon dataprotection challengeswith new edgetechnologylikecloud
2. SurveyonGeneralData ProtectionRegulation(GDPR)
3. SurveyonData classificationandtagginginNaturalLanguageProcessing
4. SurveyonRansomwaredatasecurity.
5. SurveyonKubernetes.

SuggestanassessmentScheme:

MSE,ESE, HA

TextBooks:(AsperIEEEformat)

1. Robert Spalding, *'Storage Networks: The Complete Reference'.*
2. *Vic(J.R.)Winkler,'SecuringTheCloud:CloudComputingSecurityTechniquesandTactics',Syngress/Elsevier-978-1-59749-592-9*

ReferenceBooks:(AsperIEEEformat)

1.MartinKleppmann,'DesigningData-IntensiveApplications',O'Reilly

WebReferences:

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

CourseOutcome:

Bytakingthis course,thelearnerwill beableto–

1. Understandthedatamanagementworld,challengesandbestpractices.
2. Comparevariousconcepts andtechnologies for enablingdata storageand highavailability.
3. Illustratevarioustypesofdatathreatsandapproachestoensuredata centersecurity.
4. Explainthevarious conceptsrelatedto dataprotection.
5. Outlinedifferentstandardsfor compliance and governanceofdata.
6. Understandvariousapproachesfordesigningdataintensive

enterpriseapplicationsand industrystandard solutionsin datamanagement.

AI4005: 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

5. 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.
6. 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.
7. 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.
8. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on presentation skills, questions based on the Project Work, understanding of the Project, analysis and design performed for the project.
9. 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.
10. The outcome of the project should be tangible in terms of paper publication/patent/SOP/prototype
11. 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	Resultsand 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 networksand 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.

AI4008: 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, andmodern 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

AI4011: INTERNATIONAL INTERNSHIP

Credit: 16

Course Relevance: Implementation of technical knowledge acquiredduring 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, andmodern 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

AI4010: RESEARCH INTERNSHIP

Credit: 16

Course Relevance: Implementation of technical knowledge acquiredduring previous three years of 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, andmodern 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

AI4009: 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