SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III		Program			B.Tech – Artificial Intelligence and Data Science				
Subject Category	DC	Subject Code:		AI 601	Subject Name		Machine Learning				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression methods, classification methods, clustering methods.
3. To become familiar with Dimensionality reduction Techniques.

UNITs	Descriptions	Hrs.
I	Definition of learning systems. Goals and applications of machine learning. designing a learning system: training data, concept representation, function approximation. well posed learning problems, perspective & issues in machine learning ,The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypothesis. FIND-S ,candidate elimination algorithm	8
II	Introduction, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, hyperspace search in decision tree learning, issues in decision tree learning . Probability theory and Bayes rule. Naive Bayes learning algorithm	10
III	Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies. Introduction, K-nearest neighbour learning, case-based learning, radial basis functions.	12
IV	Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labelled and unlabelled data.	8
V	Introduction, neural network representation , problems for neural network learning, perceptron's, multilayer network & Back propagation Algorithm. Introduction, genetic operators, genetic programming, models of evolution & learning, parallelizing genetic algorithm. .	7
Total Hours		45

Course Outcomes:

CO-1: Gain knowledge about basic concepts of Machine Learning.
CO-2: Identify machine learning techniques suitable for a given problem
CO-3: Solve the problems using various machine learning techniques
CO-4: Apply Dimensionality reduction techniques.
CO-5: Design application using machine learning techniques

Text Book

1. Tom M. Mitchell. "Machine Learning" McGraw-Hill, 2297.

Reference Books-

1. P. Langley. "Elements of Machine Learning" Morgan Kaufmann Publishers, Inc. 2296.
2. Ethem Alpaydin "Introduction to machine learning ".Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Universities Press.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106131/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
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 Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve 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. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. 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 Java/Python ML library classes/API.
8. 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 Java/Python ML library classes/API in the program.
9. 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.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select

appropriate data set for your experiment and draw graphs	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Ramratan Ahirwal & Rashi Kumar
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III		Program			B.Tech – Artificial Intelligence and Data Science				
Subject Category	DC	Subject Code:		AI 602	Subject Name		Data Mining and Data Warehousing				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

1. To provide students with knowledge, advanced skills and understanding of Data Warehousing.
2. Its components, design principles and modelling.
3. Provide students with in-depth concepts in knowledge discovery.
4. Data mining, different data mining algorithms and classification techniques.

UNITs	Descriptions	Hrs.
I	**Data Warehousing:** Introduction to Data warehousing, needs for developing data Warehouse, Data warehouse systems and its Components, Design of Data Warehouse, Dimension and Measures, Data Marts:-Dependent Data Marts, Independents Data Marts and Distributed Data Marts, Conceptual Modelling of Data Warehouses, Star Schema, Snowflake Schema, Fact Constellations. Multidimensional Data Model and Aggregates.	8
II	Characteristics of OLAP System, Motivation for using OLAP, Multidimensional View and Data Cube, Data Cube Implementations, Data Cube Operations, Guidelines for OLAP Implementation, Difference between OLAP and OLTP, OLAP Servers: ROLAP, MOLAP, HOLAP Queries.	8
III	Introduction to Data Mining, Knowledge Discovery, Data Mining Functionalities, Data Mining System categorization and its Issues. Data Processing: Data Cleaning, Data Integration and Transformation. Data Reduction, Data Mining Statistics, Guidelines for Successful Data Mining.	8
IV	Introduction, Basic, The Task and a Naïve Algorithm, Apriori Algorithms, Improving the efficiency of the Apriori Algorithm, Apriori-Tid, Direct Hasing and Pruning (DHP), Dynamic Itemset Counting (DIC), Mining Frequent Patterns without Candidate Generation (FP-Growth), Performance Evaluation of Algorithms.	8
V	Introduction, Decision Tree, The Tree Induction Algorithm,Split Algorithms Based on Information Theory, Split Algorithm Based on the Gini Index, Overfitting and Pruning, Decision Trees Rules, Naïve Bayes Method. Cluster Analysis: Introduction, Desired Features of Cluster Analysis, Types of Cluster Analysis Methods: Partitional Methods, Hierarchical Methods, Density- Based Methods, Dealing with Large Databases, Quality and Validity of Cluster Analysis Methods	8
Total Hours		45

Course Outcomes:

CO1: Explain the functionality of the various data warehousing models and components.
CO2: Apply data pre- processing techniques on different datasets.
CO3: Evaluate the performance of different association rules and classification techniques.
CO4: Compare different association rule mining techniques.
CO5: Identify different advance Classification and Clustering data mining techniques.

Text Book

Text Book-

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Elsevier Pub.

Reference Books-

1 Arun K. Pujari, “Data Mining Techniques”, University Press.
2. Berson, “Data Warehousing and Data Mining and OLAP”, TMH

List and Links of e-learning resources:

- https://ocw.mit.edu/
- www.weka.com

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

1 Installation of WEKA Tool
2 Creating new Arff File
3 Data Processing Techniques on Data set
4 Data cube construction – OLAP operations
5 Implementation of Apriori algorithm
6 Implementation of FP- Growth algorithm
7 Implementation of Decision Tree Induction
8 Calculating Information gains measures
9 Classification of data using Bayesian approach
10 Implementation of K-means algorithms
11 Case Study: Create Placement.arff file to identify the students who are eligible for placements using KNN

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Ramratan Ahirwal & Rashi Kumar
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III		Program		B.Tech – Artificial Intelligence and Data Science				
Subject Category	DE-2	Subject Code:		AI 603 (A)	Subject Name	Optimization Technique				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	-	3

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

Identify and develop operational research models from the verbal description of the realsystem.

Analyse the results to resolve resource optimization

To practice their skills on many well-known real-life problems.

UNITs	Descriptions	Hrs.
I	Introduction What is optimization, Formulation of LPP, Solution of LPP: Simplex method, Basic Calculus for optimization: Limits and multivariate functions, Derivatives and linear approximations: Single variate functions and multivariate functions	8
II	Machine Learning Strategy ML readiness, Risk mitigation, Experimental mindset, Build/buy/partner, setting up a team, Understanding and communicating change.	8
III	Responsible Machine Learning AI for good and all, Positive feedback loops and negative feedback loops, Metric design and observing behaviours, Secondary effects of optimization, Regulatory concerns.	8
IV	Machine Learning in production and planning Integrating info systems, users break things, time and space complexity in production, when to retain the model? Logging ML model versioning, Knowledge transfer, Reporting performance to stakeholders.	8
V	Care and feeding of your machine learning model MLPL Recap, Post deployment challenges, QUAM monitoring and logging, QUAM Testing, QUAM maintenance, QUAM updating, Separating Datastack from Production, Dashboard Essentials and Metrics monitoring.	8
Total Hours		40

Course Outcomes:

CO1. Demonstrate a familiarity with major optimization algorithms.

CO2. Apply important optimization algorithmic and analyze the results.

CO3. finding out the local and global optimum.

CO4. formulation of design problems as mathematical programming problems.

CO5. design supervised and unsupervised learning approaches for real-life problems.

Text Book

Optimization for Machine Learning, SuvritSra, Sebastian Nowozin and Stephen J. Wright, MITPress, 2011

Reference Books-

Optimization in Machine Learning and Applications, Suresh Chandra Satapathy, Anand J. Kulkarni, Springer, 2019

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Ramratan Ahirwal
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III		Program		B.Tech – Artificial Intelligence and Data Science				
Subject Category	DE-2	Subject Code:		AI 603(B)	Subject Name	Knowledge Representation				
Maximum Marks Allotted								Contact Hours		Total Credits
Theory				Practical			Total Marks			
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P
60	20	10	10				100	3	0	0	3

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

UNITs	Descriptions	Hrs.
I	The Key Concepts: Knowledge, Representation, and Reasoning, Why Knowledge Representation and Reasoning? Knowledge-Based Systems, why knowledge Representation? Why Reasoning? The Role of Logic, Propositional Logic basics, Soundness & Completeness, Resolution Proof, Semantic Tableaux, Binary Decision Diagrams	8
II	The Language of First-Order Logic: Introduction, The Syntax, The Semantics, Interpretations, Denotation, Satisfaction and Models, Logical Consequence Why We Care, Explicit and Implicit Belief, Knowledge-Based Systems. Expressing Knowledge. Knowledge Engineering, Vocabulary, Basic Facts, Complex Fact, Terminological Fact, Entailments, Abstract Individuals, Other Sorts of Facts.	8
III	Resolution: The Propositional Case, Resolution Derivations, An Entailment Procedure, Handling Variables and Quantifiers, First-Order Resolution, Answer Extraction., Skolemization, Equality, Dealing with Computational Intractability, The First-Order Case, The Herbrand Theorem, The Propositional Case , The Implications , SAT Solvers, Most General Unifiers, Other Refinements	8
IV	Reasoning with Horn Clauses: Horn Clauses, Resolution Derivations with Horn Clauses, SLD Resolution, Goal Trees, Computing SLD Derivations, Backward Chaining, Forward Chaining, The First-Order Case.	8
V	Procedural Control of Reasoning: Facts and Rules , Rule Formation and Search Strategy, Algorithm Design, Specifying Goal Order , Committing to Proof Methods , Controlling Backtracking, Negation as Failure Dynamic Databases, The PLANNER Approach.	8
Total Hours		40

Course Outcomes:

CO-1: Express knowledge of a domain formally (Understand)

CO-2: Explain the production systems, frames, inheritance systems and approaches to handle uncertain or incomplete knowledge (Understand).

CO-3: Examine the principles of reasoning (Analyze)

CO-4: Describe how knowledge-based systems work (Understand)

CO-5: Illustrate knowledge-based approaches to problem solving (Apply)

CO-6: Design & develop a knowledge- based system (Create)

Text Book

Text Book-

1. Language, Proof and Logic, Jon Barwise & John Etchemendy, CSLI Publications (1999); 2. Knowledge representation and Reasoning, Ronald J. Brachman & Hector J. Levesque, Elsevier (2004);

Reference Books-

1. The Description Logic Handbook: Theory, implementation, and applications, Franz Baader, Deborah L.
2. McGuinness, Daniele Nardi and Peter F. Patel-Schneider, Cambridge University Press (2010)

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Ramratan Ahirwal
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF AIADS

Semester/Year		VI/III		Program		B.Tech – Artificial Intelligence and Data Science				
Subject Category	DE-2	Subject Code:		AI 603(C)	Subject Name	Computer Vision				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	0	3

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics.

Course Objective:

- Identify basic concepts, terminology, theories, models and methods of computer vision.
- Describe basic methods of computer vision related to multi-scale representation.
- Understanding edge detection of primitives, stereo, motion and object recognition.
- Developed the practical skills necessary to build computer vision applications.
- To have gained exposure to object and scene recognition.

UNITs	Descriptions	Hrs.
I	**Introduction to Computer Vision and Basic Concepts of Image Formation**: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts. **Fundamental Concepts of Image Formation**: Radiometry, Geometric Transformations, Geometric Camera Models, Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.	8
II	**Image Processing Concepts**: Image Transforms, Image Enhancement, Image Filtering, Colour Image Processing, Image Segmentation.	8
III	**Image Descriptors and Features**: Texture Descriptors, Colour Features, Edges/Boundaries, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency.	8
IV	**Fundamentals of Machine Learning**: Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis.	8
V	**Applications of Computer Vision**: Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoders, Gesture Recognition, Motion Estimation and Object Tracking, Programming Assignments.	8
Total Hours		40

Course Outcomes:

- CO1: Ability to understand the fundamental concepts in computer vision.
- CO2: Ability to apply segmentation techniques and descriptors.
- CO3: Ability to analyse medical problems using computer vision techniques.
- CO4: Ability to evaluate performance of computer vision algorithms in biomedical applications.
- CO5: Suggest a design of a computer vision system for a specific problem.

Reference Books-

1. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education.
2. M.K. Bhuyan , " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, ISBN 9780815370840 - CAT# K338147.

3. Richard Szeliski, “Computer Vision- Algorithms & Applications”, Springer.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

1. Detect the RGB color from a webcam using Python – OpenCV
2. Face Detection using Python and OpenCV with a webcam
3. Face and Hand Landmarks Detection using Python – Mediapipe, OpenCV
4. Real-Time Edge Detection using OpenCV
5. Implement Canny Edge Detector in Python using OpenCV
6. Gun Detection using Python-OpenCV
7. Real-time object color detection using OpenCV
8. Right and Left Hand Detection Using Python
9. Age Detection Using Deep Learning in OpenCV
10. OpenCV – Drowsiness Detection
11. Build GUI Application Pencil Sketch from Photo in Python
12. Measure Size of an Object Using Python OpenCV

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of AIADS

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III		Program		B.Tech – Artificial Intelligence and Data Science				
Subject Category	DE-3	Subject Code:		AI 604(A)	Subject Name	Cryptography and Network Security				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	1	-	4

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

This course will provide students with a practical and theoretical knowledge of cryptography and network security.

UNITs	Descriptions	Hrs.
I	Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security, Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.	8
II	Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm	8
III	Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – KeyInfrastructure.	8
IV	Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security,HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.	8
V	E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, Combining security associations, Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.	8
Total Hours		40

Course Outcomes:

CO1. Understand cryptography and network security concepts and application

CO2. Apply security principles to system design

CO3. Identify and investigate network security threat

CO4. Analyse and design network security protocols

CO5. Conduct research in network security

Text Book

Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

Reference Books-

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1stEdition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Ramratan Ahirwal
Subject handled by department	Department of IT

AI **Semester:VI Sem**	**Code** **Subject** **AI - 604 (B)** **Soft Computing**	**LTP C** **3 1 0 4**
Prerequisite: NIL		
CO1	Learn soft computing techniques and their applications.	Level 2: Understand
CO2	Analyze various neural network architectures.	Level 3: Apply
CO3	Define the fuzzy systems.	Level 3: Apply
CO4	Understand the genetic algorithm concepts and their applications..	Level 3: Apply
CO5	Identify and select a suitable Soft Computing technology to solve the problem.	Level 4: Analyze
Unit - I	Introduction to Soft Computing Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.	6 Hrs.
Unit - II	Perceptron networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network –Architecture, Training algorithm.	7 Hrs.
Unit - III	Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets,fuzzy relations - operations on fuzzy relations.Fuzzy membership functions, fuzzification, Methods of membership value assignments – intuition – inference – rank ordering, Lambda –cuts for fuzzy sets, Defuzzification methods.)	7 Hrs.
Unit - IV	Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules - Decomposition of rules – Aggregation of rules, Fuzzy Inference Systems - Mamdani and Sugeno	7 Hrs.
Unit - V	Introduction to genetic algorithm, operators in genet algorithm -coding - selection - crossover – mutation, Stoppir condition for genetic algorithm flow,	8 Hrs.

Text Books

1. S. N. Sivanandam and S. N.Deepa, Principles of soft computing – John Wiley & Sons, 2007.
2. Timothy J. Ross, Fuzzy Logic with engineering applications , John Wiley

Reference Books

1. N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc.1998
3. R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
4. Driankov D., Hellendoorn H. and Reinfrank M., An Introduction to Fuzzy Control-

Narosa Pub., 2001.
5. Bart Kosko, Neural Network and Fuzzy Systems- Prentice Hall, Inc., Englewood Cliffs, 1992
6. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning-Addison Wesley, 1989.

CO – PO – PSO Mappings

COs	**Programme Outcomes (POs)**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	**2**		**2**	**2**										
CO2	**1**		**2**	**2**	**1**								**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**								**2**	**2**
CO4		**1**	**2**	**2**	**1**								**2**	**2**
CO5	**2**	**2**	**2**	**2**	**1**						1		**2**	**2**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III		Program		B.Tech – Artificial Intelligence and Data Science
Subject Category	DE-3	Subject Code:	AI 604(C)	Subject Name		Robotics and process automation

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	1	-	4

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

Understand the RPA and the ability to differentiate it from other types of automation.

2. Model the sequences and the nesting of activities.

3. Experiment with workflow in a manner to get the optimized output from a Bot

UNITs	Descriptions	Hrs.
I	Automation RPA vs Automation - Processes & Flowcharts - Programming Constructs Types of Bots Workloads automated RPA Advanced Concepts - Standardization of processes - RPA Development methodologies SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document Risks & Challenges with RPA - RPA and emerging ecosystem.	8
II	User Interface - Variables - Managing Variables - Naming Best Practices - Variables Panel The Arguments Panel - Importing New Namespaces- Control Flow - Control Flow Introduction - Control Flow Activities - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data	8
III	Basic and Desktop Recording , Web Recording , Input/Output Methods Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval	8
IV	Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event, EXCEPTION HANDLING: Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors	8
V	DEPLOYING AND MAINTAINING THE BOT: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.	8
Total Hours		40

Course Outcomes:

CO 1: Describe RPA, where it can be applied and how it's implemented.

CO 2: Shows the different types of variables, Control Flow and data manipulation techniques.

CO 3: Identify and understand Image, Text and Data Tables Automation.

CO 4: Describe how to handle the User Events and various types of Exceptions and strategies.

CO 5: Understand the Deployment of the Robot and to maintain the connection.

Text Book

Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.

Reference Books-

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. 4. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Ramratan Ahirwal & Rashi Kumar
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		V/III		Program		B.Tech – Artificial Intelligence and Data Science
Subject Category	OC-4	Subject Code:	AI 605-A	Subject Name		Cloud Computing

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	0	3

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics Computer Networks.

Course Objective:

1 To learn how to use Cloud Services.
2. To implement Virtualization
3. To implement Task Scheduling algorithms.
4. Apply Map-Reduce concept to applications.
5. To build Private Cloud.
6. Broadly educate to know the impact of engineering on legal and societal issues involved

UNITs	Descriptions	Hrs.
I	Introduction Cloud, Types – NIST model, Cloud Cube model, Deployment models Service models ,Reference model, Characteristics, Benefits and advantages ,Cloud Architecture Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to Cloud by Clients Services and Applications, Types.	8
II	Abstraction and Virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) ,Load Balancing, Network resources, Application Delivery Controller and Application Delivery Network, Google Cloud. Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging Distinction between SaaS and PaaS.	8
III	Application frameworks Google Web Services ,Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, Google Toolkit, features of Google App Engine service, Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store.	8
IV	Windows Azure platform: Microsoft's approach, architecture, and main elements, AppFabric, Content Delivery Network, SQL Azure, and Windows Live services, Types of services, Consulting, Configuration, Customization and Support Cloud Management. network management systems ,vendors, Monitoring cloud computing deployment stack , Lifecycle management cloud services .	8
V	Cloud security concerns, service boundary Security of data, Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management. Service Oriented Architecture, message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, System abstraction Cloud Bursting, Applications, APIs.	8
Total Hours		40

Course Outcomes:

CO1: Describe the principles of cloud computing from existing technologies.
CO2: Implement different types of Virtualization technologies and Abstraction.
CO3: Elucidate the concepts of Google Cloud Computing architecture.
CO4: Analyze the issues in Resource provisioning and Security governance in clouds
CO5: Choose among various cloud technologies and Service Oriented Architecture.

Text Book

1. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

2.Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013 .

Reference Books-

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013.
2. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
3. Cloud Computing, Miller, Pearson
4. Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson

List/Links of e-learning resource

- https://nptel.ac.in/courses/117103063/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		V/III		Program		B.Tech – Artificial Intelligence and Data Science				
Subject Category	OC-4	Subject Code:		AI 605(B)	Subject Name	Data Science Analytics				
Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical			Total Marks			
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	0	3

Prerequisites:

- Data Science,
- Machine Learning

Course Objective:

1. To provide the knowledge and expertise to become a proficient data scientist;
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
3. Produce Python code to statistically analyze a dataset;
4. Critically evaluate data visualizations based on their design and use for communicating stories from data;

UNITs	Descriptions	Hrs.
I	**Statistical Analysis System(SAS)**: Collection of Data, Sample Measurement and Scaling Techniques, Statistical Derivatives and Measures of Central Tendency, Measures of Variation and Skewness, Correlation and Simple Regression, Time Series Analysis, Index Numbers, Probability and Probability Rules Probability Distributions, Tests of Hypothesis–I, Tests of Hypothesis – II, Chi-Square Test	8
II	**Apache Spark**: Introduction, Features, Spark built on Hadoop,Components of Spark: Apache Spark Core, Spark SQL, Spark Streaming, MLlib (Machine Learning Library), GraphX **BigML: Web Interface, Command Line Interface, API, Creating a deep learning model with BigML**	8
III	**Data-Driven Documents (D3.js)**: Introduction, Web Standards: HyperText Markup Language (HTML), Document Object Model (DOM), Cascading Style Sheets (CSS), Scalable Vector Graphics (SVG), JavaScript. **MatLab**: Matlab Environment Setup, Syntax, Variables, Commands, M-files, Datatypes and Operators.	8
IV	**Natural Language Toolkit (NLTK)**:Tokenizing Text, Training Tokenizer & Filtering Stopwords, Looking up words in Wordnet Stemming & Lemmatization, Natural Language Toolkit - Word Replacement, Synonym & Antonym Replacement. **TensorFlow**: Convolutional Neural Networks, TensorBoard Visualization, TensorFlow - Word Embedding, TensorFlow - Linear Regression	8
V	**Tableau**: Design Flow, File Types, Data Types, Data Terminology, Data source, worksheet and calculations. **Scikit-learn**: Introduction, Modelling Process, Data Representation, Estimator	8

	API, Conventions, Linear Modeling	
Total Hours		40

Course Outcomes:

CO1: To explain how data is collected, managed and stored for data science.

CO2: To understand the key concepts in Big data science, including their real-world applications and thetoolkit used for Big Data

CO3: To implement data collection and management scripts using D3.js.

CO4: Examine the techniques of NLTK toolkit and Tensor flow.

CO5: Identification of various applications of Tableau.

Text Book

1. Statistical Data Analysis Using SAS: Intermediate Statistical Methods (Springer Texts in Statistics)

2. Big Data and Analytics, 2ed | IM | BS | e Paperback – 1 January 2019
by Subhashini Chellappan Seema Acharya (Author)

Reference Books-

1. Big Data For Dummies by Judith S. Hurwitz, Alan Nugent

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		V/III		Program		B.Tech – Artificial Intelligence and Data Science
Subject Category	OC-4	Subject Code:	AI 605(C)	Subject Name		Artificial Intelligence

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	0	3

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

1 Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
2 Review of classical problem solving: search and forward and backward chaining.
3 Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem etc.

UNITs	Descriptions	Hrs.
I	Definitions – Foundation and History of AI, Evolution of AI - Applications of AI, Classification of AI Systems with respect to environment. Artificial Intelligence vs Machine learning, Tic - Tac – Toe problem. Intelligent Agent: Concept of Rationality, nature of environment, structure of agents.	8
II	Heuristic Search Techniques: Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best first Search; Problem Reduction. Constraint Satisfaction problem: Interference in CSPs; Back, tracking search for CSPs; Local Search for CSPs; structure of CSP Problem. Beyond Classical, Search: Local search algorithms and optimization problem, local search in continuous spaces, searching with nondeterministic action and partial observation, online search agent and unknown environments.	8
III	Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic- Structured representation of knowledge	8
IV	Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Natural Language Processing Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.Hopfield Network, Learning in Neural Networks, Application of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI and Symbolic AI.	8
V	Development Process, knowledge Acquisition. PROLOG Introduction, Syntax and Numeric Function, Basic List Manipulation, Functions, Predicates and Conditional, input, output and Local Variables, iteration and Recursion, Property Lists and Arrays, LISP and other AI Programming Languages.	8
Total Hours		40

Course Outcomes:

CO1: Describe various searching methods and reasoning in AI.
CO2: Uses of Knowledge Representation Techniques.
CO3: Analysis the concepts of reasoning and planning
CO4: Illustrate the concept of NLP and NN
CO5: Apply and evaluate AI Techniques using PROLOG and LISP

Text Book

1. Artificial Intelligence -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press.

Reference Books-

1. Introduction to Prolog Programming By Carl Townsend.
2. Programming with PROLOG —By Klocksin and Mellish.
3. Artificial Intelligence (Fifth Edition) -By George F Luger, Pearson Education.
4. Artificial Intelligence (Second Edition}-By Stuart Russell and Peter Norvig, Pearson Education.
5. Artificial Intelligence Application Programming, Tim Jones, Wiley India
6. Artificial Intelligence And Expert Systems - By D.W Patterson .

List/Links of e-learning resource

List and Links of e-learning resources:

- https://nptel.ac.in/courses/117103063/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		VI/III	Program	B.Tech – Artificial Intelligence andData Science
Subject Category	DLC	Subject Code:	AI 506	Subject Name: Advance Data Science Lab II

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
				30	10	10	50			2	1

Prerequisites:

- Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

- How to use R for analytical programming
- How to implement data structure in R
- R loop functions and debugging tools
- Object-oriented programming concepts in R
- Data visualization in R
- How to perform error handling
- Writing custom R functions

UNITs	Descriptions	Hrs.
I	Creating strings, paste() and paste0(), Formatting numbers and string using format(), String manipulation	8
II	Creating lists, manipulating list elements, merging lists, Converting lists to vectors	8
II I	ARRAYS IN R: Creating arrays, Accessing array elements, Calculations acrossarray elements	8
I V	R FACTORS: Understanding factors, Modifying factors, Factors in Data frames	8
V	Creating data frame: Operations on data frames, Accessing data frames, Creatingdata frames from various sources, need for data visualization, Bar plot, Plotting categorical data, Stacked bar plot, Histogram, plot() function and line plot, pie chart / 3D pie chart, Scatter plot, Box plot	8
Total Hours		40

Course Outcomes:

CO1: Explain critical R programming concepts for data preprocessingCO2: Analyze data and generate reports based on the data in the R

CO3: Apply machine learning concepts in R programming

Experiments (R- Intermediate)
Write an R script to handle outliers.
Write an R script to handle invalid values.
Visualize iris dataset using mosaic plot.
Visualize correlation between sepal length and petal length in iris data set using scatter plot.
Experiments(R- Advance)
Linear Regression: Consider the following mice data: Height:140,142,150,147,139,152,154,135,148, 147. Weight: 59, 61, 66, 62, 57, 68, 69, 58, 63, 62. Derive relationship coefficients and summary for the above data.
Consider the above data and predict the weight of a mouse for a given height and plot the results using a graph.
Logistic Regression: Analyse iris data set using Logistic Regression. Note: create a subset of iris dataset with two species.
Perform Logistic Regression analysis on the above mice data(Sl.No.21) and plot the results.
Decision Tree: Implement ID3 algorithm in R.
Implement C4.5 algorithm in R.
Time Series: Write R script to decompose time series data into random, trend and seasonal data.
Write R script to forecast time series data using single exponential smoothing method.
Clustering: Implement K-means algorithm in R.
Implement CURE algorithm in R.
Write an R script to handle outliers.
Modes of Evaluation and Rubric
The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Ramratan Ahirwal
Subject handled by department	Department of IT