BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi)

Avalahalli, Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Artificial Intelligence and Machine Learning

V and VI Semester Scheme and Syllabus
2021 Scheme - Autonomous

Approved in the BoS meeting held on 25.05.2023

Vision and Mission of the Department

Vision of the Department

To develop professionals equipped to build sustainable and intelligent solutions that effectively interact with the natural intelligence towards creating a digitally empowered environment for future generations, safeguarding social ethics.

Mission of the Department

- To enable students with the spirit and power of interdisciplinary acumen by integrating a world of knowledge into a world of intelligent systems and subsystems.
- Boost academic outcome through place-based education and collaborations with established research labs and industries.
- Encourage entrepreneurship efforts among students and develop them into great leaders.

Program Educational Objectives (PEOs)

1. Possess essential professional engineering skills that make them confident to develop high-quality AI solutions for various application domains under realistic constraints.
2. Demonstrate the importance of life-long learning through professional development, computing practises, and specialized certifications.
3. Engage and succeed in their professional careers through team work, ethical behaviour, proactive involvement, and effective communication.

Program Specific Outcomes (PSOs)

1. Ability to apply acquired skills to build optimized solutions adhering to principles and practices of Computational Intelligence.
2. Employ ethical strategies and policies in project and product development.

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(An Autonomous Institution affiliated to VTU, Belagavi)
Yelahanka, Bengaluru-560064

Date: 14.06.2023

CIE and SEE Pattern for 2021 Scheme
(Applicable from the AY 2021-22 onwards)

Important Note:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examinations (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 marks out of 50). The student is declared as a pass in the course if he / she secures 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.

4 CREDIT and 3 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs to be conducted for 40 Marks (90 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10 marks, total **20 marks**.
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (3 hours).

Question Paper Pattern:

Part - A: Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.

Part - B: There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question from each module.**

SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.

2 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (2 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 100 questions each of 01 marks. The same is scale down to 50 marks.

1 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 50 Marks (1 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 50 questions each of 01marks. The same is scale down to 50 marks.

1 CREDIT LABORATORY COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Cumulative Assessment (CA) of each experiment is 20 Marks (Conduction 10 marks + Records 5 marks +Viva 5marks). The average of all the experiments to be taken for **20 marks.**
- Open Ended Experiments (OE) **10 marks.**
- 2 IAs Test to be conducted for 100 marks. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks. The average of 2 IA marks is scale down to **20 marks**.
- CIE marks =20 (CA) +10 (OE) + 20 (IA test) = 50 marks.
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks and scale down to 50 Marks.

Examinations to be conducted jointly by Two examiners. All the experiments are to be included for practical examination. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks.

CoE 16/06/2023

Dean AA 16/06/2023

Principal 19/6/23

Scheme of VI Semester

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021–22Choice Based Credit System (CBCS)

UG PROGRAM: Artificial Intelligence and Machine Learning (AIML) — **Semester: VI**

Sl. No	Course Category	CourseCode	Course Title	Teaching Dept.	Teaching Hours /Week				Credits	Examination			
					L	T	P	PW		Duration in Hours	CIE Marks	SEE Marks	Total Marks
1	HS	21HSS61	Project and Finance Management	AIML	2	0	0	0	2	2	50	50	100
2	AEC	21AEC62	Bio Informatics (Common to all)	AIML	0	2	0	0	1	1	50	50	100
3	AEC	21AM63	Robotic Process Automation (AEC from Department)	AIML	0	2	0	0	1	1	50	50	100
4	PE	21AM64X	Professional Elective II	AIML	3	0	0	0	3	3	50	50	100
5	OE	21AM65X	Open Elective I	AIML	3	0	0	0	3	3	50	50	100
6	PW	21AM66	Mini Project	AIML	0	0	0	4	2	3	50	50	100
7	PC	21AM67	Software Engineering	AIML	3	0	0	0	3	3	50	50	100
8	PC	21AM68	Data Science	AIML	3	0	2	0	4	3	50	50	100
9	PC	21AML69A	Machine Learning Laboratory	AIML	0	0	2	0	1	3	50	50	100
10	PC	21AML69B	Mobile Application Development Laboratory	AIML	0	0	2	0	1	3	50	50	100
TOTAL					14	4	6	4	21		500	500	1000

Professional Elective - Group II	
Course Code	**Course Title**
21AM641	Natural Language Processing
21AM642	Reinforcement Learning
21AM643	Big Data Analytics
21AM644	Deep Learning
21AM645	Computer Vision: Foundations and Applications

Open Elective (OE) - Group I	
CourseCode	**Course Title**
21AM651	Principles of Artificial Intelligence & its applications
21AM652	Real Time Operating Systems
21AM653	Game Theory
21AM654	Programming in Java

VI Semester Syllabus

B.E , ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - VI

Project & Finance Management (2:0:0) 2

(Effective from the academic year 2021-22)

Course Code	21HSS61	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Define the fundamentals of Project Management.
2. Identify the strategies involved in selection, prioritization, planning & scheduling of a project.
3. Understand the time value of money & apply it for decision making.
4. Analyze project risk, progress & results.
5. Make awareness about various sources of finance.
6. Gain Knowledge on working capital & capital budgeting.

Module – 1

Project Management: Need for project management, management practices to meet the challenges of new economic environment, globalization process, rapid technological advancement, and quality concerns of the stakeholders. **Finance: L**ife blood of any enterprise, efficient utilization and generation of monetary resources and funds, a comparative study of finance and economics, costs and revenue evaluation for various engineering operations.

Project Management: Definition of project, characteristics of projects, types of projects, project roles.

Project Selection & Prioritization: Strategic planning process, strategic objectives, identifying potential projects, feasibility study (environment, society), methods of selecting projects (financial model / scoring models), prioritizing projects, securing and negotiating projects.

(05 Hours)

Module – 2

Project planning & scheduling: Project scope & check list, work break down structure, project schedule, uncertainty in project schedules.

Project resourcing & risk planning: Abilities needed when resourcing projects, estimate resource needs, cost planning & estimating, risk management planning, risk identification, risk analysis, project quality planning and project kick-off.

(05 Hours)

Module – 3

Project performing, progress & results: Project supply chain management, project balanced score card approach, terminate project early, finish project, customer feedback & approval.

Network Analysis: Introduction, network construction-rules, Fulkerson's rule for numbering the events, AON and AOA diagrams, PERT & CPM Techniques.

(05 Hours)

Module – 4

Financial Management: Evolution of financial management, key activities of finance manager, key decision areas in financial management, financial statement with balance sheet problems.

Capital Budgeting: Types of capital budgeting decisions, capital budgeting proposals, estimating cash flows for project appraisal, green capital budgeting, problems on fixed budget & flexible budget.

(05 Hours)

Module – 5

Working capital management: Factors affecting working capital requirement, operating cycle analysis, negative working capital, cash planning & managing cash flows.

Cost of capital and leverage Analysis: Concept, significance, assumptions, factors affecting cost of capital, Leverage Analysis: operating leverage, financial leverage. **Recap:** All the 5 modules

(05 Hours)

Course outcomes:

The students will be able to:

CO1: Understand the selection, prioritization & initiation of individual projects.

CO2: Understand WBS, scheduling, uncertainty & risks associated in project.

CO3: Identify & Evaluate the progress and results of the project.

CO4: Understand time value of money & use it for decision making.

CO5: Outline capital requirements for starting a business & management of working capital.

Textbooks

1. Timothy J Kloppenborg, Project Management, Cengage Learning, 2nd Edition, 2009.
2. John J Hampton, Financial Management, PHI Publication, 4th edition.

References

1. Pennington Lawrence, Project Management, McGraw-Hill, 1st edition.
2. Joseph A Moder, Philips New Yark, Project Management with CPM & PRT, McGraw-Hill, 2nd edition, 1983.
3. Harold Kerzner, Project Management A system approach to Planning, Scheduling & Controlling, CBS Publication, 2nd Edition,2006.
4. S.D. Sharma, Operations Research, Kedar Nath Ramnath, Meerut, New Edition,2015.
5. M.Y. Khan, Financial Management, Tata Mc-Graw Hill, Fifth Edition,2007.
6. O.P. Khanna, Industrial Engineering & Management, Dhanpat Rai Publications, Second Edition, 1999.

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Bioinformatics (0:2:0) 1

COMMON TO ALL BRANCHES

(Effective from the academic year 2020 -2021)

Course Code	21AEC62	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:2:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	2 Hours

Course Objectives:

This course will enable students to:

1. Better understanding of dynamic biological processes and their understanding at molecular level enabled through and correlated using internet and Bioinformatics.
2. To relate the basic knowledge in Genetics & Molecular Biology and see how it can be applied through Bioinformatics perspective.
3. To utilize bioinformatics tools and databases for retrieving, analyzing, understanding and managing biological data.

Module – 1

Preamble: Bioinformatics is an interdisciplinary field mainly involving molecular biology and genetics, computer science, mathematics, and statistics. Data intensive, large-scale biological problems are addressed from a computational point of view.

Biological Data Acquisition

The form of biological information. Retrieval methods for DNA sequence, protein sequence and protein structure information (3 Hours)

Module – 2

DATABASES

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases primary sequence databases, protein sequence and structure databases, Organism specific databases.

(3 Hours)

Module – 3

DATA PROCESSING

DataAccess, Retrieval and Submission: Standard search engines; Data retrieval tools Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local versus global. Distance metrics. Similarity and homology. Scoring matrices. (3 hours)

Module – 4

METHODS OF ANALYSIS

Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, and PSI BLAST**.** (3 hours)

Module – 5

APPLICATIONS

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis: Comparative genomics, orthologs, paralogs. (3 hours)

Course Outcomes:

The students will be able to:

CO1: Apply the basic methodology in Bioinformatics to retrieve data.

CO2: Analyse bioinformatics tools and databases for understanding and managing biological data.

CO3: Examine the applications of bioinformatics in allied areas.

Textbooks:

1. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press.
2. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin, S.Eddy, A.Krogh, G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall,O"Reilley Media

References:

1. Bioinformatics The Machine Learning Approach by Pierre Baldi and Soren Brunak.

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Robotic Process Automation (0:2:0) 1

COMMON TO ALL BRANCHES

(Effective from the academic year 2020 -2021)

Course Code	21AM63	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:2:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	2 Hours

Course Objectives:

This course will enable students to:

1. Understand basic concepts of RP A
2. Describe RPA, where it can be applied and how it is implemented
3. Describe the different types of variables, Control Flow and data manipulation technique s
4. Understand Image, Text and Data Tables Automation
5. Describe various types of Exceptions and strategies to handle.

Module – 1

What is Robotic Process Automation? Scope and techniques of automation Robotic process automation -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.

(3 Hours)

Module – 2

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).

(3 Hours)

Module – 3

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**.**

(3 Hours)

Module – 4

Tame that Application with Plugins and Extensions: Terminal plugin- SAP automation, Java plugin- Citrix automation- Mail plugin- PDF plugin-Web integration.

Handling User Events and Assistant Bots: What are assistant bots?- Monitoring system event triggers- Monitoring image and element triggers-Launching an assistant bot on a keyboard event

(3 Hours)

Module – 5

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

(3 Hours)

Course Outcomes:

The students will be able to:

- **CO1:** To Understand the basic concepts of RPA and describe various components and platforms of RPA
- **CO2:** To Describe the different types of variables, control flow and data manipulation techniques
- **CO3:** To Understand various control techniques and OCR in RPA
- **CO4:** To Understand various Plugins and assisting Bots
- **CO5:** To Describe various types and strategies to handle exceptions

Textbooks:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN:9781788470940

References:

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

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Natural Language Processing (3:0:0) 3

(Effective from the academic year 2021 -2022)

Course Code	21AM641	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To introduce the fundamentals of Language processing from the algorithmic viewpoint.
2. To discuss various issues those, make natural language processing a hard task.
3. To discuss some applications of Natural Language Processing (NLP).

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends. Introduction to Natural Language Processing (NLP), understanding and generation of language, application areas of NLP

Introduction to Natural Language Understanding- Levels of language analysis- Syntax, Semantics, Pragmatics. Linguistic Background- An Outline of English Syntax.

(8 Hours)

Module – 2

Lexicons, POS Tagging, Word Senses.

Grammars and Parsing- Features, Agreement and Augmented Grammars.

Grammars for Natural Language, Parsing methods, and Efficient Parsing. Ambiguity Resolution- Statistical Methods. Probabilistic Context Free Grammar

(8 Hours)

Module – 3

Semantics and Logical Form: Linking Syntax and Semantics- Ambiguity Resolution- other Strategies for Semantic Interpretation- Scoping and the Interpretation of Noun Phrases

(8 Hours)

Module – 4

Knowledge Representation and Reasoning- Local Discourse 8 20% Context and Reference- Using World Knowledge- Discourse Structure- Defining a Conversational Agent.

(8 hours)

Module – 5

Applications- Machine Translation, Information Retrieval and Extraction, Text Categorization and Summarization.

Recap/Summary of the Course

(8 hours)

Course Outcomes:

The students will be able to:

CO1: Understand the various levels of Language Analysis

CO2: Describe the context free parsing of textual descriptions.

CO3: Apply semantics and logical forms to process language

CO4: Implement knowledge representation towards describing context and meaning of language.

Textbooks:

1. D. Jurafsky and J. H. Martin, Speech and Language Processing, Prentice Hall India, 2000
2. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Reference Books:

1. James Allen, Natural Language Understanding, The Benjamin/Cummings Publishing Company Inc, 2nd Edition, 2013.
2. U. S. Tiwary and Tanveer Siddiqui, Natural Language Processing and Information Retrieval, Oxford University Press, 2008

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

REINFORCEMENT LEARNING (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM642	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand of the foundational ideas on which modern reinforcement learning is built, including Markov decision processes, value functions, Monte Carlo estimation.
2. Design and apply required knowledge to apply reinforcement-learning techniques to novel applications.

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective.

Overview of the course in current Innovations and Research trends. Course Overview: Overview of reinforcement learning: the agent environment framework, successes of reinforcement learning, Bandit problems and online learning, Markov decision processes.

(8 Hours)

Module – 2

Returns, and value functions, Solution methods: dynamic programming, Solution methods: Monte Carlo learning.

(8 Hours)

Module – 3

Solution methods: Temporal difference learning, Eligibility traces, Value function approximation (function approximation)

(8 Hours)

Module – 4

Value function approximation (function approximation), Models and planning (table lookup case), Case studies: successful examples of RL systems.

(8 Hours)

Module – 5

Case studies: successful examples of RL systems, Frontiers of RL research

Recap/Summary of the Course.

(8 Hours)

Course Outcomes:

The students will be able to:

- CO1 Understand and explore the knowledge of reinforcement learning techniques.
- CO2 Analyze the problems of different reinforcement techniques.
- CO3 Design and solve the different RL techniques

Textbooks

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT, Second Edition.
2. Csaba Szepesvari , "Algorithms for Reinforcement learning", Morgan & Claypool, July 2010..

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Big Data Analytics (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM643	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

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

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.

Text book 1: Chapter 1: 1.2 -1.7 (8 Hours)

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.

Text book 1: Chapter 2 :2.1-2.6

Text Book 2: Chapter 3 Text Book 2: Chapter 7 (except walk throughs)

(8 hours)

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.

Text book 1: Chapter 3: 3.1-3.7

(8 hours)

Module – 4

MapReduce, Hive and Pig:

Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.

Text book 1: Chapter 4: 4.1-4.6

(8 hours)

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:
Text book 1: Chapter 6: 6.1 to 6.5
Text book 1: Chapter 9: 9.1 to 9.5

(8 hours)

Course Outcomes:

The students will be able to:

CO1 Understand fundamentals of Big Data analytics.

CO2 Investigate Hadoop framework and Hadoop Distributed File system..

CO3 Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data..

CO4 Demonstrate the Map Reduce programming model to process the big data along with Hadoop tools.

CO5 Use Machine Learning algorithms for real world big data and analyze web contents and Social Networks to provide analytics with relevant visualization tools.

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

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Deep Learning (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM644	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short-term memory cells and convolutional neural networks.
2. Identify the deep learning algorithms, which are more appropriate for various types of learning tasks in various domains.
3. Implement deep learning algorithms and solve real-world problems.

Module – 1

Why Deep Learning: What is AI and deep learning? The history and rise of deep learning, why deep learning, The motivation of deep architecture, Applications, Future potential and challenges

Getting Yourself Ready for Deep Learning: Basics of linear algebra, Deep learning with GPU, Deep learning software frameworks, Setting up deep learning on AWS.

Chapter 1,2 (8 Hours)

Module – 2

Getting Started with Neural Networks: Multilayer perceptron's, how a network learns, Deep learning models, Deep learning models, Deep learning models, Recurrent neural networks (RNN/LSTM), Recurrent neural networks (RNN/LSTM).

Deep Learning in Computer Vision: Origins of CNNs, Fine-tuning CNNs, Popular CNN architectures.

Chapter: 3,4 (8 hours)

Module – 3

NLP - Vector Representation: Traditional NLP, Deep learning NLP, Word embeddings, Word2Vec, Applications.

Advanced Natural Language Processing: Deep learning for text, Recurrent neural networks, long short-term memory network, Chatbots.

Chapter: 5, 6 (8 hours)

Module – 4

Multimodality: What is multimodality learning? Challenges of multimodality learning, Image captioning, Visual question answering, multi-source based self-driving.

Deep Reinforcement Learning: What is reinforcement learning (RL)? Deep reinforcement learning, Implementing reinforcement learning.

Chapter:7,8 **(**8 hours)

Module – 5

Deep Learning Hacks: Massaging your data, Tricks in training, Fine-tuning, Model compression.

Deep Learning Trends: Recent models for deep learning, Novel applications, Genomics, Predictive medicine, Clinical imaging, Lip reading, Visual reasoning, Code synthesis.

Chapter:9,10 (8 hours)

Course Outcomes:

The students will be able to:

CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO2	Implement deep learning algorithms and solve real-world problems.
CO3	Build, train, test and evaluate neural networks for different applications and data types.
CO4	Execute performance metrics of Deep Learning Techniques.
CO5	Identify the deep learning algorithms which are more appropriate for various types of learning.

Question paper pattern:

- SEE will be conducted for 100 marks.
- Part A: First question with 20 MCQs carrying 1 mark each.
- Part B: Each full question is for 16 marks. (Answer five full questions out of 10 questions with intra modular choice). In every question, there will be a maximum of three sub-questions.
- CIE will be announced prior to the commencement of the course.
- 30 marks for test. Average of three test will be taken.
- 20 marks for Alternate Assessment Method.

Textbooks

1 Wei Di, Anurag Bhardwaj, Jianing Wei, “Deep Learning Essentials” , Packt publishers, 2018

Reference Books

1 Aurélien Géron, Hands-On Machine Learning with Scikit-Learn,Keras, and TensorFlow, 2ndEdition, O'Reilly Media, Inc. 2019.

2 Neural Networks and Deep Learning, Charu C. Aggarwal, Springer International Publishing, 2018

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Computer Vision: Foundations and Applications (3:0:0) 3

(Effective from the academic year 2021 -2022)

Course Code	21AM645	CIE Marks	50
Teaching Hours/Week (L: T:P)	3-0-0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course objectives:

This course will enable students:

1. To review image processing techniques for computer vision
2. To understand shape and region analysis
3. To understand Hough Transform and its applications to detect lines, circles, ellipses
4. To understand three-dimensional image analysis techniques
5. To study some applications of computer vision algorithms

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends.

Overview, CAMERAS: Pinhole Cameras, **Radiometry – Measuring Light:** Light in Space, Light Surfaces, Important Special Cases, **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, **Color:** The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

(8 Hours)

Module – 2

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges, **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture

(8 Hours)

Module – 3

The Geometry of Multiple Views: Two Views, **Stereopsis:** Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, **Segmentation by Clustering:** What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering

(8 Hours)

Module – 4

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

(8 Hours)

Module – 5

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations,

Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization,

Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

Recap/Summary of the Course.

(8 Hours)

Course outcomes:

The students should be able to:

CO1: Perform shape analysis

CO2: Develop applications using computer vision techniques.

CO3: Implement fundamental image processing techniques required for computer vision

CO4: Apply chain codes and other region descriptors.

CO5: Analyze the applications of Computer vision algorithms

Textbooks:

1. Simon Prince, "Computer Vision: Models, Learning and Interference", Cambridge University Press, 2012

References:

1. Forsyth, Ponce, "Computer Vision: A modern Approach", Pearson Publications, 2011

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Principles of Artificial Intelligence and its applications (3:0:0) 3

(Effective from the academic year 2021-22)

Subject Code	21AM651	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Identify the problems where AI is required and the different methods available
2. Compare and contrast different AI techniques available.
3. Define and apply learning algorithms

Module – 1

Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends. Introduction: AI in transforming the world, Impact of AI on international trade, National strategy for AI, Introduction to Artificial Intelligence, Philosophical Foundations of Artificial Intelligence, weak AI and strong AI, Ethics and Risk of developing AI, Applications of Artificial Intelligence, Agents and Environments, Intelligent Agents, Structure of Intelligent Agents.

(8 Hours)

Module – 2

Problem Solving: Solving problems by searching, Problem solving agents, searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimization problems, constraint satisfaction, Means End Analysis, Adversarial Search, Games, Optimal Decision in Games, Alpha - Beta pruning.

(8 Hours)

Module – 3

Knowledge and Reasoning: Knowledge based Agents, The Wumpus world, Logic, Propositional Logic: A very simple logic, Propositional theorem proving, first order logic, Representation revisited, Syntax and semantics of first order logic, using first order logic Knowledge in first order logic.

(8 Hours)

Module – 4

Slot Filler Structures: Weak slot filler structures, Semantic Nets, Frames, Strong filler structures, conceptual dependency Scripts, Frames, CYC.

(8 Hours)

Module – 5

Planning, Understanding and Expert System: Overview, Block world Problem example, components of a planning system, Goal stack planning, Nonlinear planning using constraint posting, hierarchical planning, other planning techniques, what is understanding? What makes understanding hard? Understanding as constraint satisfaction

Representing and using domain knowledge, Expert System Shells, Explanation, Knowledge Acquisition

(8 Hours)

Recap/ Summary of the Course

Course outcomes:
The students will be able to:

CO1	Identification and representation of AI based problems.
CO2	Apply appropriate search techniques to solve AI problems.
CO3	Analyze various learning techniques for solving AI problems.
CO4	Design and demonstrate AI applications benefiting to real time problems.

Textbooks:

1. Stuart Russell, Peter Norvig, Artificial Intelligence – A Modern Approach, Pearson Education, Third Edition,2015
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hil, Third Edition l, 2010

Reference Book:

1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Pearson Education, Fourth Edition-2002.
2. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education,2008.
3. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India.
4. D W Rolston, "Artificial Intelligence and Expert Systems", Mc Graw hill

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – VI

Real Time Operating System (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM652	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Setup and demonstrate the development environment for RTOS
2. Illustrate strategies to interface memory and I/O with RTOS kernels
3. Interpret tasks used in handling multiple activities
4. impart skills necessary to develop software for embedded computer systems using a real-time operating system

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends. Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Architecture of OS (Monolithic, Microkernel, Layered, kernel and Hybrid kernel structures), Batch, Multi programming, Multitasking, Multiuser, parallel, distributed & real –time O.S.

(8 Hours)

Module – 2

Scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing techniques.

(8 Hours)

Module – 3

STM32f4_RTOS_BSP, Testing STM32f4_RTOS_BSP, Time Management
Timer Management, Resource Management Disable/Enable Interrupts, Lock/Unlock Semaphores, Mutex, Deadlocks, Synchronization.

(8 Hours)

Module – 4

Introduction to Internal Task, Idle Task, Tick Task, Statistics Task, Timer Task, ISR Handler Task, Scheduling, Preemptive Scheduling, Scheduling points, Round Robin Scheduling Context Switching , coding cooperation.

(8 Hours)

Module – 5

Interrupt Management, Interrupt Service Routine, Non-Kernel Aware Interrupt Service Routine CPUs with Multiple Interrupt Priorities, All Interrupts Vector to a Common Location, Every Interrupt Vectors to a Unique Location, Direct vs. Deferred Post Methods.
Recap/Summary of the Course.

(8 Hours)

Course Outcomes:

The students will be able to:

CO1	Create, test and debug on RTOS environment
CO2	Implement Inter task communication mechanism.
CO3	Compare general purpose OS with RTOS
CO4	Demonstrate methods in storing, retrieving data in RTOS
CO5	Analyze performance of task during multitasking

Textbooks

1 Jean J Labrosse, "Micro C/OS-II, The Real Time Kernel", CMP, 3rd, 2016.

2 Mazidi, "STM32 Arm Programming for Embedded Systems", MircordigitalED, 1st 2018.

Reference Books

1 Colin walls, "Building a Real Time Operating System: RTOS from the Ground Up", Newness, 2020.

2 Sam, "Real-Time Embedded Components and Systems: With Linux and RTOS", Mercury Learning, 2015.

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - VI

Game Theory (3:0:0) 3

(Effective from the academic year 2021 -22)

Course Code	21AM653	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Students will be able to explain and describe the concepts central to the creation of knowledge bases and expert systems.
2. Students will be knowledgeable about the tools and the processes used for the creation of an expert system.
3. Student will know methods used to evaluate the performance of an expert system.
4. Students will be able to conduct an in-depth examination of an existing expert system with an emphasis on basic methods of creating a knowledge base.
5. Students will be able to examine properties of existing systems in a case-study manner, comparing differing approaches

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends.

Games and Solutions Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation Nash Equilibrium- Strategic Games, Nash Equilibrium Examples Existence of a Nash Equilibrium, Strictly Competitive Games, Bayesian Games: Strategic Games with Imperfect Information

(8 Hours)

Module – 2

Mixed, Correlated, and Evolutionary Equilibrium-Mixed Strategy Nash Equilibrium Interpretations of Mixed Strategy Nash Equilibrium Correlated Equilibrium Evolutionary Equilibrium Rationalizability and Iterated Elimination of Dominated Actions-Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions

(8 Hours)

Module – 3

Knowledge and Equilibrium: A Model of Knowledge Common Knowledge, Can People Agree to Disagree? Knowledge and Solution Concepts, The Electronic Mail Game

(8 Hours)

Module – 4

Extensive Games with Perfect Information

Extensive Games with Perfect Information Sub-game Perfect Equilibrium Two Extensions of the Definition of a Game The Interpretation of a Strategy, Two Notable Finite Horizon Games, Iterated Elimination of Weakly Dominated Strategies Bargaining Games -Bargaining and Game Theory , A Bargaining Game of Alternating Offers Sub-game Perfect Equilibrium Variations and Extensions

(8 Hours)

Module – 5

Repeated Games

The Basic Idea Infinitely Repeated Games vs.\ Finitely Repeated Games Infinitely Repeated Games: Definitions Strategies as Machines Trigger Strategies: Nash Folk Theorems Punishing for a Limited Length of Time: A Perfect Folk Theorem for the Limit of Means Criterion Punishing the Punisher: A Perfect Folk Theorem for the Overtaking Criterion Rewarding Players Who Punish: A Perfect Folk Theorem for the Discounting Criterion The Structure of Sub-game Perfect Equilibria Under the Discounting Criterion Finitely Repeated Game

(8 Hours)

Recap/Summary of the Course.

Course outcomes:

The students will be able to:

CO1: Understand the different types of games and their uses in strategic thinking.

CO2: Analyze different games and use a variety of tools to find equilibria.

CO3: Construct models of bargaining and negotiation and how they can be applied to models of competition.

CO4: Distinguish between the different strands of game theory.

CO5: Assess the importance of information in games and how this can change behaviors.

Textbooks:

1. M. J. Osborne and A. Rubinstein, "A course in Game Theory", MIT Press Roger Myerson
2. E N Barron, Game Theory: An Introduction, Wiley India

References:

1. J Von Neummann and Mogenstern, "Theory of Games and Economic Behavior", John Wiley and Sons.
2. R.D Luce and H. Raiffa, "Games and Decessions", John Wiley and Sons
3. G. Owen, "Game Theory" , Newyork: Academic Press

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - VI

PROGRAMMING IN JAVA (3:0:0) 3

(Effective from the academic year 2021 -22)

Course Code	21AM654	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Learn fundamental features of object-oriented language and JAVA
2. Set up Java JDK environment to create, debug and run simple Java programs.
3. Learn object-oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object-Oriented concepts

Module – 1

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Text book 1: Ch 2, Ch 3 (8 Hours)

Module – 2

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java‟s Selection Statements, Iteration Statements, Jump Statements.

Text book 1: Ch 4, Ch 5 (8 Hours)

Module – 3

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

Text book 1: Ch 6, Ch 7.1-7.9, Ch 8. (8 Hours)

Module – 4

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java‟s Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.

Text book 1: Ch 9, Ch 10 (8 Hours)

Module – 5

Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.

Text book 1: Ch 12.1,12.2, Ch 13, Ch 15 (8 Hours)

Recap/Summary of the Course.

Course outcomes:

The students will be able to:

CO1: Describe object-oriented programming and different Data types, Variables, and Arrays in Java programming..

CO2: Develop simple Java programs using operators and control statements

CO3: Introduce the concepts of Classes and Inheritance in Java programs to solve real world problems.

CO4: Demonstrate the creation and use of packages, and the concept of exception handling in Java

CO5: Demonstrate the concept of I/O, Enumeration, type wrapper, Applet and string handling in Java.

Textbooks:

1. 1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)

References:

1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - VI

SOFTWARE ENGINEERING (3:0:0) 3

(Effective from the academic year 2021 -22)

Course Code	21AM67	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Learn fundamental features of object-oriented language and JAVA
2. Set up Java JDK environment to create, debug and run simple Java programs.
3. Learn object-oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object-Oriented concepts

Module – 1

Introduction:

Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies.

Software Processes:

Models: Waterfall Model (Sec 2.1.1), Incremental Model (Sec 2.1.2) and Spiral Model (Sec 2.1.3). Process activities.

Requirements Engineering: Requirements Engineering Processes (Chap 4). Requirements Elicitation and Analysis (Sec 4.5). Functional and non-functional requirements (Sec 4.1). The software Requirements Document (Sec 4.2). Requirements Specification (Sec 4.3). Requirements validation (Sec 4.6). Requirements Management (Sec 4.7). (8 Hours)

Module – 2

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is Object oriented development? Object oriented Themes; Evidence for usefulness of Object-oriented development; Object oriented modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models;

Textbook 2: Ch 1,2,3. (8 Hours)

Module – 3

System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5).

Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 7). Object-oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open-source development (Sec 7.4). (8 Hours)

Module – 4

Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 212).

Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4). (8 Hours)

Module – 5

Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5).
Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)

(8 Hours)

Recap/Summary of the Course.

Course outcomes:

The students will be able to:

CO1: Design a software system, component, or process to meet desired needs within realistic constraints.
CO2: Assess professional and ethical responsibility
CO3: Function on multi-disciplinary teams.
CO4: Use the techniques, skills, and modern engineering tools necessary for engineering practice
CO5: Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems

Textbooks:

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.

References:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - VI

DATA SCIENCE (3:0:2) 4

(Effective from the academic year 2021 -22)

Course Code	21AM68	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40 + 10	Exam Hours	03

Course objectives:

This course will enable students to:

1. Determine the appropriate natural language processing, machine learning and deep learning models to solve the business-related challenges.
2. Indicate proficiency with statistical analysis of data to derive insight from results and interpret the data findings visually.
3. Demonstrate skills in data management by obtaining, cleaning and transforming the data.
4. Discuss how social networks appraise the ways in which the social clustering shape individuals and groups in contemporary society.

PART A :Theory Component

Module – 1

Introduction : What is Data Science?

Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, **Linear Algebra,** Vectors, Matrices, **Statistics,** Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, **Probability,** Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

Chapters 1, 3, 4, 5 and 6 (8 Hours)

Module – 2

Hypothesis and Inference,Statistical Hypothesis Testing, Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, Bayesian Inference, **Gradient Descent,** The Idea Behind Gradient Descent Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent, **Getting Data,** stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, **Working with Data,** Exploring Your Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction.

Chapters 7, 8, 9 and 10 (8 Hours)

Module – 3

Machine Learning, Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, **k-Nearest Neighbors,** The Model, Example: The Iris Dataset, The Curse of Dimensionality, **Naive Bayes,** A Really Dumb Spam Filter, A More Sophisticated Spam Filter, Implementation, Testing Our Model, Using Our Model, **Simple Linear Regression,** The Model, Using Gradient Descent, Maximum Likelihood Estimation, **Multiple Regression,** The Model, Further Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization, **Logistic Regression,** The Problem, The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines.

Chapters 11, 12, 13, 14, 15 and 16 (8 Hours)

Module – 4
Decision Trees, What Is a Decision Tree?, Entropy, The Entropy of a Partition, Creating a Decision Tree, Putting It All Together, Random Forests, **Neural Networks,**Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example: Fizz Buzz, **Deep Learning,** The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Example: XOR Revisited, Other Activation Functions, Example: FizzBuzz Revisited, Softmaxes and Cross-Entropy, Dropout, Example: MNIST, Saving and Loading Models, **Clustering,** The Idea, The Model, Example: Meetups, Choosing k, Example: Clustering Colors, Bottom-Up Hierarchical Clustering. **Chapters17, 18, 19 and 20** (8 Hours)
Module – 5
Natural Language Processing, Word Clouds, n-Gram Language Models, Grammars, An Aside: Gibbs Sampling, Topic Modeling, Word Vectors, Recurrent Neural Networks, Example: Using a Character-Level RNN, **Network Analysis,** Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, **Recommender Systems,**Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization. **Chapters 21, 22 and 23** (8 Hours) Recap/Summary of the Course.

PART B -PRACTICAL COMPONENT

1	A study was conducted to understand the effect of number of hours the students spent studying on their performance in the final exams. Write a code to plot line chart with number of hours spent studying on x-axis and score in final exam on y-axis. Use a red '*' as the point character, label the axes and give the plot a title.

Number of hrs spent studying (x)	10	9	2	15	10	16	11	16
Score in the final exam (0-100) (y)	95	80	10	50	45	98	38	93

2	For the given dataset mtcars.csv (www.kaggle.com/ruiromanini/mtcars), plot a histogram to check the frequency distribution of the variable 'mpg' (Miles per gallon)
3.	Consider the books dataset BL-Flickr-Images-Book.csv from Kaggle (https://www.kaggle.com/adeyoyintemidayo/publication-of-books) which contains information about books. Write a program to demonstrate the following. 1. Import the data into a DataFrame 2. Find and drop the columns which are irrelevant for the book information. 3. Change the Index of the DataFrame 4. Tidy up fields in the data such as date of publication with the help of simple regular expression. Combine str methods with NumPy to clean columns
4	Train a regularized logistic regression classifier on the iris dataset (https://archive.ics.uci.edu/ml/machine-learning-databases/iris/ or the inbuilt iris dataset) using sklearn.Train the model with the following hyperparameter C = 1e4 and report the best classification accuracy.
5	Consider the dataset spiral.txt (https://bit.ly/2Lm75Ly). The first two columns in the dataset corresponds to the co-ordinates of each data point. The third column corresponds to the actual cluster label. Compute the rand index for the following methods:

	1. K – means Clustering 2. Single – link Hierarchical Clustering 3. Complete link hierarchical clustering. Also visualize the dataset and which algorithm will be able to recover the true clusters

Course outcomes:

The students will be able to:

CO1: Interpret the concepts and methods of mathematical disciplines relevant to data analytics and statistical modeling.

CO2: Examine, visualize, curate, and prepare data and recognize how the quality of the data and the means of data collection may affect interpretation.

CO3: Determine the machine learning, deep learning and natural language processing skills to design and implement efficient, data-driven solutions for real world problems.

CO4: Illustrate how network analysis and recommender systems can contribute to increasing knowledge about diverse aspects of societal clustering.

Textbooks:

1. Joel Grus, "Data Science from Scratch", 2ndEdition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-9352138326

References:

3. Emily Robinson and Jacqueline Nolis, "Build a Career in Data Science", 1st Edition, Manning Publications, 2020. ISBN: 978-1617296246.
4. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-1492032649.
5. François Chollet, "Deep Learning with Python", 1st Edition, Manning Publications, 2017. ISBN-13: 978-1617294433

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - VI

Machine Learning Laboratory (0:0:2) 1

(Effective from the academic year 2021 -2022)

Course Code	21AML69A	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	13	Exam Hours	3

Course objectives:

This course will enable students to

1. To learn and understand the Importance Machine learning Algorithms
2. Compare and contrast the learning techniques like Bayesian learning and reinforcement learning.
3. Able to solve and analyse the problems on Artificial Neural Network techniques.
4. To impart the knowledge of clustering and classification Algorithms for predictions and evaluating Hypothesis.

PART A

1	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples.
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
5	Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API
7	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML library classes/API in the program.
8	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10	Implement and demonstrate the working of SVM algorithm for classification.

PART B (Open Ended Experiments)

A problem statement for each batch is to be generated in consultation with the co-examiner and student should develop an algorithm, program and execute the Program for the given problem with appropriate outputs.

Course Outcomes:

The students will be able to:

CO1: Create, test and debug Android application by setting up Android development environment.
CO2: Implement adaptive, responsive user interfaces that work across a wide range of devices.
CO3: Infer long running tasks and background work in Android applications.
CO4**:** Demonstrate methods in storing, sharing and retrieving data in Android applications.
CO5: Infer the role of permissions and security for Android applications.

Text Books:

1. Google Developer Training, **"Android Developer Fundamentals Course – Concept Reference",** Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentalscourse concepts/details (Download pdf file from the above link)

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from each of the lot.
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
4. PART –A: Procedure + Conduction + Viva: 10 + 35 +05 (50)
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - VI

Mobile Application Development Laboratory (0:0:2) 1

(Effective from the academic year 2021 -2022)

Course Code	21AML69B	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	13	Exam Hours	3

Course objectives:

This course will enable students to

1. Learn and acquire the art of Android Programming.
2. Configure Android studio to run the applications.
3. Understand and implement Android's User interface functions.
4. Create, modify and query on SQlite database.
5. Inspect different methods of sharing data using services.

	PART A
1	Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number.
2	Develop an Android application using controls like Button, TextView, EditText for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and Division
3	Create a SIGN Upton activity with Username and Password. Validation of password should happen
4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds. Keystrokes / Mouse:
5	Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter
6	Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.
7	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice.
8	Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.
	PART B

1. Design an application that accesses your camera and scans the QR code or barcode and returns the results by Integrating the Mobile Vision API of Google Play Service.
2. Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.
3. Design an android media player application that includes audio, video and recording media. The applications should be able to l control the audio/video playback like start, stop, pause etc, record the audio/video file and store it in the external directory in mp3/mp4 format.
4. Design an application using SQLite database to perform database operations on Student database like Name, USN, contact details and email id. Create the database handler class that extends SQLiteOpenHelper and implement its methods.
5. Develop a content provider application with an activity called "Meeting Schedule" which takes Date, Time and Meeting Agenda as input from the user and store this information into the SQLite database. Create another application with an activity called "Meeting Info" having DatePicker control, which on the selection of a date should display the Meeting Agenda information for that particular date, else it should display a toast message saying "No Meeting on this Date".
6. Write a program to create an activity having a Text box, and also Save, Open and Create buttons. The user has to write some text in the Text box. On pressing the Create button the text should be saved as a text file in MkSDcard. On subsequent changes to the text, the Save button should be pressed to store the latest content to the same file. On pressing the Open button, it should display the contents from the previously stored files in the Text box. If the user tries to save the contents in the Textbox to a file without creating it, then a toast message has to be displayed saying "First Create a File".
7. Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On pressing the Start Task button, the banner message should scroll from right to left. On pressing the Stop Task button, the banner message should stop. Let the banner message be "Demonstration of Asynchronous Task".
8. Develop an application that makes use of the clipboard framework for copying and pasting text. The activity consists of two EditText controls and two Buttons to trigger the copy and-paste functionality.

Course Outcomes:

The students will be able to:

CO1: Understand and explore the basic components of Automation Anywhere

CO2: Apply the feature of AA for designing BOTS

CO3: Build applications related to website, email.

CO4: Design BOTS by writing automated scripts

Procedure to Conduct Practical Examination

- **Experiment distribution**

For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity from Part A. Part B would be a mini project.

Change of experiment is allowed only once and marks are allotted the for the procedure to be made zero of the changed part only.

- **Marks Distribution**

For laboratories having PART A and PART B

i. Part A – Procedure + Execution + Viva = 7 + 35 + 8 = 50 Marks

ii. Part B – Project Demo and Presentation + Viva = 7 + 35 + 8 = 50 Marks

Text Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
https://www.gitbook.com/book/google-developer-training/android-developerfundamentals-course-concepts/details (Download pdf file from the above link)

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition,
3. O"Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
4. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 3rd Edition, Big Nerd Ranch Guides, 2017. ISBN-13: 978-0134706054