Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

B.Tech.

(AIDS)

Effective from Academic Year 2022-23

Prepared by: - Board of Studies in AIDS

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

Signed by

Chairman – BOS **Chairman – Academic Board**

B.Tech. AIDS (applicable w.e.f. AY23-24)Index

Institute Vision:

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

Institute Mission:

- To impart knowledge and skill-based Education in Collaboration with Industry, Academia and Research Organizations.
- To strengthen global collaborations for Students, Faculty Exchange and joint Research
- To prepare competent Engineers with a spirit of Entrepreneurship
- To Inculcate and Strengthen Research Aptitude amongst the Students and Faculty

Department Vision

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

Department Mission

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

Program Education Objectives (PEO)

PEO	PEOFocus	PEOStatement
PEO1	Preparation	To prepare the students with a commitment towards meeting the needs ofusers within an organizational and societal context through the selection,creation,application,integrationandadministrationofInformation Technologyprojects.
PEO2	Corecompetence	To facilitate students with foundation of mathematical & engineeringfundamentalsalongwithknowledgeofInformationTechnologyprinciples and applications and be able to integrate this knowledge in avariety ofbusinessandinter-disciplinarysetting.
PEO3	Breadth	Toenablestudenttoexerciseproblemsolvingcapacitywith effectiveuseofanalysis,design,development thataddressidearealization.
PEO4	Professionalism	To inculcate students with professional and ethical values with effectiveskillsleadingtoparticipativeteamworkhavingmultidisciplinaryknowledge usefultothe society.
PEO5	LearningEnvironment	To provide students an academic environment that develops leadershipqualities,excellenceinsubjectareasofInformationTechnology andlifelonglearningineverysphere oftheirlife.

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 team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
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 recognised by the industry and academia.

B.Tech.AIDS Structure

(Applicablew.e.f.AY22-23)

SY AIDS 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		20			20	20	20	20	100	4
S2	CS2221	Internet of Things	2	2	1			20		20	20	20	20	100	4
S3	CS2218	Object Oriented Programming	2	2	1	40				20	-	20	20	100	4
S4	CS2227	Database Management Systems	2	2	1		20			20	20	20	20	100	4
S5	AI2253	Engineering Design & Innovation – I	-	2	-	-	-	-	30			70	-	100	6
S6	AI2269	Design and Thinking	-	-	1	-	-	-	-			-	-		1
Total															23

SY AIDS 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	40				20	-	20	20	100	4
S2	AI2002	Discrete Structure and Automata Theory	2	2	1		20			20	20	20	20	100	4
S3	AI2003	Computer Network	2	2	1			20		20	20	20	20	100	4
S4	AI2007	Computer Organization and Architure	2	2	1		20			20	20	20	20	100	4
S5	AI2005	Engineering Design & Innovation – III	-	2	-	-	-	-	30			70	-	100	6
S6	AI2008	Design and Thinking	-	-	1	-	-	-	-			-	-		1
Total															23

FF No.: 654

MD2201: DATA SCIENCE

Course Prerequisites:

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

Course Objectives:

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

Credits: 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,Platforms,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
7.

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 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
70. Discuss Packages, Access specifiers and Encapsulation in java.
71. Difference between abstraction and encapsulation in Java.
72. Daemon Threads Vs user threads
73. Preemptive scheduling Vs slicing
74. Is it possible to call the run()method directly to start a new thread? pls comment
75. Arraylist Vs Vector
76. Arrays Vs Collections
77. is Iterator a class or an Interface? what is its use?
78. List Vs Set
79. BufferedWriter and BufferedReader classes in java
80. BufferedReader Vs Scanner class in java
81. Buffered Reader Vs FileReader in java
82. Instanceofjava
83. Difference between CPP and JAVA
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

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 ssystem 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

AI2001: ADVANCED DATA STRUCTURES

Course Prerequisites:

Basic programming Skills (C/C++).

Course Objectives:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques.
3. To construct and implement various data structures and abstract data types including lists, stacks, queues, trees, and graphs.
4. To make understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
5. To emphasize the importance of data structures in developing and implementing efficient algorithms.

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

Tut:1 Hour/Week

Lab:2 Hours/Week

Course Relevance:

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

SECTION-1 **Arrays, Stacks, Queues and Linked Lists**
Arrays: Representation and application of Single and Multidimensional arrays, Time & Space Complexity Analysis. **Sorting Techniques:** Bubble, Selection, Insertion, Merge, Quickwith Analysis. **Searching techniques:** Linear Search, Binary search, Fibonacci search. **Stack:** Stack representation and Implementation using arrays and Linked lists. Applications of stack-Balanced parenthesis, Expression conversions and evaluations.**Queues:** Representation and implementation using array and Linked lists.Linear, Circular, Priority and Double ended Queue. Applications.**Linked Lists:** Dynamic memory allocation, Singly Linked Lists, doubly linked Lists, Circular linked lists and Generalized linked lists. Applications of Linked list.

SECTION-II

Trees, Graphs and Hashing

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

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.

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

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

List of Projects:

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

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

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

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

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

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

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

AI2002: DISCRETE STRUCTURES AND AUTOMATA THEORY

Course Prerequisites:

Basic mathematics and programming

Course Objectives:

1. Formulate and solve counting problems, problems based on recurrence relations and probability theory
2. To study graph and tree based models to be applied in real life problems
3. To design suitable computational model/sfor accepting a given language
4. To compare these models with respect to their power in recognizing different types of languages

Credits: 05 **Teaching Scheme Theory: 03** Hours/Week

Lab: 02 Hours/Week

Course Relevance:

This course lays a strong foundation for higher studies as well as research.For higher studies, there are different courses such as 'Program Analysis and Verification' which are based on the concepts of computation theory.For Research scholars,it would help 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.

SECTION-1

Topics and Contents

Logic, Proofs, Elementary Discrete Structures: Propositional logic, applications of propositional logic, propositional equivalences, predicates and quantifiers, rules of inference, introduction to proofs: direct, contrapositive, contradiction, Elementary set theory, relations, functions. (05 hrs)

Basic Counting and Recurrence relations: Basic counting principles, permutations, combinations,Pigeon-Hole Principle, Recurrence relations, Fibonacci numbers, solution of linear recurrence relations with constant coefficients. (05 hrs)

Probability Theory and Graph Theory: Discrete Probability, Conditional Probability, Bayes Theorem, Graphs, different representations, paths, cycles in graph, tree, bipartite graphs (graph with only odd cycles, 2-colorable graphs), Planar graphs, Eulerian path and Eulerian circuit, Hamiltonian circuit. (04 hrs)

SECTION-1I

Topics and Contents

Finite Automata and Regular Expression: Automaton as a model of computation, Deterministic Finite Automata (DFA),Nondeterministic finite Automata (NFA), Regular expression (RE) Definition, Applications, Kleene's Theorem: Equivalence of RE and DFA, Closure properties of Regular Languages(05 hrs)

Grammar: Context Free Grammars (CFG), Derivation, Languages of CFG, Constructing CFG, Derivation trees, Ambiguity in CFGs, CNF, GNF, Chomsky hierarchy, Applications of CFG. (04 hrs)

Pushdown Automata and Turing Machine: Pushdown Automata (PDA), Acceptance by final state / empty stack, Deterministic and Non-deterministic PDAs, Equivalence of PDA and CFG, Turing Machine (TM) definition, Instantaneous Description, Language acceptance, equivalence ofTM variants, Universal Turing Machine. (5 hrs)

List of Practical's: (Any Six)

1. Tower of Hanoi: Generate recurrence relation and solve.
2. Fibonaccinumbers: Generate recurrence relation and solve.
3. Explore various set operations. Consider the universal set U: ={0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15}. Consider 2 sets A and B. Use the randomly generated sets to determine the following. A∪B , A ∩ B,A', A ∩ (B ∩ C), A − B , A'∩B , (A ∪ C) ∩ B
4. Problems based on Conditional Probability.
5. Exercises on conversion of Regular expression to DFA and vice versa
6. Problems on NFA to DFA conversion.
7. Numerical based on minimization and equivalence of Automata
8. Proof of Closure properties of Regular Languages
9. Problems on checking of Ambiguity of Grammar and Simplification of CFGs
10. Problems on Normal forms of CFGs: CNF and GNF
11. Problems based on PDA construction
12. Problems on Turing machine design

List of Course Seminar Topics:

1. Set Theory and its applications in Artificial Intelligence
2. Different Counting principles
3. Applications of Bipartite graphs in biology and medicine
4. Applications of Probability theory in risk assessment and modeling
5. Hamiltonian graph vs Eulerian graph
6. Zero divisors and Integral domain
7. Comparison of RE, DFA and NFA
8. Minimization of DFA
9. Myhill-Nerode Theorem
10. Context Free Grammar
11. Pumping lemma for CFLs
12. Context Sensitive Languages, Context Sensitive Grammars
13. Linear Bounded Automata
14. Turing Machine vs Pushdown Automata
15. Recursive and Recursively Enumerable Languages

16. Universal Turing Machine
17. Applications of DFA and NFA
18. Decidability and Undecidability

List of Course Group Discussion Topics:

1. Need of Graphs in real life applications
2. Applications of Set Theory
3. Applications of Euler's Theorem in counting remainders
4. Homogeneous Vs non-homogeneous recurrence relation
5. Pigeonhole principle and its applications
6. NFA vs DFA
7. Power of Automata
8. Need of Automata in Computer Science
9. Ambiguity in Grammar
10. Mealy vs Moore Machine
11. CNF vs GNF
12. CFL and Non CFL and its applications
13. Power of Turing machine and Linear Bounded Automata
14. Closure Properties of CFL
15. Applications of Automata
16. NFA with epsilon transition
17. Closure and Decision properties of Context Free Languages (CFLs)

List of Home Assignments:

Design:

1. Design of social network using graphs
2. Design of railway network using graph
3. Design of POC MAN Game
4. Design Switching Circuit
5. Digital Logic Design using DFA
6. Digital Logic Design using NFA
7. Design Multitape TM for Palindrome
8. Design PDA for String Copy
9. Design LBA for real world application
10. Design parser to recognize string

Case Study:

1. Discuss ways in which telephone numbering plan can be extended to accommodate the rapid demand for more telephone numbers.For each numbering plan, find how different telephone numbers can be formed
2. Investigate the properties of web graph, analyse web graphs by correlating the graph theoretic concepts with properties of web graph
3. Study any one real life application where DFA and NFA is used,study its merits and demerits
4. Study any one example of Turing machine with Multitapeand its benefits
5. Study any one real life applications of PDA, discuss its advantages and limitations
6. Study all Automata and discuss their power
7. Study Membership Algorithm and discuss its applications
8. Study of Chomsky Hierarchy
9. Study of Pattern Matching Algorithm

10. Study of Myhill-Nerode Theorem
11. Pumping Lemma
12. Finite Automata in Markov Model

Blog

1. Proofs to differentiate direct, contrapositive, contradiction with suitable examples
2. Importance of discrete mathematics in real life. Write an article related to any four domains where discrete mathematics is dominantly used
3. How graph theory is used as a technology in recent trends? Graph theory and its applications (atleast 8)
4. Significance of Combinatorics and Discrete Probability in today's world
5. How search engines use graph concepts?
6. Automata Theory Limitations and Applications
7. Pumping Lemma
8. Kleene's star and Positive Closure
9. Regular Expression and its Closure Properties
10. PDA vs TM and its Advantages

Surveys

1. Recurrence relations for dynamic programming
2. Graphs in computer networks
3. Probability theory for weather forecasting
4. Game Theory: an application of probability
5. Graph theory for Machine learning problem
6. Pattern matching algorithm
7. Evolution of Computational Models
8. Applications of Computer Theory in real life
9. Applications where Automata Theory is Beneficial
10. Power of Turing Machine
11. Real life examples to find ambiguity in it and its elimination
12. Closure properties of Regular and Context Free Languages
13. Role of Non Determinism
14. Working of Parser
15. Evolution of Models of Computations

Suggest an assessment Scheme:

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

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

1. Kenneth Rosen ,"Discrete Mathematics and its applications", 7th Edition, McGraw-Hill, ISBN 0–07–338309–0.
2. Alan Tucker ,"Applied Combinatorics",6th Edition, Wiley Publishing company.
3. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill
4. Hopcroft J, Motwani R, Ullman, Addison-Wesley, "Introduction to Automata Theory, Languages and Computation", Second Edition, ISBN 81-7808-347-7.
5. Michael Sipser, , "Introduction to Theory of Computation", Third Edition, Course Technology,

ISBN-10: 053494728X.

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

1. Peter J. Cameron, "Combinatorics: Topics, techniques, algorithms", Cambridge University Press
2. Reinhard Diestel , "Graph Theory", 5th Edition, Springer Verlag Publishing Company
3. Douglas B. West ,"Introduction to Graph Theory", Prentice-Hall publishers
4. Edgar G. Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education
5. 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 understand propositional logic and proof techniques
2. Students should be able to solve counting problems and problems based on recurrence relations and probability
3. Students should be able to apply knowledge of Graph and Tree based models to solve real life problems
4. Students should be able to design Automata / Turing machine for given computational problems
5. Students should be able to correlate given computational model with its Language
6. Students should be able to analyse power of different computational models

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

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

AI2007: COMPUTER ORGANIZATION AND ARCHITECTURE

Course Prerequisites:

Basics of computer system and any programming language.

Course Objectives:

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

Credits: 4

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

Course Relevance:

Modern computer technology requires an understanding of both hardware and software, since the interaction between the two offers a framework for mastering the fundamentals of computing. The purpose of this course is to cultivate an understanding of modern computing technology through an in-depth study of the interface between hardware and software. In this course, you will study the history of modern computing technology before learning about modern computer architecture and a number of its essential features, including instruction sets, processor arithmetic and control, the Von Neumann architecture, pipelining, memory management, storage, and other input/output topics. The course will conclude with a look at the recent switch from sequential processing to parallel processing by looking at the parallel computing models and their programming implications.

Section 1:

Basic concepts of Digital Electronics, Organization and Architecture, Structure & Function, Brief History of computers, Von Neumann Architecture, Integer Representation: Fixed point & Signed numbers. Integer Arithmetic: 2's Complement arithmetic, multiplication, Booth's Algorithm, Floating point representation: IEEE Standards for Floating point representations for 32 bits. ----------5hrs

8086 Microprocessor Architecture, Register Organization, Instruction types, addressing modes, Instruction cycles. RISC Processors: RISC- Features, CISC Features, Comparison of RISC & CISC Superscalar Processors. -------- 4hrs

Fundamental Concepts: Single Bus CPU organization, Register transfers, Performing an arithmetic/ logic

operations, fetching a word from memory, storing a word in memory, Execution of a complete instruction. Micro-operations, Hardwired Control, Example- Multiplier CU. Micro-programmed Control: Microinstructions, Microinstruction- sequencing: Sequencing techniques, Micro-program sequencing. ---------- **5 hrs**

Section2:

Need, Hierarchical memory system, Characteristics, Size, Access time, Read Cycle time and address space. Main Memory Organization: ROM, RAM, EPROM, E 2 PROM, and DRAM, Design examples on DRAM, SDRAM, and Cache memory Organization: Address mapping. Basic concepts: role of cache memory, Virtual Memory concept**. ---------- 6 hrs**

Pipeline and its performance, Data hazard, Instruction hazards: unconditional branches, conditional branches and branch prediction. **----------4 hrs**

Parallelism in Uniprocessor system, Evolution of parallel processors, Architectural Classification, Flynn's, Fengs, Handler's Classification, Multiprocessors architecture basics, Parallel Programming Models : Shared memory, Message passing, Performance considerations : Amdahl's law, performance indications.Modern GPU architecture (in brief), Performance comparison: Speedup, Gain time and scalability**. ---------- 4 hrs**

List of Practical (Any Six)

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

Projects

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

List of Course Seminar Topics:

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

List of Course Group Discussion Topics:

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

List of Home Assignments:

Design:

1. Write the sequence of control steps required for the single bus organization for each of the following instructions:
   1. ADD the (immediate) number NUM to register R1
   2. ADD the contents of memory location NUM to register R1

   Assume that each instruction consists of two words. The first word specifies the operation and addressing mode, and second word contains the number NUM
2. Configure a 32 Mb DRAM chip. Consider cells to be organized in 8K X 4 array. Find out the number of address lines.
3. A set associative cache consists of 64 lines, or slots, divided into four-line sets. Main memory contains 4K blocks of 128 words each. Analyze the format of main memory addresses with proper explanation.
4. A one pipeline system takes 50 ns to process a task. The same task can be processed in 6 segment pipeline with a clock cycle of 10 ns. Determine the speedup ratio of pipeline for 100 tasks. What is maximum speedup ratio?

Case Study:

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

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

Survey:

Blog:

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

Suggest an assessment Scheme: (Actual 100 marks each component is map to following weightage)

1. ESE 10Marks
2. MSE 10Marks
3. HA 10 Marks
4. Seminar 15Marks
5. GD 15Marks
6. Course project 10 marks
7. Lab 10 Marks
8. VIVA 20 Marks

Text Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", 7th Edition, Pearson Prentice Hall Publication, ISBN 81-7758-9 93-8.

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

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

4. Douglas Hall, "Microprocessors and Interfacing", 2nd Edition, Tata McGraw Hill Publications, ISBN 0-07-025742-6.

5. Peter Abel, "Assembly Language Programming," 5th Edition, Pearson Education Publications,ISBN 10:013030655.

Reference Books:

1. *Hwang and Briggs,"Computer Architecture and Parallel Processing", Tata McGraw Hill Publication ISBN 13: 9780070315563.*

2. A. Tanenbaum, "Structured Computer Organization", Prentice Hall Publication, ISBN 81 – 203 – 1553 – 7, 4th Edition.

Moocs Links and additional reading material:

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

Course Outcomes:

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

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

.

TY-AIDS 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	40	-	-		20	-	20	20	100	4
S2	AI3002	Operating System	2	2	1		20	-		20	20	20	20	100	4
S3	AI3003	Statistical Inference	2	2	1	-	-	20		20	20	20	20	100	4
S4	AI3004	Machine Learning	2	2	1	40	-	-		20	-	20	20	100	4
S5	AI3005	Engineering Design & Innovation – III	-	2	-	-	-	-	30			70	-	100	6
S6	AI3006	Design and Thinking	-	-	1	-	-	-	-			-	-		1
Total															23

TY-AIDS 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	AI3007	Cloud Computing	2	2	1	-	20	-		20	20	20	20	100	4
S2	AI3008	Deep learning	2	2	1	-	20	-		20	20	20	20	100	4
S3	AI3009	Complexity and Algorithms	2	2	1	-	-	20		20	20	20	20	100	4
S4	AI3010	Software Design and Methodologies	2	2	1	40	-	-		20	-	20	20	100	4
S5	AI3011	Engineering Design & Innovation – V	-	2	-	-	-	-	30			70	-	100	6
S6	AI3012	Design and Thinking	-	-	1	-	-	-	-			-	-		1
Total															23

AI3001: ARTIFICIAL INTELLIGENCE

Course Prerequisites:

Data structures, Computer programming

Course Objectives:

To make students

1. familiar with basic principles of AI

2. capable of using heuristic searches

3. aware of knowledge based systems

4. able to use fuzzy logic and neural networks

5. Learn various applications domains AI

Credits: 4

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

Course Relevance:

This course is highly applied in many scientific and engineering disciplines

SECTION-1

Topics and Contents

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

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

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

Knowledge Representation
Knowledge based agents, Wumpus world. Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.First order
Logic: Representation, Inference, Reasoning Patterns, Resolution, Forwardand Backward Chaining.
Introduction to PROLOG and ANN
AI Programming Language (PROLOG): Introduction, How Prolog works?Some hands on PROLOG examples.
Introduction to Neural networks:- basics, comparison of human brain and machine, biological neuron, general neuron model, activation functions, Perceptron learning rule, applications and advantages of neural networks. Brief introduction to single layer and multiplayer networks.

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

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

List of course Projects: (Any project within following domain but not limited to)
1.Pattern recognition –Classification, Clustering, hybrid-classification clustering
2. Prediction using -Regression –Linear or nonlinear
3. Game playing- single player/2-player/multi-player
4. Use of Knowledge based system for generating inferences
5. Deep Learning
6. Neural network training and using for a real application
7. Use of fuzzy sets for human like reasoning
8. Use of any ML algorithm for solving real world problem
9. Deep Learning framework-PyTorch
10. Expert system applications in medicine suggestions
11. Some other projects mutually decided by instructorand students

Suggest an assessment Scheme:

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

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

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

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

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

Moocs Links and additional reading material:

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

Course Outcomes:

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

1. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.

2. Evaluation of different uninformed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.

3. Design and Analysis of informed search algorithms on well formulated problems.

4. Formulate and solve given problem using Propositional and First order logic.

5. Apply neural network learning for solving AI problems

6. Apply reasoning for non-monotonic AI problems.

FF No.: 654

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.(4 Hrs) Process management: Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control, Multithreading models, Thread implementations – user level and kernel level threads, Concurrency: Issues with concurrency, Principles of Concurrency, Mutual Exclusion: OS/Programming Language Support: Semaphores, Mutex,Classical Process Synchronization problems.(7 Hrs) Uniprocessor Scheduling: FCFS, SJF, RR, Priority(3 Hrs)

SECTION-2

Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery (4Hrs)

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(7 Hrs)

I/O management: I/O Devices - Types, Characteristics of devices, I/O Buffering. Disk Scheduling: FCFS, SSTF,SCAN, C-SCAN(3Hrs)

List of Tutorials:

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

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

Assessment Scheme:

1. ESE
2. CVV

3. LAB-Course Assignment and Project Evaluation
4. Programming Practical

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.

FF No.: 654

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: 5

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

Course Relevance:

Machine learning, DataScience

SECTION-I
Topics and Contents (4Hrs): Introduction, Basic concepts from statistics, definition and uses of models, how models areused in practice, key steps in the modeling process. Linear models and optimization, leastsquareestimation,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 andVarianceDilemma, Training and Testing CurvesCaseStudyof Polynomial CurveFitting
SECTION-II
Topics and 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 ofprobability models(5hrs)**, various distributions (Bernoulli, Binomial, Normal distribution), mixture models,boot strap maximum likelihood methods, Bayesian method, expectation maximization, **Markov-chain models(5Hrs)**, Hidden Markov model, Conditional randomfields, Latent variable probability models

List of Tutorials:(Any Three)

1. Considerthe following set ofpoints:{(-2,-1),(1,1),(3,2)}
a. Find the least square regressionline
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,Mode for the following data7,11,1
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 iscorrect or not usingOne-Way ANNOVA AB
C
23 4
45 6
67 8
6. Solve Poisson Regression model problem using aworkable example.
7. Find the Principal Components for Z1,Z2 for the following matrix A
T
=
2 1 0 -1
4 3 1 0.5
8. A Die is thrown 6-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 is tossed 10 times then find the probability of
i. Exactly6heads
ii. Atleast6heads
iii. Atmost6heads
10. In a boltfactory, Machines A, B and C manufacture respectively 25%, 35% and 40% ofthe total bolts. Out of their total output 5, 4 and 2 percentage are respectively defectivebolts. A bolt is drawn at random from the product. If the bolt is defective, what is theprobabilitythatthe boltismanufacturedbyMachineB.

List of Practicals: (Any Six)

1. Least square estimate
2. Over fitting and underfitting
3. Regularization for LASSO and RIDGE
4. Factor analysis

5. Principal component analysis
6. Noisy channel model
7. Source channelmodel
8. Maximum likelihoodmethod
9. Expectation maximization
10. Markovchains
11. HiddenMarkov 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 factor analysis to find the important features out of all features present in the Student Performance Dataset.
4. Implement Principal Component analysis to identify the crucial features out
Of al lfeatures present in the Breast cancer dataset.
5. Implement Logistic regression modelfor the prediction of Lung cancer disease using UCI Lungca ncerdataset.
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 discriminant analysis
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 Discussion Topics:

1. Noisychannel model
2. Sourcechannelmodel
3. Montecarlosimulation
4. BinomialDistribution

5. NormalDistribution
6. Markovchainmodel
7. Bootstrapmaximumlikelihoodmethods
8. BayesianMethod
9. Performance Evaluation Metrics for Regression problems
10. Measures of central tendency vs measures of variability
11. Avoidingoverfittingandunderfittinginclassifiers

List of Home Assignments:
Design:
1. Heart diseaseprediction
2. CustomerReviewclassification
3. Sensorlessdrivediagnosis
4. Defaultcreditcardclientclassification
5. Devnagrihandwrittencharacterclassification

Case Study:
1. Classificationmodels
2. Regressionmodels
3. Maximumlikelihood
4. Generalizedlineardiscriminantanalysis.
5. ConditionalRandomfields

Blog
1. Logisticregression
2. Support vectormachine
3. Typesoferror
4. Markovchainmodel
5. Latentvariableprobabilitymodel

Surveys
1. Randomforestvs Decisiontree
2. PrincipalComponent analysis
3. Bayesianmethod
4. Typesofdistribution
5. Differentvariancemodels

Text Books:*(AsperIEEEformat)*

1.The Elements of Statistical Learning: Data Mining, Inference, and Prediction. By TrevorHastie, Robert Tibshirani, Jerome Friedman, Hardcover: 745 pages, Publisher: Springer; 2nded.2009,ISBN-10:0387848576
2. StatisticalModelsbyA.C.Davison Paperback:738pages,Publisher:CambridgeUniversityPress;1edition(30June2008)ISBN-10:0521734495CambridgeUniversityPress

Reference Books:*(AsperIEEEformat)*

1. S.C.Gupta;"FundamentalsofStatistics7thEdition"; HimalayaPublishingHousePvt.Ltd.
2. AbdulHamidKhan,MANOJKUMARSRIVASTAVA,andNAMITASRIVASTAVA;"STATISTICALINFERENCE:THEORYOFESTIMATION";PhiLearning

MOOCs Links and additional reading material:

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

Course Outcomes:

1. Understandbasicsaboutstatisticalmodelsandhowthemodelsareusedinpractice
2. Understandbasicconceptsoflinearmodelsandregression
3. Understandbasicsofprobabilisticmodels,Markovmodels,Markovprocesses
4. Understandbasicsoftreebasedmodels
5. Determinesuitable statisticalmodels forthepracticalproblems.
6. Applysuitablemodeltothepracticaldataandderivethestatisticalinferences

FF No.: 654

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, List-then-eliminate algorithm, inductive bias, Bias, Variance, Underfitting, Overfitting. **Bayesian Learning:** Probability, Bayesian Learning: Bayes theorem, Maximum likelihood hypothesis, minimum description length principle, Gibbs algorithm, Bayesian belief networks. **SVM:** Kernel functions, Linear SVM, Nonlinear SVM, Hyper parameter tuning, Handling Imbalanced Data set. KNN Model. **Decision Tree Learning:** Representation, Basic decision tree learning algorithm, Hypothesis space, Issues in decision tree learning, and Random Forest Model.
SECTION-II
Clustering Algorithms-Distance Based Models: Distance based clustering algorithms - K-means and C-means, Hierarchical clustering, Association rules mining – Apriori Algorithm, Confidence and Support parameters. Hidden Markov model, Genetic algorithm.Collaborative filtering-based recommendation. **Dimensionality Reduction Techniques:** PCA, SVD, NLPCA, ICA etc. Validation: Cross validation, Confusion matrix. **Ensemble Learning:** Bagging and boosting. **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. Collaborative filtering
6. Q Learning
7. Item based Recommender system
8. Real time applications
9. 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. Deep convolutional models
17. Keras Tutorial
18. 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 Practicals:

1. Implement Find-S algorithm
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 Naïve Bayes
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 SVM
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 KNN classifier.
5. 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.
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 Random Forest.
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 Kmeans clustering
8. Implement the C-means algorithm on a data set obtained from UCI ML repository

9. Genetic algorithm: Implement Genetic algorithm for the Travelling salesman problem
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

8.Scalable Nearest Neighbor Algorithms for High Dimensional Data

18. A survey on concept drift adaptation 10.Simultaneous Detection and Segmentation

List of Course Group Discussion Topics:

1. Supervised Vs Unsupervised

2. Univariate Vs Multivariate analysis

3. Accuracy measuring methods

4. Bias Vs Variance Tradeoff

5. Data Reduction Vs Dimensionality reduction

6. Continuos Vs Discrete variables

7.Feature Extraction Vs Automatic Feature detection

List of Home Assignments:

Design:

1. Propensity to Foreclose:Predicting propensity of the customer to foreclose their loans. The objective is to retain the customer for the maximum tenure.

2. Portfolio & Price Prediction for Intra-day trades:Price movement prediction using a masked set of features - This involves predicting short-term to mid-term price movements using a combination of multiple features.

3. Smart Building Energy Management System using Machine Learning

4. Quick analysis of quality of cereals, oilseeds and pulses using ML

5. Video Library Management System using Machine Learning

6. Building a Recurrent Neural Network

7. Character level Dinosaur Name generation

8. Music Generation

9. Operations on Word vectors

10. Neural Machine translation with attention

Case Study:

1. Product Recommendation: Given a purchase history for a customer and a large inventory of products, identify those products in which that customer will be interested and likely to purchase. A model of this decision process would allow a program to make recommendations to a customer and motivate product purchases. Amazon has this capability. Also think of Facebook, GooglePlus and LinkedIn that recommend users to connect with you after you sign- up.

2. Medical Diagnosis: Given the symptoms exhibited in a patient and a database of anonymized

patient records, predict whether the patient is likely to have an illness. A model of this decision problem could be used by a program to provide decision support to medical professionals.

3. Stock Trading: Given the current and past price movements for a stock, determine whether the stock should be bought, held or sold. A model of this decision problem could provide decision support to financial analysts

4. Customer Segmentation: Given the pattern of behaviour by a user during a trial period and the past behaviors of all users, identify those users that will convert to the paid version of the product and those that will not. A model of this decision problem would allow a program to trigger customer interventions to persuade the customer to covert early or better engage in the trial.

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

Blog

11. Focusing Too Much on Algorithms and Theories.

12. Mastering ALL of ML.

13. Having Algorithms Become Obsmgolete as Soon as Data Grows.

14. Getting Bad Predictions to Come Together With Biases.

15. Making the Wrong Assumptions.

16. Receiving Bad Recommendations.

17. Having Bad Data Convert to Bad Results.

8.Open AI

9.Computer Vision

10.Google Brain

11. Deep Learning and Natural Language Processing

12.Multi-task Learning and Transfer Learning

Surveys

1. Concept learning

2. reinforcement learning

3. semi supervised learning

4. deep learning

5. transfer learning

6. Deep Neural Networks in Speech and Vision Systems

7. GANs

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. Jacek M. Zurada, ―Introduction to Artificial neural System, JAICO publishing house,2002.
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. Formulate a given problem within the Bayesian learning framework
3. Evaluate decision tree learning algorithm.
4. Apply different clustering algorithms used in machine learning.
5. Explore Reinforcement Learning.
6. Analyse research-based problems using Machine learning techniques.

FF No.: 654

AI3007: CLOUD COMPUTING

SECTION I

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 database.

SECTION II

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.

FF No.: 654

AI3008: 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 oftrends
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 ashallow Neuralnetwork
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 convolutionalneural network
5) Implement convolutional networks for image recognition/classificationtasks
6) Demonstrate Understanding of Recurrent nets and theirapplications

FF No.: 654

AI3009: 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-completenessandtheirrelationshipwiththeintractabilityofdecisionproblems.
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 relevantfor studentswhowanttopursueresearchcareersintheoryofcomputing,computationalcomplexity 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.

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.

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

FF No.: 654

AI3010: 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

Teaching Scheme

Theory: 2 Hours/Week

Lab: 2 Hours/Week

Course Relevance: Software Architecture

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
13)

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

1. To study modeling methodologies and identify their applicability to various categories of projects
2.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 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

BTech AI&DS Module-VII (B20Pattern)

Subject head	Coursecode	Course name	Contact hours perweek			Credits
			Theory	Lab	Tut	
S1(OE1)	MD4201	EngineeringandManagerialEconomics	2	0	0	2
S2(OE2)	AI4001	BlockChain&cybersecurity	2	0	0	2
	AI4002	OptimizationTechnique	2	0	0	
	AI4003	HumanComputerInteraction	2	0	0	
	AI4004	PatternRecognition usingFuzzyNeuralNetworks	2	0	0	
	AI4005	SoftwareEngineering	2	0	0	
S3(OE3)	AI4006	DataVisualization	2	0	0	2
	AI4007	Informationretrieval	2	0	0	
	AI4008	Augmented RealityandVirtualReality	2	0	0	
	AI4009	InternetofThings	2	0	0	
S4	AI4010	Engineering design and innovation –iii				10

BTech AI &DS Module-VIII (B20Pattern)

Subjecthead	Coursecode	Course name	Contact hours perweek			Credits
			Theory	Lab	Tut	
S1	AI4051	IndustryInternship				16
OR						
S2	AI4052	InternationalInternship				16

OR						
S3	**AI4053**	**ResearchInternship**				**16**
OR						
S4	**AI4054**	**ProjectInternship**				**16**

AI4001: BLOCK CHAIN & CYBER SECURITY

CoursePrerequisites:

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

CourseObjectives:

1. TostudybasicsofBlockchain Technology,itsapplicationsand different typesofusecases
2. ToacquireknowledgeofsmartcontractsinethereumBlockchainandHyperledgerfabric.
3. To acquire knowledge of standard algorithms and protocols employed to provideconfidentiality,integrityandauthenticity.
4. Todeployencryptiontechniquesto ensuredataintransitacrossdatanetworks.
5. To enhance awareness about Personally Identifiable Information (PII), InformationManagement,cyberforensics

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

CourseRelevance:

During the course, students will learn more about the history, the most important blockchainconcepts,thephilosophyofdecentralizationbehindblockchain,andthemaindiscussionshappeningwithintheblockchainenvironment.Inaddition,youwilllearnabout(potential)applications of blockchain and the impact it could have on the business world. Thiscourse Provides an in-depth study of the rapidly changing and fascinating field of computerforensics.Combines both the technical expertise and the knowledge required to investigate,detect and prevent digital crimes.Knowledge on digital forensics legislations, digital crime,forensicsprocessesandprocedures,dataacquisitionandvalidation,e-discoverytoolsE-evidence collection and preservation, investigating operating systems and file systems, networkforensics,artofsteganographyandmobile deviceforensics.

SECTION-I

Topicsand Contents

Introduction to Blockchain: Features & Industry Applications of Blockchain, Centralized &DecentralizedSystemwithExamples, DecentralizedSystem&DistributedLedgerTechnology

Blockchain Computing Power, Hash & Merkle Tree with Hands on Examples, Multiple Use-CasesofBlockchain asperdifferentindustriesandgovernment,BlockchainforTechnology:

Blockchain in Technology, Business and Management, Different Types of Blockchain, PublicBlockchain, Private Blockchain, Federated Blockchain with Examples and Difference, DigitalSignaturesandDemoofBlockchainTools,BlockchainApplicationsandusecasesinGovernment,RealTimeUseCaseApplicationsinBlockchain:ConsensusandTypesofConsensuswithexamples SmartContracts inBlockchain,NeedofSmartContractswithExamples Practical Hands-On with Smart Contracts, Developing Smart Contracts, IndustryusecasesofSmartContracts,SmartContractsforBusinessandProfessionals:SmartContracts in Detail Developing own Smart Contracts, Programming basics of Solidity (DataTypes) and Advanced Solidity, EVM in relation with Smart Contracts and Gas Price, Runningand Debugging Smart Contracts in Remix (Detailed), Deploy and Debug Smart Contract withTruffle

Smart Contracts in Ethereum Blockchain, Crypto-Economics and Cryptocurrency, Types ofCryptocurrency andCryptography,Cryptonomics and Cryptocurrency Transactions,ValidandInvalidTransactions,PrevioususecasesofCryptocurrency,Bitcoinindetail: HowBitcoin System works, Decentralized Cryptocurrency and its use cases, Making your ownCryptocurrencywithDevelopmentanddeployment,PermissionedBlockchain(RAFTConsensus, Byzantine General Problem, Practical Byzantine Fault Tolerance), Blockchain forEnterprise–Overview,BlockchainComponentsandConcepts,HyperledgerFabric–TransactionFlow

Hyperledger Fabric Details, Fabric – Membership and Identity Management, HyperledgerFabricNetworkSetup,FabricDemoonIBMBlockchainCloud,FabricDemoonIBMBlockchain Cloud continued., Fabric Demo, deploy from scratch, Hyperledger Composer – Application Development, Hyperledger Composer – Network Administration, Blockchain UseCases.

SECTION-II

Topicsand Contents

Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of CyberCrime:SocialEngineering,CategoriesofCyberCrime,Property CyberCrime.

CYBER CRIME ISSUES: Unauthorized Access to Computers, Computer Intrusions, Whitecollar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks,Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation,Stalking andObscenityinInternet,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,ForensicBallistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis,WindowsSystem Forensics,Linux System Forensics,Network Forensics.

List ofCourseSeminarTopics:

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

ListofCourseGroupDiscussionTopics:

1. IntroductiontoCyberSpace
2. ClassificationofMalware,Threats
3. VulnerabilityAssessment
4. Biometric AuthenticationMethods
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. JurisdictionofCyber Crime,Cyber SecurityAwarenessTips

ListofHomeAssignments:
Design:

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

Case Study:

1. NetworkVulnerabilityusing OpenVAS
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 checkifitcovers allaspectsofBloom'sTaxonomy.
MSE ESE PPT GD VIVA HA

Text Books:(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",Tata McGraw-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. Studyandunderstandtheblockchainconceptsandtoolsrequiredforits implementation.
6. Developtheapplicationsofblockchainforsolvingsocialproblems.

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

Future Courses Mapping:
Advance Blockchain Technology
EthicalHacking

JobMapping:
BlockchainDeveloper
Bitcoincryptocurrencydeveloper
Business Analytics
Associateprotectingnetworks,
Securingelectronicassets,
preventingattacks,ensuringprivacy,
Buildingsecureinfrastructure

FF No.: 654

AI4002: OPTIMIZATION TECHNIQUES

CoursePrerequisites: Datastructure,computerprogramming

CourseObjectives:

1. Toformulatemathematicalmodelsofbusinessproblems.
2. Tolearneffectiveprojectmanagementandplanningofresources.
3. To make optimalutilizationofresources.
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 Linear ProgrammingModel,Maximization&MinimizationModels,GraphicalMethodforSolvingLinearProgramming problems, Unbounded LP Problem, Additional Variables Used In SolvingLPP,MaximizationCase,MinimizationProblems,BigMMethod,DegeneracyinLPProblems,UnboundedSolutions inLPP,MultipleSolutions inLPP.

CPM/PERT:PERT/CPMNetworkComponents,RulesinConstructingaNetwork,Scheduling of Activities: Earliest Time and Latest Time, Determination of Float and SlackTimes,Critical Pathmethod forprojectmanagement,ProjectEvaluation ReviewTechnique

–PERT,Ganttchart(timechart).Terminology.

Sequencing:TypesofSequencingProblems,AlgorithmforSolvingSequencingProblems,Processing n jobsthrough 2,3,mmachines.Processing 2jobsthroughmachines.

SECTION-II

Topicsand Contents

Transportation:GeneralMathematicalmodeloftransportationproblem,Thetransportation algorithm, Method of finding initial solution: North west corner method,Least cost method, Vogel's Approximation method, Test for optimality: MODI method,Variationintransportationproblems.

Game Theory: Terminologies of game theory, Two-person-zero-sum-game, Game with purestrategy, Methods of solving game with mixed strategy, Dominance Property, Graphicalmethodfor 2xnandmx2games.LinearProgrammingapproachforgames theory,

Inventory Management: Inventory Control Models: Purchase model with instantaneousreplenishment with and without shortages, calculate EOQ, classification of inventory likeABC-Always, Better, Control, FSN –Fast, Slow and non-Moving, VED -Vital, Essential,Desirableetc

List ofCourseSeminarTopics:

1. FormulationofLinearProgramming
2. SimplexMethodofsolvingLPPproblem.
3. PrimalToduelwithexampleand solutionofproblem
4. DegeneracyinLPProblems
5. BigMmethod
6. CPM/PERT
7. Sequencing-Processingnjobsthrough2,3machines
8. Processing2jobsthroughmmachines
9. Queuing
10. SequencingVsQueuingtechniques

ListofCourseGroupDiscussionTopics:

1. ComparisonofTransportation-N-WCornermethodandLeastcostcellmethod.
2. Transportation-VAMmethod.
3. Two-person-zero-sum-game,Gamewithpurestrategy.
4. Methodsofsolvinggamewith mixedstrategy.
5. Inventory-Purchasemodelwithinstantaneousreplenishmentwithshortagesand without shortages.
6. Discussinventoryclassificationtechniques
7. Comparativeanalysesofpurchasemodels
8. EOQ
9. Inventorycontrolmodels
10. Transportation-MODImethod

ListofHomeAssignments:

Design:

1. DesignnetworkactivitydiagramusingCPMforconstructionworkofbuilding.
2. Designnetworkactivitydiagramusing CPMfora researchwork.
3. DesignatransportationmodelusingVAM–Vogel's Approximationmethod.
4. Designoptimalstrategiesfortwoplayers-Zerosumgame.
5. Designmathematicalmodelforabusinessproblem.

Case Study:

1. Writeacasestudyongoalprogrammingforan IT startupcompany.
2. Casestudyonprojectcrashingofasoftwaredevelopmentcompany.
3. Writeacasestudyonspecialcasesinlinearprogramming.
4. Writeacasestudyonprojectmanagement.
5. Writeacasestudytoimproveasalesofamanufacturingcompany.
6. Writeacasestudyonclassificationofinventory.

Blog

1. OptimizationTechniques-Aquantitativeperspectivetodecisionmaking.
2. Themethodologytosolveoptimization problems.
3. Writeablogonnon-linearingprogramming
4. WriteablogonapplicationsofOptimizationTechniques.
5. WriteablogonLinear Programmingapproachforgamestheory.

Surveys:

1. Takethe surveyofapplicationsoflinearprogramming.
2. Takethesurveyofdifferenttransportationmodels.
3. Takesurveyinventoryclassificationmodels.
4. Takethe surveyofoptimizationtechniquesindatascience
5. Takethesurveyofoptimizationtechniquesinshortestpathfinding

SuggestanassessmentScheme:

SuggestanAssessmentschemethatisbestsuited for the course.Ensure360degreeassessmentandcheckifitcovers allaspects ofBloomsTaxonomy.
MSE ESE PPT GD VIVA HA

Text Books:(AsperIEEEformat)

1. *KantiSwarup,GuptaP.K.,ManMohan,"OperationsResearch",12thEdition; SultanChand&Sons,NewDehli.*
2. *R.Panneerselvam,"OperationsResearch",2ndEdition, PHILearningPrivateLtdNewDehli.*
3. *Taha H AOperationResearchand Introduction9thEditionPearsonEducation2014*
4. *Gupta&Hira OperationsResearchRevisedEditionChand&Co.2007*

ReferenceBooks:(AsperIEEEformat)

1. *BillyE.Gillett,"AComputer–OrientedAlgorithmicApproach",1979Edition,TataMcGraw-HillPublications Company Ltd.,NewDehli.*
2. *HillerLieberman,"IntroductiontoOperationsResearch",7thEdition;TataMcGrew-hillpublishingCompany Ltd.,NewDehli*
3. *S.D.SharmaOperationsResearch 15thEditionKedarnath,Ramnath&Co*
4. *JKSharmaOperationsResearch3rdeditionLaxmiPublications2009*

MoocsLinksandadditionalreadingmaterial:

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

CourseOutcomes:

Thestudentwillbeableto–

1. Developlinearprogrammingmodelstosolvereallife businessproblems.(3)
2. AnalyzeCriticalpathusingCPMand PERT(3)
3. Usesequencingtechniquesforeffectiveschedulingofjobs(4)
4. Solvetransportationproblemsusing variousmethods.(4)
5. Computethevalueofthegameusingpure/mixedstrategiesandaccordingly deviceoptimalstrategies towinthe game(5)
6. Learnvarious modelsandtechniquesofinventorymanagement.(5)

COattainmentlevels
CO1-3
CO2- 3
CO3-4
CO4-4
CO5-5
CO6-5

FutureCoursesMapping:

OperationResearch, Operationsmanagement, SupplyChainmanagement

JobMapping:

OperationResearchAnalyst,Inventorymanager,Projectmanager,Operationresearchengineer.

FF No.: 654

AI4003: HUMAN COMPUTER INTERACTION

Course Prerequisites:

Computer Programming,WebTechnology

CourseObjectives:

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

Credits:2 **TeachingSchemeTheory: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 both individual and team projects to design, implement and evaluatecomputer interfaces. The course is open to students from all disciplines, providing them withexperience workingininterdisciplinarydesignteams.

SECTION-I

Topicsand Contents

IntroductiontoHuman-ComputerInteraction(HCI)

Human, Definition of Human Computer Interaction, Interdisciplinary Nature, Goals, HumanFactors, Measurable Factors – Learn ability, Speed, Efficiency, Satisfaction. Early Focus onUsers,Ergonomics,Usability,TypesofUsability,UserInterface(UI),Contexts-Web,Business,Mobile,GamingApplications,CategorizationofApplications basedonHumanFactors,AccessibilityandSecurity.

Principlesand Models

EightGoldenRulesofInterfaceDesign,PrinciplesofGoodDesign,FaultyDesigns,Miller's

Principle, Norman's Action Model, Gulf of Execution and Evaluation, Errors –Mistakes, Slips,Lapses and Violations, Guidelines for Data Display, Guidelines for Data Entry, Conceptual,Semantic, Syntactic and Lexical Model, Task Analysis, GOMS, Keystroke-Level Model, 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, Interaction Styles – Direct Manipulation, MenuSelection,Form-Filling,Commands,NaturalLanguage,Internationalization,InteractionDesign Patterns.s - Apex professional bodies, Industries, international curriculum, curriculumof IIT and other prominent Universities, etc. Make the course in 2 sections - Section I andSectionII.

SECTION-II

Topicsand Contents

EvaluationTechniquesandInterfaceCategories

Expert-basedEvaluation,User-basedEvaluation,HeuristicEvaluation,CognitiveWalkthrough, Semiotic Analysis, Expert Reviews, Usability Testing, User Surveys, Interviews,Think Aloud, Acceptance Tests, Statistical Methods, Touch Interfaces, Public Place Interfaces,WearableInterfaces,TangibleInterfaces,IntelligentInterfaces,UbiquitousandContext-Aware Interaction.**DocumentationandGroupware**

Classification of Documents, Printed Manuals, Reading from Displays, Online Help, Tutorial,Error / Warning Messages, Groupware, Goals / Dimensions of Cooperation, AsynchronousInteractions,SynchronousInteractions,Online Communities,Communityware

Miscellaneous

Case Studies: Web Usability, Mobile Usability, Embedded Systems, Social Networking Sites,Messengers,E-Governance Sites,SecurityTools,e-Healthapplications

List ofCourseSeminarTopics:

1.TheFutureofSmartEverydayObjects
2. CooperativeArtifacts
3. IntelligentKitchenUtilities
4. InteractingwithSmartProducts
5. Intimate Interfaces
6. MultitouchInterfaces
7. InteractiveTables
8. Microsoft Surface Technology
9.SenseCam
10. SpokenDialogueSystems

ListofCourseGroupDiscussionTopics:1.
W3C Multimodal Interaction Activity

2.MultimodalDialogue Systems
3.TangibleInteractionwithIntelligentVirtualAgents
4. MixedandAugmentedReality
5. MultimodalGenerationforVirtualCharacters
6. Expressive VirtualCharacters
7. Recognizing and Expressing Affect
8.EmotionalInterfacesandInputDevices
9.NaturalMachines
10.DataEntryInterfaces

ListofHomeAssignments:

Design:

1. ApplyNorman'sactionmodelonthetask–'Tomakeonlinepayment'.
2. Illustratemajormodelsevolved incontextualenquirywithanexample.
3. Designaccommodationforvisuallyimpairedusersinmobileapplications
4. DesignUIforInformationKioskforaMetroTerminusRelatedUIsketches
5. Formulateauser personasofIndianUserfor ITproduct.

Case Study:

1. HCIguidelines/principlesfordesigninghome page formuseumwebsite.
2. Vitalethnographicobservations inIT products.
3. Gulfofexecutionwithrespect toleft-handed users.
4. User-basedandexpert-basedusabilityevaluationmethods.
5. Anymobileapphighlightingitsethno-culturalandaccessibilityfeatures.

Blog

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

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

SuggestanassessmentScheme:
SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentand checkifitcovers allaspectsofBloomsTaxonomy.
MSE ESE PPT GD VIVA HALAB

Text Books:(AsperIEEEformat)

1. "Human-Computer Interaction", AlanDix, JanetFinlay, GregoryD. Abowd, RussellBeale, PearsonEducation, ISBN81-297-0409-9,3rdEdition.
2. "DesigningtheUserInterface",BenShneiderman,PearsonEducation,ISBN 81-7808-262-4,3rdEdition

ReferenceBooks:(AsperIEEEformat)

1. The DesignofEveryday Things",DonaldNorman,Basic Books,ISBN 100-465-06710-7,2002Edition
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. Differentiatecomputingapplicationsinto categoriesbasedonhumanfactors
3. Designanuserinterfacebyapplyingsuitabledesignprinciples,modelsandusabilityguidelines
4. Integrateethno-culturalandaccessibilitycomputingaspects intotheuserinterfacedesign
5. Displaytheimpactofusabilityevaluationandtestingincomputingapplications

6.Followrequiredprocessesandstandardswhiledesigninguserinterfaces

COattainmentlevels
Co1-2
Co2-1
Co3-3
Co4-4
Co5-4
Co6-3

FutureCoursesMapping:
AugmentedRealityand Virtual Reality

JobMapping:
*1.*GraphicDesigner
2. User Interaction Designer
3. Product DesignManager
4. SeniorInformationArchitect

FF No.: 654

AI4004: PATTERN RECOGNITION USING FUZZY NEURAL NETWORKS

CoursePrerequisites:

Datastructure,computerprogramming,Linearalgebra

CourseObjectives:

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

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

CourseRelevance: Thiscourseapplicablefor complexpatternrecognitiontasks

SECTION-I
Topicsand Contents **Pattern recognitionfundamentals:-** Definitionofapattern,statisticalandsyntacticpatterns,featurevector,featuredimensionality,pattern class,definitionofclassification,clustering,hybridclassification-clustering **Introductiontofuzzysettheory:-** Definition of fuzzy set, membership function, types of fuzzy sets, operations on fuzzy setslikeunion, intersection, compliment, plot of fuzzy membership function, core and support parts offuzzy sets

IntroductiontoArtificialNeuralnetworks:-

Biologicalneuron,McCullochPittsmodel,generalneuronmodel,perceptron,activationfunctiontypes,perceptronlearningalgorithmfor2-classclassification,singlelayerperceptron classifiersand learningalgorithms,brief introto multilayersperceptrons

SECTION-II

Topicsand Contents

Fuzzymin-maxneuralnetwork (FMN)architectureforclassification-

Concept of hyper-box, hyper-box as a fuzzy set, hyperbox membership function-definition,interpretationanduse,FMNlearningalgorithm-hyper-boxexpansion,overlaptestandhyperbox contraction, FMN recall/testing algorithm, comments on hyperbox size, sensitivityparameterandperformanceevaluation.

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

FuzzyHyperlineSegmentNeuralNetwork(FHLSNN)classifier:-

Concept ofhyperline, hyperline as a fuzzy set, fuzzy membership function design, FHLSNNtrainingandtestingalgorithm,

ComparisonofFMNandFHLSNNarchitectures.

ModifiedFuzzyHyperlineSegmentNeuralNetwork(MFHLSNN) classifier:-

Modified fuzzy membership function design, convexity and normalityroperties, training and testingalgorithms,comparisonofFHLSNNandMFHLSNN

List ofCourseSeminarTopics:
1. DrawbacksinthemembershipfunctiondesignofFMN.
2. FHLSNNmembership functiondesign
3. FMNclusteringalgorithm
4. FMNclassificationalgorithm
5. Fuzzysetsandapplications
6. Fuzzy neuralnetworksashybridsystem
7. Softcomputing
8. Someothertopicsdecided byinstructor

ListofCourseGroupDiscussionTopics:
1. FHLSNNclassifierdrawbacksin membershipfunction
2. FMNapplicationinHCR
3. FHLSNNforheartdiseasedetection
4. Fuzzyclusteringtechnique
5. ComparisonofK-NNclassifierandFMNclassifier
6. Someothertopicsdecided byinstructor

ListofHomeAssignments:

Design:
1. DesignafuzzymembershipfunctionforFMNforefficiency
2. DesignafuzzymembershipfunctionforFHLSNNwithlesscostlyoperations
3. DesignFMNarchitecturefor8-Dinputpatternsfor4classes
4. DesignafuzzymembershipfunctionforFHLSNNwithoutusingsquarerootoperationsinceitis costly
5. Someothertopicsdecided byinstructor

Case Study:
1. HCRusingFHLSNN
2. Fourier Fuzzyneuralnetworkfor patternrecognition
3. FuzzyneuralnetworkbyKawnandKai
4. UFHLSNNforpatternrecognition
5. Someothertopicsdecided byinstructor

Blog
1. Fuzzyneuralnetworksashybridsystem
2. FMNforhybridclassificationandclusteringbyBargiala
3. FHLSNNmembershipfunctiondesign
4. Flaws in the contractionofhyperboxesinFMN
5. Someothertopicsdecided byinstructor

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

4. Backpropagationtrainingalgorithm
5. Someothertopicsdecided byinstructor

SuggestanassessmentScheme:
SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentand checkifitcovers allaspectsofBloomsTaxonomy.
MSE PPTPresentation ESE GD Viva LAB

Text Books:(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, IEEE TransactionsonNeuralNetworks,Vol.3(5),1992,https://doi.org/10.1109/72.159066.*
2. *P. K. Simpson, Fuzzy min-max neural networks Part-2. clustering, IEEE Transactions onFuzzy Systems,Vol.1(1),1993*
3. *U. V. Kulkarni, T. R. Sontakke and G. D. Randale, Fuzzy hyperline segment neural networkforrotationin 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 of handwrittencharactersusingmodifiedfuzzyhyperlinesegmentneuralnetwork,The12thIEEEInternationalC onferenceonFuzzy Systems,2003.FUZZ'03.*
5. *PriyadarshanDhabe,PrashantVyas,DevratGaneriwal,AdityaPathak,Patternclassification using updated fuzzy hyper-line segment neural network and it's GPU parallelimplementationforlargedatasetsusingCUDA,InternationalConferenceonComputing,Analyticsand dSecurityTrends (CAST),2016*
6. *PriyadarshanSDhabe,SanmanDSabane,ImprovedUFHLSNN(IUFHLSNN)forGeneralizedRepresent ationofKnowledgeandItsCPUParallelImplementationUsingOpenMP, Springers EAI International Conference on Big Data Innovation for SustainableCognitiveComputing,2020*

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

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

CourseOutcomes:
Thestudentwill beableto–
1. Designfuzzysetforagivenapplication
2. DecidearchitectureofFNNforagivenrealproblem
3. ApplyFMNforsolvingrealworldproblems
4. TrainFNN forpatternrecognition
5. TestFNNfortheir recallinpatternrecognition
6. Evaluate performance ofFNN

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

FutureCoursesMapping:
Mentionothercoursesthatcanbetaken aftercompletionofthiscourseSoftComputing,HybridFuzzyneuro-systems,Neuro computing

JobMapping:
WhataretheJobopportunitiesthat onecanget afterlearningthiscourse

ML-Engineer,SoftComputing-Engineer,AI-Solutionarchitect-Fuzzyneurosystem,Predictivemaintenance-Engineer

IT4230: SOFTWARE ENGINEERING

CoursePrerequisites:

Fundamentalknowledgeaboutprogramming

CourseObjectives:

1. To learn fundamental knowledge of Software Engineering, to be successful professional inthe IT/ITESSector
2. To understand and exhibit professional and ethical principles of Software Engineering whilefunctioningasmembers,leadersofmulti-disciplinaryteams
3. Toanalyze project knowledge areaactivities todetermine abasis of successful projectexecution
4. To interpret and diagnose impact of changing project requirements using an appropriateprinciple, processes and produce specific sections of the project plan used to manage changerequests
5. TodesignanddocumentProject Managementpracticeswithinternationalstandards

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

Course Relevance: Industry always need talented software developers across every domain. Astechnologyadvances,theabilitytobuildqualitysoftwaresolutionconsideringdesign,development, security, and maintenance is a need. Software Engineering is a field that is vitallyimportant to Computer Technology as a whole, rather, it is a backbone of any software productdevelopment. This scientific and technically-driven field has always focus on implementation ofthe best processes and methodologies in the production of high-quality software. It developsproblem understanding and designing ability, as well as analytical and problem-solving abilityamongstlearner.Anyapplication'sfoundationstartswithanunderstandingofuserneeds,followe dby design andimplementation.AcquiringandpracticingprinciplesofSoftwareEngineering, learner can work in any domain for industry or can carry entrepreneurial activities.The purpose of this course is to present Software Engineering as a body of knowledge. Thecourse is designed to learn and experience Software Engineering concepts, principles in parallelwithumbrella activitiesand demonstrate knowledge withreallife problemstatements.

SECTION-I

Topicsand Contents

Professional software development: Software engineering ethics, Software process : Softwareprocessmodels,Processactivities,Copingwithchange,Therationalunifiedprocess,RequirementEngineering:Functionalandnon-functionalrequirements,Thesoftwarerequirementsdocument,Requirementsspecification,Requirementsengineeringprocesses,Requirements elicitation and analysis, Requirements validation, Requirements management,Architecturaldesign,Architecturaldesigndecisions,Architecturalviews,Architecturalpatterns,Applicationarchitectures,Softwarereuse,Thereuselandscape,Applicationframeworks, Software product lines, Commercial-Off-the-Shelf (COTS) product, Component-basedsoftwareengineering,Distributedsoftwareengineering,Aspect-orientedsoftwareengineering,Agile Development Process:Agile Development:Agile manifesto,agility andcost of change, agility principles, myth of planned development, toolset for the agile process.Extreme Programming:XP values,process,industrialXP,SCRUM -process flow,scrumroles,scrum cycle description,productbacklog,sprintplanning meeting,sprintbacklog,sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprintreviewandretrospective.

SECTION-II

Topicsand Contents

IntroductiontoProjectManagement:Projectoverview,ProjectAttributes,TheTripleConstraint, Concept of Project Management, Project Stakeholders, Project Life Cycle: ProjectPre-Initiation and Initiation, Project Planning, Project Execution, Project Monitoring andControlling, Project Closing. Project Management Knowledge Areas, Project ManagementTools and Techniques, The Role of the Project Manager, Project Manager Job Description,Suggested Skills for Project Managers, The Project Management Process Groups, ProjectKnowledgeAreas:IntegrationManagement,ScopeManagement:CreatingtheWorkBreakdownStructure,ApproachesofdevelopingWorkBreakdownStructures,TimeManagement, Cost Management : Basic Principles of Cost Management, Estimating Costs,TypesofCostEstimates,CostEstimationToolsandTechniques,ParametersofQualityManagement, Quality Standards : ISO/IEC, IEEE related to Project Management activities,Project Human Resource Management, Essentials of Project Communications Management,Risk Management : Identifying risks, Qualitative Risk Analysis , Quantitative Risk Analysis,RMMMPlan, ProcurementManagement

List ofCourseSeminarTopics:

1. AnalysisandSelectionofProcessModeltobe adopted
2. RequirementEngineering: AnArt&Science
3. Selectionofappropriate methodologiesforRequirementCollection
4. Understandingrequirementsvia notationsanddiagrams
5. Importance of Functional, Non-Functional, Domain Requirements from TestingPerspective
6. Deciding parametersforfinalizationofboundaryofrequirements
7. Commercial-Off-the-Shelf(COTS)product
8. Methodsadoptedforuseranalysis
9. IdentificationofessentialNon-FunctionalRequirements
10. AnalysisofDomainRequirementstofinalizerequirementsboundary

GuidelinesforGroupDiscussion:

Forming a group of 5 students shall be strictly based on students with different course projectofSoftwareEngineeringlaboratory.Eachstudentmustbewellawareaboutthecourseprojects of group members. Various topics listed below will be available in form of chits in abox at the time of group discussion. One of the group members will pick up the topic chit fromshuffled chit box. Participation of each group member in group discussion is mandatory sinceassessmentisindividual.

ListofCourseGroupDiscussionTopics:

1. StakeholderAnalysisandRoleofStakeholders
2. RelevanceofimplementationofTripleConstraints
3. WBSandWorkAssignmentinteam
4. Waysto handleChangeManagementIssues
5. Identificationofminimumfivepossiblepotentialriskswhensystemisunderconstructionandsteps toreducetheserisks
6. IssuestobeaddressedduringChangeManagement
7. Analysisofprojectfailures
8. ImportanceofProjectManagementdocumentsfromQualityAssuranceperspective
9. ProjectRiskIdentificationandRiskAssessmentwithStartups-Challenges&SolutionsStylesofAgileSoftwaredevelopment
10. Requirement Tools: IBM Requisite Pro vs Contour
11. Configuration Management Tools: IBM ClearCase vs Microsoft Visual SourceSafe
12. Code Review Tools: Code Collaborator vs Cast
13. BPM Modeling tools: JBPM vs Activiti
14. Agile Project Management Tools: Rally vs Jira Agile
15. Testing Tools: Rational Functional Tester RFT vs Selenium
16. Defect Tracking Tools: JIRA vs ClearQuest

ListofHomeAssignments:

Design:

1. You want to monitor the efforts spent and the time spent on different activities of project.CanitbepossiblebyusingMSExcel?Thedesignshouldbesuchthatautomatedprocessing is possible.
2. Duringthesemesteryouaredevelopingyourcourseproject.Assumethat,youaresupposedtohand overthis system totheclientat theendof thesemester.Design adocumentcomprisinginstructions andguidelines.
3. After an application is installed (course project) at client side, it is necessary to providetraining to the users. Design stage wise trainingprogram for the users along with stagewisefeedbackformsatvariousstages oftraining
4. During the semesteryou are developingyour course project. Perform costestimationtechniquesofidentifiedcourseproject.
5. While using your application, clients/users may give you some changes. Document thischange andpredictitseffectonexistingapplication.
6. A customer decides to upgrade her PC and purchase a DVD player. She begins by calling the sales department of the PC vendor and they tell her to talk to customer support. She then calls customer support and they put her on hold while talking to engineering. Finally, the customer support tells the customer about several supported DVD options. The customer chooses a DVD and it is shipped by the mail department the customer receives the DVD, installs it satisfactorily and then mails her payment accounting. Draw the UML diagram.
7. The garage is for different types of four wheelers. The advanced booking/appointment is done on phone. On the day of appointment as soon as a customer arrives, a job card is created to not all the problems, requirements for the vehicle. An engineer is assigned based on availability to service a vehicle. On completion of the repair/maintenance/service the engineer prepares a report based on which a bill is created. The payment is accepted in cash against the bill. Make suitable assumptions about scope and working of your Garage.
8. Draw a UML Class Diagram representing the following elements from the problem domain for a hockey league. A hockey league is made up of at least four hockey teams. Each hockey team is composed of six to twelve players, and one player captains the team. A team has a name and a record. Players have a number and a position. Hockey teams play games against each other. Each game has a score and a location. Teams are sometimes led by a coach. A coach has a level of accreditation and a number of years of experience, and can coach multiple teams. Coaches and players are people, and people have names and addresses.
9. A society management system maintains a list of members, maintenance paid, flat no., type of flat(owned/rented). The expenditures made are maintained with date, bill no, description of expenditure, contact details of vendor. At financial year end, the balance report is generated, which includes amount collected, expenditure, previous balance etc.
10. A college has different student associations like sports, literary, science club etc. A student can login to college website, look at the various available associations and choose one of them to join. All the associations expect you to be a valid student first. The joining process

could be different for different associations for example sports association expects you to undergo a fitness test too. The associations organize various events. A member can register for the event online for free. Non-members need to pay nominal fees by credit card to register and in either case one gets a confirmation of registration of event. The registrations information needs to be passed onto the activity that sends the email confirmations.

11. A university has an online registration system that enables the staff of each academic department to examine the courses offered by their department, add and remove courses, and change the information about them (e.g., the maximum number of students permitted). It should permit students to examine currently available courses, add and drop courses to and from their schedules, and examine the courses for which they are enrolled. Department staff should be able to print a variety of reports about the courses and the students enrolled in them. The system should ensure that no student takes too many courses and that students who have any unpaid fees are not permitted to register. (Assume that a fees data store is maintained by the university's financial office, which the registration system accesses but does not change).

Case Study:

1. Whatwentwrong?
2. Risksassociatedwithidentifiedproblem(s)
3. Effectofidentifiedrisksonexistingworkcompleted
4. Estimatetimerequiredtosolvetheissue
5. Changeindocumentscreated

Blog

1. AgileDevelopment
2. SCRUM
3. ExtremeProgramming(XP)
4. Importanceofdocumentation intotaldevelopmentprocess
5. ProfessionalcertificationsindomainofSoftwareEngineering

Surveys

1. Recenttrends inSoftwareEngineering
2. RecenttrendsinProject Management
3. Qualitystandardsrequiredessentialfor softwareproduct
4. SoftwareDevelopmentProcessAudits
5. SoftwareDesignEngineering

SuggestanassessmentScheme:
SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentand checkifitcoversallaspects ofBloomsTaxonomy.

MSE ESE Lab HA VIVA GD SEMINAR

Text Books:(AsperIEEEformat)

1. *Sommerville,Ian;SoftwareEngineering; 9th Edition.,AddisonWesley*
2. *Pressman Roger; Software Engineering: A Practitioner's Approach; 7th Edition, McGrawHill*
3. *BobHughes,MikeCotterell,RajibMall;SoftwareProjectManagement;6thEdition,McGrawHill*

JosephPhillips, ITProjectManagement–OnTrackFromStarttoFinish, TataMcGraw-Hill

ReferenceBooks:(AsperIEEEformat)

1. *PankajJalote;SoftwareEngineeringA PreciseApproach;2010; WileyIndia*
2. *RajibMall; Fundamentals of Software Engineering; Third Edition; PHI Robert*

K.Wysocki;"EffectiveSoftwareProjectManagement"; O'Reilly

MoocsLinksandadditionalreadingmaterial:

1. www.nptelvideos.in
2. www.coursera.com
3. www.udemy.com
4. www.swayam.gov.in

CourseOutcomes:

1. Understandprocessesofprofessionalsoftwaredevelopment
2. Applyappropriatelifecyclemodelofsoftwaredevelopment
3. Analyzesoftwarerequirementsbyapplyingvariousmodelingtechniques
4. UnderstandITprojectmanagementthroughprojectlifecycleandknowledgeareas
5. Applytimeandcostestimationstopredictprojectactivities

Analyzeriskassessmentactivitiestowardsdevelopmentofqualityproduct

COattainmentlevels

Co1-2
Co2-3

Co3-3
Co4-3
Co5-2
Co6-3

FutureCoursesMapping:

1. SoftwareProjectManagement
2. SoftwareQualityAssurance

JobMapping:

Business Analyst , Application Developer, Web Developer, Information Systems Engineer,SoftwareEngineeringAssociate,SystemAdministrator,ProjectManagementProfessional,Data Scientist, Full Stack Developer, Python Developer, Java Developer, Cloud Engineer,Scrum Master,TechnicalWriter

AI4006: DATA VISUALIZATION

CoursePrerequisites:

Someprogrammingexperienceinanylanguage.Ideallyyouhavetakenacourseoncomputergraphics ,butt hisis notstrictlyrequired.

CourseObjectives:

1. Learntodesignand createdatavisualizations.
2. Learntoconductexploratorydataanalysisusingvisualization.
3. Craftvisualpresentationsofdataforeffectivecommunication.
4. Useknowledgeofperceptionandcognitiontoevaluatevisualizationdesignalternatives.
5. Designandevaluatecolorpalettesforvisualizationbasedonprinciplesofperception.
6. Applydatatransformationssuchasaggregationandfilteringfor visualization.

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

CourseRelevance:

VeryImportantforstrategicdecisionmakingandforecasting.Skillrequiredfordatasc ientistandbusiness analyst.

SECTION-I
Topicsand Contents **Introduction to Data Visualization**: A Brief History ofData Visualization, need of DataVisualization,GoodGraphics,StaticGraphics,DataVisualizationthroughtheirGraphRepresentations, High-dimensional Data Visualization, Multivariate Data Glyphs: Principlesand Practice, Linked Views for Visual Exploration, Linked Data Views, Visualizing Trees andForests, Display of Geographically Referenced Statistical Data, Multidimensional Scaling,Huge Multidimensional Data Visualization, Multivariate Visualization by Density Estimation,StructuredSets ofGraphs

SECTION-II

Topicsand Contents

Methodologies:, Regression by Parts: Fitting Visually Interpretable Models with GUIDE,Structural Adaptive Smoothing by Propagation–Separation Methods, Smoothing Techniquesfor Visualization, Data Visualization via Kernel Machines, Visualizing cluster Analysis andFinite Mixture Models, Visualizing Contingency Tables, Mosaic Plots and Their Variants,ParallelCoordinates:Visualization,Exploration,andClassificationofHigh-DimensionalData,Matrix Visualization,VisualizationinBayesianDataAnalysis.

Applications: Exploratory Graphics of a Financial Dataset, Visualizing Functional Data withanApplication,eBay'sOnlineAuctions,VisualizationforGeneticNetworkReconstruction

List ofCourseSeminarTopics:

1.BringdatatolifewithSVG,CanvasandHTML.2.Progressive<svg>pie,donut,barandlinecharts
3.A visualization grammar.4.matplotlib: plotting with Python5.PYthonsvgGrAphplottingLibrary
6.Ageneralpurpose,real-timevisualizationlibrary.7.Anobject-orientedAPIforbusinessanalytics
8.Airpollutionvisualizationandforecastingplatformbasedon SpringCloud(
9.AtimevisualizationofkeywordsinTwitterwithPythonandtweepy,json,panda,andvincentlibraries
10. Agriculture_Commodities_Prices_Seasons

ListofCourseGroupDiscussionTopics:

1.scanpy
2.Tools to Design or Visualize Architecture of Neural Network3.Plexus-InteractiveEmotionVisualizationbasedonSocialMedia4.Pre-builtGrafanaXXL
5.Singlecellinteractiveplottingtools6. Interactivewordcloud
7.Encoding Data with Marks and Channels8.RenderingMarksandChannelswithD3.jsand SVG9.IntroductiontoD3Scales
10.onlinedatavisualization

ListofHomeAssignments:

Design:

1. AprogramforvisualisingdatafromaWhatAppchat.
2. RepositoryforthetidyNanopackagetoanalyzeandvisualizeNanoSight/NTAdata.3.Wrangling,Exploring,Analyzing,andVisualizingData
4. Visualizingdiscreteandcontinuousdataforknowngroups
5. GUI for displayingBinarySearchTreeswritteninC++usingtheQtLibrary.

Case Study:

1. Hubfordatavisualization&webcontentsusing JavaScriptdifferentchartlibrary2.Plexus - InteractiveEmotionVisualizationbasedonSocialMedia
3. UsefulformakingplotsfromMEICA
4. Interactivecounty-levelmappingprojectfor UnitedStates
5. AcollectionofReactcomponentsforbuilding interactivedatavisualizations

Blog

1. Retrieving,Processing,andVisualizingDatawithPython
2. MetaOmGraph:a workbenchforinteractiveexploratory data analysisof largeexpressiondatasets
3. Map-of-emergency-incidents
4. AsmalldatavisualizationforAssemblyElectionresultsinvariousIndianstates5.GD D Visualization

Surveys

1. isualiser foranalysingMachineLearning&featureengineering
2. googleMe3.Visualizin gsurveydata
4. VisualizingRealTimedata5. VisualisingBigdata

SuggestanassessmentScheme:

SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentandcheckifitcovers allaspectsofBloomsTaxonomy.

MSE ESE GD SEMINAR HA VIVA LAB

Text Books:(AsperIEEEformat)

1. DataVisualizationwithPython:Createanimpactwithmeaningfuldatainsightsusinginteractiveand engagingvisuals,February2019,byMario Dobler,Packt Publishing

2. MasteringPythonDataVisualizationPaperback,October2015byKirthiRaman,PacktPublishing

ReferenceBooks:(AsperIEEEformat)

1. DataVisualization–APracticalIntroductionPaperback–Import,4Jan2019byKieranHealyChen,
2. Handbookofdatavisualization.SpringerScience&BusinessMedia.byChun-houh,WolfgangKarlHärdle,andAntonyUnwin,eds.

MoocsLinksandadditionalreadingmaterial:
www.nptelvideos.in

CourseOutcomes:
1. Designandcreatedatavisualizations.
2. Performexploratorydataanalysisusingvisualization.
3. Evaluatevisualizationdesignalternatives.
4. Designandevaluatecolorpalettesforvisualization
5. Applydatatransformationssuchasaggregationandfilteringforvisualization.
6. Developavisualizationintensiveproject.

COattainmentlevels
Co1-2
Co2-3
Co3-4
Co4-3
Co5-4
Co6-4

FutureCoursesMapping:
Mentionothercoursesthat canbetakenaftercompletionofthiscourse
MS in data analytics and visualization

JobMapping:
WhataretheJob opportunitiesthat onecanget afterlearningthiscourse
Data visualization application developer, power BI developer-data visualization, data visualization engineer, data visualization engineer, data visualization expert, data analytics specialist-visualization, software development engineer-data visualization, data visualization designer, senior analyst-visualization

AI4007: INFORMATION RETRIEVAL

CoursePrerequisites:

Datastructures,basicprogramming,basicprobabilityandstatistics

CourseObjectives:

1. Tostudybasicprinciplesandalgorithmsusedforinformationretrieval
2. Toanalyseretrievalmodelsandtheirretrievalfeedbackwithrespecttowebinformationmanagement
3. ToanalyseeffectivenessofgivenIRsystemby applyingvariousevaluation methods
4. Toapply indexingtechniquesand studytheireffectonperformanceofIRsystem
5. Tounderstandwebsearchingtechniquesandarchitectures

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

Course Relevance: This course provides an overviewof theimportant techniques with respectto the information retrieval system implementation. It emphasizes on the theory related to websearchengines.Evaluationandindexingtechniquesalsogiveinsightsintoissueswrtperformance. This course is very relevant for the advanced study or research in the related fieldssuchas naturallanguageprocessing(NLP).

SECTION-I
Topicsand Contents **InformationRetrievalIntroductionandModels:**Introduction,AFormalDocumentRepresentation,ComponentsofaSearchEngine,CharacterizationofIRModels,Pre-processing, Porter'sStemmingAlgorithm, termweightingtechniques,Zipf'slaw,Heap'slaw **RetrievalModels:**Overview ofRetrievalModels oBooleanRetrieval,TheVectorSpaceModel,ProbabilisticModels,LatentSemanticIndexing,BayesianModel,InformationRetrieval as Classification, Relevance Models and Pseudo-Relevance, Feedback, ComplexQueries and Combining Evidence, Introduction to Lucene, Machine Learning and InformationRetrieval,LearningtoRank

EvaluatingSearchEngines: Testcollections,Querylogs,EffectivenessMetrics,RecallandPrecision,Averagingandinterpolation,Focusingonthetopdocuments

Indexes:,FastInversion(FAST-INV)Algorithm,SignatureFiles,Partitioning,Tries,SuffixTreesandSuffixArrays,PATTree,DistributedIndexing,Index Compression

SECTION-II

Topicsand Contents

QueriesandInterfaces: InformationNeedsandQueries,QueryProcessing,Structuredqueries,QueryTransformationandrefinement,StoppingandStemmingRevisited,SpellCheckingandQuerySuggestions,QueryExpansion,RelevanceFeedback,ContextandPersonalization, Displaying the Results, Result Pages and Snippets, Clustering the Results,Translation,User Behavior Analysis.

Ranking: Query Likelihood Ranking, Inverted Indexes, Document-at-a-time evaluation, Term-at-a-timeevaluation,Optimizationtechniques,Caching,TheBM25RankingAlgorithm

AcquiringData:CrawlingtheWeb,DocumentFeeds,DocumentConversion,DocumentStorage,DetectingDuplicates,NoiseDetectionandRemoval

Processing Text: Text Statistics, Document Parsing, Document Structure, Link extraction,Feature and Named Entity Extraction, Social Search, BeyondBagofWords,PageRankAlgorithm,HilltopAlgorithm

List ofCourseSeminarTopics:

1. ParallelIR
2. DistributedIR
3. AGenericMultimediaIndexing(GEMINI)
4. Automatic imageannotationandretrieval
5. Audioretrievalalgorithms
6. Multimediasearchengine
7. Semanticsearchengine
8. Textsummarization
9. Cross-lingualsearchengine
10. SearchEngineSpamming

ListofCourseGroupDiscussionTopics:

1. QueryingStructuredandunstructuredData
2. Relevanceranking
3. Similarityofdocumentsmetric: whichoneto choose
4. Measuresoftheeffectivenessofan informationretrievalsystem
5. Similarity-basedretrievaltechniques
6. Linkanalysistechniques
7. Crawlingandnear-duplicatepages
8. Personalizedsearch
9. Collaborativefilteringapproaches
10. XMLindexingandsearch

ListofHomeAssignments:

Design:

1. Design a "person search engine". The search engine should automatically crawl and buildtextual representations of people that can be queried against. Example queries might includespecific names (e.g., "george bush"), job descriptions (e.g., "car company ceos"), facts aboutthe person(e.g.,"highestpaidfemalemusician"),etc.

2. Designasearchenginethatadaptstoimplicituserfeedback. Thisrequiresdevelopingauserinterfacethattracksvarioususerbehaviouralsignals(e.g.,clicks,dwell times,mousemovement, etc.) and uses that information to improve the quality of the ranking function overtime asmoreandmoreinformationbecomes available.

3. Designanalgorithmthatwillautomaticallysummarize,eachhour,themostwidelydiscussed topics on Twitter. The summary should be short (e.g., tweet-length) and provide anadequate summaryofthetopic.

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

5. Design a cross-lingual search engine. For example, use Wikipedia as a source of parallelcorpora.

Case Study:

1. Lucene
2. PatternMatchingtechniques
3. LatentSemanticIndexing

4. Learning-basedrankingalgorithms
5. Classicalevaluationmetrics

Blog

1. IndexcreationforIRsystem:InvertedFiles
2. IndexcreationforIRsystem:SignatureFiles
3. IndexcreationforIRsystem:SuffixTreesandSuffixArrays
4. Developmentofsemanticsearchenginetodealwithpolysemy,synonymyissuesoftextdocuments
5. Developmentoftextsearchengine

Surveys

1. Crawlingandnear-duplicatepages
2. Content-based filtering
3. Unifiedfiltering
4. Topicdetectionandtracking
5. Crosslanguage informationretrieval

SuggestanassessmentScheme:
SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentandcheckifitcovers allaspectsofBloomsTaxonomy.

MSE,ESE,GD,Seminar,HA

Text Books:(AsperIEEEformat)

1."*ModernInformationRetrievalTheConceptsandTechnologybehindSearch",RicardoBaeza-Yates,BerthierRibeiro-Neto,PearsonEducation:NewDelhi,2007*

2. "IntroductiontoInformationRetrieval",ChristopherD.Manning,PrabhakarRaghavanandHinrichSchütze,CambridgeUniversityPress,2012

ReferenceBooks:(AsperIEEEformat)

1."*Information Storage and Retrieval Systems Theory and Implementation", Gerald Kowalski,Mark Maybury,SpringerPvt.Ltd.,2006*
2. "InformationRetrievalDataStructures&Algorithms"WilliamFrakes,RicardoBaeza-Yates,PearsonEducation,2008

3.*"InformationRetrieval",C.J.VanRijsbergen,InformationRetrievalGroup,UniversityofGlasgow,onlineat http://www.dcs.gla.ac.uk/Keith/Preface.html*

MoocsLinksandadditionalreadingmaterial:
www.nptelvideos.in

CourseOutcomes:
1. Explainbasicprinciplesofinformationretrievalsystems
2. Describevarious informationretrievalsystemarchitecturesandmodels
3. Validateretrievalperformanceofan informationretrievalsystem
4. Constructvariousindexesusingsuitabletechniques
5. Understandhowqueriesareprocessed
6. Learntoolsandtechniquesusefulincutting-edgeresearchintheareaofinformationretrieval

COattainmentlevels
Co1-1
Co2-2
Co3-3
Co4-4
Co5-3
Co6-4

FutureCoursesMapping:
AdvancedIR

JobMapping:
Sr. Software Engineer, Data Engineer, Data Analyst / Statistical Analyst, Search Lead, Data(orMachineLearning)Scientist

AI4008: AUGMENTED REALITY AND VIRTUALREALITY

CoursePrerequisites:

ComputerGraphics

CourseObjectives:

1. LearningdifferentcomponentsofAugmentedandVirtualRealitySystems
2. UnderstandingVRmodeldevelopment
3. UnderstandingARmodeldevelopment
4. IntegratingdifferentsensorswithAR/VRsystems
5. UnderstandingdifferentapplicationsofAR-VR

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

CourseRelevance: Thissubjectisimportantinalldomainstoimplementsimulationorprototypeofdifferentsystems.

SECTION-I
Topicsand Contents 3D User Interface:Input device characteristics, Desktop input devices, Tracking Devices, 3DMice, Special Purpose Input Devices,Direct Human Input, Home-Brewed Input Devices,ChoosingInputDevices for 3DInterfaces. SoftwareTechnologies:Database-WorldSpace,WorldCoordinate,WorldEnvironment,Objects-Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and otherattributes, Virtual Reality, VR Environment-VR Database, Tessellated Data, LODs, Cullersand Occluders, Lights and Cameras, Scripts, Interaction-Simple, Feedback, Graphical UserInterface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions,World AuthoringandPlayback,VRtoolkits,Available software in the market
SECTION-II

TopicsandContents

AugmentedandMixed Reality, Taxonomy,technologyand featuresofaugmentedreality,difference between AR and VR, Challenges with AR, AR systems and functionality, Augmentedrealitymethods,visualizationtechniquesforaugmentedreality,wirelessdisplaysineducational augmented reality applications, mobile projection interfaces, marker-less trackingforaugmentedreality,enhancing interactivityinARenvironments,evaluatingARsystems.

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.Ensure360degreeassessmentand checkifitcovers allaspectsofBloomsTaxonomy.
HA Seminar GD MSE ESE LAB VIVA

Text Books:(AsperIEEEformat)

1. AlanBCraig,WilliamRShermanandJeffreyDWill,DevelopingVirtualRealityApplications:Foundations ofEffective 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

COattainmentlevels
Co1-1
Co2-2
Co3-3
Co4-3
Co5-4
Co6-4

FutureCoursesMapping:
3D modelling

JobMapping:
WhataretheJob opportunitiesthat onecan getafterlearningthiscourseGame developers,graphicsdesigner,Game architect,

AI4009: INTERNET OF THINGS

CoursePrerequisites:

ComputerNetworks,ComputerProgramming

Course Objectives:

1. UnderstandtheIOTTerminologyandTechnology
2. DescribeintelligentIOTsystems.
3. AnalyzeProtocolstandardizationfor IOT
4. PerformananalysisofIOT securityissuesusingAItechnology.
5. IdentifytheroleofcloudcomputinginIOT.

Credits:4 **TeachingSchemeTheory:3**Hours/Week

Lab:2 Hours/Week

Course Relevance: IoT or Internet of Things is primarily a full system of all the interconnectedcomputing devices, having all the mechanical and digital machines.The Internet of Thingsisgettingsmarter.Companiesareincorporatingartificialintelligenceinparticular,machinelearning into their IoT applications. Vendors of IoT platforms—Amazon, GE, IBM, Microsoft,Oracle,PTC, and Sales force are integrating AI capabilities IoT is beneficial because itmakesour workeasy and is very less time-consuming.IoT has got a lot more scope in terms of makingacareerandevenexploringmoreopportunitiesifstartingup withtheirownbusiness.

SECTION-I

Topicsand Contents

Introduction to Internet of Things – Definition & Characteristics, Importance of IoT, PhysicalDesign of IOT, Logical Design of IOT, IOT Enabling technologies, IOT Levels & DeploymentTemplates, IoT and M2M, The role of Artificial Intelligence in IOT, Introduction to AIOT,Applications ofArtificialIntelligenceinInternetofThings:CollaborativeRobots,DigitalTwins,Drones,SmartRetailing,SmartCities,SmartHealth,etc.

AI and the Internet of Thing: Real World Use-Cases: Automated vacuum cleaners, like that ofthe iRobotRoomba,Smartthermostatsolutions,like thatofNestLabs

Design Methodology – Purpose & Requirements Specification, Process Specification, DomainModelSpecification,InformationmodelSpecification,Servicespecification,IOTlevelSpecifications,FunctionalView Specifications, OperationalView Specification,device andcomponentintegration,applicationdevelopment,EmbeddedsuiteforIoTPhysicaldevice–

Arduino/RaspberryPiInterfaces

SECTION-II

Topicsand Contents

ConnectivityTechnologiesandCommunicationProtocolsinIOT:RFID:Introduction,PrincipleofRFID,Components ofanRFIDsystem,RFIDProtocols&NFC protocols,Wireless SensorNetworks:WSNArchitecture,thenode,connectingnodes,NetworkingNodes,SecuringCommunicationWSNspecificIoTapplications,**ProtocolsinIOT:**CoAP,XMPP,AMQP,MQTT, **Internetofthings Challenges:**VulnerabilitiesofIoT,Security,Privacy& Trustfor IoT,Security requirements Threat analysis, Use cases and misuse cases, Introduction to cloudcomputing,RoleofCloudComputinginIoT,Cloud-to-DeviceConnectivity,Clouddatamanagement,clouddatamonitoring,ClouddataExchange,ENHANCINGRISKMANAGEMENTbypairingIoTwithAI

List ofCourseSeminarTopics:

1. Self-drivingvehicles
2. Securityand accessdevices
3. AI-poweredIoT
4. RoleofAIandIOTinHealthandMedicine
5. RPioperatingsystemfeaturesoverArduino
6. Arduinoarchitectureanditsinterfacingtechniques
7. IPv6technologies fortheIoT.
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

ResourceManagementInTheInternet OfThings

ListofHomeAssignments:

Design:

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

Case Study:

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

Text Books:(AsperIEEEformat)

1.ArshdeepBahga,VijayMadisetti,"Internetof Things–Ahands-onapproach",UniversitiesPress,2015
2 Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies forSmart Environments and Integrated Ecosystems", River Publishers, ISBN-10: 87929827353JanHoller,VlasiosTsiatsis,CatherineMulligan,StefanAvesand,StamatisKarnous kos,
DavidBoyle,"FromMachine-to-MachinetotheInternetofThings:Introductionto aNewAgeofIntelligence",1stEdition,AcademicPress,2014.
4FrancisdaCosta,"RethinkingtheInternetofThings:AScalableApproachtoConnectingEverything", 1stEdition,ApressPublications,2013

ReferenceBooks:(AsperIEEEformat)

1. Pethuru Raj, Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms,and Use Cases, CRC Press Taylor & Francis Group, International Standard Book Number-13:978-1-4987-6128-4
2. Rajkumar Buyya, Amir Vahid Dastjerdi Internet of Things – Principals and Paradigms,Morgan Kaufmann is an imprint of Elsevier, ISBN: 978-0-12-805395-9 HakimaChaouchi, "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. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things",.Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13:978-0989973700.

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

CourseOutcomes:
Upon thecompletion ofthecourse,student willbeableto
1. Designanapplicationbased onIOTTerminologyandTechnology
2. DifferentiatetheroleofAIinIOTintermsofAIOT.
3. Implementtheconnectivitytechnologiesandprotocols inIOT
4. Produceasolutionfor IOTsecuritychallengesusingtheconceptofAI.
5. ApplyCloudtechnologyconcepts for developingIOTbasedprototype
6. Performprogramminganddataanalysistobuildandtestacompleteworking IntelligenceIoTsys tem.

COattainmentlevels
Co1-
2Co2-
1Co3-
3Co4-
4Co5-
4Co6-
5

FutureCoursesMapping:

KnowledgeofIOTcanbeappliedforthe developmentofapplications basedonAIorML

JobMapping:
1. IOTdeveloper
2. IOTEmbeddedsoftwaredeveloper
3. Cloud Engineer
4. NetworkEngineer
5. Agriculture(E-Market,LivestockTraceability,AgricultureDronesetc)
6. WarehouseManagers
7. SmartPathology
8. Canlaunchstartupbusiness

AI4010: PREDICTIVE ANALYTICS

CoursePrerequisites:

Descriptive statistics, Probability Distribution, Hypothesistesting

CourseObjectives:

1. To learn, how to develop models to predict categorical and continuous outcomes.
2. Usage of techniques such as neural networks, decision trees, logistic regression, support vectormachines and Bayesian network models.
3. To know the use of the binary classifier and numeric predictor nodes.
4. To get familiarity on automation of modelselection.
5. To advice on when and how to use each model.
6. To learn how to combine two or moremodels to improve prediction performance.

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

CourseRelevance:

Thiscourseiswidelyapplicableto all types ofindustriesfor improving productivityandquality.

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 on various kinds of data, Applications of Data Mining, Challenges of Data Mining. Data Understanding and Preparation Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables,Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.

SECTION-II

Topicsand Contents

Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminantanalysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression,Association rules.

Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, MetaLevel Modeling, Deploying Model, Assessing Model Performance, Updating a Model.

List ofCourseSeminarTopics:

1. Handling missing values
2. Handling outliers in data.
3. Principle Component Analysis.
4. Cross Validation.
5. Variable Importance.
6. Dealing with Nominal Predictors
7. Sampling Techniques.
8. Confusion Matrix
9. Predictive inference
10. Time series forcasting

ListofCourseGroupDiscussionTopics:

1. Bias Variance Tradeoff
2. Explain vs Predict
3. Classification vs Regression
4. Single model vs Ensemble model
5. Supervised vs Unsupervised approaches.
6. Accuracy vs explainability
7. Performance evaluation of classifier vs Performance evaluation of Regressor
8. Auto-regressive and moving average models.
9. Additive & Multiplicative models.
10. SEMMA (SAS) and CRISP (IBM)

ListofHomeAssignments:

Design:

1. Design a classifier for real world application.
2. Design a regression model for real world application.
3. Design s voting-based ensemble model for real world application.
4. Design a time series forecasting model.
5. Design s stacked ensemble model for real world application.

Case Study:

1. Writeacasestudyongoalprogrammingforan ITstartupcompany using predictive analytics tools.
2. Casestudyonprojectcrashingofasoftwaredevelopmentcompany using predictive maintenance tools.
3. Writeacasestudyon efficient projectmanagement by utilizing predictive maintenance tools.
4. Writeacasestudytoimproveasale of a manufacturing company using predictive analytics.
5. Writeacasestudyonclassificationofinventory.

Blog

1. Write a blog on data summaries.
2. Write a blog on data visualization.
3. Write a blog on data preprocessing.
4. Write a blog on model evaluation and comparison of models.
5. Write a blog on dimensionality reduction techniques.

Surveys:

1. Takethe surveyofapplicationsofpredictive analytics in banking sector.
2. Takethesurveyofdifferentmodel deployment techniques.
3. Takesurveyinventoryclassificationmodels using datamining techniques.
4. Takethe surveyofoptimizationtechniquesindatascience.
5. Take a survey on time series forecasting.

SuggestanassessmentScheme:

SuggestanAssessmentschemethatisbestsuitedforthecourse.Ensure360degreeassessmentandcheckifitcovers allaspects ofBloomsTaxonomy.

MSE ESE PPT GD VIVA HA

Text Books:(AsperIEEEformat)

1. *"An Introduction to Statistical Learning: with Applications in R" by James, Witten, Hastie and Tibshirani, Springer, 1st. Edition, 2013.*
2. *Regression Modeling with Actuarial and Financial Applications, Edward W. Frees, 2010, New York: Cambridge. ISBN: 978-0521135962.*
3. *E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010*

ReferenceBooks:(AsperIEEEformat)

1. *ASM Study Manual for SRM- Statistics for Risk Modeling | 2nd Edition, Weishaus | ASM. ISBN: 978-1-64756-065-2*
2. *Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, 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. Understand the process of formulating business objectives
2. Study data selection/collection, preparation and process.
3. To successfully design, build, evaluate and implement predictive models for a various business application.
4. Compare the underlying predictive modeling techniques.
5. Select appropriate predictive modeling approaches to identify cases to progress with.
6. Apply predictive modeling approaches using a suitable packages.

COattainmentlevels
CO1-3
CO2- 3
CO3-4
CO4-4
CO5-5
CO6-5

FutureCoursesMapping:

MS in Data Science, MS in Machine Learning

JobMapping:

ResearchAnalyst,Projectmanager, Data Scientist

AI4011: DATA MANAGEMENT, PROTECTION AND GOVERNANCE

Course Prerequisites:

Database Management System, Operating System

Course Objectives:

To facilitate the learner to –

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

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

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

SECTION-I

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

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

Data Threats and Data center security: - Type of Threats: Denial of Service (DoS), man in the middle attacks, Unintentional data loss,Repudiation,Malicious attacks to steal data; Introduction to Ransomware; Understanding, Identification and Threat modelling tools ;Security: Authorization and authentication - access control, Transport Layer. Security (TLS), key management, security in cloud, Design and architecture considerations forsecurity

SECTION-II

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

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

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

List of Home Assignments:

Design:

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

5. Design data management for any Multi-Tiered application.

Case Study:

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

Blog:

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

Surveys:

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

Suggest an assessment Scheme:

MSE, ESE, HA

Text Books: (As per IEEE format)

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

Reference Books: (As per IEEE format)

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

Web References:

1. https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html
2. https://searchstorage.techtarget.com/definition/data-life-cycle-management
3. https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
4. https://www.bmc.com/blogs/data-lifecycle-management/
5. https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/
6. https://medium.com/jagoanhosting/what-is-data-lifecycle-management-and-what-phaseswould- it-pass-through-94dbd207ff54
7. https://www.spirion.com/data-lifecycle-management/
8. https://www.bloomberg.com/professional/blog/7-phases-of-a-data-life-cycle/
9. https://www.datacore.com/storage-virtualization/
10. https://www.veritas.com/content/dam/Veritas/docs/solutionoverviews/
11. V0907_SB_InfoScale-Software-Defined-Infrastructure.pdf
12. https://www.veritas.com/solution/digital-compliance
13. https://www.veritas.com/solution/data-protection
14. https://www.veritas.com/gdpr

Course Outcome:

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

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

applications and industry standard solutions in data management.

AI4012:REINFORCEMENT LEARNING

Course Prerequisites: Proficiency in Python, Calculus, Linear Algebra, Basic Probability and Statistics, Foundations of Machine Learning

Course Objectives:

1. To pursue basic knowledge of reinforcement learning techniques.
2. To understand foundation Techniques of Deep Reinforcement Learning.
3. To inculcate dynamic programming techniques.
4. To provide a clear and simple account of the key ideas and algorithms of reinforcement learning.
5. To explore how the learning is valuable to achieve goals in the real world.
6. To explore about how Reinforcement learning algorithms perform better and better in more ambiguous, real-life environments while choosing from an arbitrary number of possible actions.

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

Course Relevance: Reinforcement learning (RL) refers to a collection of machine learning techniques which solve sequential decision-making problems using a process of trial-and-error. It is a core area of research in artificial intelligence and machine learning, and today provides one of the most powerful approaches to solving decision problems.

SECTION-1

The Reinforcement Learning Problem: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope
Finite Markov Decision Processes: The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation
Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming
Model-free solution techniques: Temporal difference learning, Monte Carlo Methods, Efficient Exploration and value updating

SECTION-1I

Topics and Contents

Batch Reinforcement Learning: Introduction, Batch Reinforcement Learning Problem, Foundations of Batch RL Algorithms, Batch RL Algorithms, Batch RL in Practice
Learning and Using Model: What is Model, Planning: Monte Carlo Methods, Combining Models and Planning, Sample Complexity, Factored Domains, Exploration, Continuous Domains, Empirical Comparisons, Scaling Up
Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting, and Learning, When the Model Is Wrong, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search

List of Course Seminar Topics:
1. Naive REINFORCE algorithm
2.TD Control methods - SARSA
3.Probability Primer
4.Bellman Optimality
5.Imitation learning
6.Sequential Decision-Making
7.Michael Littman: The Reward Hypothesis
8.multi-agent learning
9.An n-Armed Bandit Problem
10.Q-Learning

List of Course Group Discussion Topics:
1.Human Intelligence versus machine intelligence
2.Security and Privacy in Pervasive Network
3. Security of Smart devices
4.Future of Ubiquitous Computing
5.Online Least-Square Policy Iteration
6. Gradient-Descent Methods
7. Bellman Optimality
8. Reward Shaping
9. Hierarchical RL
10. Atari Reinforcement Learning Agent

List of Home Assignments:
Design:
1. Smart personal health assistant
2. Human activities sensor
3.Intelligent buildings
4. Data storage searching in IOT
5. Protocols in IOT

Case Study:
1. Challenges in age of Ubiquitous computing
2. Ethnography in Ubiquitous computing
3.Cyber Physical System
4.Approaches to Determining Location Ubiquitous computing
5.Q-Learning for Autonomous Taxi Environment

Blog
1. Smart Devices for smart life
2.Mobile affective computing
3. IOT and Cloud Computing
4.Deep Q-Learning for Flappy Bird
5. Q-Learning for any game

Surveys
1.Data Collection for Ubiquitous computing Field
2. Usage of smart devices in daily life style
3.Video Summarization
4.Behaviour Suite for Reinforcement Learning
5.Causal Discovery with Reinforcement Learning

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 PPT GD VIVA HA

Text Books: (As per IEEE format)

1. Ed. John Krumm; Ubiquitous Computing Fundamentals; Chapman & Hall/CRC 2009
2. Richard S. Sutton and Andrew G. Barto, Reinforcement learning: An introduction, Second Edition, MIT Press, 2019

Reference Books: (As per IEEE format)

1. Wiering, Marco, and Martijn Van Otterlo. Reinforcement learning. Adaptation, learning, and optimization 12 (2012)
2. Mohammad S. Obaidat and et al; Pervasive Computing and Networking, Wiley

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

Course Outcomes:
The students should be able to
1) Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning
2) Formalize problems as Markov Decision Processes
3) Understand basic exploration methods and the exploration / exploitation trade-off
4) Understand value functions, as a general-purpose tool for optimal decision-making
5) Implement dynamic programming as an efficient solution approach to a real-world problem
6) Explain various tabular solution methods.