BansilalRamnathAgarwalCharitableTrust's

VishwakarmaInstituteofTechnology

(AnAutonomousInstituteaffiliated toSavitribaiPhulePuneUniversity)

Structure & Syllabus of

B.Tech.

(InformationTechnology)

EffectivefromAcademicYear2022-23

Prepared by: - Board of Studies in Information Technology

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

Signedby

Chairman–BOS　　　　　　　　**Chairman–AcademicBoard**

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

16	IT3209	Software Design and Methodologies	70
17	IT3218	Artificial Intelligence	104
18	IT3213	Engineering Design And Innovation-III	106
19	IT3222	Design and Thinking-VI	107

	Structure	Module VI	
20	IT3207	Web Technology and cloud computing	**108**
21	IT3216	Machine learning and Deep learning	**115**
22	IT3202	System Programming	**122**
23	IT3215	Design and Analysis of Algorithms	**128**
24	IT3214	Engineering Design And Innovation-IV	**130**
25	IT3223	Design and Thinking-VI	**131**
	Module VII	**Structure**	
26	MD4201/MD4206	OE1:Project Management/Financial Management and Costing	**133**
27	IT4210	OE2: Machine Learning	**141**
28	IT4212	OE2:Advanced Communication Engineering	**143**
29	IT4216	OE3 : Data management , Protection and Governance	**147**
30	IT4213	OE3:Deep Learning	**151**
31	IT4214	OE3:Cloud Computing	**155**
32	IT4215	Distributed Computing	**159**
33	IT4218	Network Security	**162**
34	IT4205	Major Project	**164**
	Module VIII	**Structure**	
35	IT4251	Industry Internship	**167**
36	IT4252	International Internship	**169**
37	IT4253	Research Internship	**171**

38	IT4254	Project Internship	172

Institute Vision

"TobegloballyacclaimedInstituteinTechnicalEducationandResearchforholisticSocio-economic development".

Institute Mission

- To ensure that 100% students are employable and employed in Industry, Higher Studies,become Entrepreneurs, Civil / Defense Services / Govt. Jobs and other areas like Sports and Theatre.

- TostrengthenAcademicPracticesintermsofCurriculum,Pedagogy,AssessmentandFacultyCompetence.

- PromoteResearchCultureamongStudentsandFacultythroughProjectsandConsultancy.

- TomakestudentsSociallyResponsibleCitizen.

Department Vision

"Toprovidestudent-centeredstate-of-the-artacademicallyenrichedenvironmentforproductivecareersintheworldofcomputingthroughcreativity andinnovation"

Department Mission

- Topromoteaspiringethicallyconsciousengineersdemonstratingsustainableemployabilityandent repreneurship.

- Toimpartqualityeducationwiththefocusonanalyticalandproblem-solvingskilldevelopment.

- Tofosterinspiredscholarlyenvironmentthroughactivestudent-facultyparticipationinresearchanddevelopmentresultinginnew knowledge-base orinsights.

- Topreparestudents toshouldersocial responsibilitiesby application of theirskillsetforbettermentofsociety.

ProgramEducationObjectives(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.

ListofProgrammeOutcomes[PO]

Graduateswillbeable

PO	POStatement
PO1	**Engineeringknowledge:**Applytheknowledgeofmathematics,science,engineering fundamentals,andanengineeringspecializationtothesolutionofcomplexengineeringproblems.

PO2	**Problemanalysis:**Identify,formulate,reviewresearchliterature,andanalyzecomplexengineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesof mathematics,naturalsciences,andengineeringsciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problemsanddesignsystemcomponentsorprocessesthatmeetthespecifiedneedswithappropriateconsiderationforthepublichealthandsafety,andthecultural,societal,and environmentalconsiderations.
PO4	**Conductinvestigationsofcomplexproblems:**Useresearch-basedknowledge and researchmethodsincludingdesignofexperiments,analysisandinterpretationofdata,andsynthesisoftheinformationtoprovidevalidconclusions.
PO5	**Moderntool usage:**Create, select,andapply appropriatetechniques,resources,andmodernengineeringandITtoolsincludingpredictionand modelingtocomplex engineeringactivitieswithanunderstandingofthelimitations.
PO6	**Theengineerandsociety:**Applyreasoninginformedbythecontextualknowledgeto assess societal,health, safety,legal and cultural issues and the consequent responsibilitiesrelevant totheprofessionalengineeringpractice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineeringsolutionsinsocietalandenvironmentalcontexts,anddemonstratetheknowledge of,andneedforsustainabledevelopment.
PO8	**Ethics:**Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilities andnormsoftheengineeringpractice.
PO9	**Individualandteamwork:**Functioneffectivelyasanindividual,andasamemberor leaderindiverseteams,and inmultidisciplinarysettings.
PO10	**Communication:**Communicateeffectivelyoncomplexengineeringactivitieswiththeengineeringcommunityandwithsocietyatlarge,suchas,beingabletocomprehendand writeeffectivereportsanddesigndocumentation,makeeffectivepresentations,andgiveandreceiveclearinstructions.
PO11	**Projectmanagementandfinance:**Demonstrate knowledge and understanding of theengineeringandmanagementprinciplesandapplythesetoone'sownwork,asa memberandleaderinateam,tomanageprojectsandinmultidisciplinaryenvironments.
PO12	**Life-longlearning:**Recognizetheneedfor,andhavethepreparationandabilityto engageinindependentandlife-longlearninginthebroadestcontextoftechnologicalchange.

PSO	PSOStatement
PSO1	Applyinformationsciencetheory,algorithmicandprogrammingprinciplesforcomprehendingtechnologicaltrade-offinordertodetermineconceptualaspectsofreal worldproblemsininformationtechnology.
PSO2	Analyzeandcreateproblemframesinordertoformulatedecompositionstructureof informationtechnologyproblemwithcorrectresources,infrastructureandtechnologyrequirementsdeterminationforsolutionrealization.
PSO3	Composetechnicaldesignspecificationsusingtemplatebasedapproachesforformallyexpressingthesolutionimplementationbyapplyingtechniquesandmethodstocreate, enhance, anddeliver ITtoolswithappropriateCASEtoolsselection.
PSO4	Exerciseresearchanddevelopmentaptitudefocusingknowledgecreationanddissemination through engineering artifacts construction, preparation and presentation ofengineeringevidencesusingprocedures,techniques,guidelines,andstandards consideringtechnologymigrationandevolution.

B.Tech.InformationTechnologyStructure

(Applicablew.e.f.AY22-23)SYITModule-III

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme								Total	Credits
						CA			MSA	ESA					
			Theory	Lab	Tut	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	IT2253	Engineering Design & Innovation – I	-	2	-	-	-	-	30			70	-	100	6
S6	IT2269	Design Thinking- III	-	-	1	-	-	-	-			-	-		1
		Total													23

SYITModule-IV

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme								Total	Credits
						CA			MSA	ESA					
			Theory	Lab	Tut	Lab	Seminar	GD		CP	HA	ESE	CVV		
S1	IT2265	Advanced Data Structure	2	2	1	40				20	-	20	20	100	4

S2	IT2202	Discrete Structure and Automata Theory	2	2	1		20				20	20	20	20	100	4
S3	IT2266	Computer Network	2	2	1			20			20	20	20	20	100	4
S4	IT2201	Computer Organization and Architure	2	2	1		20				20	20	20	20	100	4
S5	IT2254	Engineering Design & Innovation – II	-	2	-	-	-	-	30			70	-		100	6
S6	IT2268	Design Thinking- III	-	-	1	-	-	-	-			-	-			1
		Total													23

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MD2201: DATA SCIENCE

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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

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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

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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., Williams H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt.

Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.

7. Dalton Patrik, SQL Server – Black Book, DreamTech Press.

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

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

Moocs Links and additional reading material:

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

https://onlinecourses.nptel.ac.in/noc21_cs04/preview

https://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

FFNo.:654

IT2265: 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.

IT2202: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

IT2266: COMPUTER NETWORK

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

Course Objectives:

1. Understand the importance of Computer Network and its usage.

2. Study error control and flow control techniques.

3. Solve real-world problems in the context of today's internet (TCP/IP and UDP/IP).

4. Distinguish and relate various physical Medias, interfacing standards and adapters.

5. Implement mathematically and logically the working of computer protocols in abstract.

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

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance:

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

Section 1

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

Physical Layer:Transmission media- Guided media, unguided media. Transmission Modes- Simplex, Half-Duplex and Full-Duplex. Network Devices- Hub, Repeater, Bridge, Switch, Router,

Gateways and Brouter. Spread spectrum signal, FHSS, DSSS.

Data Link Layer:Logical Link Layer- Services to Network Layer, Framing, Error Control and FlowControl. Framing in LLC- framing challenges, types of framing. Error Control in LLC- error

detection, error correction, Parity Bits, Hamming Codes (11/12-bits) and CRC. Flow Control

Protocols- Unrestricted Simplex, Stop and Wait, Sliding Window Protocol. WAN Connectivity- PPPand HDLC.

Medium Access Control: Channel Allocation-Static and Dynamic, Multiple Access Protocols- Pureand Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, CSMA/CD.

Section 2

Network Layer: Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting,

NAT, CIDR, ICMP, Routing Protocols- Distance Vector, Link State, Path Vector, Routing inInternet- RIP,OSPF, BGP, Congestion control and QoS,

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

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

Network Management Protocol (SNMP).

List of Tutorials: (Any Three)

1. Identification of various networks components

2. Establishing LAN

3. Installation of network device drivers

4. Use/installation of proxy server

5. Configuration of network devices in CISCO packet tracer (Windows/Linux)

6. Implement communication between various network devices using CISCO packet tracer

(Windows/Linux)

7. Network traffic monitoring using Wireshark/Ethereal (Windows/Linux)

List of Practical's: (Any Six)

1. Study and implement various networking commands on terminal.

2. Use Socket programming to create Client and Server to send Hello message.

3. Write a program for error detection and correction for 7/8 bits ASCII codes using HammingCodes or CRC. Demonstrate the packets captured traces using Wireshark Packet AnalyzerTool for peer-to-peermode. (50% students will perform Hamming Code and others willperform CRC)

4. Write a program to simulate Go back N and Selective Repeat Modes of Sliding WindowProtocol in peer-to-peer mode

5. Write a program to find class and type of a given IP address.

6. Write a program to demonstrate subnetting and find the subnet masks.

7. Write a program using TCP socket for wired network for following: a. Say Hello to Eachother (For all students) b. File transfer (For all students) c. Calculator (Arithmetic) (50%students) d. Calculator (Trigonometry) (50% students)

8. Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Videoone file each) between two machines.

9. Write a program to implement: a. Network Routing: Shortest path routing, AODV. b.Analysis of congestion control (TCP and UDP).

10. Write a program to analyse following packet formats captured through Wireshark for

wirednetworks. 1.Ethernet 2. IP 3.TCP 4. UDP

List of Course Projects:

1. Write a program using TCP sockets for wired networks to implement a. Peer to Peer Chat b.Multi User Chat Demonstrate the packets captured traces using Wireshark Packet AnalyzerTool for peer-to-peer mode.

2. Implementation of shortest path protocol

3. Implementation of string encryption and decryption

4. Implementation of character stuffing and destuffing

5. Execution and analysis of Network commands

6. To find out details of network from IP addressing scheme using 'C' code

7. Implement real time Internet route optimization.

8. Implement Broadcast Server System.

9. Implement a real time voting System.

10. Real time packet capture and analysis for malwares in wireless networks.

List of Course Seminar Topics:

1. Asynchronous Transfer Mode

2. Need Of Multiplexing for Signal Modulation

3. TDM with PAM a case study

4. Noise signal

5. Basic Network Protocols

6. Manchester Vs Differential Manchester coding technique

7. Amplitude Shift Keying: Working and Applications

8. Nyquist Sampling Theorem

9. CDMA

10. Line coding Techniques with example

List of Course Group Discussion Topics:

1. TCP/IP Model

2. Mobile IP

3. Congestion Control and QoS

4. Wireless Technology for Short range and long range

5. Application Protocols and its security

6. IP Protocols

7. Data Communication Issues in IP Networks and Solutions to it

8. Congestion control in hybrid networks

9. Issues in Real time Audio and video transmission protocol.

10. IPV6

List of Home Assignments:

Design:

1. Enumerate the challenges in Line coding. Draw the line code for the sequence 010011110using Polar NRZ-L and NRZ-1 schemes.

2. 2.Design the procedure to configure TCP/IP network layer services.

3. Simulation of Routing Protocols using NS2

4. Simulation of FTP based Protocols using CISCO packet Tracer/ NS2

5. Simulation of Congestion Control Protocols Using NS2

Case Study:

1. Amplitude and Frequency Modulation Technique

2. Digital to Analog and Analog to Digital converters

3. Study of Various VPNs

4. IoT Solutions to Current Network Requirement

5. Unix Solutions for Broadcast System

Blog:

1. Communication Protocol

2. Emerging Trends in Computer Networks

3. Use of IOT in Networks

4. Cloud based Network Solutions for real world problems

5. Recent Trends in Computer Security

Surveys:

1. Survey of wireless Technologies

2. Survey of Congestion control methodologies

3. Survey of Bluetooth Technology

4. Survey of Virtual Private Networks

5. Survey of ADHOC Networks

Assessment Scheme:

PPT/GD

HA

ESE

Course Project

CVV

Text Books:

1. James F. Kurose, and Keith W. Ross,'' A Top-Down Approacht,'' 4th edition, Publisher:

Addison-Wesley ISBN: 0-321-49770-8

2. Behrouz A. Forouzan ,"Data Communication and Networking", 4th edition, Tata McGraw Hill

3. Andrew S. Tanenbaum, "Computer Networks" ,5th Edition, Pearson Education

Reference Books:

1. Kurose, Ross,"Computer Networking a Top Down Approach Featuring the Internet‖", Pearson;

6th edition (March 5, 2012), ISBN-10: 0132856204

2. Holger Karl and Andreas Willig,"Protocols and Architectures for Wireless Sensor Network",

Wiley, ISBN: 0-470-09510-5

3. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and

Protocols", Prentice Hall, 2004

Moocs Links and additional reading material:
1. www.nptelvideos.in 2. https://www.my-mooc.com/en/categorie/computer-networking

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

IT2267: 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

Survey:

1. New memory technologies and their potential impact on **architecture**

2. Virtual Memory

3. Simulation of a superscalar processor and analyzing impact of design tradeoffs

4. Cache Consistency Models in Modern Microprocessors

Blog:

1. Super Computer

2. Intel Journey

3. New Arm Interconnect technologies

4. Distributed Systems and Parallel Computing

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.

TYITModule-V

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme								Total	Credits
						CA			MSA	ESA					
			Theory	Lab	Tut	Lab	Seminar	GD		CP	HA	ESE	CVV		
S1	IT3221	Operating System	2	2	1	40	-	-		20	-	20	20	100	4
S2	IT3203	Image Processing and Computer Vision	2	2	1		20	-		20	20	20	20	100	4
S3	IT3209	Software Design and Methodologies	2	2	1	-	-	20		20	20	20	20	100	4
S4	IT3218	Artificial Intelligence	2	2	1	40	-	-		20	-	20	20	100	4
S5	IT3212	Engineering Design & Innovation – III	-	2	-	-	-	-	30			70	-	100	6
S6	IT3222	Design Thinking- V	-	-	1	-	-	-	-			-	-		1
		Total													23

TYITModule-VI

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)	Examination scheme	Total	Credits

			Theory	Lab	Tut	CA			MSA	ESA					
						Lab	Seminar	GD		CP	HA	ESE	CVV		
S1	IT3207	Web Technology and Cloud Computing	2	2	1	-	20	-		20	20	20	20	100	4
S2	IT3216	Machine Learning and Deep learning	2	2	1	-	20	-		20	20	20	20	100	4
S3	IT3202	System Programming	2	2	1	-	-	20		20	20	20	20	100	4
S4	IT3215	Design and Analysis of Algorithms	2	2	1	40	-	-		20	-	20	20	100	4
S5	IT3214	Engineering Design & Innovation – IV	-	2	-	-	-	-	30			70	-	100	6
S6	IT3223	Design Thinking- VI	-	-	1	-	-	-	-			-	-		1
	Total														23

FF No.: 654

IT3221: OPERATING SYSTEM

Course Prerequisites:

1. Basics of Computer System

2. Computer Organization

3. Data Structures

4. Any Programming Language.

Course Objectives:

1. To understand the basic concepts and functions of Operating System.

2. To gain knowledge of process synchronization and its mechanism.

3. To get familiar with CPU scheduling algorithms.

4. To discuss different deadlock handling mechanisms.

5. To learn memory management techniques and virtual memory.

6. To evaluate various disk scheduling algorithms.

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

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance:

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

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 Practicals: (Any Six)

11. Execution of Basic Linux commands.

12. Execution of Advanced Linux commands.

13. Any shell scripting program.

14. Write a program demonstrating use of different system calls.

15. Implement multithreading for Matrix Operations using Pthreads.

16. Implementation of Classical problems using Threads and Mutex.

17. Implementation of Classical problems using Threads and Semaphore.

18. Write a program to compute the finish time, turnaround time and waiting time for the following algorithms:

    First come First serve b) Shortest Job First (Preemptive and Non Preemptive)

    Priority (Preemptive and Non Preemptive) d) Round robin

19. Write a program to check whether given system is in safe state or not using Banker's Deadlock Avoidance algorithm.

20. Write a program to calculate the number of page faults for a reference string for the following page replacement algorithms:

    a. FIFO   b) LRU   c) Optimal

List of Course Projects:

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

    i.   CPU/ Machine Simulation

    ii.   Supervisor Call through interrupt

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

    i.   Paging

  ii. Error Handling

  iii. Interrupt Generation and Servicing

  iv. Process Data Structure

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

  i. Multiprogramming

  ii. Virtual Memory

  iii. Process Scheduling and Synchronization

  iv. Inter-Process Communication

  v. I/O Handling, Spooling and Buffering

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.

IT3203: IMAGE PROCESSING AND COMPUTER VISION

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

Course Objectives:

1. To learn Image Processing fundamentals.

2. To study Image preprocessing methods.

3. To understand image lossless and lossy compression techniques.

4. To introduce the major ideas, methods, and techniques of computer vision and pattern recognition.

5. To acquaint with Image segmentation and shape representation.

6. To explore object recognition and its application

Credits: 5   **Teaching Scheme Theory:** 2 Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

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

SECTION-1

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

SECTION-1I

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

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

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

Applications of Image Processing and Computer Vision.

List of Tutorials: (Any Six)

1) Implement Image preprocessing and Edge detection

2) Image Arithmetic Operations

3) Image quality Enhancement by using following techniques-Logarithmic transformation,   Histogram Equalization,   Gray level slicing with and without background,   Inverse transformation.

4) Image Compression

5) Implement Segmentation methods

6) Implement camera calibration methods

7) Determine depth map from Stereo pair

8) Construct 3D model from defocus image

9) Construct 3D model from Images

10) Implement object detection and tracking from video

11) Face detection and Recognition

12) Object detection from dynamic Background for Surveillance

13) Content based video retrieval

14) Construct 3D model from single image

List of Practicals: (Any Six)

1) A. Write matlab code to display following binary images

    Square, Triangle,Circle

    B. Write MATLAB code to perform following operations on images

    Flip Image along horizontal and vertical direction, Enhance quality of a given image by changing brightness of image, Image negation operation, change contrast of a given

Image.

2) Pseudo coloring operation of a given image using Intensity slicing technique and

    Gray to Colour transform

3) Study of different file formats e.g. BMP, TIFF and extraction of attributes ofBMP.

4) Write C-language code to read and Display BMP image. Perform following operations on the given image 1. Flip Image along horizontal and vertical direction 2. Crop the image 3. Convert gray scale image into Binary image

5) Write matlab code to find following statistical properties of an image- Mean, Median, Variance, Standard deviation, Covariance.

6) Write matlab code to enhance image quality by using following techniques-Low pass and weighted low pass filter, Median filter, Laplacian mask.

7) Write matlab code for edge detection using Sobel, Prewitt and Roberts operators.

8) Write C-language code to find out Huffman code for the following word - COMMITTEE.

9) Write matlab code to design encoder and decoder by using Arithmetic coding for the following word MUMMY. (Probabilities of symbols M-0.4, U-0.2, X-0.3,Y- 0.1).

10) Develop an algorithm for pre-processing of an input image for geometric

transformation of image.

11) Develop an algorithm for pre-processing of an input image for enhancement of image.

12) Develop an algorithm for feature extraction of an input image using point detector

13) Develop an algorithm for segmentation of an input image

14) Develop an algorithm for recognition of an object from input image

15) Develop an algorithm for motion estimation from a given video sequence.

16) Design an algorithm for SVM classifier

17) Design an algorithm for adaboost classifier

18) Line detection using Hough transform

19) To design and develop optical flow algorithm for Motion Estimation

20) Write matlab code to apply second level of DWT decomposition on the given image and display your result.

List of Projects:

1. Lossless and Lossy Compression Techniques

2. Pseudo Colour Image Processing Model

3. Image and Video Enhancement models

4. Human Motion Detection

5. Object Detection Model

6. Face Recognition Model

7. Dynamic Texture Synthesis

8. Image and Video Editing

9. Develop an application for a vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.

10. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Automobile tracking/ face tracking/ human tracking).

11. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Space vehicle tracking/ solar energy tracking/ crowd pattern tracking).

List of Course Seminar Topics:

1. Linear Algebra used for Image Processing
2. Image File format-TIFF
3. Color Model
4. Pseudo Colour Image Processing
5. Image Enhancement-Spatial Domain
6. Image Smoothening
7. Image Enhancement-Frequency Domain
8. Image Sharpening
9. Image Segmentation
10. Watershed Transformation
11. 3-D model
12. Face Detection
13. Object Recognition

List of Course Group Discussion Topics:

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

List of Home Assignments:

Design:

1. Human Motion Detection

2. Object Detection Model

3. Face Recognition Model

4. Dynamic Texture Synthesis

5. Image and Video Editing

6. Design 3-D models

7. Face Detection Models

8. Develop an application for a vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.

9. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Automobile tracking/ face tracking/ human tracking).

10. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Space vehicle tracking/ solar energy tracking/ crowd pattern tracking).

Case Study:

1. Image Processing for Smart City

2. Computer Vision for AR AVR

3. Research Areas in Image Processing & Computer Vision

4. Image Processing for Swastha Bharat

5. Image Processing in IoT

6. Computer Vision in Health Analytics

7. Computer Vision in wearable computing

Blog:

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

Surveys:

1. Steganography and Cryptography

2. Image Processing for Educations

3. Dynamic Texture Synthesis

4. Classifications and Recognitions

5.Image & Video Compression

6.Drone based Surveillance

7.Video Editing

8.Human Motion/Object tracking and detections

9.Image Processing using High-Performance Computing-Computational

10.Complexity/Time Complexity and Execution time

11.Recent Trends in Image and Video Processing

Suggest an assessment Scheme:

1. MSE

2. ESE

3. LAB+Course Project

4. GD

5. PPT

6. VIVA

Text Books: *(As per IEEE format)*

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

2. S. Jayaraman, S Esakkirajan, & T Veerakumar, "Digital Image Processing," Tata McGraw Hill Education, ISBN(13) 9780070144798.

3. Anil K. Jain, "Fundamentals of Digital Image Processing," 5th Edition, PHI publication, ISBN 13: 9780133361650.

4. Richard Szeliski, "Computer Vision: Algorithms and Applications (CVAA)", Springer, 2010.

5. E. R. Davies, "Computer & Machine Vision," 4thEdition, Academic Press, 2012.

6. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

Reference Books: *(As per IEEE format)*

1. Pratt, "Digital Image Processing," Wiley Publication, 3rd Edition, ISBN 0-471-37407-5.

2. K.R. Castleman, "Digital Image Processing," 3rd Edition, Prentice Hall: Upper Saddle River, NJ, 3, ISBN 0-13-211467 -4.

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

4. D. Forsyth and J. Ponce, "Computer Vision - A modern approach," Prentice Hall

5. E. Trucco and A. Verri, "Introductory Techniques for 3D Computer Vision," Publisher: Prentice Hall.

6. D. H. Ballard, C. M. Brown,"Computer Vision", Prentice-Hall, Englewood Cliffs, 1982.

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

Course Outcomes:

The student will be able to-

1. Apply lossless and Lossy compression techniques for image compression.

2. Explore pre-processing algorithms to acquire images

3. Use Wavelet transforms to analyze and modify image

4. Extract features from Images and do analysis of Images

5. Apply Supervised and Unsupervised Machine Learning for Image Classification

6. Make use of Computer Vision algorithms to solve real-world problems.

IT3209: SOFTWARE DESIGN AND METHODOLOGIES

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

Course Objectives:

1. Understanding object-oriented analysis anddesign.

2. Learn different software process models and principles andpractices

3. Practicing UML to model OOsystems

4. Familiarity with current models and standards fordesign.

5. Exposure to organizational issues in softwaredesign.

6. Anabilitytoanalyzeandevaluateproblemsanddrawonthetheoreticalandtechnical knowledge to develop solutions andsystems

Credits: 4

Course Relevance:
Software Architecture

Teaching Scheme

Theory:2 Hours/Week

Lab: 2Hours/Week

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SECTION-
I

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

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

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

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

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

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

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SECTION-II

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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.

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List of Tutorials:(Any Three)

1) Goals of softwareengineering

2) Software process models, life cyclemodels

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3) Process improvement, Capability MaturityModel

4) Unified Modeling Language(UML)

5) Designpatterns

6) Frameworks, software productlines

7) Softwarearchitecture

8) Software measurements andmetrics

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9) Software estimationmethods

10) Static and dynamicanalysis

11) Version control, configurationmanagement

12) Software quality, verification and validation, softwaretesting

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

1. To study modeling methodologies and identify their applicability to various categories of projects2.TounderstandRequirementElicitationTechniquesandrecognizetypesofrequirement   while preparing System RequirementSpecification.

3. TostudyMDD/MDAandidentifytheimportanceofModelTransformation.

4. TostudytypesofMOFandmetamodelconceptsforvariousdiagramsinUML2.0.

5. To identify System Scope, Actors, Use Cases, Use Case structuring for a given problem and perform Use Case narration in template form with normal/alternateflows.

6. ToidentifyEntity,Control,Boundaryobjectsandtraceobjectinteractionsforscenariosfrom use cases.

prepare a state chart diagram for given object scenario.

8. TopreparedetailedActivitydiagramwithnotationalcompliancetoUML2.0indicatingclearuse of pins, fork-join, synchronization,datastores.

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

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

List of Projects:

1. ERPsystem

2. HospitalManagement

3. RailwayReservation

4. Stock marketmanagement

5. Parkingautomation

6. LibraryManagement

7. Onlineshopping

8. Contentmanagement

List of Course **Seminar Topics:**

1. CMMI

2. ProcessModels

3. AgileMethodology

4. Modelling usingUML

5. Analysis and Design in OOsystems

6. RequirementEngineering

7. Principles and Practices of good SoftwareDesign

8. Collaborative softwaredevelopment

9. Componentdiagram

10. Deploymentdiagram

List of Course Group Discussion Topics:

1. Traditional VsAgile

2. Phases of SDLC.Which is moreimportant?

3. UMLmodeling

4. Analysis VsDesign

S. Design Patterns

6. Design VsArchitecture

7. Architecturestyle

8. Design VsFramework

9. Framework VsArchitecture

10. Archetypepatterns

List of Home Assignments:
Design:

1.Requirement Engg steps
2.Analysis modeling 3.design
modeling 4.Architechtura1
styles 5.design patterns

Case Study:

1.Imaging Softwarearchitecture
2.Banking Softwarearchitecture
3.ERP Softwarearchitecture

4.Online Shopping Software architecture
5.AI Software architecture

Blog:

1 Software Engg Do's and Don'ts
2.Which Process Model?

3.Scrum
4.Devops
5.Data ops
Surveys:

1.Software Design
2.Software Methodologies
3.Software Architectures
4.Design Patterns

5.Architechtura1 Patterns

Suggest an assessment Scheme:

MSE PPTPresentation   ESE   GD   Riva   Lab assignments +CourseProject

Text Books:

1. RogerSPressman,"SoftwareEngineering:Apractitioner'sApproach",6thedition.McGraw Hill International Edition,2005

2. Jim Arlow, Ila Neustadt, "UML 2 and the unified process –practical object-oriented analysis and design", Addison Wesley, Second edition, ISBN 978-0201770605.

3. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Second Edition, Pearson ,ISBN 978-81-775-8996-2

Reference Books:

1. Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures", Cambridge University Press, 2011, ISBN 978-0-521-76414-8

2. Gardy Booch, James Rambaugh, Ivar Jacobson, "The unified modeling language user guide" , Pearson Education, Second edition, 2008, ISBN 0-321-24562

3. Ian Sommerville, "Software Engineering", Addison and Wesley, ISBN 0-13-703515-2

Moocs Links and additional reading material:

   www.nptelvideos.in

Course Outcomes:

The student will be able to —

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

 2. Discriminatecompetingandfeasiblesystemrequirementsindicatingcorrectrealworldproblem scopeandpreparestepwisesystemconceptualmodelusingstakeholderanalysisandrequirement validation.

3. FormulatesystemspecificationsbyanalyzingUser-leveltasksandcomposesoftwareartifacts   using agile principles, practices and Scrumframework.

4. Propose and demonstrate realistic solutions supported by well-formed documentation with applicationofagileroles,sprintmanagement,andagilearchitecturefocusingprojectbacklogsand velocitymonitoring.

5. Conform to Configuration Management principles and demonstrate cohesive teamworkskills avoidingclassicmistakesandemphasizingonsoftwaresafetyadheringtorelevantstandards.

6. Analyzethetargetsystempropertiesandrecommendsolutionalternativesbypracticingproject
planning,   scheduling,   estimation   and   risk   managementactivities.

IT3218: ARTIFICIAL INTELLIGENCE

Course Prerequisites:Data structures, Computer programming

Course Objectives:

To make students

1. familiar with basic principles of AI

2. capable of using heuristic searches

3. aware of knowledge based systems

4. able to use fuzzy logic and neural networks

5. Learn various applications domains AI

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

Tut: 1 Hour/Week

Lab: 2 Hours/Week

Course Relevance: This course is highly applied in many scientific and engineering disciplines

SECTION-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	CVV	Practical exam

		written		
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.

IT3207: WEB TECHNOLOGY AND CLOUD COMPUTING

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

Course Objectives:

1. To learn the fundamentals of HTML and CSS.

2. To obtain knowledge of client-side technologies in web development.

3. To acquire skills of server-side technologies in web development.

4. To study fundamental concepts of Cloud Computing.

5. To understand the basics of virtualization in Cloud Computing.

6. To learn security management in Cloud Computing.

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

Tut: 1Hours/Week

Lab: 2 Hours/Week

Course Relevance: Web development is the work involved in developing a <u>website</u> for the <u>Internet</u> or an <u>intranet</u> . Web development can range from developing a simple single <u>static page</u> of plain text to complex web-based internet applications (web apps), <u>electronic businesses</u>, and social network services. Cloud Computing is the on-demand solution for storing and retrieving data globally.cloud computing has become a very integral part of the entire infrastructure of the

IT industry.

SECTION-1

Introduction: Introduction to web technology, Internet and WWW, web site planning and design issues, HTML5: structure of html document, alignment, heading, commenting, formatting tags,list tags, hyperlink tags, image, table tags, frame tags, form tags, CSS(4Hrs)

Client Side Technologies: JavaScript: Overview of JavaScript, Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS, Form validation, DOM: DOM levels, DOM Objects and their

properties and methods, Manipulating DOM,JQuery: Introduction to JQuery, Loading JQuery, Selecting elements, changing styles, creating elements, appending elements, removing elements, handling events.(5Hrs)

Server Side Technologies: Introduction to PHP, features, sample code, PHP syntax, control structures, functions, arrays, string manipulation, form handling, include and require statements, file handling, Error Handling and Reporting, MySQL with PHP (5 Hrs)

SECTION-1I

Cloud Computing: Introduction, Definition, Characteristics, Components, Cloud computing, Cluster computing,Grid computing, Distributed Computing,Cloud Service Models: SaaS, PaaS, IaaS, Cloud providers, benefits and limitations. (4Hrs)

Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to Virtualization ,Different approaches to virtualization, Cloud file-systems: GFS and HDFS, Map-Reduce: Parallel computing, The map-Reduce model, Example/Application of Map-reduce(3Hrs)

Platform as a Service (PaaS): Introduction to PaaS , Service Oriented Architecture (SOA).(2Hrs)

Software as a Service (SaaS) : Introduction to SaaS, Web services, Web 2.0, Web OS(3Hrs)

Cloud Security:Infrastructure Security - Network level security, Host level security, Application-level security. Risk in Cloud computing,cloud security services. (2Hrs)

List of Tutorials: (Any Three)

  1) Learn various HTML tags

  2) Use of CSS tags in web page designing

  3) Understand use of Javascript objects in web page designing

  4) Configuration and Installation of PHP

  5) Web based application development using AJAX framework

  6) Setup and configure cloud environment

  7) Study of IBM cloud

8) Deploy and manage cloud environment

9) Study of performing Data, ML task in cloud

10) Study of cloud security tools

List of Practicals: (Any Six)

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

2) Design a web page to demonstrate the use of different HTML tags and use of inline, internal and external CSS.

3) Design a HTML form for student registration and perform validation using JavaScript.

4) Design a web page demonstrating various effects using jQuery.

5) Write a PHP program to create a simple calculator that can accept two numbers and perform operations like add, subtract, multiplication and divide.

6) Write a PHP Script to perform file handling operations like creating, reading, copying,

moving, deleting, updating and uploading.

7) Design a dynamic web application using PHP and MYSQL as back-end for student data with insert, delete, view and update operation.

8) Implement SaaS application and host it on Cloud Platform.

9) Create an Amazon Virtual Private Cloud (Amazon VPC).

10) Install and configure Google App Engine.

List of Projects:

1. Student Registration System

2. Tours and Travel System

3. Canteen Food Ordering and Management System.

4. Online personal counseling

5. Online recruitment System

6. Farming Assistant Web Service

7. Cloud based Attendance system

8. University campus online automation using Cloud

9. Cloud based student information chatbot

10. E-learning platform using cloud computing

List of Course Seminar Topics:

1. EJB

2. Bootstrap

3. Spring Framework

4. Joomla

5. Progressive Web Apps

6. Servlet

7.Object Oriented PHP

8. Client side technologies

9. Server side technologies

10. Web Technology frameworks

List of Course Group Discussion Topics:

1. Cloud Service Models

2. Cloud computing vs. Cluster computing vs. Grid computing

3. Virtualization

4. Cloud file-systems

5. Cloud data stores

6. Databases on Cloud

7. Map-Reduce model for Cloud

8. Data security and Storage for Cloud

9. Application security for Cloud

10. Commercial and business risk and opportunities in Cloud

List of Home Assignments:

Design:

1. Design, Develop and Deploy social web applications using Bootstrap.

2. Design, Develop and Deploy web applications using CMS.

3. Design, Develop and Deploy web application for department/college

4. Design Local Train ticketing system using Cloud

5. Design online Book-store system using Cloud

Case Study:

1. Secure file storage in Cloud

2. AWS

3. e-Bug tracking in Cloud

4. Rural Banking using Cloud

5. Wordpress

6. Angular JS

Blog:

1. Recent web development trends

2. Databases for web developers

3. Web services

4. Private Vs Public Cloud

5. Storage and Energy efficient Cloud computing

6. Openstack Vs Cloudstack

Surveys:

1. Comparison of web services

2. Frameworks for web development

3. Scripting languages for Web Designing.

4. Public cloud security

5. Cloud based Improved file handling

Suggest an assessment Scheme:

1. Home Assignment

2. ESE

3. CVV

4. Seminar

5. Group Discussion

6. LAB-Course Assignment and Project Evaluation

Text Books: (As per IEEE format)

1. Thomas A. Powell; "Complete reference HTML"; 4th edition, Tata McGraw-Hill Publications

2. Black book; "Web Technologies:HTML,JS,PHP,Java,JSP,ASP.NET,XML and AJAX" ; Dreamtech Press, 2016.

3.Dave Mercer, Allan Ken; "Beginning PHP 5"; Dreamtech Publications.

4. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Cloud Computing for Dummies", Wiley India.

5. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India

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Reference Books: (As per IEEE format)

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5. McGraw Hill, "Cloud Computing", Que Publishing.

 Moocs Links and additional reading material:

1.https://www.w3schools.com

2. https://www.udemy.com

3.https://www.coursera.org

4. https://nptel.ac.in/courses/106106222

5. https://nptel.ac.in/courses/106106156

6.https://onlinecourses.nptel.ac.in/noc20_cs55/preview

7. https://nptel.ac.in/courses/106105167

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

Course Outcomes:

The student will be able to –

1) Design reliable, efficient, scalable front end view of web pages using HTML5, CSS with

Bootstrap framework.

2) Perform client-side web page validation using JavaScript

3) Deliver realistic and extensible lightweight web application using PHP

4) Describe the main concepts, key technologies, strengths, and limitations of cloud computing.

5) Illustrate the architecture and infrastructure of cloud computing including SaaS, PaaS,

IaaS.

6) Understand risk management and security in cloud computing

FFNo.: 654

IT3216: MACHINE LEARNING AND DEEP LEARNING

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

Tut: 1 Hours/Week

Lab: **2** Hours/Week

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

 Course Objectives:

1. Understanding Human learning aspects.

2. Acquaintance with primitives in the learning process by computer.

3. Understanding the nature of problems solved with Machine Learning and Deep Learning.

4. To study different Machine learning algorithms.

5. To study different Deep learning algorithms.

6. To understand the application development process using ML and DL

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

SECTION-I

 Topics and Contents

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

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

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Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.

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

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

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

SECTION-II

Topics and Contents

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

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

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

List of Course Seminar Topics:

1. Validation

2. Naive Bayes Algorithm

3. Machine And Privacy

4. Limitations of ML

5. Ensemble Learning

6. Dimensionality reduction algorithms

7. Comparison of Machine Learning algorithms

8. Feature Extraction In Machine Learning

9. Reinforcement Learning

10. Probabilistic Model

11. Dropout: a simple way to prevent neural networks from overfitting

12. Deep Residual Learning for Image Recognition

13. Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shift

14. Large-Scale Video Classification with Convolutional Neural Networks

15. Generative adversarial nets

16. High-Speed Tracking with Kernelized Correlation Filters

17. Do we need hundreds of classifiers to solve real world classification problems   Scalable Nearest Neighbor Algorithms for High Dimensional Data

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

List of Course Group Discussion Topics:

1. Supervised Vs Unsupervised

2. Univariate Vs Multivariate analysis

3. Accuracy measuring methods

4. Bias Vs Variance Tradeoff

5. Data Reduction Vs Dimensionality reduction

6. Continuos Vs Discrete variables

7. Feature Extraction Vs Automatic Feature detection 8. RNN
Vs LSTM

9. Sentence Classification using Convolutional Neural Networks

10. Dog-breed Classifier

11. Generate TV Scripts

12. Generate Faces

13. Factoid Question Answering

14. Neural Summarization

15. Dialogue Generation with LSTMs

List of Home Assignments:

Design:

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

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

3. Smart Building Energy Management System using Machine Learning

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

5. Video Library Management System using Machine Learning

6. Building a Recurrent Neural Network

7. Character level Dinosaur Name generation

8. Music Generation

9. Operations on Word vectors

10. Neural Machine translation with attention

Case Study:

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

2. Medical Diagnosis: Given the symptoms exhibited in a patient and a database of anonymized patient records, predict whether the patient is likely to have an illness. A model of this decision problem could be used by a program to provide decision support to medical professionals.

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

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

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

6. AlexNet

7. VGG

8. Inception

9. ResNet

10. YOLO

Blog

1.   Focusing Too Much on Algorithms and Theories.

2.   Mastering ALL of ML.

3.   Having Algorithms Become Obs mgolete as Soon as Data Grows.

4.   Getting Bad Predictions to Come Together With Biases.

5.   Making the Wrong Assumptions.

6.   Receiving Bad Recommendations.

7.   Having Bad Data Convert to Bad Results.

8.   Open AI

9. Computer Vision

10.Google Brain

11. Deep Learning and Natural Language Processing

12.Multi-task Learning and Transfer Learning

Surveys

1. Concept learning

2. Reinforcement learning

3. Semi supervised learning

4. Deep learning

5. Transfer learning

6. Deep Neural Networks in Speech and Vision Systems

7. GANs

8. Deep Learning for big data

9. Deep Learning for NLP

Suggest an assessment Scheme:

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

Text Books: *(As per IEEE format)*

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

2. Anup Kumar Srivastava, Soft Computing, Alpha Science International limited. 2009.

3. Deep Learning with Python by François Chollet, Manning Publications Co, ISBN: 9781617294433

4. Deep Learning - A Practical Approach by Rajiv Chopra, Khana Publications, ISBN: 9789386173416

Reference Books: *(As per IEEE format)*

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT press, 2004.

2. Jacek M. Zurada, "Introduction to Artificial neural System", JAICO publishing house,2002,.

3. Deep Learning by Ian Goodfellow and Yoshua Bengio and Aaron CourvillePublished by An MIT Press book.

Course Outcomes:

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

IT3202: SYSTEM PROGRAMMING

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

Course Objectives:

1. To introduce students the concepts and principles of system programming and to enable them to understand the duties and scope of a systemprogrammer.

2. To provide students the knowledge about both theoretical and practical aspects of system programming,teachingthemthemethodsandtechniquesfordesigningandimplementingsystem-levelprograms.

3. To train students in developing skills for writing system software with the aid of sophisticated OS services, programming languages and utilitytools.

4. To train students in developing skills for writing compiler fromscratch

5. To understand encoding-decoding of instruction set for a newmachine.

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

Tut: 1Hours/Week

Lab:2 Hours/Week

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

SECTION-1

Introduction: software types, software hierarchy, components of system software, machine structure, interfaces, address space, levels of system software, recent trends in software development.

Language processors: Programming languages and language processors, fundamentals of language processing, life cycle of a source program, language processing activities, data structures for language processing: search data structures, allocation data structures.

Macroprocessor: Introduction, macro definition and call, macro expansion, nested macro calls, designofmacroprocessor,designissuesofmacroprocessors,two-passmacroprocessors,one-passmacroprocessors.Assembler:Elementsofassemblylanguageprogramming,designofthe

assembler, assembler design criteria, types of assemblers, two-pass assemblers, one-pass assemblers, assembler algorithms, multi-pass assemblers, variants of assemblers design of two pass assembler, machine dependent and machine independent assembler features. Allocation, relocation, linker v/s loader.

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

SECTION-II

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

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

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

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

List of Tutorials: (Any Three)

1) File handlingbasics

2) Debuggingconcepts

3) logic development for implementingassignments

4) Booting process and systemfiles

5) Inbuilt drivers structure ofLinux

6) Study ofLinkers

7) Study ofLoaders

8) DifferentDLL

9) Paging

10) Segmentation

List of Practicals: (Any Six)

1) Design and implementation of ansymbol Table

2) Simulation oflinkers.

3) Simulation ofloaders.

4) Implementation of 2 Pass Assembler

5) Design and implementation of an Editor: Design of a Line or Screen Editor using C Language.

6) Implementation of Macroprocessor

7) Write a TSR program in 8086 ALP to implement Real Time Clock (RTC). Read the Real Time from CMOS chip by suitable INT and FUNCTION and display the RTC at the bottom right corner on the screen. Access the video RAM directly in yourroutine.

8) Write a TSR program in 8086 ALP to implement Screen Saver. Screen Saver should get activatedifthekeyboardisidlefor7seconds.AccessthevideoRAMdirectlyinyourroutine.

9) WriteaTSRprogramin8086ALPtohandlethe"Dividebyzero"interrupt.Testyour

program with a small code, which causes the divide by zero interrupt.

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

List of Projects:

1. DesignMacroprocessor

2. Design One passAssembler

3. Design Two passAssembler

4. Design direct linkingloader

5. Mouse driver forLinux

6. USB driver forLinux

7. Keyboard driver forLinux

8. Implement a Lexical Analyzer using LEX for a subset ofC.

9. Design and implementation of DLL on Linux sharedlibrary

10. Design a device driver on Linuxsystem

List of Course Seminar Topics:

1. Macro processordesign

2. Assemblerdesign

3. machine dependent and machine independent assemblerfeatures

4. linker v/sloader

5. StructuredPrograms

6. MSDOSlinker

7. dynamic linkingloader.

8. dynamic linkinglibraries

9. static and dynamic linker with subroutinelinkages

10. Linux linkingschemes

List of Course Group Discussion Topics:

1. Windows Vs LinuxOS

2. Application Programming Vs SystemProgramming

3. Carrers in Application Programming Vs SystemProgramming

4. API VsABI

5. Single pass Vs multipassstrategy

6. Compiler VsInterpret

List of Home Assignments:

Design:

1. Design and implementation of 2 PassMacroprocessor.

2. Design and implementation of 2 PassAssembler.

3. Simulation of linker &loader.

4. Implement a Lexical Analyzer using LEX for a subset ofC.

5. Design and implementation of DLL on Linux sharedlibrary.

6. Design a device driver on Linuxsystem.

Case Study:

1. Linux OS systemarchitecture

2. Windows OS systemarchitecture

3. Android OS systemarchitecture

4. MAC OS systemarchitecture

5. New trends in linker andloaders

Blog:

1. PASS-IAssembler

2. PASS-IIAssembler

3. Macro expansionAlgorithm

4. Macro DefinitionAlgorithm

5. Machine Language Instruction Generation from Assembly LanguageInstruction

6. Language ProcessorPass

7. Procedure vs Problem OrientedLanguages

8. Macro Expansion and Macrodefinition

9. Linux FileSystem

10. DeviceDrivers

11. Dynamic LinkLibrary

12. BIOS

13. DOS

14. LINKER

15. LOADER

Surveys:

1. Displaydrivers

2. Networkdrivers

3. Printerdrivers

4. New trends in device driversdesign

5. Driveradaptability

Suggest an assessment Scheme:

1. HomeAssignment

2. MSE &ESE

3. Quiz

4. Seminar

5. GroupDiscussion

6. LAB-Course Assignment and ProjectEvaluation

Text Books: *(As per IEEE format)*

1. D M Dhamdhere, "Systems Programming & Operating Systems", Tata McGrawHill

Publications, ISBN – 0074635794

2. John J Donovan, "Systems Programming", ISBN -0070176035

Reference Books: *(As per IEEE format)*

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

Moocs Links and additional reading material:

1.www.nptelvideos.in

Course Outcomes:

The student will be able to –

1. Discriminate among different System software and theirfunctionalities.

2. Design language translators like Macroprocessor andAssembler.

3. Develop approaches and methods for implementing linker andloader.

4. Identify and interpret the different phases of a compiler and theirfunctioning.

5. Design a well-structured system to ensure the syntactic and semanticcorrectness

of aprogram.

6. Interpret the methods and techniques about instructions Encoding and Decoding for implementing system-level programs and Device Drivers.

FF No. : 654

IT3215: DESIGN AND ANALYSIS OF ALGORITHMS

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

Course Objectives:

1. To understand asymptotic notations and apply suitable mathematical techniques to find asymptotic time and space complexities of algorithms.

2. To provide students with foundations to deal with a variety of computational problems using different design strategies.

3. To select appropriate algorithm design strategies to solve real world problems.

4. To understand notions of NP-hardness and NP-completeness and their relationship with the intractability of decision problems.

5. To understand randomized, approximation algorithms for given computational problems.

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

Tut: 1 Hour/Week

Lab:2 Hours/Week

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

SECTION-1

Basic introduction to time and space complexity analysis: Asymptotic notations (Big Oh, small oh, Big

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Omega, Theta notations). Best case, average case, and worst-case time and space complexity of algorithms. Using Recurrence relations and Mathematical Induction to get asymptotic bounds on time complexity. Master's theorem and applications. Proving correctness of algorithms.

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

Greedy strategy: General strategy, Analysis and correctness proof of minimum spanning tree and shortest

path algorithms, fractional knapsack problem, Huffman coding,conflict free scheduling.

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

SECTION-II

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

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

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

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

List of Practical: (Any Six)

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

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

3. Assignment based on Divide and Conquer strategy (e.g. majority element search, finding

    kth rank element in an array)

4. Assignment based on Divide and Conquer strategy (e.g. efficient algorithm for Josephus

    problem using recurrence relations, fast modular exponentiation)

5. Assignment based on Dynamic Programming strategy (e.g. Matrix chain multiplication,

    Longest increasing subsequence)

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

7. Assignment based on Greedy strategy (e.g. Huffman encoding, fractional knapsack problem)

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

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

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

List of Projects:

1. Applications of A* algorithm in gaming

2. Pac-Man game

3. Creation / Solution of Maze (comparing the backtracking-based solution and Dijkstra's algorithm)

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

5. Knight tour algorithms

6. Network flow optimization and maximum matching

7. SUDOKU solver

8. Algorithms for factoring large integers

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

11. Slider puzzle game

List of Course Seminar Topics:

1. Complexity classes

2. Space complexity

3. Divide and Conquer Vs Dynamic Programming

4. Greedy strategy Vs Backtracking strategy

5. Dynamic Programming Vs Greedy

6. Computational Complexity

7. Comparison of P Vs NP problems

8. Compression Techniques

9. Approximation algorithms

10. Pseudorandom number generators

List of Home Assignments:

Design:

1. Divide and Conquer strategy for real world problem solving

2. Dynamic Programming strategy for real world problem solving

3. Problems on Randomized Algorithms

4. Problems on Approximation Algorithms

5. Problems on NP completeness

Case Study:

1. Encoding techniques

2. Network flow optimization algorithms

3. Approximation algorithms for TSP

4. Sorting techniques

5. AKS primality test

Blog:

1. How to decide suitability of Approximation Algorithms

2. When do Randomized Algorithms perform best

3. Applications of Computational Geometry Algorithms

4. Role of number-theoretic algorithms in cryptography

5. Performance analysis of Graph Theoretic Algorithms

Surveys:

1. Primality Testing Algorithms

2. Integer Factoring Algorithms

3. Shortest Path Algorithms

4. Algorithms for finding Minimum Weight Spanning Tree

5. SAT solvers

Suggest an assessment Scheme:

1. Home Assignment

2. MSE & ESE

3. Seminar

4. LAB-Course Assignment and Project Evaluation

Text Books:

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

2. *Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9*

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

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

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Reference Books:

1. *Anany Levitin, "Introduction to the Design & Analysis of Algorithm", Pearson, ISBN 81- 7758-835-4.*

2. *Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244-3.*

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

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

Moocs Links and additional reading material:

1. https://nptel.ac.in

2. https://www.edx.org **Vishwakarma Institute of Technology, Pune**   **Issue 01 : Rev No. 1 : Dt. 01/07**

3. https://www.coursera.org

4. https://www.geeksforgeeks.org

Course Outcome:

The student will be able –

1. To formulate computational problems mathematically.

2. To apply appropriate algorithmic paradigm to design efficient algorithms for computational problems.

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

4. To understand the significance of NP--completeness of some decision problems and its relationship with intractability of the decision problems.

5. To understand significance of randomness, approximability in computation and design randomized and approximation algorithms for suitable problems.

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

Structure Module VII

Course code	Course name	Total number of Contact hours				Credits
		Theory	**Lab**	**Tut**	**Total Hrs**	
MD4201/MD4206	OE1:Project Management/Financial Management and Costing	2	-	-	2	2
IT4210	OE2: Machine Learning					
IT4211	OE2:Natural Language Processing					
IT4212	OE2:Advanced Communication Engineering	2	-	-	2	2
IT4216	OE3 : Data management , Protection and Governance					
IT4213	OE3:Deep Learning					
IT4214	OE3:Cloud Computing	2	-	-	2	2
IT4215	Distributed Computing	2	-	-	2	2
IT4218	Network Security	2	-	-	2	2
IT4205	Major Project	-	20	-	20	10
	Total	**8**	**20**	**-**	**20**	**18**

Structure Module VIII

Subject	BTech Sem1/Sem2 (Internship Module)	Theory	Lab	Tut	Credits
IT4251	Industry Internship	-	40	-	16
OR					

IT4252	International Internship	-	40	-	16
OR					
IT4253	Research Internship	-	40	-	16
OR					
IT4254	Project Internship	-	40	-	16
					Total Credits-16

FF No. : 654

MD4206: FINANCIAL MANAGEMENT AND COSTING

Course Prerequisites:

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

Course Objectives:

Students will be able to:

1. Understand, analyze and interpret financial statements

2. Understand and concept of financial accounting for analysis of financial statements of a business.

3. Develop an ability of decision making about investments.

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

Course Relevance: Basic knowledge of Finance for working in a industry

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<div>

SECTION-1

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

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

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

SECTION-1I

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

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

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

List of Tutorials: (Any Three)

1.Capital financing
2.Working capital finance

3.Preparation of Journal entries, Ledgers 4.Profit
and Loss Account and Balance Sheet 5.Ratio
Analysis

6.Investment decisions
7.Product Costing
9.Service Costing.

10.Process Costing

List of Practicals: (Any Six)

1. Case study on sources of capital and working capital

2. Case study on assessment of working capital

3. Studying and understanding Financial Statements - Profit and Loss

4. Studying and understanding Financial Statements - Balance sheet

5. Studying and understanding various financial ratios used in practice

6. Studying and understanding various financial ratios for decision making

7. Case study on Analysis of published results of an organisation – Manufacturing

8. Case study on Analysis of published results of an organisation – Service industry

9. Prepare a cost sheet to estimate the cost of any product10. Prepare a cost sheet any process

11. Case study on use Marginal Costing to determine Break Even Point and profitability

12. Case study on use Marginal Costing to determine profitability

List of Projects:

1.Budgeting including sources of capital financing 2.Budgeting including sources of working capital finance 3.Preparation of Journal entries, Ledgers

4.Preparation Profit and Loss Account and Balance Sheet
5.Preparation of Balance Sheet

6.Ratio Analysis based on real life data from project on Profit and loss and Balance sheet
7.Compare Analysis of published results of organisations to enable investment decision
8.Apply Product Costing to estimate cost of any process used in practice

9.Apply Service Costing to estimate cost of any process used in practice
10.Apply Process Costing to estimate cost of any process used in practice
11.Apply Standard Costing to estimate cost of any process used in practice
12.Apply Marginal Costing to determine Break Even Point and profitability

List of Course Seminar Topics:
1.Sources of Capital Financing
2.Working Capital Management
3.Profit and Loss Account
4.Balance Sheet

5.Turnover and Ratios
6.Taxation

7.Product Costing
8.Service Costing
9.Process Costing
10.Investment Decisions

List of Course Group Discussion Topics:

 1.Sources of Capital Financing - Bank or Investors.

 2.Working Capital Management - Which is better - Less or More?
 3.Profit and Loss Account

 4.Balance Sheet - Effect on share prices.

 5.Turnover and Ratios - which should be focused on?
 6.Taxation - Fair or Unfair in India

7.Product Costing - does it drive Profits or Markets?
8.Service Costing - Quality or Cost?
  SY-TY-FINAL YEAR INFORMATION TECHNOLOGY AY 2022-23 SYLLABUS
9.Process Costing - Automation or Manual Labour?
10.Investment Decisions - Guts or Statistics?

List of Home Assignments:

Design:

1.   Design a cost estimate for running a Shoe Company.

2.   Design a cost estimate for running a Fabrication Shop.

3.   Design a cost estimate for running an Online Book Company.

4.   Design a cost estimate for running a Grocery Company.

5.   Design a cost estimate for running a Data Science Company.

Case Studies :

1. Ratio Analysis based on real life data from project on Profit and loss and Balance sheet in any one sector Company (KPO/BPO, Manufacturing, Pharma,....

2. Compare Analysis of published results of organisations to enable investment decision
3. Apply Product Costing to estimate cost of any process used in any one sector Company (KPO/BPO, Manufacturing, Pharma,....

4. Apply Service Costing to estimate cost of any process used in any one sector Company (KPO/BPO, Manufacturing, Pharma,....

5. Apply Process Costing to estimate cost of any process used in any one sector Company (KPO/BPO, Manufacturing, Pharma,....

Blog

1. Taxation

2. Product Costing

3. Service Costing

4. Process Costing

5. Investment Decisions

Surveys

1. Interest Rates

2. Domestic Investment Decisions

3. Industrial Investment Decisions

4. Government Schemes

5. Suggestions about taxation.

Text Books:

1. Prasanna Chandra, Financial Management – Theory and Practi
ce, Edition 8, 2011, Tata McGraw Hill Education,

2. B. K. Bhar, Cost Accounting– Methods and Problems, Academi
c Publishers,1980

3. M.Y. Khan and P K Jain, Financial Management: Text, Proble
ms and Cases, Tata McGraw Hill Education

4. Amitabha Mukherjee and Mohammed Hani, Modern Accountancy, Edition 2, 2002, Tata

McGraw Hill Education

Reference Books:

1. Paresh P. Shah, Financial Management, Reprint No. 2 2011, Biztantra, New Delhi,

2. S. N. Maheshwari, Introduction to Accountancy, Edition 11, 2013, Vikas Publishing House

3. M. Y. Khan, P. K. Jain, Management Accounting –Text, Problems, Cases, Edition No.
Tata McGraw Hill Publishers, 2013

Course Outcomes:

1.Understand and analyze financial statements and budgeting, interpret accounting ratios
2.Understand the concepts of Capital Budgeting and Working Capital management
3.Understand the mechanics of financial accounting for preparation of financial statements to
ascertain the performance and financial position of a business

4.Classify, apply different types of costs and overheads to ascertain costs of a product/ process
5.Apply costing methods as per the suitability for various production processes and services.
6.Develop decision making of optimum product mix, profit planning, make or buy decisions

<div align="right">**FF No. : 654**</div>

IT4210: MACHINE LEARNING

Course Objectives:

1. Understanding Human learning aspects.

2. Acquaintance with primitives in the learning process by computer.

3. Understanding the nature of problems solved with Machine Learning.

4. To study different supervised learning algorithms.

5. To study different unsupervised learning algorithms.

6. To understand the application development process using ML

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

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

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

Section 1:
Introduction: What is Machine Learning, Examples of Machine Learning applications in various domains, Introduction to Data Science, Training versus Testing, Positive and Negative Class, Cross-validation.Framework of ML Model development. **Types of Learning**: Supervised, Unsupervised and Semi-Supervised Learning. **Regression and Generalization:**Regression: Linear and Logistic Regressions, Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, Univariate Regression, Multivariate Linear Regression. **Classification:**Binary and Multiclass Classification: Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, KNN, Decision Tree, and Random Forest, Assessing Classification Performance.
Section2:
Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis and Singular Value Decomposition. **Logic Based and AlgebraicModels:**Support Vector Machines (SVM), Distance Based Models: Distance based clustering algorithms - K-means and C-means, Hierarchical clustering, Association rules mining – Apriori Algorithm, Confidence and Support parameters. **Probabilistic Models:** Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods. **Trends in Machine Learning:**Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning. **Introduction to Deep Learning:** The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU

Neurons, reinforcement learning.

Text Books

1. T. Mitchell, ― Machine Learning‖, McGraw-Hill, 1997.

2. Anup Kumar Srivastava, Soft Computing, Alpha Science International limited. 2009.

Reference Books

1. EthemAlpaydin, "Introduction to Machine Learning", MIT press, 2004.

2. Jacek M. Zurada, ―Introduction to Artificial neural System‖, JAICO publishing house,2002.

Course Outcomes:

The student will be able to –

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

IT4212: ADVANCED COMMUNICATION ENGINEERING

Course Prerequisites:

Communication Engineering, Digital Signal Processing, Wireless Communication

Course Objectives:

1. Analyze the path loss and shadowing effects in wireless communication.

2. Understand diversity techniques of communication.

3. Understand wireless channel modelling.

4. Analyze Orthogonal Frequency Division Multiplexing system.

5. Evaluate the performance of Multiple Input Multiple Output systems.

6. Simulate MIMO receivers

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

Course Relevance:

Future generations of cellular communication require higher data rates and a more reliable transmission link. The transmission data rates can be increase by increasing transmission bandwidth and using higher transmitter power. Wireless communication channels suffer from various factors. Fading problem is the major impairment problem. To improve the performance of those fading channels, diversity techniques are used. Advanced Communication Engineering begins with wireless channel modelling. Also it covers Bit Error Rate performance in fading wireless channel. It covers deep fading issues in wireless communication. Also, it covers how to solve fading problems. It also

covers advanced technologies like OFDM (Orthogonal Frequency Division Multiplexing) and MIMO (Multiple Input Multiple Output. An integral part of the course is MATLAB based computer assignments, which are designed to reinforce theoretical concepts.

SECTION-I
Wireless Communication and Diversity Path Loss and Shadowing, Wireless Channel Modelling, Bit Error Rate (BER) performance in Additive White Gaussian Noise (AWGN) communication channel-Analysis, Bit Error Rate (BER) performance in fading wireless channel, Deep fade phenomenon in wireless channels. Diversity in Wireless System Multiple antenna Wireless Systems, optimal receiver combining, Bit Error Rate (BER) performance with diversity, Types of diversity, Deep Fade Analysis with Diversity.
SECTION-II
Orthogonal Frequency Division Multiplexing Multicarrier modulation, Introduction to Orthogonal Frequency Division Multiplexing (OFDM), OFDM system model, IFFT/ FFT Transceiver Model, OFDM -BER and SNR performance, multiuser OFDM.   Multiple Input Multiple Output (MIMO) Technology MIMO System model, MIMO- Zero-Forcing (ZF) and Minimum Mean Square Error (MMSE) Receivers, Singular Value Decomposition (SVD), MIMO channel capacity, Optimal water filling power allocation.
List of Course Seminar Topics: 1. Performance analysis of multiple-input multiple-output singular value decomposition 29 transceivers. 2. Modeling the Indoor MIMO Wireless Channel 3. Channel Modelling for 5G mobile Communication 4. Comparison of Indoor Geolocation methods in DSSS and OFDM Wireless Lan Systems 5. Analysis of MIMO system through Zero Forcing and MMSE detection scheme 6. SVD for Engine design of High Throughput MIMO OFDM system 7. Measured capacity gain using water filling in frequency selective MIMO Channels 8. MIMO channel capacity in Co-channel interference. 9. OFDM Channel estimation using Singular value decomposition 10. Increase in capacity of Multiuser OFDM system
List of Course Group Discussion Topics:

1. Fading Environment

2. Deep Fade Phenomenon in Wireless Communication

3. OFDM versus CDMA

4. Filtered -OFDM & OFDM modulation

5. OFDM vs MIMO-OFDM

6. OFDM for Optical Communication

7. MIMO -opportunities and challenges

8. MIMO Radar

9. Massive MIMO for next generation wireless systems

10. 5G - Spectrum, Deployment & Customer Trends

List of Home Assignments:

Design:

1. Design of OFDM for UWB environment

2. Design of 4G MIMO OFDM wireless system

3. OFDM for underwater Acoustic communication

4. Design LMSE algorithm for equalization

5. Design Zero forcing Algorithm

Case Study:

1. Role of digital communication in digital transformation

2. Digital Communication over fading channels

3. Network coding for wireless Mesh Networks

4. Capacity of wireless communication systems employing antenna arrays

5. MIMO OFDM

Blog

1. 5G and Industrial IoT

2. Equalization Techniques for MIMO

3. Diversity Techniques for 4G wireless Communication

4. Massive MIMO

5. Will 5G change the world?

Surveys

1. Diversity techniques in Wireless Communication

2. Space time coding scheme for MIMO 31

3. Survey on resource allocation techniques in OFDM (A) networks

4. Survey on Mobile WiMax

5. Performance Analysis in MIMO OFDM system

Suggest an assessment Scheme:

1. Seminar

2. Group Discussion

3. Home Assignment

4. Course Viva

5. MSE

6. ESE

Text Books: (As per IEEE format)

1. Principles of Modern wireless communication systems. Theory and practice , Aditya K. Jagannatham ,McGraw –Hill publication.

2. Wireless Communications-Andrea Goldsmith –Cambridge university press.

3.Wireless Communications- Principle and practice- Theodore S, Rappaport, Pearson.

4. Digital communications -Fundamentals and applications –Bernard Sklar, Prentice Hall

Reference Books: (As per IEEE format)

1. Baseband Receiver Design for wireless MIMO-OFDM communications, Tzi-Dar Chiueh, Pei-Yun Tsai, I-Wei Lai, Wiley-IEEE Press, 2012.

2.Theory and applications of OFDM and CDMA : Wideband Wireless COmmunications , Henrik Schulze, Christian Lueders, Wiley, 2005.

3. Radio Propagation and Adaptive Antennas for Wireless Communication Networks, Nathan Blaunstein, Christos G. Christodoulou, Wiley , 2014.

4. Fundamentals of Wireless Commu

Moocs Links and additional reading material:

www.nptelvideos.in

Advanced 3G, 4G Wireless Mobile Communications

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

Course Outcomes:

The student will be able to –

1) Calculate received power by system and keep required margin

2) Differentiate between diversity techniques

3) Understand channel modelling

4) Illustrate OFDM System

5) Discuss performance behavior of MIMO systems

6) Differentiate between ZF & MMSE receivers

IT4216: DATA MANAGEMENT, PROTECTION AND GOVERNANCE

Course Prerequisites: Database Management System, Operating System

Course Objectives:

To facilitate the learner to –

1. Get acquainted with the high-level phases of data life cycle management.

2. Acquire knowledge about the various aspects of data storage, data availability,

data protection.

3. Gain exposure to various solutions/reference architectures for various use-cases.

4. Understand the technical capabilities and business benefits of data protection.

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

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

SECTION-I

Data Storage, Availability and Security

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

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

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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 for security

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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.

FFNo.:654

IT4213: DEEP LEARNING

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

Course Objectives:

1. To present the mathematical, statistical and computational concepts for stable representations of high-dimensional data, such as images, text

2. To introduce NN and techniques to improve network performance

3. To introduce Convolutional networks

4. To introduce Sequential models of NN

5. To build deep nets with applications to solve real world problem

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

Course Relevance: Deep learning is revolutionizing the technology and business world today. It is a

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

Section-I
Topics and Contents Foundations of neural networks and deep learning, Logistic regression as a neural network, different activation function, logistic regression cost function, logistic regression gradient descent, vectorizing logistic regression, forward and backward propagation, Techniques to improve neural networks: regularization and optimizations, hyperparameter tuning, batch normalization, data augmentation, deep learning frameworks, Implementation of neural network for a case study.
Section-II
Convolutional Neural Networks, padding, strided convolution, pooling layers, convolutional implementation of sliding windows, Applications: object classification, object detection, face verification. ResNet, inception networks, bounding boxes, anchor boxes. Sequence modelling: recurrent nets, architecture, vanishing and exploding gradient problem, Applications & use cases.

List of Course Seminar Topics:

1. Deep learning for Stock Market Clustering

2. Application of Deep Networks in health care

3. Credit card fraud detection

4. Classification of skin cancer with deep neural networks

5. ALEXNET

6. VCGNET

7. Accelerating Deep Network Training by Reducing Internal Covariate Shift

8. Deep learning applications for predicting pharmacological properties of drugs

9. GAN (Generalised Adversial network)

10. Auto encoders

11. LSTM

List of Course Group Discussion Topics:

1. Recurrent or Recursive Networks for sequential Modelling?

2. Initializing network weights vs performance

3. Difficulty of training deep feedforward neural networks

4. Hyperparameter tuning: Is there a rule of thumb?

5. Problem of overfitting: How to handle?

6 Which cost function: Least squared error or binary cross entropy?

7. How to tackle with loss of corner information in CNN

8. Need of hundred classifiers to solve real world classification problem

9. Which optimization: Batch gradient descent of stochastic gradient descent

10. Activation functions: Comparison of trends

11. Remedy of problem of vanishing gradient and exploding gradient in RNN

List of Home Assignments:

Design:

1. Deep learning for library shelf books identification

2. Development of control system for fruit classification based on convolutional neural networks

3. Classifying movie review using deep learning

4. Sentiment analysis of the demonetization of economy 2016 India

5. Predicting Students Performance in Final Examination

Case Study:

1. Deep learning for security

2. Bag of tricks for efficient text classification

3. Convolutional Neural Networks for Visual Recognition

4. Deep Learning for Natural Language Processing

5. Scalable object detection using deep neural networks

Blog

1. Brain tumor segmentation with deep neural networks

2. Region-based convolutional networks for accurate object detection and segmentation

3. Human pose estimation via deep neural networks

4. Content Based Image Retrieval

5. Visual Perception with Deep Learning

6. Music genre classification system

Surveys:

1. Machine translation using deep learning - survey

2. Shaping future of radiology using deep learning

3. Training Recurrent Neural Networks

4. Text generation with LSTM

5. Deep learning applications in Biomedicine

Suggest an assessment Scheme:

1. Seminar – 10 Marks

2. Group Discussion – 10 Marks

3. Home Assignment – 10 Marks

4. Course Viva – 20 Marks

5. MSE – 25 Marks

6. ESE –25Marks

Text Books: (As per IEEE format)

1. Goodfellow, I., Bengio, Y., and Courville, A., Deeep Learning, MIT Press, 2016.

2. C., M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books: (As per IEEE format)

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.

2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.

3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Moocs Links and additional reading material:

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

Course Outcomes:

Students will be able to

1) Demonstrate understanding of a logistic regression model, structured as a shallow Neural network

2) Build and train a deep Neural Network

3) Apply techniques to improve neural network performance

4) Demonstrate understanding of functionality of all layers in a convolutional neural network

5) Implement convolutional networks for image recognition/classification tasks

6) Demonstrate Understanding of Recurrent nets and their applications

FFNo.:654

IT4214: CLOUD COMPUTING

Course Prerequisites:

Operating Systems, Fundamentals of Computer Networks

Course Objectives:

1. To become familiar with Cloud Computing and its ecosystem

2. To learn basics of virtualization and its importance

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

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

5. To understand security issues in cloud computing

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

Course Relevance:

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

SECTION-I

Introduction to Cloud Computing: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Evolution of cloud computing Cloud Computing Architecture: Cloud versus traditional architecture, Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), , Public cloud, Private cloud, Hybrid cloud, Community cloud, Google Cloud architecture, The GCP Console, Understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs175 111 Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Storage options in the cloud, Structured and unstructured storage in the cloud, unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL option

SECTION-II

Platform as a Service (PaaS): Introduction to PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing and accounting, Billing in GCP Cloud Security: Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM. Cloud Network : Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, Multiple VPC networks, Building hybrid clouds using VPNs, interconnecting, and direct peering, Different options for load balancing.

List of Course Seminar Topics:

1. Storage Cost Optimization On Cloud

2. Cloud Security And Cryptography

3. Infrastructure As A Code (IAC)

4. Cloud Computing In Healthcare

5. Serverless Architecture

6. Deployment Of Microservices In Kubernetes Engine

7. RPA Using AWS Cloud

8. Cloud Trends In Supporting Ubiquitous Computing

9. Mobile Cloud Computing

10. Modern Data Center Architecture

List of Course Group Discussion Topics:

1. Data Storage Security in Cloud

2. Cloud Services for SMB's

3. Monitoring Services Provided by GCP and AWS

4. Docker and Kubernetes

5. SaaS vs FaaS (Function as a service)

6. Hybrid Cloud

7. GCP Vs AWS Web Service Architecture

8. Cloud based security issues and threats

9. Authentication and identity 113

10. Future of Cloud-Based Smart Devices

List of Home Assignments:

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

    2. Deploying App on Kubernetes

    3. Serverless web Application (GCP Cloud Functions)

    4. Demonstration of EBS, Snapshot, Volumes

    5. Single Node Cluster Implementation (Hadoop)

   Case Study:

1. PayU Migration to AWS

2. Cloud object storage

3. Deployment and Configuration options in AWS

4. Deployment and Configuration options in Microsoft Azure

5. Deployment and Configuration options in GCP

Blog

1. Comparing design of various cloud computing platforms

2. AWS EKS and Google Cloud Functions

3. App Engine

4. Cloud Endpoints

5. Cloud Pub/Sub

Surveys

1. Disaster Recovery in Cloud Computing 114

2. Cloud Economics

3. Data archiving solutions

4. Salesforce

5. Dropbox

Suggest an assessment Scheme:

MSE, ESE, GD, Seminar, HA

Text Books: (As per IEEE format)

1. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Cloud Computing for Dummies", Wiley,India.

2. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India

3. Gautam Shroff. "Enterprise Cloud Computing", Cambridge

Reference Books: (As per IEEE format)

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley India

2. Antohy T Velte, et.al, "Cloud Computing : A Practical Approach", McGraw Hill.

3. Michael Miller, "Cloud Computing", Que Publishing. 115

4. Tim Malhar, S.Kumaraswammy, S.Latif, "Cloud Security & Privacy", SPD,O'REILLY

5. Scott Granneman, "Google Apps", Pearson

Moocs Links and additional reading material**:**

Course Outcome:

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

1) Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing

2) Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.

3) Identify problems, and explain, analyze, and evaluate various cloud computing solutions.

4) Choose the appropriate technologies, algorithms, and approaches for the related issues.

5) Display new ideas and innovations in cloud computing. 116

6) Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing

IT4215: DISTRIBUTED COMPUTING

Course Pre requisites: Operating System, Data Structures and Programming languages

Course Objectives:

1. To learn fundamentals of distributed systems.

2. To discuss different interprocess communication and clock synchronization approaches.

3. To gain knowledge of distributed transaction and distributed deadlock.

4. To understand Fault tolerance and Distributed Shared Memory.

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

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

SECTION-1

Introduction: Motivation, Examples,Design issues, Hardware and Software Concepts,Applications, Architectural Model,**Interprocess Communication:**Communication primitives, Message Oriented Communication, Stream Oriented Communication, RPC, Model, Transparencies in RPC, Implementation, Stub Generation, RPC Messages, Server Management, Call Semantics, Communication Protocols, Distributed Objects: Remote Method Invocation, Java RMI

Clock Synchronization: Introduction, Logical Clocks, Scalar time, Vector time,Election Algorithm,Mutual Exclusion

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SECTION-1I

Distributed Transaction: Transaction Model, Classification, Implementation, Concurrency Control: Serializability, 2 Phase Locking, Strict 2 PL, Distributed Commit: 2 Phase Commit, Recovery, **Distributed Deadlock:** Avoidance, Prevention, Detection and Recovery,**Fault

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Tolerance: Introduction, Failure Models, Failure Masking by Redundancy, Process Resilience, Agreement in Faulty Systems: Two Army Problem, Byzantine Generals Problem, Reliable Client Server Communication, Reliable Group Communication,**Distributed Shared Memory:**Introduction, Advantages, Disadvantages, Architecture, Design and Implementation issues of DSM

List of Home Assignments:

Design:

1. Client-Server application using RMI

2. Client-Server application using socket programming

3. Distributed application using MapReduce under Hadoop

4. Distributed application using Mutual exclusion

5. Distributed Deadlock

Case Study:

1. GFS:Google file system

2. Hadoop

3. DCE RPC

4. Bigtable: A Distributed Storage System for Structured Data

5. HPC: High performance computing

Blog:

1.Consistency protocols in distributed system

2. Security in distributed system

3. Distributed programming models

4. Resource management in distributed system

5. Wireless distributed computing

Surveys:

1. Distributed file system

2. Distributed database system

3. Cloud computing vs Cluster computing vs Grid computing

4.Challenges and Benefits in designing distributed computing

5.Recent trends in distributed computing

Suggest an assessment Scheme:

1.Home Assignment: Design, Case study, Blog and Survey

2.MSE

3.ESE

4. CVV

Text Books: (As per IEEE format)

1. Andrew S. Tanenbaum & Maarten Van Steen; "Distributed Systems Principles and Paradigms";5th Edition, Prentice Hall India.

2.Pradeep K. Sinha; "Distributed Operating Systems Concepts and Design;1997, Prentice Hall India.

Reference Books: (As per IEEE format)

1. Ajay Kshemkalyani, Mukesh Singhal; "Distributed Computing: Principles, Algorithms, and Systems";   2008, Cambridge University Press.

2. George Coulouris, Jean Dollimore & Tim Kindberg;"Distributed Systems – Concepts and Design"; 5th Edition, Addison-Wesley.

3. Mukesh Singhal, Niranjan G. Shivaratri; "Advanced Concepts In Operating Systems",2001, McGrawHill.

4. M. L. Liu ;"Distributed Computing: Principles and Applications";2004, Addison-Wesley.

Moocs Links and additional reading material:

1. https://.nptel.ac.in

2. https://www.udemy.com

3. https://www.coursera.org

Course Outcomes:

The student will be able to –

1. Identify the basic principles, design issues and architectural aspects of distributed systems.

2. Analyze the different techniques used for Communication in distributed system.

3. Compare the mechanisms used forClock synchronization, Mutual exclusion in distributed system.

4. Determine an optimal solution for Distributed Deadlock.

5. Apply important methods in distributed systems to support Fault tolerance.

6. Illustrate architecture and design issues of Distributed Shared Memory.

FFNo.:654

IT4218: NETWORK SECURITY

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

Prerequisites: Computer Networks.

Unit 1:   **(5 Hours)**

Introduction

Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services.

key security properties - Confidentiality, Integrity, Availability.

Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks.

Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing

Unit 2:   **(4 Hours)**

 Private key cryptography

Iathematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm),
 Role of random numbers in security, Importance of prime number, DES, AES.

Chinese remainder theorem

Unit 3:   **(5 Hours)**

Public key cryptography

RSA: RSA algorithm, Key generation in RSA, attacks on RSA.

Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack.

Elliptic Curve Cryptography (ECC), Elliptic Curve arithmetic. Diffie-Hellman key exchange

Unit 4:   **(5 Hours)**

Authentication and access control

Message authentication and Hash Function. Authentication: One-Way Authentication, Mutual Authentication, SHA-512, The Needham-Schroeder Protocol.

Kerberos, X.509 authentication service, public key infrastructure.

Access Control in Operating Systems: Discretionary Access Control, Mandatory Access Control, Role Based Access Control.

Unit 5:   **(5 Hours)**

Security application and design

Part A: Network layer security: IPSec for IPV4 and IPV6.

Transport layer security: SSL and TLS.

Application layer security: Security services, S/MIME, PGP, Https, Honey pots.

Unit 6:   **(4 Hours)**

Cyber Security:

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

Text Books

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

Reference Books

1. *"Computer Security: Art and Science", by Matt Bishop, Pearson Education, 2002, ISBN 0201440997, 1st Edition.*

2.   *"Network security, private communication in a public world", by Charlie Kaufman, Radia Perlman and Mike Spencer, Prentice Hall, 2002, ISBN 9780130460196, 2nd Edition.*

3. *"Cryptography and Information Security", by V.K. Pachghare, PHI, 2015, ISBN-978-81-203-5082-*

3, Second Edition.

Additional Reading

1.“Security architecture, design deployment and operations”, by Christopher M. King, Curtis Patton and RSA press, McGraw-Hill, 2001, ISBN 0072133856, 1ˢᵗ Edition.

2 ‘Inside Network Perimeter Security” by Stephen Northcott, Leny Zeltser, et al, Pearson Education Asia, ISBN 8178087618, 1ˢᵗ Edition.

Course Outcomes

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

1. Analyze cryptographic techniques using a mathematical approach by examining nature of attack.

2. Establish type of attack on a given system.

3. Identify different types of attacks.

4. Justify various methods of authentication and access control for application of technologies to various sections of industry and society.

5. Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization.

6. Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.

IT4205: MAJOR PROJECT

Credits: 10   **Teaching Scheme Lab:** 20 hours/week

Course Relevance:

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

The Motivation for this Major Project is

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

The Project Work can lead to:

 a. Novice algorithm development

 b. Optimization of existing system/method

 c. New state of the art application

 d. Some incremental work in any existing field of their choice

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Overview of the Course:

 1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).

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2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student's own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.

3. The project must be open-ended – meaning that there is not a known correct answer to the design problem. Students are expected to apply their creativity (simply copying or re-creating something that already exists is not acceptable).

4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.

5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting Requirement Definition Document, Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.

6. The Project Work will be assessed jointly by a panel of examiners having more than Five Years experience. The Project Groups will deliver the presentation of the Project Work which will be assessed by the panel.

7. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on presentation skills, questions based on the Project Work, understanding of the Project, analysis and design performed for the project.

8. The Student Project Groups are expected to work on the recommendations given by the panel of examiners. In no case any variation in Project Theme will be permitted.

9. The outcome of the project should be tangible in terms of paper publication/patent/SOP/prototype

10. The Project should justify the work worth 10 credits.

Assessment Scheme

Sr. No.	Content	Marks
1	Development of Prototype/ Model	20
2	Innovativeness and intellectual input	20

3	evaluation of literature review	10
4	Individual contribution	10
5	Usage of Modern Tool/ Technology and experimental competency	10
6	Presentation of the Project Work	10
7	Resultsand analysis	10
8	Quality Publication and Project Report	10

Note:

The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice like signal processing, computer vision, machine learning and artificial intelligence, control systems, game theory, and communication networksand address the problem by formulating a solution for the identified problem. The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members.

The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted.

Following is the list of recommended domains for Project Work:

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

Course Outcomes:

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

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

FFNo.:654

IT4251: INDUSTRY INTERNSHIP

Credit: 16

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

SECTION-1

Get used to corporate culture

 Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

SECTION-2

Problem Statement

 Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

Knowledge of domain, Latest technology, andmodern tools used /to be used

Neat project documentation

Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

Course Outcomes:

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

CO1: Explore career alternatives prior to graduation.

CO2: Integrate theory and practice.

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

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

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

CO6: Practice Project Management and learn team dynamics

IT4252: INTERNATIONAL INTERNSHIP

Credit: 16

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

SECTION-1

 Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

SECTION-2

Problem Statement

 Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

Knowledge of domain, Latest technology, andmodern tools used /to be used

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

Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

Course Outcomes:

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

CO1: Explore career alternatives prior to graduation.

CO2: Integrate theory and practice.

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

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

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

CO6: Practice Project Management and learn team dynamics

IT4253: RESEARCH INTERNSHIP

Credit: 16

Course Relevance: Implementation of technical knowledge acquiredduring previous three years of Internship and to inculcate Industry culture.

SECTION-1

 Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

SECTION-2

Problem Statement

 Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

Knowledge of domain, Latest technology, andmodern tools used /to be used

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Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

FFNo.:654

IT4254: PROJECT INTERNSHIP

Credit: 16

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

SECTION-1

Get used to corporate culture and get sponsorship from the company

 Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

SECTION-2

Problem Statement

 Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

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

Neat project documentation

Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

Course Outcomes:

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

CO1: Explore career alternatives prior to graduation.

CO2: Integrate theory and practice.

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

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

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

CO6: Practice Project Management and learn team dynamics