ADVANCED ARTIFICIAL INTLLIGENCE (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI71	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs
CREDITS –4			

Course Learning Objectives: This course will enable students to:

- Demonstrate the fundamentals of Intelligent Agents
- Illustrate the reasoning on Uncertain Knowledge
- Explore the explanation based learning in solving AI problems
- Demonstrate the applications of Rough sets and Evolutionary Computing algorithms

Module 1	**Contact Hours**
IntelligentAgents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents **Problem Solving :**Game Paying **T1: Chapter 2, Chapter 5 (2.1 to 2.4, 5.1 to 5.6)**	10
Module 2	
Uncertain knowledge and Reasoning: Quantifying Uncertainty**,** Acting under Uncertainty , Basic Probability Notation, Inference Using Full Joint Distributions, Independence , Bayes'Rule and Its Use The WumpusWorld Revisited, **T1: Chapter 13**	10
Module 3	
Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks , Efficient Representation of Conditional Distributions Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks. **T1: Chapter 14**	10
Module 4	
Perception: Image Formation, Early Image-Processing Operation, Object Recognition by Appearance, Reconstructing the 3DWorld. Object Recognition from Structural Information, Using Vision **T1: Chapter 24**	10
Module 5	
Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model. **T2: Chapter 1, 2**	10

Course Outcomes: The student will be able to :

- Demonstrate the fundamentals of Intelligent Agents
- Illustrate the reasoning on Uncrtain Knowledge

- Explore the explanation based learning in solving AI problems
- Demonstrate the applications of Rough sets and Evolutionary Computing algorithms

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Artificial Intelligence, A Modern Approach, Stuart J. Russell and Peter Norvig, Third Edition, Pearson, 2010
2. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

Reference Books:

1. An Introduction to Multi Agent Systems, Michael Wooldridge, Second Edition, John Wiley & Sons

ADVANCED MACHINE LEARNING (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI72	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs
CREDITS –4			

Course Learning Objectives: This course will enable students to:

- Demonstrate the fundamentals of GDT
- Illustrate the use of KNN
- Explore the Text feature Engineering concepts with Applications
- Demonstrate the use of Ensemble Methods

Module 1	**Contact Hours**
Advanced Machine Learning: Overview, Gradient Descent algorithm, Scikit-learn library for ML, Advanced Regression models, Advanced ML algorithms, KNN, ensemble methods. **T2: Chapter 6 (upto 6.5.4)** **Forecasting:**Overview, components, moving average, decomposing time series, auto-regressive Models. **T2: Chapter: 8**	10
Module 2	
Hidden Markov Model: Introduction, Issues in HMM(Evalution, decoding, learning, classifier) **T3: Chapter 12** **CLUSTERING** **Introduction,** Types of clustering, Partitioning methods of clustering (k-means, k-medoids), hierarchical methods **T3: Chapter 13**	10
Module 3	
Recommender System: Datasets, Association rules, Collaborative filtering, User-based similarity, item-based similarity, using surprise library, Matrix factorization **Text Analytics:** Overview, Sentiment Classification, Naïve Bayes model for sentiment classification, using TF-IDF vectorizer, Challenges of text analytics **T2: Chapter 9 and** 10	10
Module 4	
Neural networks and genetic algorithms: Brief history and Evolution of Neural network, Biological neuron, Basics of ANN,Activation function, MP model. **T3: Chapter 6** Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Genetic Algorithms – Hypothesis Space Search – Genetic	10

Programming – Models of Evolution and Learning. **T1: Chapter 4 & 9**	
Module 5	
Instant based learning and learning set of rules: Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning(review), locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning **T1 :Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3**	10

Course Outcomes: The student will be able to :

- Apply effectively ML algorithmsto solve real world problems.
- Apply Instant based techniques and derive effectively learning rules to real world problems.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

T1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013

T2. Machine Learning using Python ,Manaranjan Pradhan, U Dinesh Kumar, Wiley 2019

T3. Machine Learning, Anuradha Srinivasaraghavan, VincyJoeph, Wiley 2019

Reference Books:

1. EthemAlpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

INTERNET OF THINGS (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI731	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			

Course Learning Objectives: This course will enable students to:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.

Module 1	**Contact Hours**
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. **Textbook 1: Ch.1, 2** **RBT: L1, L2, L3**	08
Module 2	
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. **Textbook 1: Ch.3, 4** **RBT: L1, L2, L3**	08
Module 3	
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. **Textbook 1: Ch.5, 6** **RBT: L1, L2, L3**	08
Module 4	
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment **Textbook 1: Ch.7, 8** **RBT: L1, L2, L3**	08
Module 5	
IoT Physical Devices and Endpoints – Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints –RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture,	08

Smart City Use-Case Examples. **Textbook 1: Ch.12** **Textbook 2: Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6** **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,**"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** 1st Edition, Pearson Education (Cisco Press Indian Reprint). (**ISBN:** 978-9386873743)
2. Srinivasa K G, **"Internet of Things",**CENGAGE Leaning India, 2017

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1st Edition, VPT, 2014. (**ISBN:** 978-8173719547)
2. Raj Kamal, **"Internet of Things: Architecture and Design Principles",** 1st Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224)

Mandatory Note:

Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessment

Maintain a copy of the report for verification during LIC visit.

Posssible list of practicals:

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

MULTIAGENT SYSTEMS
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI732	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- To introduce the concept of amultiagent systems and Distributed Constraints
- To explore the main issues surrounding the 93omputer and extended form games.
- To understand learning in Multiagent Systems
- To introduce a contemporary platform for implementing agents and multiagent systems.

Module – 1	**Contact Hours**
Multiagent Problem Formulation: Utility, Markov Decision Processes, Planning **Distributed Constraints**:Distributed Constraint Satisfaction, Distributed Constraint Optimization **T1: Chapters 1 &2, T2: Chapter 1**	08
Module – 2	
Standard and Extended Form Games: Games in Normal Form, Games in Extended Form, Self-interested agents, Characteristic Form Games, Coalition Formation **T1: Chapters 3&4, T2: Chapter 3**	08
Module – 3	
Learning in Multiagent Systems: The Machine Learning Problem, Cooperative Learning, Repeated Games, Stochastic Games, General Theories for Learning Agents, Collective Intelligence **T1: Chapters 5**	08
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 **T1: Chapters 6&7,** **T2: Chapter 11**	08
Module – 5	
Voting and Mechanism Design: The Voting Problem, Mechanism Design. **Nature-Inspired Approaches:**Ants and Termites, Immune System **T1: Chapters 8&10,** **T2: Chapter 10**	08

Course outcomes: The students should be able to:

- Explain the concept of anmulti-agent systems and Distributed Constraints
- Explore the applications of 93omputer and extended form games.
- Understand learning in Multiagent Systems
- Introduce a contemporary platform for implementing agents and multi-agent systems.

Question Paper Pattern:

- The question paper will have ten questions.

- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

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, 2nd edhttp://www.masfoundations.org/mas.pdf

Reference Books:

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

BLOCKCHAIN TECHNOLOGY
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI733	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Decribe the models of blockchain
- Analyze and demonstrate the Ethereum

Module – 1	**Contact Hours**
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **Text Book 1: Chapter 1**	08
Module-2	
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys **Text Book 1: Chapter 2,Chapter 4**	08
Module-3	
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash **Text Book 1: Chapter 3, Chapter 6, Chapter 8**	08
Module-4	
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts. **Text Book 1: Chapter 10**	08
Module-5	
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance,	08

Media **Text Book 1: Chapter 17**	

Course outcomes: The students should be able to:

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Decribe the models of blockchain
- Analyze and demonstrate the Ethereum
- Analyze and demonstrate Hyperledger fabric

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbook:

1.**Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017**

Reference Books:

1. Blockchain Technology (Concepts and applications), Kumar saurabh, Ashutosh saxena, Wiley, 2020
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten,2016
3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017
4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

CLOUD COMPUTING AND VIRTUALIZATION
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI734	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Interpret the data in the context of cloud computing.
- Identify an appropriate method to analyze the data in cloud enviornmnet
- Understanding of virtalization concept

Module – 1	**Contact Hours**
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, Exercises and problems. **Textbook 1: Chapter 1 (1.3-1.6), Chapter 3 (3.1-3.5, 3.7,3.8)** RBT: L1, L2	08
Module – 2	
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GreThe Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing. **Textbook 1: Chapter 4 (4.1-4.11)** RBT:L1,L2	08
Module – 3	
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems	08

Textbook 1: Chapter 5 (5.1-5.9, 5.11,5.12,5.16) RBT:L1,L2	
Module – 4	
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems. **Textbook1: Chapter 6 (6.1-6.14, 6.16)** RBT : L1, L2, L3	08
Module – 5	
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to useS3 in java **Textbook1: Chapter 9 (**9.1-9.9, 11.1-11.5) RBT: L1, L2, L3	08
Course outcomes: The students should be able to:	
• Understand the concepts of cloud computing, virtualization and classify services of cloud computing • Illustrate architecture and programming in cloud • Define the platforms for development of cloud applications and List the application of cloud.	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module.	

• The students will have to answer 5 full questions, selecting one full question from each module.
Text Books:
1. Cloud Computing Theory and Practice, Dan C. Marinescu, Morgan Kaufmann, Elsevier 2013.
Reference Books:
1. Mastering Cloud Computing Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi McGraw Hill Education

FUZZY LOGIC AND ITS APPLICATION (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI741	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Define crisp set and fuzzy set theory.
- Identify the requirements to make calculation of fuzzy set theory.
- Describe fuzzy arithmetic principles.
- Explain fuzzy rules based systems.
- Apply fuzzy graphical techniques to draw inference over the computing problems.

Module – 1	**Contact Hours**
Introduction: Historical perspective, utility of fuzzy systems, limitations of fuzzy systems, statistics andrandom processes, uncertainty in information, fuzzy sets and membership, chance versus fuzziness, sets aspoints in Hypercube.**Classical Sets and Fuzzy Sets:** classical sets, operations on them, mapping of classical sets to functions, fuzzysets, fuzzy set operations, properties of fuzzy sets, non-interactive fuzzy sets. **RBT: L1, L2**	08
Module – 2	
Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations – Cardinality of Crisp Relations,Operations on Crisp Relations, and Properties of Crisp Relations, Composition. Fuzzy Relations –Cardinalityof Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Productand Composition, Non-interactive Fuzzy Sets. **RBT: L1, L2**	08
Module – 3	
Membership Functions: Features of the Membership Function, Standard Forms and Boundaries,Fuzzification, defuzzification to crisp sets, Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations,DefuzzificationMethods.Development of membership Functions: Membership value assignments **RBT: L1, L2**	08
Module – 4	
Fuzzy Arithmetic and the Extension Principle : Crisp Functions, Mapping and Relations,	08

Functions of fuzzySets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations. Fuzzy Numbers IntervalAnalysis in Arithmetic, Approximate Methods of Extension – Vertex method, DSW Algorithm, RestrictedDSW Algorithm, Comparisons. Fuzzy Vectors. **RBT: L1, L2**	
Module – 5	
Fuzzy Rule Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems – Canonical RuleForms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules.Graphical Techniques of Inference. **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Provide basic elements of fuzzy sets. • Differentiate between fuzzy set and classical set theory. • Apply fuzzy membership functions to solve value assignment problems. • Explain approximate methods of fuzzy arithmetic and extension principle. • Discuss the applications of fuzzy rule based systems.	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Textbooks:	
1. Fuzzy Logic with EngineeringApplicationsTimothy J. Ross Wiley IndiaInternational edition,2010 reprint	
Reference Books:	
1. Fuzzy Logic- Intelligence,Control, and informationJohnYenRezaLangariPearson Education 1st Edition, 2004 2. Fuzzy Sets and Fuzzy Logic-Theory and ApplicationsGeorge J. KlirBoYuanPrentice Hall of India 1st Edition, 2000 3. Fuzzy Mathematical approach to pattern Recognition, S K Pal, and D Dutta majumder , John wiley 1986 4. Neuro-fuzzy pattern recognition: methods in Soft computing, S K Pal and S Mitra 5. Fuzzy set theory and its applications by H J Zimmermann, Springer Publications	

COMPUTER VISION **(Effective from the academic year 2018 -2019)** **SEMESTER – VII**			
Subject Code	18AI742	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			
Course Learning Objectives: This course will enable students to:			
• Learn basic principles of image formation, image processing algorithms and different			

algorithms for recognition from single or multiple images (video). • Understand the core vision tasks of scene understanding and recognition. • Applications to 3D modelling, video analysis, video surveillance, object recognition	
Module – 1	**Contact Hours**
Introduction and Image Formation: What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital camera. Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic Parameters and Extrinsic Parameters, Geometric Camera Calibration **T1: Chap 1-1.1 & 1.2, Chap 2-2.1 to 2.3. T2:Chap 1-1.1 to 1.3**	08
Module – 2	
Early Vision – One Image: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Local Image Features, Texture **T2:Chap 4-4.1 to 4.5, Chap5-5.1 to 5.5, Chap6-6.1 to 6.3, 6.5**	08
Module – 3	
Early Vision – Multiple Images: Stereopsis and Structure from Motion **T2:Chap7-7.1 to 7.7, Chap 8-8.1 to 8.3**	08
Module – 4	
Mid-level Vision: Segmentation by Clustering, Grouping and Model fitting, Tracking **T2:Chap9-9.1 to 9.4, Chap 10-10.1 to 10.7, Chap 11-11.1 to 11.3**	08
Module – 5	
High-level Vision: Registration, Smooth Surface and their Outlines, Range Data Detecting Objects in Images, Recognition **T2:Chap12-12.1 to 12.3, Chap 13-13.1 to 13.3, Chap 14-14.1 to 14.4, Chap 17-17.1 to 17.3. T1:Chap 6-6.1 to 6.6**	08
Course outcomes: The students should be able to:	
• Implement fundamental image processing techniques required for computer vision • Understand Image formation process • Perform shape analysis • Develop applications using computer vision techniques • Understand video processing and motion computation	
Question Paper Pattern:	
• The question paper will have ten questions.	

- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Computer Vision: Algorithms and Applications (CVAA), Richard Szeliski, Springer, 2nd edition, 2020, http://szeliski.org/Book/
2. Computer Vision – A modern approach, by D. Forsyth and J. Ponce, Prentice Hall, 2nd edition, 2012

Reference Books:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University, Press, 2012
5. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
6. Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in OpencvAndTensorflow With Python, Shamshad Ansari,Apress, 2020

SEMANTIC WEB AND SOCIAL NETWORKS

(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI743	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

Module – 1	**Contact Hours**
Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide. Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map,Logic on the semantic Web. **T1: Chapter 1,3,4**	08

RBT: L1, L2	
Module – 2	
Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema. **T1: Chapter 2,5** **RBT: L1, L2**	08
Module – 3	
Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools,Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic,Rule and Inference Engines. **T1: Chapter 7,8** **RBT: L1, L2**	08
Module – 4	
Semantic Web Applications, Services and Technology: Semantic Web applications and services,Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services,Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods **T1: Chapter 10,11,12** **RBT: L1, L2**	08
Module – 5	
Social Network Analysis and semantic web. What is social Networks analysis, development of the social networks analysis, Electronic Sources forNetwork Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features. **T2: Chapter 2,3** **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Work on the internal components of the social network. • Model and visualize the social network. • Analyse the behaviour of the users in the social network. • Predict the possible next outcome of the social network. • Apply social network in real time applications.	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks	

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

Reference Books:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen,Springer Publications.
4. Programming the Semantic Web, T. Segaran, C.Evans, J. Taylor, O'Reilly, SPD.

BUSINESS INTELLIGENCE
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AI744	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Explain the Decision Support systems and Business Intelligence framework.
- Illustrate the significance of computerized Decision Support, and understand the mathematicalmodelling behind decision support.
- Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.Explore knowledge management, explain its activities, approaches and its implementation.
- Describe the Expert systems , areas suitable for application of experts system

Module – 1	**Contact Hours**
Decision Support and Business Intelligence: Opening Vignette, Changing Business Environments andComputerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, AnEarly Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), Aframework for Business Intelligence (BI), A Work System View of Decision Support. **Text Book 1: Chapter 1** **RBT: L1, L2**	08
Module – 2	
Computerised Decision Support: Decision Making, Models, Phases of the Decision-Making Process, TheIntelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions AreSupported.**Modelling and Analysis:**Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, andRisk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, andGoal Seeking **Text Book 1: Chapter 2** **RBT: L1, L2**	08
Module – 3	
Data Warehousing: Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, DataWarehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes. **Text Book 1: Chapter 5** **RBT: L1, L2**	08
Module – 4	
Knowledge Management: Introduction to Knowledge Management, Organizational Learning andTransformation, Knowledge Management Activities, Approaches to Knowledge Management, InformationTechnology (IT) In Knowledge Management, Knowledge Management Systems Implementation. **Text Book 1: Chapter 11** **RBT: L1, L2**	08

Module – 5	
Expert Systems: Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of ExpertSystems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems,Benefits, Limitations, and Critical Success Factors of Expert Systems. **Text Book 1: Chapter 12** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Apply the basics of data and business to understand Decision Support systems and Business Intelligence framework.
- Describe the significance of 106omputerized Decision Support, apply the basics of mathematics to understand the mathematical modelling behind decision support.
- Explain Data warehousing , its architecture and Extraction, Transformation, and Load (ETL) Processes.
- Analyze the importance of knowledge management and explain its activities, approaches and its implementation.
- Describe the Expert systems and analyze its development , discuss areas suitable forapplication of experts system.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Business Intelligence and Analytics: Systems for decision support, RameshSharda,DursunDelden, Efraim Turban, Pearson Tenth edition

Reference Books:

1. Data Mining Techniques. ForMarketing, Sales and CustomerRelationshipManagementBerry M.&Linoff G. Wiley Publishing Inc 2004
2. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly Media,Inc2013

INTRODUCTION TO BIG DATA ANALYTICS
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18CS751	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Interpret the data in the context of the business.
- Identify an appropriate method to analyze the data
- Show analytical model of a system

Module – 1	**Contact Hours**
Introduction to Data Analytics and Decision Making: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step ModelingProcess.**Describing the Distribution of a Single Variable**:Introduction,Basic Concepts, Populations and Samples, Data Sets,Variables,and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools,Charts for Numerical Variables, Time Series Data, Outliers and Missing Values,Outliers,Missing Values, Excel Tables for Filtering,Sorting,and Summarizing. **Finding Relationships among Variables**: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables. **Textbook 1: Ch. 1,2,3** **RBT: L1, L2, L3**	08
Module – 2	
Probability and Probability Distributions:Introduction,Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Subjective Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation. **Normal,Binormal,Poisson,and Exponential Distributions**:Introduction,The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density,Standardizing:Z-Values,Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution. **Textbook 1: Ch. 4,5** **RBT: L1, L2, L3**	08

Module – 3	
Decision Making under Uncertainty:Introduction,Elements of Decision Analysis, Payoff Tables, Possible Decision Criteria, Expected Monetary Value(EMY),Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In,Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility Maximization Used? **Sampling and Sampling Distributions**: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling. **Textbook 1: Ch. 6,7** **RBT: L1, L2, L3**	08
Module – 4	
Confidence Interval Estimation: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters. **Hypothesis Testing**:Introduction,Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence. **Textbook 1: Ch. 8,9** **RBT: L1, L2, L3**	08
Module – 5	
Regression Analysis: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships,Outliers,Unequal Variance, No Relationship,Correlations:Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained:R-Square,Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit. **Regression Analysis**: Statistical Inference:Introduction,The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table,Multicollinearity,Include/Exclude Decisions, Stepwise Regression,Outliers,Violations of Regression Assumptions,Nonconstant Error Variance,Nonnormality of Residuals,Autocorrelated Residuals ,Prediction. **Textbook 1: Ch. 10,11** **RBT: L1, L2, L3**	08

Course outcomes: The students should be able to:

- Explain the importance of data and data analysis
- Interpret the probabilistic models for data
- Define hypothesis, uncertainty principle
- Evaluate regression analysis

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cenage Learning

Reference Books:

1. ArshdeepBahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577
2. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966

PYTHON APPLICATION PROGRAMMING
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18CS752	**IA Marks**	40
Number of Lecture Hours/Week	3:0:0	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03

CREDITS – 03

Course Objectives: This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python.

Module – 1	**Contact Hours**
Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions **Textbook 1: Chapters 1 – 4** **RBT: L1, L2, L3**	08
Module – 2	
Iteration, Strings, Files **Textbook 1: Chapters 5– 7** **RBT: L1, L2, L3**	08
Module – 3	
Lists, Dictionaries, Tuples, Regular Expressions **Textbook 1: Chapters 8 – 11** **RBT: L1, L2, L3**	08
Module – 4	
Classes and objects, Classes and functions, Classes and methods **Textbook 2: Chapters 15 – 17** **RBT: L1, L2, L3**	08
Module – 5	
Networked programs, Using Web Services, Using databases and SQL **Textbook 1: Chapters 12– 13, 15** **RBT: L1, L2, L3**	08

Course Outcomes: After studying this course, students will be able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

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. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)

Reference Books:

1. Charles Dierbach, **"Introduction to Computer Science Using Python",**1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
2. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372
3. Mark Lutz, **"Programming Python",**4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, **"Data Structures and Algorithms in Python",**1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
5. ReemaThareja, **"Python Programming Using Problem Solving Approach",** Oxford university press, 2017. ISBN-13: 978-0199480173

INTRODUCTION TO ARTIFICIAL INTELLIGENCE
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18CS753	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Identify the problems where AI is required and the different methods available
- Compare and contrast different AI techniques available.
- Define and explain learning algorithms

Module – 1	**ContactHours**
What is artificial intelligence?, Problems, Problem Spaces and search **TextBook1: Ch 1, 2** **RBT: L1, L2**	08

Module – 2	
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules, **TextBoook1: Ch 4, 5 and 6.** **RBT: L1, L2**	08
Module – 3	
Symbolic Reasoning under Uncertainty, Statistical reasoning **TextBoook1: Ch 7, 8** **RBT: L1, L2**	08
Module – 4	
Game Playing, Natural Language Processing **TextBoook1: Ch 12 and 15** **RBT: L1, L2**	08
Module – 5	
Learning, Expert Systems. **TextBook1: Ch 17 and 20** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Identify the AI based problems
- Apply techniques to solve the AI problems
- Define learning and explain various learning techniques
- Discuss on expert systems

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. E. Rich , K. Knight & S. B. Nair – Artificial Intelligence, 3/e, McGraw Hill.

Reference Books:

1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.
4. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill.
5. N.P. Padhy "Artificial Intelligence and Intelligent Systems" , Oxford University Press-2015

INTRODUCTION TO DOT NET FRAMEWORK FOR APPLICATION DEVELOPMENT
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18CS754	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
- Understand Object Oriented Programming concepts in C# programming language.
- Interpret Interfaces and define custom interfaces for application.
- Build custom collections and generics in C#
- Construct events and query data using query expressions

Module – 1	**Contact Hours**
Introducing Microsoft Visual C# and Microsoft Visual Studio 2015: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions **T1: Chapter 1 – Chapter 6** **RBT: L1, L2**	08
Module – 2	
Understanding the C# object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays **Textbook 1: Ch 7 to 10** **RBT: L1, L2**	08
Module – 3	
Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management **Textbook 1: Ch 11 to 14** **RBT: L1, L2**	08
Module – 4	
Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, Introducing generics, Using collections **Textbook 1: Ch 15 to 18** **RBT: L1, L2**	08
Module – 5	
Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading **Textbook 1: Ch 19 to 22** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Build applications on Visual Studio .NET platform by understanding the syntax and semantics of

C#

- Demonstrate Object Oriented Programming concepts in C# programming language
- Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
- Illustrate the use of generics and collections in C#
- Compose queries to query in-memory data and define own operator behaviour

Question paper pattern:

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016

Reference Books:

1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.
2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

AI AND ML APPLICATION DEVELOPMENT LABORATORY
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Subject Code	18AIL76	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours		**Exam Hours**	3 Hrs

Credits – 2

Course Learning Objectives: This course will enable students to:

- Explore the knowledge of AI and ML concepts and practice to groom students into well-informed application developers.
- Demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering for designing intelligent systems
- Apply computational knowledge and project development skills to provide innovative solutions.
- Strong practice in AI and ML programming through a variety of AI and ML problems.
- Develop AI and ML applications using front-end and back-end tools

Descriptions (if any): 1. The programs can be implemented in either JAVA or Python.

2. Data sets can be taken from standard repository

Part A

1. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions.
2. Develop a program to apply K-means algorithm to cluster a set of data stored in .CSV file. Use the same data set for clustering using **EM algorithm**. Compare the results of these two algorithms and comment on the quality of clustering.
3. Implement the non-parametric **Locally Weighted Regressionalgorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets
5. Demonstrate **Genetic algorithm** by taking a suitable data for any simple application.
6. Demonstrate **Q learning** algorithm with suitable assumption for a problem statement.

PART B

Mini Project

- Use Java, C#, PHP, Python, or any other similar front-end tool. Developed mini projectns must be demonstrated on desktop/laptop as a stand-alone or web based application
- Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.
- Indicative areas include: health care, education, agriculture, banking, library, agent based systems, registration systems, industry, reservation systems, facility management, super market etc.,Similar to but not limited to:

Handwritten Digit Recognition
Prediction of Cardiac Arrhythmia type using Clustering and Regression Approach
Hybrid Regression Technique for House Prices Prediction
An Iris Recognition Algorithm for Identity Authentication
An Approach to Maintain Attendance using Image Processing Techniques
Unconstrained Face Recognition
Vehicle Number Plate Detection System
Detection of Fake News
Stock Prediction using Linear Regression
Prediction of Weather Report
Analyzing Bike Sharing Trends
Sentiment Analysis for Movie Reviews
Analyzing and Recommendations of Music Trends
Forecasting Stock and Commodity Prices
Diabetes Prediction
Speech Recognition
Spam Detection using neural Networks in Python
Combining satellite imagery and to predict poverty

Conduct of Practical Examination:

- Experiment distribution

- For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
- For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accordance with university regulations)*
  s) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  t) For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

NEURAL NETWORKS AND DEEP LEARNING **(Effective from the academic year 2018 -2019)** **SEMESTER – VIII**			
Subject Code	18AI81	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Execute performance metrics of Deep Learning Techniques.

Module – 1	**Contact Hours**
Introduction to ANN: Biological to Artificial neuron, Training an MLP, Training a DNN with TensorFlow , Fine tuning NN HyperParametersUp and Running with TensorFlow **Chapter 9 and 10**	08
Module-2	
Deep Neural network: Introduction, Vanishing Gradient problems, Reusing Pretrained layers, Faster optimizers, avoiding over fitting through regularization **Chapter 11**	08
Module-3	
Distributing Tensor flow across devices and servers: Multiple devices on a single machine, multiple servers, parallelizing NN on a Tensor Flow cluster **Convolution Neural Network**: Architecture of the visual cortex, Convolutional layer, Pooling layer, CNN architecture	08

Chapter 12 and 13	
Module-4	
Recurrent Neural Network: Recurrent neurons, Basic RNN in Tensor Flow, Training RNN , Deep RNNs, LSTM Cell, GRU Cell, NLP **Chapter 14**	08
Module-5	
Autoencoders: Efficient data representation, Performing PCA, Stacked autoencoders, Unsupervised pretraining using SA, Denoising, Sparse autoencoders, variational and other autoencoders. **Reinforcement Learning:** Learning to optimize rewards, policy search, Introduction to OpenAI Gym, Neural network polices, Evaluating actions, Policy gradients, Markov decision processes, TDL and Q-learning, Learning to play Ms.Pac-man using Deep Q Learning **Chapter 15 and 16**	08

Course outcomes: The students should be able to:

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Execute performance metrics of Deep Learning Techniques.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Hands on Machine Learning with Scikit-Learn &TensorFlow, AurelienGeron, O'Reilly, 2019

Reference Books:

1. Deep Learning Lan Good fellow and YoshuaBengio and Aaron CourvilleMIT Press2016.
2. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer International Publishing, 2018

SYSTEM MODELLING AND SIMULATION (Effective from the academic year 2018 -2019) SEMESTER – VIII			
Subject Code	18AI821	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			

Course Learning Objectives: This course will enable students to:

- Explain the basic system concept and definitions of system;
- Discuss techniques to model and to simulate various systems;
- Analyze a system and to make use of the information to improve the performance.

Module 1	**Contact Hours**
Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. **General Principles.** **Textbook 1: Ch. 1, 2, 3.1.1, 3.1.3** **RBT: L1, L2, L3**	08
Module 2	
Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions. **Queuing Models:**Characteristics of queuing systems,Queuingnotation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont…,Steady-state behavior of M/G/1 queue, Networks of queues, **Textbook 1: Ch. 5,6.1 to 6.3, 6.4.1,6.6** **RBT: L1, L2, L3**	08
Module 3	
Random-NumberGeneration: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, **Random-Variate Generation:** ,Inverse transform technique Acceptance-Rejection technique. **Textbook 1: Ch. 7,8.1, 8.2** **RBT: L1, L2, L3**	08
Module 4	
Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models. **Estimation of Absolute Performance:** Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, **Textbook 1: Ch. 9, 11.1 to 11.3** **RBT: L1, L2, L3**	08
Module 5	
Measures of performance and their estimation,Output analysis for terminating simulations Continued..,Output analysis for steady-state simulations. **Verification, Calibration And Validation:** Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models,Calibration and validation of models, Optimization via Simulation.	08

Textbook 1: Ch. 11.4, 11.5, 10 **RBT: L1, L2, L3**	
Course Outcomes: The student will be able to :	
• Explain the system concept and apply functional modeling method to model the activities of a static system • Describe the behavior of a dynamic system and create an analogous model for a dynamic system; • Simulate the operation of a dynamic system and make improvement according to the simulation results.	
Question Paper Pattern:	
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Textbooks:	
1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.	
Reference Books:	
1. Lawrence M.Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006. 2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007	

SOFT AND EVOLUTIONARY COMPUTING (Effective from the academic year 2018 -2019) SEMESTER – VIII			
Subject Code	18AI822	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Describe the basics of Soft computing
- Explain the process Fuzzy &Genetic Algorithm to solve the optimization problem.
- Analyse the Neuro Fuzzy system for clustering and classification.
- Illustrate the process of swarm intelligence system to solve real world problems.

Module – 1	**Contact Hours**
Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. **Introduction to classical sets and fuzzy sets:** Classical relations and fuzzy relations, Membership functions. **T1: Chapter 1 and 7& 8**	08
Module – 2	
Fuzzification and Defuzzification **T1: Chapter 9 & 10**	08
Module – 3	
Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, Operators, Stopping conditions for GA flow. **T1: Chapter 15.1 To 15.10** **RBT: L1, L2**	08
Module – 4	
Swarm Intelligence System: Introduction, background of SI, Ant colony system Working of ant colony optimization, ant colony for TSP. **T2: 8.1 to 8.5** **RBT: L1, L2**	08
Module – 5	
Unit commitment problem, particle Swarm Intelligence system Artificial bee colony system, Cuckoo search system. **T2: 8.6 to 8.9** **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Implement machine learning through neural networks.
- Design Genetic Algorithm to solve the optimization problem.
- Develop a Fuzzy expert system.

- Model Neuro Fuzzy system for clustering and classification

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Principles of Soft computing, Shivanandam, Deepa S. N, Wiley India, 2011/Reprint2014
2. Soft Computing with MATLAB Programming, N. P. Padhy, S.P. Simon, Oxford, 2015.

Reference Books:

1. Neuro-fuzzy and soft computing, .S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012
2. Soft Computing, SarojKaushik, SunitaTiwari, McGrawHill, 2018

ROBOTIC PROCESS AUTOMATION DESIGN & DEVELOPMENT (Effective from the academic year 2018 -2019) SEMESTER – VII			
Subject Code	18AI823	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			

Course Learning Objectives: This course will enable students to:

- To understand basic concepts of RPA
- To DescribeRPA,where it can be applied and how it is implemented
- To Describe the different types of variables,Control Flow and data manipulation techniques
- To Underst and Image,Text and DataTables Automation
- To Describe various types of Exceptions and strategies to handle

Module – 1	**Contact Hours**
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** **RBT:L1,L2**	08
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** **RBT: L1, L2**	08
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** **RBT:L1,L2**	08
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. **Text book 2: Ch 5** **RBT:L1,L2**	08
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- Future of RPA **Text book 2: Ch 8** **Text book 1: Ch 13** **RBT:L1,L2**	08

Course outcomes: The students should be able to:

- ToUnderstand the basicconcepts of RPA
- To Describe various components and platforms of RPA
- To Describe the different types of variables,control flow and data manipulation techniques
- To Understand various control techniques and OCR in RPA
- To Describe varioustypes and strategies to handle exceptions

Question paper pattern:

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

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 Books:

1. Frank Casale,Rebecca Dilla,Heidi Jaynes,Lauren Livingston,"Introductionto 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
https://www.uipath.com/rpa/robotic-process-automation

MODERN INFORMATION RETRIEVAL (Effective from the academic year 2018 -2019) SEMESTER – VIII			
Subject Code	18AI824	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- To learn the classical techniques of Information Retrieval and extract meaningful patterns from it.
- To get an insight into practical algorithms of textual document indexing, relevant ranking, web mining, text analytics and their performance evaluations.
- To acquire the necessary experience to design, and implement applications using Information Retrieval systems

Module – 1	**Contact Hours**
Introduction: Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models. **Text Book 1: Chapter 1, Chapter 2**	08
Module – 2	
Retrieval Techniques: Structured Text Retrieval Models –Retrieval Evaluation – Word Sense Disambiguation. **Text Book 1: Chapter 3**	08
Module – 3	
Querying: Languages – Key Word based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis **Text Book 1: Chapter 4, Chapter 5**	08
Module – 4	
Text Operations: Document Pre-processing – Clustering – Text Compression - Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching. **Text Book 1: Chapter 7, Chapter 8**	08
Module – 5	
User Interface&Applications: User Interface and Visualization – Human Computer Interaction – Access Process – Starting Points – Query Specification - Context – User relevance Judgment – Interface for Search. Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Metasearchers – Online IR systems – Online Public Access Catalogs. **Text Book 1: Chapter 10, Chapter 13, Chapter 14**	08

Course outcomes: The students should be able to:

- Apply information retrieval principles to locate relevant information in large collections of data
- Implement features of retrieval systems for web-based search tasks.
- Apply the common algorithms and techniques for information retrieval related to document indexing and query processing
- Demonstrate a thorough understanding and solid knowledge of the principles and techniques of

human-computer interaction

- Implement graphical user interfaces with modern software tools
- Develop and design interactive software systems applications for real time applications
- Design and develop web applications for the effective informational retrieval

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, Modern Information Retrieval, Pearson Education Asia, 2012.

Reference Books:

1. G.G. Chowdhury, Introduction to Modern Information Retrieval, Second Edition, Neal- Schuman Publishers, 2010.

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