VII Semester

BIG DATA ANALYTICS			
Course Code	21CS71	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives:

CLO 1. Understand fundamentals and applications of Big Data analytics
CLO 2. Explore the Hadoop framework and Hadoop Distributed File system and essential Hadoop Tools
CLO 3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
CLO 4. Employ MapReduce programming model to process the big data
CLO 5. Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.

Textbook 1: Chapter 1: 1.2 -1.7

Teaching-Learning Process	Chalk and board https://www.youtube.com/watch?v=n_Krer6YWY4 https://onlinecourses.nptel.ac.in/noc20_cs92/preview

Module-2

Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.

Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands.

Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

Textbook 1: Chapter 2 :2.1-2.6
Textbook 2: Chapter 3

Textbook 2: Chapter 7 (except walk throughs)	
Teaching-Learning Process	1. Chalk and Board 2. Laboratory Demonstration
Module-3	
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases. **Textbook 1: Chapter 3: 3.1-3.7**	
Teaching-Learning Process	1. Chalk and Board 2. Laboratory Demonstration https://www.youtube.com/watch?v=pWbMrx5rVBE
Module-4	
Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig. **Textbook 1: Chapter 4: 4.1-4.6**	
Teaching-Learning Process	1. Chalk and Board 2. Laboratory Demonstration
Module-5	
Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining. **Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics: **Textbook 1: Chapter 6: 6.1 to 6.5** **Textbook 1: Chapter 9: 9.1 to 9.5**	
Teaching-Learning Process	1. Chalk and Board 2. Laboratory Demonstration
Course outcome (Course Skill Set) At the end of the course the student will be able to: CO 1. Understand fundamentals and applications of Big Data analytics. CO 2. Investigate Hadoop framework, Hadoop Distributed File system and essential Hadoop tools. CO 3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data. CO 4. Demonstrate the MapReduce programming model to process the big data along with Hadoop tools. CO 5. Apply Machine Learning algorithms for real world big data, web contents and Social Networks to provide analytics with relevant visualization tools.	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together	

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1 stEdition, Pearson Education, 2016. ISBN13: 978-9332570351

Reference Books

1. Tom White, "Hadoop: The Definitive Guide", 4 th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1 stEdition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1 stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. ArshdeepBahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=n_Krer6YWY4
2. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
3. https://www.digimat.in/nptel/courses/video/106104189/L01.html

4. https://web2.qatar.cmu.edu/~mhhammou/15440-f19/recitations/Project4_Handout.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Mini Project Topics for Practical Based Learning : Search Engine Optimization, Social Media Reputation Monitoring, Equity Research, Detection of Global Suicide rate, Find the Percentage of Pollution in India, Analyze crime rate in India, Health Status Prediction, Anomaly Detection in cloud server, Tourist Behaviour Analysis, BusBest Not limited to above topics

VII Semester

CLOUD COMPUTING			
Course Code	21CS72	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:0:0	SEE Marks	50
Total Hours of Pedagogy	24	Total Marks	100
Credits	02	Exam Hours	03

Course Learning Objectives:

CLO 1. Introduce the rationale behind the cloud computing revolution and the business drivers
CLO 2. Introduce various models of cloud computing
CLO 3. Introduction on how to design cloud native applications, the necessary tools and the design tradeoffs.
CLO 4. Realize the importance of Cloud Virtualization, Abstraction`s and Enabling Technologies and cloud security

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction:
Introduction ,Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka

Textbook 1: Chapter 1: 1.1,1.2 and 1.3

Teaching-Learning Process	Chalk and board, Active Learning

Module-2

Virtualization: Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples

Textbook 1 : Chapter 3: 3.1 to 3.6

Teaching-Learning Process	Chalk and board, Active Learning

Module-3

Cloud Computing Architecture: Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges

Textbook 1: Chapter 4: 4.1 to 4.5

Teaching-Learning Process	Chalk and board, Demonstration

Module-4

Cloud Security: Risks, Top concern for cloud users, privacy impact assessment, trust, OS security, VM Security, Security Risks posed by shared images and management OS.

Textbook 2: Chapter 9: 9.1 to 9.6, 9.8, 9.9

Teaching-Learning Process	Chalk and board

Module-5

Cloud Platforms in Industry
Amazon web services: - Compute services, Storage services, Communication services, Additional services. Google AppEngine: - Architecture and core concepts, Application life cycle, Cost model, Observations.

Textbook 1: Chapter 9: 9.1 to 9.2

Cloud Applications:
Scientific applications: - HealthCare: ECG analysis in the cloud, Biology: gene expression data analysis for cancer diagnosis, Geoscience: satellite image processing. Business and consumer applications: CRM and ERP, Social networking, media applications.

Textbook 1: Chapter 10: 10.1 to 10.2

Teaching-Learning Process	Chalk and board

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO 1. Understand and analyze various cloud computing platforms and service provider.
CO 2. Illustrate various virtualization concepts.
CO 3. Identify the architecture, infrastructure and delivery models of cloud computing.
CO 4. Understand the Security aspects of CLOUD.
CO 5. Define platforms for development of cloud applications

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 2 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.
2. Dan C. Marinescu, Cloud Compting Theory and Practice, Morgan Kaufmann, Elsevier 2013

Reference Books

1. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media.
2. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication.
3. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press.

Weblinks and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=1N3oqYhzHv4
- https://www.youtube.com/watch?v=RWgW-CgdIk0

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

OBJECT ORIENTED MODELING AND DESIGN			
Course Code	21CS731	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Describe the concepts involved in Object-Oriented modelling and their benefits.
CLO 2. Demonstrate concept of use-case model, sequence model and state chart model for a given problem.
CLO 3. Explain the facets of the unified process approach to design and build a Software system.
CLO 4. Translate the requirements into implementation for Object Oriented design.
CLO 5. Choose an appropriate design pattern to facilitate development procedure.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transistions and Conditions, State Diagrams, State diagram behaviour.

Textbook-1: 4, 5

Teaching-Learning Process	Chalk and board, Demonstration

Module-2

UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models.

Textbook-2:Chapter- 6:Page 210 to 250

Teaching-Learning Process	Chalk and board, Demonstration

Module-3

Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing

a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Textbook-1:Chapter- 10,11,and 12

Teaching-Learning Process	Chalk and board, Demonstration

Module-4

Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design.

Textbook-2: Chapter 8: page 292 to 346

Teaching-Learning Process	Chalk and board, Demonstration

Module-5

Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).

Textbook-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.

Teaching-Learning Process	Chalk and board, Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Describe the concepts of object-oriented and basic class modelling.
CO 2. Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
CO 3. Choose and apply a befitting design pattern for the given problem.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
3. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns –Elements of Reusable Object-Oriented Software, Pearson Education,2007.

Reference:

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007.
2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern – Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007.
3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013

Weblinks and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

DIGITAL IMAGE PROCESSING			
Course Code	21CS732	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Understand the fundamentals of digital image processing
CLO 2. Explain the image transform techniques used in digital image processing
CLO 3. Apply different image enhancement techniques on digital images
CLO 4. Evaluate image restoration techniques and methods used in digital imageprocessing
CLO 5. Understand the Morphological Operations and Segmentation used in digital imageprocessing

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Digital Image Fundamentals: What is Digital Image Processing? Originsof Digital Image Processing, Examples of fields that use DIP, FundamentalSteps in Digital Image Processing, Components of an Image ProcessingSystem, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships BetweenPixels, Linear and Nonlinear Operations.

Textbook 1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, SmoothingSpatial Filters, Sharpening Spatial Filters

Frequency Domain: Preliminary Concepts, The Discrete FourierTransform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering inthe Frequency Domain, Image Smoothing and Image Sharpening UsingFrequency Domain Filters, Selective Filtering.

Textbook 1: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10

Teaching-Learning Process	1. Chalk and board, Active Learning, Demonstration 2. Laboratory Demonstration

Module-3

Restoration: Noise models, Restoration in the Presence of Noise Onlyusing Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, InverseFiltering, Minimum Mean Square Error (Wiener) Filtering, ConstrainedLeast Squares Filtering.

Textbook 1: Chapter 5: Sections 5.2, to 5.9

Teaching-Learning Process	1. Chalk and board

Module-4

Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing. Wavelets: Background, Multiresolution Expansions.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.

Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5

Teaching-Learning Process	1.Chalk& board 2.Demonstartion of Case study /Application for wavelet transfer method

Module-5

Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, Principles of Thresholding.

Representation and Description: Representation, Boundary descriptors.

Text2: Chapter 9: Sections 9.1, to 9.7 and Text 1: Chapter 11: Sections 11.1and 11.2

Teaching-Learning Process	1.Chalk and board, MOOC. 2. Poster making activity for various image segmentation algorithms

Course Outcomes

At the end of the course the student will be able to:

CO 1. Understand the fundamentals of Digital Image Processing.
CO 2. Apply different Image transformation techniques
CO 3. Analyze various image restoration techniques
CO 4. Understand colour image and morphological processing
CO 5. Design image analysis and segmentation techniques

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Textbooks

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.
2. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd Edition, 2016

Reference:

1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, TataMcGraw Hill 2014.
2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004

Weblinks and Video Lectures (e-Resources):

1. https://https://nptel.ac.in/courses/106/105/106105032/
2. https://github.com/PrajwalPrabhuiisc/Image-processing-assignments

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Demonstration of finding the histogram from grayscale image, to check the low pass filter properties, filtering the images using Gaussian low pass filter, etc… using Python programming

Practical Based Assignment like following or any topic which is in-line with the course requirement. Students shall present and demonstrate their work at the end of semester.

- Program to show rotation, scaling, and translation of an image.
- Read an image and extract and display low-level features such as edges, textures using filtering techniques
- Demonstrate enhancing and segmenting low contrast 2D images.
- To Read an image, first apply erosion to the image and then subtract the result from the original.

VII Semester

CRYPTOGRAPHY AND NETWORK SECURITY			
Course Code	21CS733	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives:

CLO 1. To understand Cryptography, Network Security and its principles
CLO 2. To Analyze different Cryptography algorithms
CLO 3. To Illustrate Public and Private key cryptography
CLO 4. To Explain Key management, distribution and certification
CLO 5. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different encryption techniques and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and the Data Encryption Standard: Traditional block Cipher structure, Stream Ciphers and Block Ciphers, Motivation for the Feistel Cipher structure, the Feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm

Textbook 1: Chapter 2, 3

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.

Other Public-Key Cryptosystems: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems.

Textbook 1: Chapter 9, 10

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates.

Textbook 1: Chapter 14.1 – 14.3

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

X-509 certificates. Certificates, X-509 version 3

Public key infrastructure.

User Authentication: Remote user Authentication principles, Mutual Authentication, one-way authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one-way Authentication,

Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one-way Authentication.

Textbook 1: Chapter 14.4 – 15.4

Teaching-Learning Process	Chalk& board, Problem based learning

Module-5

Electronic Mail Security: Pretty good privacy, S/MIME,

IP Security: IP Security overview, IP Security policy, Encapsulating Security payload, Combining security associations, Internet key exchange.

Textbook 1: Chapter 19.1, 19.2, 20.1 – 20.5

Teaching-Learning Process	Chalk and board, Problem based learning

Course Outcomes

At the end of the course the student will be able to:

CO 1. Understand Cryptography, Network Security theories, algorithms and systems
CO 2. Apply different Cryptography and Network Security operations on different applications
CO 3. Analyze different methods for authentication and access control
CO 4. Evaluate Public and Private key, Key management, distribution and certification
CO 5. Design necessary techniques to build protection mechanisms to secure computer networks

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Textbooks

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

Reference:

1. V. K Pachghare: Cryptography and Information Security, PHI 2nd Edition
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

Weblinks and Video Lectures (e-Resources):

https://nptel.ac.in/courses/106105031
https://onlinecourses.nptel.ac.in/noc21_cs16
https://www.digimat.in/nptel/courses/video/106105031
https://www.youtube.com/watch?v=DEqjC0G5KwU
https://www.youtube.com/watch?v=FqQ7TWvOaus
https://www.youtube.com/watch?v=PHsa_Ddgx6w

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning:

Project based learning:

1. Implement classical, symmetric and asymmetric algorithms in any preferred language
2. Evaluate network security protocol using any simulator available
3. Conduct a comprehensive literature survey on the protocols and algorithms
4. Identify the security threats and models of security threats
5. Implement factorization algorithms and evaluate their complexity, identify a technologies to factorize a large prime number.

VII Semester

BLOCKCHAIN TECHNOLOGY			
Course Code	21CS734	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Explain the fundamentals of distributed computing and blockchain
CLO 2. Discuss the concepts in bitcoin
CLO 3. Demonstrate Ethereum platform

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

Textbook 1: Chapter 1, 2

Teaching-Learning Process	Chalk and board, Active Learning – Oral presentations.

Module-2

Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency,

How Bitcoin Achieves Decentralization: Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Putting it all together,

Textbook 2: Chapter 1, 2

Teaching-Learning Process	Chalk and board, Demonstration

Module-3

Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements

How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets

Textbook2: Chapter 3,4

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration, MOOC

Module-4

Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies,

Bitcoin and Anonymity: Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash,

Textbook2: Chapter 5,6

Teaching-Learning Process	Chalk& board, Problem based learning, MOOC

Module-5

Smart Contracts and Ethereum 101:
Smart Contracts: Definition, Ricardian contracts.

Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

Textbook 1: Chapter 10

Teaching-Learning Process	Chalk and board, MOOC, Practical Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Describe the concepts of Distrbuted computing and its role in Blockchain
CO 2. Describe the concepts of Cryptography and its role in Blockchain
CO 3. List the benefits, drawbacks and applications of Blockchain
CO 4. Appreciate the technologies involved in Bitcoin
CO 5. Appreciate and demonstrate the Ethereum platform to develop blockchain application.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016.

Reference:

1. Mastering Bitcoins: Unlocking Digital Cryptocurrencies by Andreas Antonopoulos. O'Reilly Media, Inc, 2013.

Weblinks and Video Lectures (e-Resources):

1. http://bitcoinbook.cs.princeton.edu/?_ga=2.8302578.1344744326.1642688462-86383721.1642688462
2. https://nptel.ac.in/courses/106/105/106105184/
3. https://ethereum.org/en/developers/
4. https://developer.ibm.com/components/hyperledger-fabric/tutorials/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

INTERNET OF THINGS			
Course Code	21CS735	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Understand about the fundamentals of Internet of Things and its building blocks along with their characteristics.
CLO 2. Understand the recent application domains of IoT in everyday life.
CLO 3. Understand the protocols and standards designed for IoT and the current research on it.
CLO 4. Understand the other associated technologies like cloud and fog computing in the domain of IoT.
CLO 5. Improve their knowledge about the various cutting-edge technologies in the field IoT and machine learning applications.
CLO 6. Gain insights about the current trends of machine learning and AI techniques used in IoT to orient towards the present industrial scenario.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT.

Textbook 1: Chapter 4 – 4.1 to 4.5

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.

Textbook 1: Chapter 5 – 5.1 to 5.9

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

Textbook 1: Chapter 6 – 6.1 to 6.5

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, WirelessHART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IoT, Wi-Fi, Bluetooth

Textbook 1: Chapter 7 – 7.1 to 7.16

Teaching-Learning Process	Chalk & board, Problem based learning

Module-5

IoT Communication Technologies: Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols

IoT Interoperability: Introduction, Taxonomy of interoperability, Standards, Frameworks

Textbook 1: Chapter 8 – 8.1, 6.2, 8.3, 8.4, 8.5, 8.6, .7
Textbook 1: Chapter 9 – 9.1, 9.2, 9.3

Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

At the end of the course the student will be able to:

CO 1. Understand the evolution of IoT, IoT networking components, and addressing strategies in IoT.
CO 2. Analyze various sensing devices and actuator types.
CO 3. Demonstrate the processing in IoT.
CO 4. Apply different connectivity technologies.
CO 5. Understand the communication technologies , protocols and interoperability in IoT.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester
6. At the end of the 13th week of the semester- Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021.

Reference:

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS			
Course Code	21CS741	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Learn How to add functionality to designs while minimizing complexity.
CLO 2. What code qualities are required to maintain to keep code flexible?
CLO 3. To Understand the common design patterns.
CLO 4. To explore the appropriate patterns for design problems

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. A Notation for Describing Object-Oriented Systems

Textbook 1: Chapter 1 and 2.7

Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.

Textbook 1: Chapter 6

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

Textbook 2: chapter 4

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

BehavioralPatterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method

Textbook 2: chapter 5

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analyzing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incompleteitems, adding a new feature, pattern-based solutions.

Textbook 1: Chapter 11

Teaching-Learning Process	Chalk & board, Problem based learning

Module-5

Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object-oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.

Textbook 1: Chapter 12

Teaching-Learning Process	Chalk and board

Course Outcomes

At the end of the course the student will be able to:

CO 1. Design and implement codes with higher performance and lower complexity
CO 2. Be aware of code qualities needed to keep code flexible
CO 3. Experience core design principles and be able to assess the quality of a design with respect to these principles.
CO 4. Capable of applying these principles in the design of object oriented systems.
CO 5. Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary.
CO 6. Be able to select and apply suitable patterns in specific contexts

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester
6. At the end of the 13th week of the semester- Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Brahma Dathan, Sarnath Rammath, Object-oriented analysis, design and implementation, Universities Press,2013
2. Erich Gamma, Richard Helan, Ralph Johman, John Vlissides , Design Patterns, Pearson Publication,2013.

Reference:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

Weblinks and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

MULTIAGENT SYSTEMS			
Course Code	21CS742	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. To introduce the concept of a multi agent systems and Distributed Constraints
CLO 2. Explore the main issues surrounding the computer and extended form games.
CLO 3. Develop cooperative learning, stochastic games
CLO 4. Exhibit the awareness about protocols about multi agent resource allocation and auctions
CLO 5. Construct voting mechanism design.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1: Multiagent Problem Formulation

Utility, Markov Decision Processes, Planning
Distributed Constraints: Distributed Constraint Satisfaction, Distributed Constraint Optimization

Textbook 1: Chapters 1 &2, Textbook 2: Chapter 1

Teaching-Learning Process	1. PPT – Decision Processes, Planning 2. Demonstration of constraints and their optimization

Module-2: Standard and Extended Form Games

Games in Normal Form, Games in Extended Form, Self-interested agents, Characteristic Form Games, Coalition Formation

Textbook 1: Chapters 3 & 4, Textbook 2: Chapter 3

Teaching-Learning Process	1. PPT – Games in different forms 2. Demonstration of coalition formation

Module-3: Learning in Multiagent Systems

The Machine Learning Problem, Cooperative Learning, Repeated Games, Stochastic Games, General Theories for Learning Agents, Collective Intelligence

Textbook 1: Chapters 5

Teaching-Learning Process	1. PPT – Cooperative learning, Collective intelligence 2. Demonstration of stochastic games

Module-4: Negotiation

The Bargaining Problem, Monotonic Concession Protocol, Negotiation as Distributed Search, Ad-hoc Negotiation Strategies, The Task Allocation Problem.
Protocols for Multiagent Resource Allocation: Auctions: Simple Auctions, Combinatorial Auctions

Textbook 1: Chapters 6&7,
Textbook 2: Chapter 11

Teaching-Learning Process	1. PPT – Bargaining problems 2. Demonstration of different auctions for resource allocation

Module-5: Voting and Mechanism Design

The Voting Problem, Mechanism Design. **Nature-Inspired Approaches:** Ants and Termites, Immune System

Textbook 1: Chapters 8&10,
Textbook 2: Chapter 10

Teaching-Learning Process	1. PPT – Voting Problem 2. Demonstration of nature inspired Approaches

Course Outcomes

At the end of the course the student will be able to:

CO 1. Demonstrate the decision process with different constraints
CO 2. Analyze games in different forms
CO 3. Apply the cooperative learning in developing games
CO 4. Analyze different negotiation strategies of Multi-Agent System
CO 5. Design and develop solutions for voting problems

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question papers are designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Fundamentals of Multiagent Systems by Jos´e M. Vidal, 2006, available online http://jmvidal.cse.sc.edu/papers/mas.pdf.
2. Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, By YoavShoham, Kevin Leyton-Brown, Cambridge University Press, 2008, 2nded http://www.masfoundations.org/mas.pdf

Reference:

1. Multiagent Systems : A Modern Approach to Distributed Artificial Intelligence Gerhard Weiss The MIT Press 2000

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://www.youtube.com/watch?v=O2su1u2AXG0.
3. https://www.coursera.org/lecture/modeling-simulation-natural-processes/multi-agent-systems-kAKyC

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

DEEP LEARNING			
Course Code	21CS743	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course Learning Objectives

CLO 1. Understand the fundamentals of deep learning.
CLO 2. Know the theory behind Convolutional Neural Networks, Autoencoders, RNN.
CLO 3. Illustrate the strength and weaknesses of many popular deep learning approaches.
CLO 4. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.
CLO 5. Learn the open issues in deep learning, and have a grasp of the current research directions.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Deep Learning: Introduction, Deep learning Model, Historical Trends in Deep Learning,

Machine Learning Basics: Learning Algorithms, Supervised Learning Algorithms, Unsupervised Learning Algorithms.

Textbook 1: Chapter1 – 1.1, 1.2, 5.1,5.7-5.8.

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Feedforward Networks: Introduction to feedforward neural networks, Gradient-Based Learning, Back-Propagation and Other Differentiation Algorithms. **Regularization for Deep Learning,**

Textbook 1: Chapter 6, 7

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Optimization for Training Deep Models: Empirical Risk Minimization, Challenges in Neural Network Optimization, Basic Algorithms: Stochastic Gradient Descent, Parameter Initialization Strategies,

Algorithms with Adaptive Learning Rates: The AdaGrad algorithm, The RMSProp algorithm, Choosing the Right Optimization Algorithm.

Textbook 1: Chapter: 8.1-8.5

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Convolutional Networks: The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features- LeNet, AlexNet.

Textbook 1: Chapter: 9.1-9.9.

Teaching-Learning Process	Chalk& board, Problem based learning

Module-5

Recurrent and Recursive Neural Networks: Unfolding Computational Graphs, Recurrent Neural Network, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.

Applications: Large-Scale Deep Learning, Computer, Speech Recognition, Natural Language Processing and Other Applications.

Textbook 1: Chapter: 10.1-10.3, 10.5, 10.6, 10.10, 12.

Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

CO1: Understand the fundamental issues and challenges of deep learning data, model selection, model complexity etc.,
CO2: Describe various knowledge on deep learning and algorithms
CO3: Apply CNN and RNN model for real time applications
CO4: Identify various challenges involved in designing and implementing deep learning algorithms.
CO5: Relate the deep learning algorithms for the given types of learning tasks in varied domain

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

Reference:

1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009.
2. N.D.Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016.
3. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications.

Weblinks and Video Lectures (e-Resources):

- https://faculty.iitmandi.ac.in/~aditya/cs671/index.html
- https://nptel.ac.in/courses/106/106/106106184/
- https://www.youtube.com/watch?v=7x2YZhEj9Dw

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT			
Course Code	21CS744	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course Learning Objectives

CLO 1. To understand basic concepts of RPA
CLO 2. To Describe RPA, where it can be applied and how its implemented
CLO 3. To Describe the different types of variables, Control Flow and data manipulation techniques
CLO 4. To Understand Image, Text and Data Tables Automation
CLO 5. To Describe various types of Exceptions and strategies to handle

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

RPA Foundations- What is RPA – Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps- Flowcharts.

Textbook 1: Ch 1, Ch 2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by-step examples using the recorder.

Textbook 2: Ch 1, Ch 2

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Sequence, Flowchart, and Control Flow-Sequencing the workflow-Activities-Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope-Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).

Textbook 2: Ch 3, Ch 4

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Taking Control of the Controls- Finding and attaching windows- Finding the control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer-Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.

Textbook 2: Ch 5

Teaching-Learning Process	Chalk& board, Problem based learning

Module-5

Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screensHOT- Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA

Textbook 2: Ch 8
Textbook 1: Ch 13

Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

CO 1. To Understand the basic concepts of RPA
CO 2. To Describe various components and platforms of RPA
CO 3. To Describe the different types of variables, control flow and data manipulation techniques
CO 4. To Understand various control techniques and OCR in RPA
CO 5. To Describe various types and strategies to handle exceptions

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Tom Taulli , The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems, 2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : Apress
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

Reference:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda,Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation

Weblinks and Video Lectures (e-Resources):

- https://www.uipath.com/rpa/robotic-process-automation

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

NOSQL DATABASE			
Course Code:	21CS745	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

CLO 1. Recognize and Describe the four types of NoSQL Databases, the Document-oriented, KeyValue
CLO 2. Pairs, Column-oriented and Graph databases useful for diverse applications.
CLO 3. Apply performance tuning on Column-oriented NoSQL databases and Document-oriented NoSQL Databases.
CLO 4. Differentiate the detailed architecture of column oriented NoSQL database, Document database and Graph Database and relate usage of processor, memory, storage and file system commands.
CLO 5. Evaluate several applications for location based service and recommendation services. Devise an application using the components of NoSQL.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL,

Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.

More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access,

Textbook1: Chapter 1,2,3

Teaching-Learning Process	Active learning

Module-2

Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums.

Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

Textbook1: Chapter 4,5,6

Teaching-Learning Process	Active Learning and Demonstrations

Module-3

Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce

Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets

Textbook1: Chapter 7,8

Teaching-Learning Process	Active Learning, Problem solving based

Module-4

Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E- Commerce Applications, When Not to Use, Complex Transactions Spanning Dif erent Operations, Queries against Varying Aggregate Structure

Textbook1: Chapter 9

Teaching-Learning Process	Active learning

Module-5

Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.

Textbook1: Chapter 11

Teaching-Learning Process	Active learning

Course Outcomes (Course Skill Set)

At the end of the course the student will be able to:

CO1. Demonstrate an understanding of the detailed architecture of Column Oriented NoSQL databases, Document databases, Graph databases.

CO2. Use the concepts pertaining to all the types of databases.

CO3. Analyze the structural Models of NoSQL.

CO4. Develop various applications using NoSQL databases.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

Reference Books

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN-13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

Weblinks and Video Lectures (e-Resources):

1. https://www.geeksforgeeks.org/introduction-to-nosql/ (and related links in the page)
2. https://www.youtube.com/watch?v=0buKQHokLK8 (How do NoSQL databases work? Simply explained)
3. https://www.techtarget.com/searchdatamanagement/definition/NoSQL-Not-Only-SQL (What is NoSQL and How do NoSQL databases work)
4. https://www.mongodb.com/nosql-explained (What is NoSQL)
5. https://onlinecourses.nptel.ac.in/noc20-cs92/preview (preview of Bigdata course contains NoSQL)

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Real world problem solving using group discussion.

VII Semester

PROGRAMMING IN PYTHON			
Course Code	21CS751	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. To understand why Python is a useful scripting language for developers
CLO 2. To read and write simple Python programs
CLO 3. To learn how to identify Python object types.
CLO 4. To learn how to write functions and pass arguments in Python.
CLO 5. To use Python data structures –- lists, tuples, dictionaries.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

INTRODUCTION DATA, EXPRESSIONS, STATEMENTS:08 Hours
Introduction: Creativity and motivation, understanding programming, Terminology: Interpreter and compiler, Running Python, The First Program; Data types: Int, float, Boolean, string, and list, variables, expressions, statements, Operators and operands.

Textbook 1: Chapter 1.1,1.2,1.3,1.6, Chapter 2.1-2.6
Textbook 2: Chapter 1

Teaching-Learning Process	Chalk and board, Active Learning

Module-2

CONTROL FLOW, LOOPS:
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for, break, continue, pass statement.

Textbook 1: Chapter 3.1-3.6, chapter 5

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

FUNCTIONS AND STRINGS:
Functions: Function calls, adding new functions, definition and uses, local and global scope, return values.

Strings: strings, length of string, string slices, immutability, multiline comments, string functions and methods;

Textbook 1: Chapter 6
Textbook 2: Chapter 3

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-4

LISTS, TUPLES, DICTIONARIES:08 Hours
Lists: List operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters, list comprehension;

Tuples: tuple assignment, tuple as return value, tuple comprehension;

Dictionaries: operations and methods, comprehension;

Textbook 2: Chapter 10,11,12

Teaching-Learning Process	Chalk& board, Active Learning

Module-5

REGULAR EXPRESSIONS,FILES AND EXCEPTION:
Regular expressions: Character matching in regular expressions, extracting data using regular expressions, Escape character

Files and exception: Text files, reading and writing files, command line arguments, errors andexceptions, handling exceptions, modules.

Textbook 1: Chapter 11.1,11.2,11.4
Textbook 2: Chapter 14

Teaching-Learning Process	Chalk and board, MOOC

Suggested Course Outcomes

At the end of the course the student will be able to:

CO 1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
CO 2. Demonstrate proficiency in handling Strings and File Systems.
CO 3. Represent compound data using Python lists, tuples, Strings, dictionaries.
CO 4. Read and write data from/to files in Python Programs

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Textbooks

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (Chapters 15, 16, 17) http://greenteapress.com/thinkpython2/thinkpython2.pdf

REFERENCE BOOKS:

1. R. Nageswara Rao, "Core Python Programming", dreamtech
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
3. Python Programming , Reema theraja, OXFORD publication

Weblinks and Video Lectures (e-Resources):

1. https://www.w3resource.com/python/python-tutorial.php
2. https://data-flair.training/blogs/python-tutorials-home/
3. https://www.youtube.com/watch?v=c235EsGFcZs
4. https://www.youtube.com/watch?v=v4e6oMRS2QA
5. https://www.youtube.com/watch?v=Uh2ebFW8OYM
6. https://www.youtube.com/watch?v=oSPMmeaiQ68
7. https://www.youtube.com/watch?v=_uQrJ0TkZlc
8. https://www.youtube.com/watch?v=K8L6KVGG-7o

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Demonstration of projects developed using python language

VII Semester

INTRODUCTION TO AI AND ML			
Course Code	21CS752	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO1. Understands the basics of AI, history of AI and its foundations, basic principles of AI for problem solving

CLO2. Explore the basics of Machine Learning & Machine Learning process, understanding data

CLO3. Understand the Working of Artificial Neural Networks

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence**,** Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents.

Textbook 1: Chapter: 1 and 2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Problem solving by searching: Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions

Textbook 1: Chapter: 3

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Introduction to machine learning: Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.

Understanding Data: What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization

Textbook 2: Chapter: 1 and 2.1 to 2.5

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Understanding Data
Bivariate and Multivariate data, Multivariate statistics **,** Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques,

Basics of Learning Theory: Introduction to learning and its types**,** Introduction computation learning theory, Design of learning system, Introduction concept learning.

Similarity-based learning: Introduction to Similarity or instance based learning, Nearest-neighbour learning**,** weighted k- Nearest **-** Neighbour algorithm**.**

Textbook 2: Chapter: 2.6 to 2.10, 3.1 to 3.4, 4.1 to 4.3

Teaching-Learning Process	Chalk& board, Problem based learning

Module-5

Artificial Neural Network: Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial neural Network**,** learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map,

Textbook 2: Chapter: 10

Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

At the end of the course the student will be able to:

CO 1. Design intelligent agents for solving simple gaming problems.
CO 2. Have a good understanding of machine leaning in relation to other fields and fundamental issues and
Challenges of machine learning
CO 3. Understand data and applying machine learning algorithms to predict the outputs.
CO 4. Model the neuron and Neural Network, and to analyze ANN learning and its applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Textbooks

1. Stuart Russel, Peter Norvig: "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2015.
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021

REFERENCE BOOKS:

1. Elaine Rich, Kevin Knight: "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009, ISBN-10: 0070087709
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, 1980, ISBN: 978-3-540-11340-9.

Weblinks and Video Lectures (e-Resources):

http://stpk.cs.rtu.lv/sites/all/files/stpk/materiali/MI/Artificial%20Intelligence%20A%20Modern%20Approach.pdf.

1. http://www.getfreeebooks.com/16-sites-with-free-artificial-intelligence-e books/https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_overview.htm
2. Problem solving agent:https://www.youtube.com/watch?v=KTPmo-KsOis.
3. https://www.youtube.com/watch?v=X_Qt0U66aH0&list=PLwdnzlV3ogoXaceHrrFVZCJKbm_laSHcH
4. https://www.javatpoint.com/history-of-artificial-intelligence
5. https://www.tutorialandexample.com/problem-solving-in-artificial-intelligence
6. https://techvidvan.com/tutorials/ai-heuristic-search/
7. https://www.analyticsvidhya.com/machine-learning/
8. https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/ml-decision-tree/tutorial/
9. https://www.javatpoint.com/unsupervised-artificial-neural-networks

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Demonstration of projects related to AI and ML.

VII Semester

INTRODUCTION TO BIG DATA			
Course Code	21CS753	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Understand Hadoop Distributed File system and examine MapReduce Programming
CLO 2. Explore Hadoop tools and manage Hadoop with Sqoop
CLO 3. Appraise the role of data mining and its applications across industries
CLO 4. Identify various Text Mining techniques

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Hadoop Distributed file system:HDFS Design, Features, HDFS Components, HDFS user commands Hadoop MapReduce Framework**:** The MapReduce Model, Map-reduce Parallel Data Flow,Map Reduce Programming

Textbook 1: Chapter 3,5,68hr

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Essential Hadoop Tools: Using apache Pig, Using Apache Hive, Using Apache Sqoop, Using Apache Apache Flume, Apache H Base

Textbook 1: Chapter 78hr

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Data Warehousing: Introduction, Design Consideration, DW Development Approaches, DW Architectures

Data Mining: Introduction, Gathering, and Selection, data cleaning and preparation, outputs ofData Mining, Data Mining Techniques

Textbook 2: Chapter 4,5

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Decision Trees: Introduction, Decision Tree Problem, Decision Tree Constructions, Lessons from Construction Trees. Decision Tree Algorithm

Regressions: Introduction, Correlations and Relationships, Non-Linear Regression, Logistic Regression, Advantages and disadvantages.

Textbook 2: Chapter 6,7

Teaching-Learning Process	Chalk& board, Problem based learning

Module-5

Text Mining: Introduction, Text Mining Applications, Text Mining Process, Term Document Matrix, Mining the TDM, Comparison, Best Practices

Web Mining: Introduction, Web Content Mining, Web Structured Mining, Web Usage Mining, Web Mining Algorithms.

Textbook 2: Chapter 11,14

Teaching-Learning Process	Chalk and board, MOOC

Suggested Course Outcomes

At the end of the course the students will be able to:

CO 1. Master the concepts of HDFS and MapReduce framework.
CO 2. Investigate Hadoop related tools for Big Data Analytics and perform basic
CO 3. Infer the importance of core data mining techniques for data analytics
CO 4. Use Machine Learning algorithms for real world big data.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

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CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Textbooks

1. Douglas Eadline,"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big DataComputing in the Apache Hadoop 2 Ecosystem", 1st Edition, Pearson Education,2016.
2. Anil Maheshwari, "Data Analytics", 1st Edition, McGraw Hill Education,2017

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/104/106104189/
2. https://www.youtube.com/watch?v=mNP44rZYiAU
3. https://www.youtube.com/watch?v=qr_awo5vz0g
4. https://www.youtube.com/watch?v=rr17cbPGWGA
5. https://www.youtube.com/watch?v=G4NYQox4n2g
6. https://www.youtube.com/watch?v=owI7zxCqNY0
7. https://www.youtube.com/watch?v=FuJVLsZYkuE

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Demonstration of Big Data related projects

Exploring the applications which involves big data.

VII Semester

INTRODUCTION TO DATA SCIENCE			
Course Code	21CS754	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. To provide a foundation in data Science terminologies
CLO 2. To familiarize data science process and steps
CLO 3. To Demonstrate the data visualization tools
CLO 4. To analyze the data science applicability in real time applications.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
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6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

PREPARING AND GATHERING DATA AND KNOWLEDGE
Philosophies of data science - Data science in a big data world - Benefits and uses of data science and big data - facts of data: Structured data, Unstructured data, Natural Language, Machine generated data, Audio, Image and video streaming data - The Big data Eco system: Distributed file system, Distributed Programming framework, Data Integration frame work, Machine learning Framework, NoSQL Databases, Scheduling tools, Benchmarking Tools, System Deployment, Service programming and Security.

Textbook 1: Ch 1.1 to 1.4

Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation

Module-2

THE DATA SCIENCE PROCESS-Overview of the data science process- defining research goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory data analysis, Build the models, presenting findings and building application on top of them.

Textbook 1:,Ch 2

Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation

Module-3

MACHINE LEARNING: Application for machine learning in data science- Tools used in machine learning- Modeling Process – Training model – Validating model – Predicting new observations –Types of machine learning Algorithm : Supervised learning algorithms, Unsupervised learning algorithms.

Textbook 1: Ch 3.1 to 3.3

Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation, Video

Module-4

VISUALIZATION–Introduction to data visualization – Data visualization options – Filters – MapReduce –
Dashboard development tools.

Textbook 1: Ch 9

Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation, MOOC

Module-5

CASE STUDIES Distributing data storage and processing with frameworks - Case study: e.g, Assessing risk when lending money.

Textbook 1: Ch 5.1, 5.2

Teaching-Learning Process	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes

At the end of the course the student will be able to:

CO 1. Describe the data science terminologies
CO 2. Apply the Data Science process on real time scenario.
CO 3. Analyze data visualization tools
CO 4. Apply Data storage and processing with frameworks

Assessment Details (both CIE and SEE)

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2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Textbooks

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman and Mohamed Ali,Manning Publications, 2016.

Reference Books

1. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.
2. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014
3. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013
4. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017.

Weblinks and Video Lectures (e-Resources):

1. https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science
2. https://www.youtube.com/watch?v=N6BghzuFLIg
3. https://www.coursera.org/lecture/what-is-datascience/fundamentals-of-data-science-tPgFU
4. https://www.youtube.com/watch?v=ua-CiDNNj30

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving using Data science techniques and demonstration of data visualization methods with the help of suitable project.