HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)
CHENNAI

M.Sc. Artificial Intelligence and Data Analytics
M.Sc(AI&DA)

(Duration: 2 Years)

CURRICULUM and SYLLABI

(Applicable for Students admitted from Academic Year 2022-23)

DEPARTMENT OF COMPUTER APPLICATIONS

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

Motto:

To Make Every Man *a* Success *and* No Man *a* Failure

Vision:

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

Mission:

- *To create an ecosystem that promotes learning and world class research.*
- *To nurture creativity and innovation.*
- *To instill highest ethical standards and values.*
- *To pursue activities for the development of the Society.*
- *To develop national and international collaborations with institutes and industries of eminence.*
- *To enable graduates to become future leaders and innovators.*

Value Statement:

Integrity, Innovation, Internationalization.

DEPARTMENT OF COMPUTER APPLICATIONS

Vision:

The department of Computer Applications aims to transform aspiring students into software professionals with a high degree of technical skills and to inculcate a research mind set.

Mission:

- *To provide strong theoretical foundations complemented with extensive practical training.*
- *To design and deliver curricula to meet the changing needs of industry.*
- *To establish strong collaborations with industry, R&D and academic institutes for training and research.*
- *To promote all-round development of the students through interaction with alumni and industry*

PROGRAMME'S EDUCATIONAL OBJECTIVES (PEO'S):

***PEO1**. To prepare graduates to be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.*

***PEO2**. To prepare graduates to achieve peer-recognition, as an individual and as a team player, through demonstration of good analytical, design, implementation and interpersonal skills.*

***PEO3.**To prepare graduates to contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.*

***PEO4.** To prepare graduates to pursue life-long learning to fulfil their goals.*

PROGRAMME'S OUTCOMES (PO'S):

1. ***Computational knowledge****:Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.*
2. ***Problem analysis****: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.*
3. ***Design/development of solutions****: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.*
4. ***Conduct investigations of complex problems****: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.*
5. ***Modern tool usage****: Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.*
6. ***Societal and Environmental Concern***: *Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.*
7. ***Innovation and Entrepreneurship:*** *Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.*
8. ***Professional Ethics****: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.*

9. ***Individual and team work****: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.*
10. ***Communication****: Communicate effectively with the computing community, and with society, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.*
11. ***Project management and finance****: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.*
12. ***Life-long learning****: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.*

PROGRAMME'S SPECIFIC OUTCOMES (PSO'S):

PSO-1*: Ability to solve complex problems in the domain of Artificial Intelligence and Data Analytics using the current software tools and technologies.*

PSO-2: *Explore the concepts of Artificial Intelligence and Data Analytics and development of computational systems in multidisciplinary fields*

PSO-3*: Create a new design, model, analyse and evaluate the solution for new real time problems in the field of Artificial Intelligence and Data Analytics.*

M.Sc. Artificial Intelligence and Data Analytics
Curriculum and Syllabi

SEMESTER- I									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	CMA02001	Statistical Modelling for Computer Science	3	0	2	4	0	5
2	PC	CAD02001	Machine Learning Algorithms	2	1	0	3	2	3
3	PC	CAD02002	Artificial Intelligence and Neural Networks	3	0	0	3	2	3
4	PC	CAD02003	Advanced Algorithms and Analysis	2	1	2	4	2	5
5	PC	CAD02004	Python Programming	2	0	2	3	2	4
PRACTICAL									
6	PC	CAD02400	Machine Learning Algorithms Lab	0	0	4	2	0	4
7	PC	CAD02401	Artificial Intelligence and Neural Networks Lab	0	0	4	2	0	4
			Total	**12**	**2**	**14**	**21**	**8**	**28**
L – Lecture ; T – Tutorial ; P – Practical ; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER- II									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	CAD02005	Fuzzy Logic and its Applications	3	0	2	4	0	5
2	PC	CAD02006	Computational Intelligence	3	0	0	3	2	3
3	PC	CAD02007	Data Analytics Tools	2	0	2	3	2	4
4	PC	CAD02008	Deep Learning Techniques	3	1	0	4	2	4
5	DE	CCA025**	DE-1	3	0	0	3	2	3
PRACTICAL									
6	PC	CAD02402	Computational Intelligence Lab	0	0	4	2	0	4
7	PC	CAD02403	Deep Learning Techniques Lab	0	0	4	2	0	4
			Total	**14**	**1**	**12**	**21**	**8**	**27**
L – Lecture ; T – Tutorial ; P – Practical ; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER- III									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	CAD02009	Artificial Intelligence in Cloud Computing	2	1	0	3	2	3
2	DE	CAD025**	DE-2	3	0	0	3	0	3
3	DE	CAD025**	DE-3	3	0	0	3	0	3
4	DE	CAD025**	DE-4	3	0	0	3	2	3
PRACTICAL									
5	PC	CAD02800	Research Paper Review	0	0	12	6	0	12
6	PC	CAD02801	Internship*	0	0	6	3	0	6
			Total	**11**	**1**	**18**	**21**	**4**	**30**
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER- IV									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
PRACTICAL									
1	PC	CAD02802	Project Work	0	0	24	12	0	24
			Total	**0**	**0**	**24**	**12**	**0**	**24**
L – Lecture ; T – Tutorial ; P – Practical ; C – Credit; S- Self Study; TCH- Total Contact Hours									

TOTAL CREDITS: 75

LIST OF DEPARTMENTAL ELECTIVES - SEMESTER WISE

SEM	COURSE	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
Elective I									
2	DE	CAD02500	Knowledge Engineering and Expert Systems	3	0	0	3	2	3
2	DE	CAD02501	Web Analytics	3	0	0	3	2	3
Elective II									
3	DE	CAD02502	Artificial Intelligence Ethics	3	0	0	3	2	3
3	DE	CAD02503	Cyber Security and Data Protection	3	0	0	3	2	3
Elective III									
3	DE	CAD02504	Reinforcement learning	3	0	0	3	2	3
3	DE	CAD02505	Digital and Social Media Analytics	3	0	0	3	2	3
Elective IV									
3	DE	CAD02506	BlockChain and Artificial Intelligence	3	0	0	3	2	3
3	DE	CAD02507	Multimedia Analytics	3	0	0	3	2	3

M.Sc. Artificial Intelligence and Data Analytics
Syllabi

SEMESTER – I

COURSE TITLE	STATISTICAL MODELING FOR COMPUTER SCIENCE			CREDITS	4
COURSE CODE	CMA02001	COURSE CATEGORY	BS	L-T-P-S	3-0-2-0
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The course focuses on the statistical modelling for computer science and the applications of statistics in the field of areas like artificial intelligence and Data Analytics
Course Objective	1. To understand the concepts of Statistics Methods and probability distribution. 2. To understand the sampling inference and testing of hypothesis. 3. To learn correlation and regression in nonparametric method 4. To understand curve fitting and decision theory 5. To Understand the analysis of variance in statistical problems.
Course Outcome	Upon completion of this course, the students will be able to 1. Apply the concepts of Statistics method and probability distribution. 2. Analyze Null and Alternative hypothesis in the statistical problems. 3. Elucidate the relation between two variables by using correlation and regression in not parametric method 4. Calculate the curve fitting equation based on the statistical data. 5. Analysis the significance difference between the classification of data.

Prerequisites: -- Mathematics

CO, PO AND PSO MAPPING

CO	PO -1	PO-2	PO-3	PO-4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O2	PS O3
CO-1	1	3	1	2	1	-	2	1	2	1	-	3	1	-	1
CO-2	2	3	1	2	1	-	2	1	2	1	-	3	2	1	1
CO-3	3	-	2	-	-	1	-	2	-	-	1	-	1	-	2
CO-4	2	1	1	1	-	1	1	1	1	-	1	1	1	3	-
CO-5	2	1	3	1	-	2	1	3	1	-	2	1	1	1	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: STATISCAL METHODS	**(9L+3P)**
Introduction – steps of statistical methods – Measures of central tendency – Measures of dispersion – coefficient of variation – skewness – kurtosis.	**CO-1 BTL-3**

Introduction – Definition of probability – addition and multiplication law of probability – conditional probability – Theorem of total probability – Baye's theorem – RV – Discrete & continuous probability distributions – Binomial, Poisson, uniform & normal distribution. **Practical Component**: Implement calculation of simple statistical measures using MATLAB	
MODULE 2: SAMPLING INFERENCE AND TESTING OF HYPOTHESIS (9L+3P)	
Introduction – One sample test– Two sample tests – Small sample test – t-test – F-test – Chi-square test. **Practical Component:** Implement various sampling tests using MATLAB	**CO-2** **BTL-3**
MODULE 3: CORRELATION AND REGRESSION (9L+3P)	
Simple, Multiple Regression and correlation – Nonparametric methods **Practical Component:** Implement regression and correlation analysis using MATLAB	**CO-3** **BTL-3**
MODULE 4: CURVE FITTING AND DECESION THEORY (9L+3P)	
Empirical laws and Curve Fitting – Decision Theory **Practical Component:** Implement curve fitting using MATLAB	**CO-4** **BTL-3**
MODULE 5: DESIGN OF EXPERIMENTS (9L+3P)	
Analysis of variance – one way & Two-way classification – Time series and forecasting. **Practical Component:** Implement analysis of variance and time series analysis using MATLAB	**CO-5** **BTL-3**
TEXT BOOKS	
1	Dirk P.Kerose, Joshua C.C.Cla(2016), Statistical Modeling and Computation ,Publisher, Springer
2	Richard I. Levin, David S. Rubin (2017), Statistics for Management, Pearson Education Prentice -Hall 8th Edition.
REFERENCE BOOKS	
1	Kroese, Dirk P., C.C. Chan, Joshua(2014), Statistical Modeling and Computation, Springer-Verlag New York.
E BOOKS	
1.	https://www.datasciencecentral.com/forum/topics/free-book-probabilistic-and-statistical-modeling-in-computer
2	https://machinelearningmastery.com/statistics-books-for-machine-learning/
MOOC	
1.	https://www.mooc-list.com/tags/statistical-modeling
2	https://www.edx.org/course/statistics-computation-and-applications

COURSE TITLE	MACHINE LEARNING ALGORITHMS			CREDITS	3
COURSE CODE	CAD02001	COURSE CATEGORY	PC	L-T-P-S	2-1-0-2
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The course gives an overall description about machine learning, various types of machine learning algorithms and its applications.
Course Objective	1. To introduce the basic concepts of machine Learning 2. To understand the supervised learning techniques. 3. To familiarize with regression methods, classification and clustering methods. 4. To learn the clustering techniques. 5. To know the probabilistic graphical models.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the concept of machine learning and also the various type of machine learning. 2. Apply classification techniques to classify the given problem. 3. Implement SVM classifier using appropriate tools 4. Demonstrate the various clustering and PCA techniques. 5. Design and implement Direct and Undirected probabilistic geographical models

Prerequisites: Probability and Statistics

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO1	PSO2	PSO3
CO-1	1	1	1	1	1	-	-	-	-	-	-	-	1	1	1
CO-2	2	1	2	2	2	2	-	-	-	-	-	-	2	3	1
CO-3	2	2	2	2	3	3	1	2	2	-	1	2	2	3	2
CO-4	2	2	2	3	3	-	-	-	1	-	2	2	2	3	3
CO-5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION (9L)	
Machine Learning - Machine Learning Fundamentals – applications - Types of machine learning - basic concepts in machine learning -Examples of Machine Learning. **Suggested Readings:** https://machinelearningmastery.com/start	**CO-1** **BTL-2**
MODULE 2: SUPERVISED LEARNING -I (9L)	
Regression Techniques – Linear and logistic regression - Decision Trees – Types of decision trees - ID3 – CART - Neural Networks- Feed Forward network and Back Propagation -Perceptron – Multi layer perceptron. **Suggested Readings:** Enrico C, Simon W, Jay R, Machine Learning Techniques for Space	**CO-2** **BTL-3**

Weather, Elsevier Norman Matlof, “Statistical Regression and Classification: From Linear Models to Machine Learning”, CRC Press, 2017.	
MODULE 3: SUPERVISED LEARNING -2	**(9L)**
K-Nearest Neighbor Classifier-Discriminant Analysis – Support Vector Machine – Linear SVM – The soft margin SVM, the kernel trick - Nonlinear Classifier, Regression by Support vector Machines. **Suggested Readings:** https://www.upgrad.com/blog/classification-algorithms-in-machine-learning cs229-notes3.pdf(stanford.edu)	**CO-3** **BTL-3**
MODULE 4: UNSUPERVISED LEARNING	**(9L)**
Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis **Suggested Readings:** https://www.ibm.com/cloud/learn/unsupervised-learning	**CO-4** **BTL-2**
MODULE 5:PROBABILISITIC GRAPHIC MODELS	**(9L)**
Directed Graphic models – Bayesian Models – Markov Random Fields – Naïve Bayes Classifiers- Markov Models – Hidden Markov Models. Undirected Graphic models – Conditional Independence properties. Ensemble learning – Random Forest **Suggested Readings:** perso.univ-lyon1.fr/alexandre.aussem/cours/PGM_cours.pdf	**CO-5** **BTL-2**
TEXT BOOKS	
1.	Kevin P. Murphy(2016), “Machine Learning – A probabilistic Perspective”, MIT Pres.
2	Ethem Alpaydın(2020), Introduction to Machine Learning, The MIT Press Cambridge, Fourth Edition, MIT Press Hardcover.
REFERENCE BOOKS	
1.	Ethem Alpaydin(2016), "Machine Learning: The New AI”, MIT Press.
2.	Shai Shalev-Shwartz, Shai Ben-David(2014), "Understanding Machine Learning: From Theory toAlgorithms”, Cambridge University Press.
E BOOKS	
1.	http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html
MOOC	
1.	https://www.coursera.org/learn/practical-machine-learning

COURSE TITLE	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS			CREDITS	3
COURSE CODE	CAD02002	COURSE CATEGORY	PC	L-T-P-S	3-0-0-2
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course gives insights into the basics of Artificial Intelligence and intelligent agents, problem solving and search techniques, knowledge representation, reasoning and natural languages, and Introduction to neural network, Multilayer Perceptron's and Kernel Methods and Support Vector Machines
Course Objective	1. To impart knowledge about Artificial Intelligence and intelligent agents 2. To enable the students to understand the basic concepts of search techniques 3. To understand the basic concepts and techniques of knowledge representation, reasoning and natural languages. 4. To impart knowledge about the basic concepts and techniques of neural network and Multilayer Perceptron's 5. To develop the skills to gain basic understanding of the areas of Kernel Methods and Support Vector Machines
Course Outcome	Upon completion of this course, the students will be able to 1. Design intelligent agents and distinguish between Utility based and Goal based agents. 2. Apply concepts, methods, and theories of search, heuristics, games 3. Apply concepts, methods, and theories of knowledge representation, planning and Natural language processing techniques. 4. Design single and multi-layer feed-forward neural networks for practical applications. 5. Describe the role of neural networks in engineering, AI, and cognitive modelling.

Prerequisites: Basic knowledge of Mathematical Logic

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	3	3	2	1	1	3	2	1	2	3	2	2	3	3
CO-2	3	3	3	2	1	1	2	2	1	1	3	2	2	2	2
CO-3	3	3	3	2	2	1	1	2	1	1	2	2	2	2	2
CO-4	3	3	3	2	1	1	3	2	1	1	3	2	2	2	2
CO-5	3	3	3	2	1	1	3	2	1	1	2	2	2	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTELLIGENT AGENTS (9L)

Introduction to Artificial Intelligence, Rational Agent, reflex, model-based, goal-based, and utility-based agents **Suggested Readings:** Interpretable models	**CO-1** **BTL-2**
MODULE 2: PROBLEM SOLVING AND SEARCH TECHNIQUES (9L)	
Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, iterative deepening, uniform cost search, Hill climbing and its Variations, simulated annealing, genetic algorithm search; Heuristics Search Techniques: Best First Search, A* algorithm, AO* algorithm, Minmax & game trees, refining minmax, Alpha – Beta pruning, Constraint Satisfaction Problem, Means-End Analysis **Suggested Readings:** Concepts and tools across AI	**CO-2** **BTL-3**
MODULE 3: KNOWLEDGE REPRESENTATION, REASONING AND NATURAL LANGUAGES (9L)	
Knowledge Representation: Introduction to First Order Predicate Calculus, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, semantic networks, Frames system, Production Rules, Conceptual Graphs, Ontologies. Reasoning with Uncertain Knowledge: Different types of uncertainty - degree of belief and degree of truth, various probability constructs, Bayes' rule, approaches to modeling uncertainty - Dempster-Shafer theory and fuzzy sets/logic. Natural Languages: Components and steps of communication, contrast between formal and natural languages in the context of grammar, parsing, and semantics, Parsing Techniques, Context-Free and Transformational Grammars. **Suggested Readings:** Natural language processing tasks	**CO-3** **BTL-3**
MODULE 4: MULTILAYER PERCEPTRONS (9L)	
Introduction to neural networks:perceptron as a model of learning, perceptron convergence theorem, batch perceptron learning algorithm, relation between perceptron and Bayesian learner for a Gaussian environment; linear regression model, maximum a posteriori (MAP) estimation of the parameter vector, least mean squares algorithm. Multilayer Perceptrons: Backpropagation algorithm, batch learning and online learning, adaptive control of learning rate; estimating regularization parameter: Tikhonov's regularization theory, complexity regularization, and network pruning. **Suggested Readings:** Convolutional Neural Networks	**CO-4** **BTL-3**
MODULE 5: KERNEL METHODS AND SUPPORT VECTOR MACHINES (9L)	
Kernel Methods and Support Vector Machines: Separability of patterns, interpolation problem, radial basis function (RBF) networks, support vector machines. Introduction to Hopefield networks, Boltzmann machines, restricted Boltzmann machines. **Suggested Readings:** Current trends in Neural network technologies	**CO-5** **BTL-3**
TEXT BOOKS	
1.	S. Russell and P. Norvig(2015), Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education.

2.	Simon O. Haykin(2016), Neural Networks and Learning Machines, Pearson Education.
REFERENCE BOOKS	
1.	Elaine Rich and Kelvin Knight(2017), Artificial Intelligence, 3rd edition, Tata McGraw Hill.
2.	C. M. Bishop (2010) , Pattern Recognition and Machine Learning, Springer
E BOOKS	
1.	https://christophm.github.io/interpretable-ml-book/
MOOC	
1.	https://www.greatlearning.in/ai-ml/course
2.	https://www.coursera.org › learn › neural-networks-dee..

COURSE TITLE	**ADVANCED ALGORITHMS AND ANALYSIS**			**CREDITS**	**4**
COURSE CODE	**CAD02003**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-1-2-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observation and lab records	Attendance	ESE	
					Th	Pr
15%	15%	10%	5%	5%	25%	25%

Course Description	This course introduces advanced methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures.
Course Objective	1. To analyze worst case and average case running times using asymptotic notation. 2. To identify limitation of algorithm. 3. To get awareness about various algorithmic techniques and real time applications. 4. To solve real world problems. 5. To identify efficient algorithm for NP hard problems.
Course Outcome	Upon completion of this course, the students will be able to 1. Apply the asymptotic notations to analyze worst-case and average case running times of algorithms. 2. Identify the limitations of algorithms in problem solving. 3. Describe the various algorithmic techniques and its real time applications. 4. Solve the real-time problem using graphs. 5. Determine an efficient algorithms NP hard problem.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO -11	PO 12	PS O1	PS O2	PS O3
CO-1	3	2	3	-	1	-	-	1	-	-	-	1	1	1	1
CO-2	3	2	-	2	-	-	1	-	-	2	-	-	1	1	-

CO-3	1	3	2	1	-	1	-	-	1	-	1	-	1	-	1
CO-4	2	2	3	2	-	-	-	-	-	-	-	1	1	1	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(9L+3P)**
Introduction – Algorithms – Analysing and Designing Algorithms - Growth of Functions – Asymptotic notation - Probabilistic Analysis and Randomized Algorithms - Indicator random variables - Randomized algorithms - Probabilistic analysis and further uses of indicator random variables **Practical component:** 1. Calculate complexity of algorithms using step count method. **Suggested Readings:** https://onlinecourses.nptel.ac.in/noc18_cs20	**CO-1** **BTL-2**
MODULE 2: DIVIDE-AND-CONQUER	**(9L+3P)**
The maximum- Subarray problem - Strassen's algorithm for matrix multiplication - The substitution method for solving recurrences- The recursion-tree method for solving recurrences – Heapsort - Quicksort - Priority queues. **Practical component:** Solve problems using divide and conquer approach and analyze its complexity. **Suggested reading:**https://onlinecourses.nptel.ac.in/noc18_cs20	**CO-3** **BTL-2**
MODULE 3: DYNAMIC PROGRAMMING AND GREEDY ALGORITHMS	**(9L+3P)**
Dynamic Programming - Elements of dynamic programming - Optimal binary search trees - Greedy Algorithms - An activity-selection problem - Huffman codes **Practical component**: 1. Solve problem using Greedy approach and analyze its complexity 2. Solve problem using dynamic programming approach and analyze its complexity. **Suggested reading:**https://onlinecourses.nptel.ac.in/noc18_cs20	**CO-3** **BTL-3**
MODULE 4: ELEMENTARY GRAPH ALGORITHMS	**(9L+3P)**
Representations of graphs - Breadth-first search - Depth-first search - Minimum Spanning Trees - The algorithms of Kruskal and Prim - Single-Source Shortest Paths - Single-source shortest paths in directed acyclic graphs - Dijkstra's algorithm - All-Pairs Shortest Paths - The Floyd-Warshall algorithm **Practical component:** 1. Implement Single source shortest path algorithm and Analyze its complexity 2. Implement All source shortest path algorithm and Analyze its complexity 3. Implement Minimum spanning tree algorithm and analyze its complexity **Suggested reading :**https://onlinecourses.nptel.ac.in/noc18_cs20	**CO-4** **BTL-2**
MODULE 5: LINEAR PROGRAMMING	**(9L+3P)**
Formulating problems as linear programs - The simplex algorithm - NP-	**CO-5**

Completeness - NP-completeness and reducibility - Approximation Algorithms - The traveling-salesman problem - The set-covering problem **Practical component:**Implement Approximation algorithms for Traveling salesman problem and analyze its complexity **Suggested Readings**: https://www.edutechlearners.com/design-analysis-algorithms.	**BTL-2**

TEXT BOOKS	
1.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein. (2012). Introduction to Algorithms, Third Edition, PHI Learning Private Limited.
REFERENCE BOOKS	
1.	Anany Levitin, (2017). Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education.
2.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman. (2006). Data Structures and Algorithms, Pearson Education.
3.	Donald E. Knuth. (2008). The Art of Computer Programming, Volumes 1&3 Pearson Education, 2009. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer.
E BOOKS	
1.	https://www.edutechlearners.com/design-analysis-algorithms.
MOOC	
1.	https://www.edutechlearners.com/design-analysis-algorithms.

COURSE TITLE	**PYTHON PROGRMMING**				**CREDITS**	**3**	
COURSE CODE	**CAD02004**	**COURSE CATEGORY**	**PC**	**L-T-P-S**		**2-0-2-2**	
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**		

ASSESSMENT SCHEME						
First Periodical Assessment	**Second Periodical Assessment**	**Observation and lab records**	**Surprise Test / Quiz**	**Attendance**	**ESE**	
					Th	**Pr**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	The Python programming course explores the concepts and algorithms in the field of artificial intelligence
Course Objective	1. To understand the python programming basics 2. To explore the applications of Artificial Intelligence using Python 3. To investigate supervised and unsupervised learning algorithms 4. To perform regression analysis 5. To comprehend predictive analytics and ensemble learning
Course Outcome	Upon completion of this course, the students will be able to 1. Implement the basic programming concepts in python 2. Implement the artificial intelligence applications using python 3. Implement the various classification algorithms 4. Implement single and multi variable regressor 5. Perform predictive analytics and ensemble learning
Prerequisites: NIL	
CO, PO AND PSO MAPPING	

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO - 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	2	3	-	1	-	-	1	3	2	1	3	3	2	3
CO-2	3	2	-	2	-	-	1	-	2	3	2	2	2	3	2
CO-3	1	3	2	1	-	1	-	-	3	3	3	3	3	3	3
CO-4	2	2	3	2	-	-	-	-	3	2	1	3	3	2	1
CO-5	3	3	3	3	-	-	-	-	2	3	2	2	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(6L+3P)**
Python fundamentals, components, functions, modules, object orientation, Exceptions, python on the command line, applying python **Practical component:** Implement basic python programs using functions, objects and exceptions	**CO-1** **BTL-2**
MODULE 2: AI WITH PYTHON	**(6L+3P)**
Applications of AI, Defining intelligence using turing test, making machines think like humans, Building rational agents**,** **Practical component:** Solving problem with GPS	**CO-3** **BTL-2**
MODULE 3: CLASSIFICATION	**(6L+3P)**
Supervised versus unsupervised learning preprocessing data, binarization, mean removal, scaling, logistics regression classifier, Naive Bayes classifier , confusion matrix. **Practical component**: Implement the classification of income data using Support vector machines	**CO-3** **BTL-3**
MODULE 4: REGRESSION	**(6L+3P)**
Regression basics, Building a single variable regressor, multivariable regressor, **Practical component:** Estimating housing prices using a Support Vector Regressor	**CO-4** **BTL-2**
MODULE 5: PREDICTIVE ANALYTICS WITH ENSEMBLE LEARNING	**(6L+3P)**
Ensemble learning , building learning models with ensemble learning decision, tree building a decision tree classifier, Random forests and extremely random forests, Estimating the confidence measure of the predictions **Practical component:** Predicting traffic using Extremely Random Forest regressor	**CO-5** **BTL-2**

TEXT BOOKS	
1.	Prateek Joshi(2017),Artificial Intelligence with Python, Packt Publishing Ltd.
2	Martin C Brown(2018), Python: The Complete Reference, McGrawHill Education
REFERENCE BOOKS	
1.	Dr. Krishna Kumar Mohbey, Dr. Brijesh Bakariya(2021), An Introduction to Python Programming: A Practical Approach,bpb publications
E BOOKS	
1.	https://oiipdf.com/download/python-programming-python-programming-for-beginners-python-programming-for-intermediates
MOOC	
1.	https://www.coursera.org/learn/python

COURSE TITLE	MACHINE LEARNING ALGORITHMS LAB			CREDITS	2
COURSE CODE	CAD02400	COURSE CATEGORY	PC	L-T-P-S	0-0-4-0
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Cycle Assessment	Second Cycle Assessment	Observation and lab records	Attendance	ESE
15%	15%	15%	5%	50%

Course Description	The course exposes the students to various tools to implement the various machine learning algorithms.
Course Objective	1. To learn and understand the different data sets in implementing the machine learning algorithms 2. To familiarize the tools available to implement various machine learning algorithms.
Course Outcome	Upon completion of this course, the students will be able to 1. Implement the machine learning algorithms using tools. 2. Design Python programs for various machine learning algorithms. 3. Apply appropriate datasets to ML algorithms. 4. Identify ML algorithms to solve real world problems. 5. Apply ML algorithms to solve real world problems.

Prerequisites: Probability and Statistics

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS-2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	-	-	-	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	-	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

LIST OF EXPERIMENTS

1. 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.
2. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
3. Write a program to implement the naïve Bayesian classifier for Iris data set. Compute the accuracy of the classifier, considering few test data sets.
4. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
5. 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.
6. Apply EM algorithm to cluster a Heart Disease Data Set. 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. 7. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

TEXT BOOKS	
1.	Dipankar Sarkar, Raghav Bali, Tushar Sharma(2018), Practical Machine Learning with Python A Problem-Solver's Guide to Building Real-World Intelligent Systems, Apress.
2.	Aurelien Geron (2019), Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition.
REFERENCE BOOKS / Link	
1.	Sebastian Raschka , Vahid Mirjalili (2019),Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition.
E-BOOKS	
1	https://scikit-learn.org/stable/
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc21_cs85/preview
2.	https://onlinecourses.nptel.ac.in/noc21_cs70

COURSE TITLE	**ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS LAB**			**CREDITS**	**2**
COURSE CODE	**CAD02401**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-4-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME				
First Periodical Assessment	**Second Periodical Assessment**	**Observation and Lab records**	**Attendance**	**ESE**
15%	**15%**	**15%**	**5%**	**50%**

Course Description	This course provides methods to design and analyze AI based algorithms, various AI tools, solution of real life problems, custom feed-forward network, layers in neural network and set and Training Functions & Parameters
Course Objective	1. To provide skills for designing and analyzing AI based algorithms. 2. To enable students to work on various AI tools 3. To provide skills to work towards solution of real-life problems. 4. To enable students to work on custom feed-forward network 5. To understand the layers in neural network 6. To provide skills to set and Training Functions & Parameters
Course Outcome	Upon completion of this course, the students will be able to 1. Elicit, analyse and specify software requirements. 2. Simulate given problem scenario and analyse its performance. 3. Develop programming solutions for given problem scenario 4. Create a custom feed-forward network

	5. Construct Layers in neural network and Set and Training Functions & Parameters

Prerequisites: Mathematical Logic and concepts of Artificial Intelligence and Neural Networks

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	1	-	1	1	-	-	-	2	2
CO-3	1	2	2	2	2	-	2	1	-	-	1	2	2	2	2
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	2	2
CO-5	2	3	2	3	2	2	-	1	2	-	1	2	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

LIST OF EXPERIMENTS

1. Installation and working on various AI tools viz. Python, R tool, GATE, NLTK,
2. MATLAB, etc.
3. Data pre-processing and annotation and creation of datasets.
4. Learn existing datasets and Tree banks
5. Implementation of searching techniques in AI.
6. Implementation of Knowledge representation schemes.
7. Natural language processing tool development.
8. Application of Machine learning algorithms.
9. Application of Classification and clustering problem.
10. Working on parallel algorithms.
11. Scientific distributions used in python for Data Science -Numpy, scify, pandas,
12. scikitlearn, statmodels, nltk.
13. Create a custom feed-forward network consisting of the following
14. Network Layers Constructing Layers Connecting Layers Setting Transfer Functions
15. Training Functions & Parameters The difference between train and adapt (Performance Functions Train Parameter
16. Constructing Layers. Define properties of input layer
    Define the number of neurons in the input layer.
17. Setting Transfer Functions and Training Functions & Parameters

TEXT BOOKS

1.	Dr. K. Uma Rao (2011), Artificial Intelligence and Neural Networks,pearson Education.

REFERENCE BOOKS

1.	Stuart Russell Peter(2010) , Artificial Intelligence: A Modern Approach , Pearson Education ,Prentice Hall of India

E BOOKS

1.	Gerardus Blokdyk(2020), Artificial Neural Networks A Complete Guide - KindleEdition

MOOC

1.	https://www.greatlearning.in/great-lakes-artificial-intelligence-and-machine-learning?

SEMESTER – II

COURSE TITLE	FUZZY LOGIC AND ITS APPLICATIONS			CREDITS	4
COURSE CODE	CAD02005	COURSE CATEGORY	PC	L-T-P-S	3-0-2-0
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observation/lab records Surprise Test / Quiz	Attendance	ESE	
					Th	Pr
15%	15%	10%	5%	5%	25%	25%

Course Description	This course introduces students to the basic concepts of modeling in systems using fuzzy sets. The concepts of fuzzy sets are introduced and their role in applications of semantic interpreters, control systems and reasoning systems.
Course Objective	1. To provide the student with the basic understanding of fuzzy logic fundamentals 2. To Provide an understanding of the basic mathematical elements of the theory of fuzzy sets. 3. To Provide an emphasis on System modeling and control system 4. Program the related algorithms and Design the required and related systems
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basic knowledge of the fuzzy sets, operations and their properties 2. Comprehend the fundamental concepts of Fuzzy functions and Fuzzy logic 3. Analyze the concepts of Fuzzy sets for System Modeling 4. Design a fuzzy logic Controller for real time problem 5. Apply the fuzzy logic controller for solving the real time problem

Prerequisites: Artificial Intelligence

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O2	PSO 3
CO-1	3	2	1	1	-	-	-	-	-	1	-	2	2	2	2
CO-2	2	1	-	-	1	-	-	2	-	-	-	-	2	2	2
CO-3	2	2	1	-	-	--	2	-	2	1	-	1	2	2	2
CO-4	2	2	2	-	-	-	-	-	-	-	1	-	2	2	2
CO-5	3	3	3	2	2	2	-	-	-	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: FUZZY SET THEORY (9L+3P)	
Fundamental Concepts- Elementary Measure Theory of Sets- Fuzzy Set Theory- Interval Arithmetic- Algebraic Properties of Interval Arithmetic- Measure Theory of Intervals- Properties of the Width of an Interval- Interval Evaluation- Interval Matrix Operations- Interval Matrix Equations- Operations on Fuzzy Sets **Practical Component**: Common operations on Fuzzy Set using Python	**CO-1** **BTL-3**
MODULE 2: FUZZY LOGIC THEORY (9L+3P)	
Classical Logic Theory-Logical Functions of the Two-Valued Logic-Boolean Algebra-Multi-Valued Logic-Fuzzy Logic and Approximate Reasoning-Fuzzy Relations-Fuzzy Logic Rule Base-Fuzzy IF-THEN Rules-Interpretation of Fuzzy IF-THEN Rules. **Practical Component**: Rule based operations using python	**CO-2** **BTL-3**
MODULE 3: FUZZY SYSTEM MODELING (9L+3P)	
Modeling of Static Fuzzy Systems-Discrete-Time Dynamic Fuzzy Systems and Their Stability Analysis-Modeling of Continuous-Time Dynamic Fuzzy Control Systems-Stability Analysis of Continuous-Time Dynamic Fuzzy Systems-Controllability Analysis of Continuous-Time Dynamic Fuzzy Systems-Analysis of Nonlinear Continuous-Time Dynamic Fuzzy Systems. **Practical Component**: Modeling Fuzzy Systems using python	**CO-3** **BTL-3**
MODULE 4: FUZZY CONTROL SYSTEMS (9L+3P)	
Classical Programmable Logic Control-General Model-Free Approach-Closed-Loop Set-Point Tracking System-Design Principle of Fuzzy Logic Controllers-Examples of Model-Free Fuzzy Controller Design-Fuzzy PID Controllers-Fuzzy PID Controllers Design-Fuzzy PID Controllers: Stability Analysis **Practical Component:** Fuzzy logic controllers using python	**CO-4** **BTL-3**
MODULE 5: ADAPTIVE FUZZY CONTROL (9L+3P)	
Fundamental Adaptive Fuzzy Control Concept-Gain Scheduling-Fuzzy Self-Tuning Regulator-Model Reference Adaptive Fuzzy Systems-Dual Control-Sub-Optimal Fuzzy Control-Applications of Fuzzy Control-Health Monitoring , Fuzzy Diagnostic Systems-Fuzzy Control of Image Sharpness for Autofocus Cameras. **Practical Component**: Fuzzy monitoring Systems using python	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Guanrong Chen, Trung Tat Pham (2001),Introduction to Fuzzy Sets, Fuzzy Logic, and Fuzzy Control Systems, CRC Pres
REFERENCE BOOKS	
1.	Tamir, Dan E., Rishe, Naphtali D., Kandel, Abraham(2005),Fifty Years Of Fuzzy Logic And Its Applications Studies In Fuzziness And Soft Computing,Springer-Verlag Berlin Heidelberg.
2.	George J. Klir ,Bo Yuan (2015),Fuzzy Sets and Fuzzy Logic: Theory and A: Theory and Applications,Pearson Education India.
E BOOKS	
1.	https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/CHEN-

	PHAM-Introduction-to-Fuzzy-sets-Fuzzy-logic-and-Fuzzy-control-systems-Page-160.pdf
MOOC	
1.	https://www.classcentral.com/course/swayam-fuzzy-logic-and-neural-networks-13036

COURSE TITLE	**COMPUTATIONAL INTELLIGENCE**			**CREDITS**	**3**
COURSE CODE	**CAD02006**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	Computational intelligence comprises practical adaptation and self-organization concepts, paradigms, algorithms and implementations that enable or facilitate appropriate actions (intelligent behaviour) in complex and changing environment
Course Objective	1. To provide a strong foundation on fundamental concepts in Computational Intelligence. 2. To enable Problem-solving through various searching techniques. 3. To apply these techniques in applications which involve perception, reasoning and learning. 4. To apply Computational Intelligence techniques for information retrieval 5. To apply Computational Intelligence techniques primarily for machine learning.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basic goals and methods of computational intelligence 2. Study of design of intelligent computational technique. 3. Apply intelligent technique for problem solving 4. Improve problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, computer vision, automatic programming and machine learning. 5. Develop easy to use software packages/codes to upsurge the benefits of the society and help other research colleagues to innovate modified but new products
Prerequisites:Artificial Intelligence	

CO, PO AND PSO MAPPING															
CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	-	-	2	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	-	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO COMPUTATIONAL INTELLIGENCE	(9L)
Introduction to Artificial Intelligence-Search-Heuristic Search-A* algorithm-Game Playing- Alpha-Beta Pruning-Expert systems-Inference-Rules-Forward Chaining and Backward Chaining- Genetic Algorithms.	**CO-1BTL-2**
MODULE 2: KNOWLEDGE REPRESENTATION AND REASONING	**(9L)**
Proposition Logic – First Order Predicate Logic – Unification – Forward Chaining -Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering – Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information – Prolog Programming**.**	**CO-2 BTL-2**
MODULE 3: UNCERTANITY	**(9L)**
Non monotonic reasoning-Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning-Neural Networks-Neuro-fuzzy Inference.	**CO-3 BTL-3**
MODULE 4: LEARNING	**(9L)**
Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks - Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees – Regression and Classification with Linear Models - Artificial Neural Networks – Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning	**CO-4 BTL-2**
MODULE 5: INTELLIGENCE AND APPLICATIONS	**(9L)**
Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-AII applications – Language Models - Information Retrieval – Information Extraction - Machine Translation – Machine Learning - Symbol-Based – Machine Learning: Connectionist – Machine Learning**.**	**CO-5 BTL-2**

TEXT BOOKS	
1.	Stuart Russell, Peter Norvig(2010)—Artificial Intelligence: A Modern Approach, Third Edition, Pearson Education / Prentice Hall of India.

REFERENCE BOOKS	
1.	Patrick H. Winston(2006). "Artificial Intelligence", Third edition, Pearson Edition.
2.	Dan W.Patterson(2006) —Introduction to Artificial Intelligence and Expert Systems, Prentice Hall

E BOOKS	
1.	https://www.springer.com/us/book/9789811587436
MOOC	
1.	https://www.my-mooc.com/en/mooc/reinforcement-learning--ud600/

COURSE TITLE	DATA ANALYTICS TOOLS			CREDITS	3
COURSE CODE	CAD02007	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observation /lab records/surprise test/Quiz	Attendance	ESE	
					Th	Pr
15%	15%	10%	5%	5%	25%	25%

Course Description	Data Analytics involves being about to go from raw data to a deeper understanding of the patterns and structures within the data, to support making predictions and decision making. The course will cover a number of topics, including: Introduction to analytics, case studies - How analytics is used in practice with the Data Analytics tools like R ,Tableau, and Power BI
Course Objective	1. To be exposed to big data 2. To understand the different ways of Data Analysis 3. To identify patterns and build practical models using R 4. To build, design, and improve advanced business intelligence solutions using Tableau 5. To create and build data models using Power BI
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the fundamental concepts and statistical analysis. 2. Familiarize with compare and contrast the data. 3. Create and build practical models using R 4. Design advanced business solutions using Tableau 5. Import and apply data transformation strategies

Prerequisites: Basics of database

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO1	PSO2	PSO3
CO-1	1	1	1	1	1	-	1	-	1	-	-	1	3	3	3
CO-2	1	1	1	1	1	-	1	-	-	1	-	1	3	3	3
CO-3	2	1	1	1	2	-	1	-	-	-	-	2	1	2	1
CO-4	2	1	1	2	2	-	2	-	-	-	-	2	2	2	2
CO-5	2	2	2	3	3	1	3	2	2	-	1	3	3	3	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO BIG DATA (6L+3P)

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Statistical concepts: Sampling distributions, resampling, statistical inference, prediction error. **Practical component:** Implement various sampling using python **Suggested Readings:** Data analytics tools and Analytic scalability	**CO-1** **BTL-2**
MODULE 2: DATA ANALYSIS	**(6L+3P)**
Regression modelling, Multivariate analysis, Bayesian modelling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods. **Practical component:** Implement regression models.**,** Develop fuzzy based neural network model **Suggested Readings:** Bayesian modelling and Neural networks	**CO-2** **BTL-2**
MODULE 3: DATA ANALYTICS USING R	**(6L+3P)**
Introduction to R, Data types of R, Programming in R, Data exploration nd manipulation, Import and export of Data , Basic visualization, Statistical analysis **Practical component:** Perform Statistical Analysis and Data Visualization **Suggested Readings:** Time series models	**CO-3** **BTL-3**
MODULE 4: DATA ANALYTICS USING TABLEAU	**(6L+3P)**
Creating worksheets and dashboards, Connecting Tableau to your data, Joins, Blends, and Data Structures , Relationships , Joins , Unions , Blends Understanding data structures **Practical component:** Create and build business solutions using tableau **Suggested Readings:** Basic Chart types	**CO-4** **BTL-2**
MODULE 5: DATA ANALYTICS USING POWER BI	**(6L+3P)**
Introduction to Power BI, Advantages, Features, Importing Data , direct Query, Live connection, Data Transformation strategies, The power Query Editor, Transform basics, Building data model **Practical component:** Import data and apply data transformation strategies **Suggested Readings**: Leveraging R with Power BI	**CO-5** **BTL-2**

S

TEXT BOOKS	
1	Anand Raja Raman and Jeffrey David Ullman(2012), Mining of Massive Datasets, Cambridge University Press.
2	Dr. Dhaval Maheta (2021),Data Analysis Using R : A Primer for Data Scientist , Publisher:Notion Press
3	Marleen Meier(2021) ,Mastering Tableau 2021: Implement advanced business intelligence techniques and analytics with Tableau, 3rd Edition , Packt Publishing Limited
4	Devin Knight , Brian Knight , Mitchell Pearson, (2018),Microsoft Power BI Quick Start Guide, Packt Publishing Limited
REFERENCE BOOKS	
1.	Bill Franks, Thomas H. Davenport (2012), Taming the Big Data Tidal Wave:

	Finding Opportunities in Huge Data Streams with advanced analytics. Wiley publishers
E BOOKS	
1.	https://www.edx.org/course/foundations-of-data-analysis-part-1-statistics-usi
MOOC	
1.	https://www.edx.org/course/foundation of data analytics
2.	https://www.coursera.org/lecture/foundations-data/welcome-to-the-google-data-analytics-certificate-aA1Wv

OURSE TITLE	**DEEP LEARNING TECHNIQUES**			**CREDITS**	**4**
COURSE CODE	**CAD02008**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course contains the various concepts of deep learning algorithms and their applications to solve real world problems.
Course Objective	• To understand the historical evolutionary concepts of deep learning • To understand the fundamental concepts of Neural Networks • To understand the fundamental concepts of Convolutional Neural Networks • To know about the various models available for sequence analysis • To understand the fundamental concepts of Deep Reinforcement Learning
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the historical evolution of deep learning. 2. Describe the feed-forward and deep networks. 3. Describe the need for Neural Networks. 4. Apply the appropriate models for Sequence Analysis. 5. Describe the concepts of deep reinforcement learning.

Prerequisites: Machine Learning

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	-	-	-	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	-	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION (9L+3T)	
Historical context and motivation for deep learning; basic supervised classification task; optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, and adaptive sub-gradient method. **Practical component:** Logistic regression classification using gradient descent and stochastic gradient descent method. **Suggested Readings:** Evolution of Deep Learning	**CO-1** **BTL-1**
MODULE 2: NEURAL NETWORKS (9L+3T)	
Building Intelligent Machines; The Mechanics of Machine Learning; The Neurons; Feed Forward Neural Networks; Linear Neurons and their limitations. **Practical component:** Feed-forward neural network for solving regression and 2-class classification problem. **Suggested Readings:** Applications of Feed Forward Networks	**CO-2** **BTL-2**
MODULE 3: CONVOLUTIONAL NEURAL NETWORKS (9L+3T)	
Neurons in human vision; Shortcomings of feature selection, Filters and Feature Maps, Max Pooling, Visualizing the learning in Convolutional Networks. **Practical component:** Create a 2D and 3D CNN for image classification **Suggested Readings:** Vanilla Deep Neural Networks	**CO-3** **BTL-2**
MODULE 4: MODELS FOR SEQUENCE ANALYSIS (9L+3T)	
Recurrent Neural Networks; Long Short-Term Memory Units (LTSM); TensorFlow Primitives for RNN Models; Implementing a Sentiment Analysis Model; Solving seq2seq Tasks with Recurrent Neural Networks **Practical component:** (a) RNN for image classification, (b) LSTM networks **Suggested Readings:** Stateful Deep Learning Models	**CO-4** **BTL-3**
MODULE 5: DEEP REINFORCEMENT LEARNING (9L+3T)	
Introduction to Deep RL; Deep Q Network; Training DQN; Learning Stability; Target Q-Network; DQN and the Markov Assumption. **Suggested Readings**: Playing Breakout with DQN	**CO-5** **BTL-2**
TEXT BOOKS	
1.	Nikhil Buduma, Nicholas Locascio(2017) —Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms, O'ReillyMedia.
REFERENCE BOOKS	
1.	Ian Goodfellow, Yoshua Bengio and Aaron Courville(2016), “Deep Learning (Adaptive Computation and Machine Learning Series)”, MIT Press.
E BOOKS	
1.	Li Deng and Dong Yu (2014), "Deep Learning: Methods and Applications", Foundations and Trends® in Signal Processing: Vol. 7: No. 3–4, pp 197-387.

MOOC	
1.	https://nptel.ac.in/courses/106/105/106105215/
2.	https://onlinecourses.nptel.ac.in/noc21_cs93/preview

COURSE TITLE	COMPUTATIONAL INTELLIGENCE LAB			CREDITS	2
COURSE CODE	CAD02402	COURSE CATEGORY	PC	L-T-P-S	0-0-4-0
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Cycle Assessment	Second Cycle Assessment	Observation /Record	Attendance	ESE
15%	15%	15%	5%	50%

Course Description	Computational intelligence lab Focus on the theory, design, application, and development of computational paradigms emphasizing fuzzy systems, neural networks, evolutionary computation and hybrid intelligent systems
Course Objective	1. To provide a strong foundation on fundamental concepts in Computational Intelligence. 2. To enable Problem-solving through various searching techniques. 3. To apply these techniques in applications which involve perception, reasoning and learning. 4. To apply Computational Intelligence techniques for information retrieval 5. To apply Computational Intelligence techniques primarily for machine learning
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basic exposition to the goals and methods of Computational Intelligence. 2. Study of the design of intelligent computational techniques. 3. Apply the Intelligent techniques for problem solving 4. Improve problem solving skills using the acquired knowledge in the areas of, reasoning, natural language 5. Familiarize with the computational intelligence techniques

Prerequisites: Probability and Statistics

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO 11	PO -12	PS O1	PS O2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	-	-	-	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	-	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

LIST OF EXPERIMENTS

1.Explain in brief about Neural Network, Fuzzy Logic, Genetic Algorithm and Hybrid System. 2. Study and Analysis of Fuzzy Vs Crisp Logic. 3. Study and Analysis of Genetic Algorithm Life Cycle. 4. Write a program to implement BFS 5. Write a program to implement DFS 6. Write a program to implement Single Player Game (Using Heuristic Function) 7. Write a program to Implement A* Algorithm 8. Implementation of Fuzzy Operations 9. Design a Fuzzy Logic system using programming language (C++,Java, etc.) 10.Write a program for Back Propagation Algorithm. 11. Implementation of Unsupervised Learning Algorithm. 12.Implementation of Neuro-Fuzzy Systemusing programming language. (C++,Java etc.)

TEXT BOOKS	
1.	Stuart Russell, Peter Norvig, —Artificial Intelligence: A Modern Approach‖, Third Edition, Pearson Education / Prentice Hall of India, 2010
REFERENCE BOOKS / Link	
1.	Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
2.	Dan W.Patterson, —Introduction to Artificial Intelligence and Expert Systems‖, PHI, 2006.
E-BOOKS	
1	https://www.springer.com/us/book/9789811587436
MOOC	
1.	https://www.my-mooc.com/en/mooc/reinforcement-learning--ud600/

COURSE TITLE	**DEEP LEARNING TECHNIQUES LAB**			**CREDITS**	**2**
COURSE CODE	**CCA02403**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-4-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	**Second Periodical Assessment**	**Observation/Lab records**	**Attendance**	**ESE**
15%	**15%**	**15%**	**5%**	**50%**

Course Description	This course contains the various concepts of deep learning algorithms and their applications to solve real world problems.
Course Objective	1. To understand the python libraries for deep learning 2. To familiarize with the software environment for deep learning algorithms 3. To understand the practical concepts of feed forward networks 4. To understand the practical concepts of CNN 5. To understand the practical concepts of RNN

Course Outcome	Upon completion of this course, the students will be able to 1. Apply python libraries for data classification 2. Implement feed forward networks 3. Implement perception concepts 4. Implement CNN classification methods 5. Implement RNN classification methods

Prerequisites: Machine learning, Python programming

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	-	-	-	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	-	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

LAB /MINI PROJECT/FIELD WORK

1. Implement logistic regression classification with (a) gradient descent and (b) stochastic gradient descent method. Plot cost function over iteration.
2. Experiment with logistic regression by adding momentum term, and adaptive sub-gradient method
3. Write the code to learn weights of a perceptron for Boolean functions (NOT, OR, AND, NOR, and NAND).
4. Implement a feed-forward neural network for solving (a) regression and (b) 2-class classification problem. Also experiment with hyper-parameter tuning.
5. Train and test a feed-forward neural network for multi-class classification using softmax layer as output.
6. Create a 2D and 3D CNN for image classification. Experiment with different depth of network, striding and pooling values.
7. Implement (a) RNN for image classification, (b) GRU network and (c) Implement LSTM network.

TEXT BOOKS

1.	Nikhil Buduma, Nicholas Locascio(2017), —Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms‖, O'ReillyMedia.

REFERENCE BOOKS

1.	Ian Goodfellow, Yoshua Bengio and Aaron Courville(2016), “Deep Learning (Adaptive Computation and Machine Learning Series)” , MIT Press.

E BOOKS

1.	Keras Tutorial: Deep learning in

	python.https://www.datacamp.com/community/tutorials/deep-learning-python?
2	https://keras.io/getting_started/learning_resources/
MOOC	
1.	https://www.udemy.com/course/deep-learning-with-python-and-keras/
2.	https://www.coursera.org/learn/introduction-to-deep-learning-with-keras

SEMESTER – III

COURSE TITLE	ARTIFICIAL INTELLIGENCE IN CLOUD COMPUTING			CREDITS	3
COURSE CODE	CCA02009	COURSE CATEGORY	PC	L-T-P-S	2-1-0-2
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course aims to give insights into how to develop AI applications with Google Cloud Platform and also to understand the cloud strategy for advanced data analytics to save time .
Course Objective	1. To familiarize with the Google cloud platform 2. To focus on AI model development and deployment in GCP without worrying about infrastructure 3. To manage feature processing, data storage, and trained models using Google Cloud Dataflow 4. To access Cloud AutoML to run your deep learning models 5. To build predictive applications
Course Outcome	Upon completion of this course, the students will be able to 1. Explain the basics of cloud computing and explore GCP component 2. Apply the pre-processing techniques in GCP for machine learning 3. Build a recommendation system using the XGBoost library. 4. Implement machine learning algorithms with Google Cloud AutoML 5. Build big data cloud machine learning algorithms and perform sentiment analysis

Prerequisites: Basics of Artificial Intelligence

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	3	1	2
CO-2	1	1	3	1	-	-	-	-	-	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	1	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Introduction	**(9L)**
Basics of Google Cloud Platform(GCP),Overview of GCP, Google Data centres , AI building blocks, AI tools available in GCP **Suggested Readings:** Cloud Computing and AI tools	**CO-1 BTL-3**
MODULE 2: Computing in GCP Platform	**(9L)**
Understanding the compute options, diving into the storage options, understanding the processing options, Building an ML Pipeline **Suggested Readings:** Artificial Intelligence with Google Cloud Platform	**CO-2 BTL-3**
MODULE 3: Machine Learning Applications with XGBoost	**(9L)**

Overview of XGBoost library , Training and storing XGBoost machine learning models , using XGBoost trained models, Building a recommendation system using the XGBoost library. **Suggested Readings:** XGBoost Environment	**CO-3** **BTL-3**
MODULE 4: Cloud AutoML	**(9L)**
Overview of Cloud AutoML, Document classification using AutoML Natural Language , Image classification using AutoML Vision APIs , Performing speech-to-text conversion using the Speech-to-Text API , Sentiment analysis using AutoML Natural Language APIs **Suggested Reading:** Cloud AutoML Custom Machine Learning Models	**CO-4** **BTL-3**
MODULE 5: Big Data Cloud Machine Learning Engine	**(9L)**
Building a Big Data Cloud Machine Learning Engine, Smart Conversational Applications Using DialogFlow, Introduction to DialogFlow , Building a DialogFlow agent , Performing audio sentiment analysis using DialogFlow **Suggested Readings:** Building prediction Applications	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Anand Deshpande, Manish Kumar, Et al(2020), Hands-On Artifi]cial Intelligence on Google Cloud Platform, Packt publishing company
REFERENCE BOOKS	
1.	Dr. V. Kumar Sharma, J. Khandelwal, T. Jain, J. Krishna R and H. Kumar(2020), Artificial Intelligence And Cloud Computing Basics, Rubicon publications
E BOOKS	
1.	Pramod Gupta, Naresh K. Sehgal(2021), Introduction to Machine Learning in the Cloud with Python , Concepts and Practices,Publisher : Springer
MOOC	
1.	https://www.coursera.org/learn/artificial-intelligence-and-networking

COURSE TITLE	**RESEARCH PAPER REVIEW**			**CREDITS**	**6**
COURSE CODE	**CAD02800**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-12-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME	
CIA	**ESE**
50%	**50%**
Course Description	The course provides students the opportunity to acquire and train skills and knowledge on how to independently assess the state of knowledge within a given narrow field of research. This course provides new insights or interpretation of a subject through thorough and systematic evaluation. In this project-based course, the students will outline a complete scientific paper.
Course Objective	1. To write brieflythe research and theories 2. To understand the basicsof the research 3. To integrate and evaluate the research and theories 4. To provide a justification for the research proposed based on the previous research.

Course Outcome	Upon completion of this course, the students will be able to 1. Identify theories and empirical results within a field of research 2. Evaluate research findings and implicit assumptions within a field of research 3. Present the theories and empirical results in a way that combines precision with readability 4. Design and write a literature review within the specified time limit 5. Organise and present the research findings for various audiences

Prerequisites: Research Methodology

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO-1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	2
CO-2	3	3	3	3	-	-	1	-	1	2	-	-	1	2	-
CO-3	3	3	3	3	-	1	-	-	-	-	-	-	1	1	2
CO-4	3	3	3	3	-	-	-	-	2	-	2	1	1	1	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related

RESEEARCH PAPER REVIEW

1. Find review articles and other basic information to use for background (outside of what is provided in textbook)
2. Find 3 empirical articles (papers have method/results sections)
3. Write the paper
    a. Background information to topic; research question/hypotheses
    b. Describe/summarize empirical articles
    c. Critically analyze topic; synthesize findings from articles
    d. Propose future directions/research (be specific)
4. The paper must be written in APA format. There are 2 primary ways you will use APA formatting: referencing and use of section headers.
    a. Referencing must be in APA style. Please see below for details or my website for APA style information sheets. You can use your textbook as an example of how to reference. Any ideas or conclusions that are not your own (information that you have learned), you must cite – give credit to the person that had that idea!
    b. Section headers are required in your paper. These should be descriptive of the paragraph(s) in that section (e.g. “Overview of false memories and children” then “Theories for false memories” then “Examination of familiarity”, etc.). The headers should be italicized and on their own line.
5. There is not a page requirement or limit, but typical papers are approximately 10 pages, double-spaced, 12-pt font, with additional, separate title page and reference page. Please include page numbers. Other APA style formatting, such as running heads or an abstract, are not required but welcomed.
6. Reference page: Only include references of papers that YOU have read. If you have any questions about how to correctly cite a source, please ask, but also see information below, on my website, or follow your textbook’s examples at the back of the book!
7. Finally Proof read, revise ,check for plagiarism and publish in indexed journals

Remarks	Allocation of Marks
Tentative Area, Topic selection	10%
Abstract, Introduction, Literature Review, Gap Identification, Objectives	20%
Methodology, (Materials and Methods, Design/Modelling/Analysis/Fabrication/Testing)	20%
Results and Discussion, Conclusion, Future Scope, References and Draft Project Report submission	20%
Project Report submission, PPT Preparation	20%
Internal and External Examiners Evaluation	20%
Total	100%

TEXT BOOKS	
1	Chris A. Mack(2018), How to Write a Good Scientific Paper, SPIE publications.
REFERENCE BOOKS	
1	James D. Lester Jr.(2001), Writing Research Papers: A Complete Guide, Pearson Education
E BOOKS	
1.	http://thuvienso.bvu.edu.vn/bitstream/TVDHBRVT/15289/1/How-to-Write-a-Research-Paper.pdf

COURSE TITLE	**INTERNSHIP***			**CREDITS**	**3**
COURSE CODE	**CAD02801**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-6-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME	
CIA	**ESE**
50%	**50%**
Course Description	The internship is guided by learning goals and reflective assignments. It is supervised academically by a faculty member and professionally by an internship supervisor. All academic internships must be approved in advance, and students must be concurrently enrolled in academic internship units
Course Objective	1. Gain an understanding of workplace dynamics, professional expectations, and the influence of culture on both. 2. Build proficiency in a range of industry skills appropriate to the field of the internship 3. Refine and clarify professional and career goals through critical analysis of the internship experience or research project
Course Outcome	Upon completion of the course the students will be able to 1. Describe main issues and challenges to be faced in the industry, both internally andon the market 2. Accomplish to unfamiliar work place , working culture and style 3. Draw skills from experience and process challenges 4. Develop an awareness of their skills and aspirations 5. Recognize more thoroughly on their company and sector as well as

	on their own experience, perceptions, and career goals 6.

Prerequisites: Basics of database

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O2	PS O3
CO-1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	-
CO-2	3	3	3	3	-	-	1	-	1	2	-	-	1	1	-
CO-3	3	3	3	3	-	1	-	-	-	-	-	-	1	1	-
CO-4	3	3	3	3	-	-	-	-	2	-	2	1	1	1	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

INTERNSHIP

The internship is guided by learning goals and reflective assignments. It is supervised academically by a faculty member and professionally by an internship supervisor. All academic internships must be approved in advance, and students must be concurrently enrolled in academic internship units. Students evaluate the work site and supervisors evaluate the student's performance at the internship.

Procedure for applying for internships

For internship, look for the companies and organisations of the industry the students are interested in and search for training, internships or any links that allow to enter your details and upload professional resume with the website. If direct application is allowed, apply for the internship.

SEMESTER-IV

COURSE TITLE	PROJECT WORK			CREDITS	12
COURSE CODE	CAD02802	COURSE CATEGORY	PC	L-T-P-S	0-0-24-0
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA	ESE
50%	50%

Course Description	The project work is introduced to improve the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. The students in a group of 3 to 4 works on a topic under the guidance of a faculty member and prepares a comprehensive project report after completing the work. The progress of the project is evaluated based on a minimum of three reviews. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.
Course Objective	1. To perform a literature review 2. To undertake detailed technical work 3. Develop a solution for the problem and develop an application by using relevant computer application concepts 4. To produce progress reports or maintain a professional journal to establish work completed and deliver a seminar on the general area 5. To present the work in a forum involving poster presentations
Course Outcome	Upon successful completion of the course students will be able to: 1. Identify a issue and derive problem related to society, environment, economics, energy and technology 2. Formulate and Analyze the problem and determine the scope of the solution chosen 3. Design solutions to complex problems utilizing a systems approach. 4. Find solution by formulating proper methodology 5. Evaluate the solution by considering the standard data / Objective function and by using appropriate performance metric

Prerequisites: Software Engineering , Programming Skills

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO1	PSO2	PSO3
CO1	2	1	3	1	-	1	-	-	-	-	-	3	3	1	2
CO2	1	1	3	1	-	-	1-	-	1	2	-	3	-	2	2
CO3	1	2	3	2	2	-	-	1	-	-	2	2	2	3	3

CO4	**1**	**3**	**3**	**2**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**3**
CO5	**2**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**3**	**2**	**3**	**3**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

Project

The students should finalize their Project immediately before commencement of 4thsemester.

The types of projects may include:

1. Industrial case study
2. Preparation of a feasibility report
3. Design and development of application
4. The overhauling of existing application
5. Creation of New facilities

Identification of Topic: The selection of topic is of crucial importance. It should be field of interest. It is advisable to choose the project can be completed on time and within the budget and resources. The topic should be clear, directional, focussed and feasible. The project should be challenging but manageable within the resources and time available. Students should undergo reviews during the internal assessment. Time table for IA should include project review. The guide should monitor the progress of Project work periodically and it should be finally evaluated. The IA marks will be evaluated based on oral presentation and assessment by the internal guide by adopting Rubrics given. Real time problems, Industry related problems, should be chosen and it is a Responsibilities of the project committee / Project coordinator.

Rubrics for Major Project Evaluation

Review #	Agenda	Criteria	Assessment	**Overall Weightage**
1	Synopsis and Proposal Evaluation	• Identification of Problem Domain and Detailed Analysis • Study of Existing systems and feasibility of project proposal • Objectives and methodology of the proposed work	10	**50%**
2	Midterm Assessment Project Evaluation	• Design methodology • Planning of project work (time frame) • Demonstration of the work done so far and presentation	10	
3	Project and Project Report Evaluation	• Incorporation of suggestions • Project demonstration presentation • Project report -description of concept and technical	20	

		details • Conclusion and discussion		
4	Evaluation by guide	• Self-motivation and determination • Working within a team • Technical knowledge and awareness related to the project • Regularity	10	
5	ESE Examination	• Presentation • Viva voce	20	**50%**

List of Electives

COURSE TITLE	KNOWLEDGE ENGINEERING AND EXPERT SYSTEMS			CREDITS	3
COURSE CODE	CAD02500	COURSE CATEGORY	DE	L-T-P-S	3-0-0-2
VERSION	1.0	APPROVAL DETAILS	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course focused on the field of knowledge-based systems and related technologies. Its treatment of the increasing variety of such systems is designed to provide the reader with a substantial grounding in such technologies as expert systems, genetic algorithms, case-based reasoning systems, data mining, intelligent agents and the associated techniques and methodologies.
Course Objective	1. To understand definition of knowledge and describe its relationship to dataand information. 2. To know the purpose and types of interviews in obtaining knowledge 3. To know the advantages and disadvantages of semantic networks 4. To Learn the of programming languages used in Expert system. 5. To Learn how a well-structured application can be implemented using an industry standard tool
Course Outcome	Upon completion of this course, the students will be able to 1. Evaluate the advantages and limitations of expert systems 2. Describe how knowledge is acquired from a human expert 3. Analyse the type of chaining used by a specific expert system (ES) 4. Describe the main elements of an ES shell and how they work 5. Evaluate the place of blackboard architectures in knowledge engineering

Prerequisites: Basic programming knowledge

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	-	-	-	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	1	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: KNOWLEDGE-BASED SYSTEMS (9L)

Introduction to Knowledge Engineering - Data, information and	**CO-1**

knowledge- Skills-Knowledge-based systems, Types of Knowledge-Based Systems - Expert systems - Neural networks- Case-based reasoning - Genetic algorithms - Intelligent agents- Data mining **Suggested Readings:** IBM Knowledge Discovery & Data Mining	**BTL-3**
MODULE 2: KNOWLEDGE ACQUISITION	**(9L)**
Introduction – Interviews - Other Sources of Knowledge, Conducting Interviews, Unstructured Interviews, Structured Interviews, Event Recall Interviews, Other Knowledge Acquisition Techniques, Documenting the Knowledge Acquisition Process, Dealing with Multiple Experts **Suggested Readings:** Knowledge Acquisition Through Explicit Representation of Knowledge Roles	**CO-2** **BTL-3**
MODULE 3: KNOWLEDGE REPRESENTATION AND REASONING	**(9L)**
Using knowledge - Different Types of Knowledge - Deep and Shallow Knowledge, Representing Rules in ESs - Features of Rule-Based Systems, Procedural vs. Declarative Programming, Logic, rules and representation - Propositional Logic - Inference Rules and Propositional Logic- Rule-Based Systems, Developing rule-based systems - Problems in Building a KBS- Rule Tracing - Building Explanation Text into an ES – Brittleness – Evaluation – Verification – Validation – Standards Knowledge Representation in Semantic Networks – Inheritance - Representing Exception Data - Semantic Networks, Levels Within Frames. **Suggested Readings:**Semantic Networks for the Representation of Knowledge	**CO-3** **BTL-3**
MODULE 4: EXPERT SYSTEM SHELLS, ENVIRONMENTS AND LANGUAGES	**(9L)**
Expert system (ES) shells - Tools Available to Produce ESs - Examples of ES Shells, Expert system development environments, Use of artificial intelligence (AI) languages - Expert System Languages - Introduction to PROLOG - Using Facts in ESs - Extracting a Set of Records from an ES - Combining Queries – Inferences - Working with Lists **Suggested Readings**: Guide to expert system building tools for microcomputers**.**	**CO-4** **BTL-3**
MODULE 5: LIFE CYCLES, METHODOLOGIES AND UNCERTAIN REASONING	**(9L)**
Need for methodologies, Blackboard architectures, Problem Solving Methods (PSMs), Knowledge Acquisition Design System (KADS), The Hybrid Methodology (HyM), Building a well-structured application using Aion BRE.Introduction to Uncertainty - Reasoning with Missing Information - Causes of Uncertainty in Expert System Design. **Suggested Readings:** Generic Task Toolset for Life cycles	**CO-5** **BTL-3**
TEXT BOOKS	
1.	S.L. Kendal and M. Creen (2007). An Introduction to Knowledge Engineering, Springer-Verlag London Limited.
REFERENCE BOOKS	
1.	Brey, P. and Søraker, J. (2009). 'Philosophy of Computing and Information Technology' Philosophy of Technology and Engineering Sciences. Vol. 14 of the Handbook for Philosophy of Science, Elsevier.
E BOOKS	

1.	https://stacks.stanford.edu/file/druid:fm522ph6624/fm522ph6624.pdf
MOOC	
1.	https://www.coursera.org/lecture/probabilistic-graphical-models/knowledge-engineering-yRimU

COURSE TITLE	**WEB ANALYTICS**			**CREDITS**	**3**
COURSE CODE	**CAD02501**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	Web Analytics is the measurement, collection, analysis, and reporting of Internet data for purposes of understanding and optimizing Web usage. Web Analytic is a tool that can measure Web site traffic. Businesses can also use it as a tool for business and market research.
Course Objective	1. To insights into the behaviour of the market and website traffic. 2. To generate valuable data from internal search analysis 3. To confidently analyses and provide business solutions 4. To conduct qualitative research and deliver actionable, data-driven business insights
Course Outcome	Upon completion of this course, the students will be able to 1. Identify the motivations behind data collection and analysis methods used by marketing professionals. 2. Describe the different analytics tools. 3. Apply advertising using analytics. 4. Implement web-based Analytics and software products. 5. Describe Affiliate, Internet, and Referral Marketing.

Prerequisites: - Basics of web

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO-1	2	3	1	2	1	-	2	1	2	1	-	3	1	-	1
CO-2	2	3	1	2	1	1	2	1	2	2	-	3	2	2	1
CO-3	3	-	2	-	-	1	-	2	-	-	2	-	1	-	2
CO-4	2	2	1	1	-	1	2	2	1	-	1	1	2	3	-
CO-5	2	1	3	1	-	2	1	3	1	-	2	1	1	1	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO WEB ANALYTICS (9L)

Introduction to Web Analytics 7: A Brief history of Web Analytics –Web Analytics Terminology – Traditional Web Analytics – Web Analytics 2.0 – Capturing Data- Tools Selection – Quality Aspects –Implementing Best Practices **Suggested Readings:** Web Analytics 2.0	**CO-1** **BTL-2**
MODULE 2: KPLS & FILES (9L)	
Data capture: tagging, logfile - Analysis: manipulation of data - Reporting: KPIs, dashboards Usability Studies – User Submitted Information – Integrating Form based data – Web Data Sources – Server Log Files – Page Tags **Suggested Readings:** Server Log Files	**CO-2** **BTL-2**
MODULE 3: GOOGLE ANALYTICS (9L)	
Measurement Strategy - Fundamentals of Google Analytics Implementation through Google Tag Manager - Understanding User Behavior through Event Tracking - Extending Google Analytics with Custom Dimensions, Custom Metrics, and Calculated Metrics - Cross-Domain Tracking, Cross-Device Tracking, and CRM Integration - Mobile App Tracking in Firebase Analytics and Google Analytics **Suggested Readings:** Cross-Domain Tracking	**CO-3** **BTL-3**
MODULE 4: SOCIAL MEDIA (9L)	
Monitoring Customer Engagement in Social Media - Identifying Opinions through Sentiment Analysis and Topic Modeling - Social Network Analysis and Metrics - Identifying Influencers in Social Network - Leveraging Social Media - Applying Analytics to Social Media Activity **Suggested Readings:** Social Network Analysis and Metrics	**CO-4** **BTL-2**
MODULE 5: TESTING, DIGITAL FORENSICS AND NEXT GENERATION SECURITY (9L)	
Digital marketing beginning - Website Planning and Creation - Search Engine Optimization (SEO) - Digital Media Planning and Buying - Mobile Marketing - Web Analytics Tools (Spring Metrics, Google Website Optimizer) **Suggested Readings:** Search Engine Optimization (SEO)	**CO-5** **BTL-2**
TEXT BOOKS	
1.	Avinash Kaushik(2009), Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity , Wiley Publishers.
REFERENCE BOOKS	
1.	Brian Clifton(2012), Advanced Web Metrics with Google Analytics , Wiley publishers.
2.	Stephan Spencer, and Jessie C. Stricchiola(2015), The Art of SEO: Mastering Search Engine Optimizationby Eric Enge of Stone Temple Consulting, Oreilly Media
E BOOKS	
1.	http://www.uou.ac.in/sites/default/files/slm/webanalytics.pdf
MOOC	

1.	https://www.edx.org/course/webanalytics-fundamentals
2.	https://www.coursera.org/specializations/digital marketing

COURSE TITLE		ARTIFICIAL INTELLIGENCE ETHICS			CREDITS	3
COURSE CODE		CAD02502	COURSE CATEGORY	DE	L-T-P-S	3-0-0-2
Version	1.0	Approval Details	35th ACM 06-08-2022	LEARNING LEVEL		BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course looks at ethical issues surrounding artificial intelligence. Students will also practice ethical and critical thinking skills, such as weighing the rights of different stakeholders, and thinking through the consequences of technological innovations. This course is designed to make the scholar familiar with the application of normative ethics, metaethics, and practical ethics to the field of AI and to AI technologies.
Course Objective	1. To gain knowledge in building ethics in machines 2. To get insights into ethical issues in AIgorithms 3. To analyse the current policies for AI and use ethical and socially responsible principles in your life. 4. To analyse the applications of Ethics in AI
Course Outcome	Upon completion of this course, the students should be able to 1. Describe the reasons for an ethical analysis applied to AI 2. Identify the ethical and social impacts and implications of AI. 3. Discuss about the normative ethics 4. Analyse the policies of AI 5. Apply critical skills in clarifying and ethically analyzing AI in different domains of life.

Prerequisites:

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2	PSO -3
CO-1	-	3	2	-	1	-	3	2	1	1	1	1	3	2	3
CO-2	-	-	1	-	1	-	-	-	3	2	-	1	-	-	3
CO-3	1	1	-	1	1	1	1	-	-	1	-	1	-	-	-
CO-4	3	3	1	1	3	3	3	1	1	-	1	1	1	1	1
CO-5	-	1	-	1	-	-	1	2	1	1	1	1	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BUILDING ETHICS TO MACHINES (9L)

Ethical learning, natural and artificial -use and abuse of the trolley problems- self driving cars, medical treatments, and the distribution of harn -moral	**CO-1 BTL-2**

psychology of AI and the ethical opt out problem modeling and reasoning computational law, symbolic discourse and the AI constitution	
MODULE 2: ETHICS OF INFORMATION &AI	**(9L)**
Ethical issues for different strengths/grades of AI and AI algorithms - Medium to strong AI: the moral relevance and effects of its ontological differences, Ethics of AI on the Web and in Web based applications	**CO-2 BTL-3**
MODULE 3: NORMATIVE ETHICS	**(9L)**
Rule consequentialism -Deontological approaches - Care ethics - Virtue Ethics - Problems with implementation-Problems with uptake and enforcement Software qualities and normative ethics- Interpretability, transparency and normative ethics - Interpretability, transparency and policy making- Extensibility, usability, and communicability	**CO-3 BTL-3**
MODULE 4: AI SAFETY, ETHICS, AND POLICY	**(9L)**
AI policy and Regulation-Economic effects of AI-Fairness bias and Inequality - Predictive policing-concrete AI safety **- Rights and moral consideration for AI and robots- Ethics and AI: teaching machines to be moral?- AI and National Security**	**CO-4 BTL-3**
MODULE 5: Use Cases	**(9L)**
Military robots and Autonomous Weapon Systems- Self-driving cars- Expert systems: COMPAS, Watson, …- Aviation and Air Traffic Management- Machine artistic creativity (TheNextRembrandt, Obvious Art, Shimon, …)- AI Ethics in Healthcare	**CO-5 BTL-3**
TEXT BOOKS	
1.	Matthew Liao(2020*), Ethics of Artificial Intelligence,* Oxford university Press
REFERENCE BOOKS	
1.	Etzioni A(2017) , *Incorporating ethics inti Artificial Intelligence* , Journal of Ethics
2.	Hooker, J., & Hooker, J. (2018). Ethics of Artificial Intelligence. In Taking Ethics Seriously
E BOOKS	
1.	Bauer, W. A. (2020). Virtuous vs. utilitarian artificial moral agents. AI and Society. https://doi.org/10.1007/s00146-018-0871-3
MOOC	
1.	https://www.edx.org/course/ethics-in-ai-and-data-science
2	https://www.coursera.org/learn/ai-ethics-analysis

COURSE TITLE	**CYBER SECURITY AND DATA PROTECTION**			**CREDITS**	**3**
COURSE CODE	**CAD02503**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-2**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course	This course gives a detail view about cyber security, different methods of

Description	encryption & authentication of files, files recovery methods and network security details.
Course Objective	1. To understand different types of cybercrimes and hacking. 2. To learn about the different data encryption and decryption methods 3. To learn about file authentication and security methods 4. To understand File Recovery techniques and tools. 5. To explore Network security measures.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the fundamental security concept and architecture with simple examples. 2. Familiarize with different encryption and authentication methods for securing the files. 3. Formulate and design various cryptographic methods for providing authentication for the files. 4. Formulate and design the file recovery methods to recover deleted files. 5. Recognize the features of network security measures to secure the data over internet.

Prerequisites: Cryptography and Network Security

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	**2**	**3**	**2**	**2**	**1**	**-**	**2**	**2**	**2**	**1**	**-**	**3**	**1**	**1**	**1**
CO-2	**2**	**3**	**2**	**2**	**1**	**-**	**2**	**1**	**2**	**1**	**-**	**3**	**2**	**1**	**1**
CO-3	**3**	**1**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**-**	**1**	**-**	**1**	**-**	**2**
CO-4	**2**	**1**	**2**	**1**	**-**	**2**	**1**	**1**	**1**	**-**	**1**	**1**	**2**	**3**	**1**
CO-5	**2**	**1**	**3**	**1**	**-**	**2**	**1**	**3**	**1**	**-**	**2**	**1**	**1**	**1**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO CYBER SECURITY	**(9L)**
Cyber Crimes – Classification of Conventional and Cyber Crime- Hacking-Cracking-Viruses-Virus Attacks -Hardware and Software Piracy-Intellectual Property in Cyber Space -Social Engineering-Mail Bombs-Bug Exploits -Application Attacks -Financial Frauds - Money laundering - Commercial Espionage and Commercial Extortion Online. **Suggested Readings:** Evolution of cyber security, principles of cyber security, Threads to E-Commerce	**CO-1** **BTL-**2
MODULE 2: ENCRYPTION AND FILE SECURITY	**(9L)**
Conventional Encryption: Conventional encryption model - Crypt Analysis of Caesar Cipher – Mono alphabetic Cipher – Hill Cipher – DES-Modes of Operations ECB –CBC-OFB-CTRRC 5 –Various modes of operations – Introduction to AES – Random number generation. **Suggested Readings:** Types of encryption, hashing, traditional ciphers	**CO-2** **BTL-2**

MODULE 3: CRYPTOGRAPHY AND AUTHENTICATION	(9L)
Public key cryptography and Digital Signatures: Modular Exponentiation- RSA algorithm- DiffieHellmann key exchange- Digital Signature – Authentication protocols- Digital Signature Algorithm and Digital Signature standard. **Suggested Readings:** Model and importance of digital signature, Authentication protocols	**CO-3** **BTL-3**
MODULE 4: FILE RECOVERY SYSTEM(9L)	
Introduction to Deleted File Recovery - Recover Swap Files, Temporary Files and Cache Files -Formatted Partition Recovery - Data Recovery Tools- Data Preservation - Complete Time Line Analysis of Computer Files- Forensic Tool Kit (FTK) - Working on Duplicate System-Working on Live System- Presentation of Evidence. **Suggested Readings:** File Recovery, Recovery Techniques, Lost, deleted and formatted data	**CO-4** **BTL-2**
MODULE 5: NETWORK SECURITY	**(9L)**
Network Security: Pretty good privacy – S/MIME-IP Security overview of IP security – security associations – security association database – security policy database , AH and ESP- Tunnel Transport mode why protect – IPV6 Authentication Header – ESP – reason for having Authentication Header - Web Security **Suggested Readings:** Network security principles, authentication methods, database security	**CO-5** **BTL-2**

TEXT BOOKS	
1.	Stalling.W(2003), "Cryptography and Network Security: principles and Practice",Third Edition, Pearson Education.
2.	William Stallings(2016), Cryptographyand NetworkSecurityPrinciplesand PracticesWilliam Stallings, Seventh Edition,Pearson.
REFERENCE BOOKS	
1	Charlie Kaufman, Radia Perlman and Mike Speciner(2002) " Network Security : Private Communication in a public work", second Edition, Pearson Education.
E BOOKS	
1.	https://uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf
MOOC	
1.	my-mooc.com/en/categorie/cybersecurity
2.	https://www.coursera.org/specializations/cyber-security

COURSE TITLE	REINFORCEMENT LEARNING			CREDITS	3
COURSE CODE	CAD02504	COURSE CATEGORY	DE	L-T-P-S	3-0-0-2
Version	1.0	Approval Details	35th ACM 06-08-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME					
First Periodical	Second	Seminar/	Surprise	Attendance	ESE

Assessment	Periodical Assessment	Assignments / Project	Test / Quiz		
15%	15%	10%	5%	5%	50%

Course Description	This course covers foundational models and algorithms used in RL, as well as advanced topics such as scalable function approximation using neural network representations and concurrent interactive learning of multiple RL agents.
Course Objective	1. To understand basic reinforcement learning techniques 2. To Understand value functions, as a general-purpose tool for optimal decision-making 3. To implement dynamic programming as an efficient solution approach 4. To Formalize problems as Markov Decision Processes 5. To implement Q-learning
Course Outcome	Upon completion of this course, the students will be able to 1. Explain the basic and advanced reinforcement learning techniques. 2. Identification of suitable learning tasks to which these learning techniques can be applied. 3. Understand the connections between Monte Carlo and Dynamic Programming and TD. 4. Understand the space of RL algorithms (Temporal- Difference learning) 5. Implement and apply Expected Sarsa and Q-learning

Prerequisites: Artificial Intelligence

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O2	PS O3
CO-1	2	1	3	1	-	-	-	1	-	-	1	2	-	1	2
CO-2	1	1	3	1	-	-	-	-	-	1	-	-	-	2	2
CO-3	1	2	3	2	2	-	2	1	-	-	-	2	2	3	3
CO-4	1	3	3	2	2	2	-	-	-	2	-	2	2	3	3
CO-5	2	3	3	3	2	2	-	-	2	-	-	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(9L)**
Reinforcement Learning- Elements of Reinforcement Learning- Limitations and Scope- Tic-Tac-Toe- Early History of Reinforcement Learning . **Practical Component:** Design a simple reinforcement learning **Suggested Readings:** Elements of Reinforcement Learning	**CO-1** **BTL-3**

MODULE 2: MULTI-ARMED BANDITS, MARKOV DECISION PROCESSES (9L)

k-armed Bandit Problem . Action-value Methods incremental Implementation- Tracking a Non-stationary Problem - Optimistic Initial Values- Upper-Confidence-Bound Action Selection . Gradient Bandit Algorithms- Associative Search (Contextual Bandits) The Agent–Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks- Policies and Value Functions - Optimal Policies and Optimal Value Functions - Optimality and Approximation . **Practical Component:** Design and conduct an experiment to demonstrate the difficulties that sample-average methods have for non-stationary problems **Suggested Readings:** Policy, rewards	**CO-2** **BTL-3**
MODULE 3: DYNAMIC PROGRAMMING, MONTE CARLO METHODS	**(9L)**
Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration- Value Iteration - Asynchronous Dynamic Programming - Generalized Policy Iteration - Efficiency of Dynamic Programming Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Monte Carlo Control- .Monte Carlo Control without Exploring Starts - policy Prediction via Importance Sampling - Incremental Implementation - policy Monte Carlo Control - Discounting-aware Importance Sampling - Per-decision Importance Sampling **Practical Component:** Write a program for policy iteration and re-solve in a car rental problem **Suggested Readings:** Monte Carlo Estimation of Action Values	**CO-3** **BTL-3**
MODULE 4: TEMPORAL-DIFFERENCE LEARNING	**(9L)**
TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - Sarsa: On-policy TD Control Q-learning: Off policy TD Control- Ex Maximization Bias and Double Learning - Games, Afterstates, and Other Special Cases **Practical Component:** Re-solve the windy grid-world assuming eight possible actions, including the diagonal moves, rather than the usual four. **Suggested Readings:** Sarsa, Q-learning	**CO-4** **BTL-3**
MODULE 5: CASE STUDIES	**(9L)**
TD-Gammon, Samuel's Checkers Player, Watson's Daily-Double Wagering, Optimizing Memory Control, Human-level Video Game Play, Personalized Web Services, Thermal Soaring **Practical Component**: Implement a Personalizing web services such as the delivery of news articles or advertisements is one approach to increasing users' satisfaction with a website or to increase the yield of a marketing campaign. **Suggested Readings**: Applications of Reinforcement Learning	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Richard S. Sutton and Andrew G. Barto(2018), Reinforcement Learning, The MIT Press.

REFERENCE BOOKS	
1.	https://www.springer.com/gp/book/9780792392347
E BOOKS	
1.	https://web.stanford.edu/class/psych209/Readings/SuttonBartoIPRLBook2ndEd.pdf
MOOC	
1.	https://www.coursera.org/learn/fundamentals-of-reinforcement-learning?specialization=reinforcement-learning

COURSE TITLE	**DIGITAL AND SOCIAL MEDIA ANALYTICS**			**CREDITS**	**3**
COURSE CODE	**CAD02505**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course is designed to help executives understand the new rules of marketing in the digital age, covering a range of topics that includes learning fundamentals, using web analytics tools, analysing social campaigns, analytics of social media and visualizing data.
Course Objective	1. To explain the fundamentals in social media analytics. 2. To familiarize in using different web analytics tools. 3. To perform analytics based on page audience, engagement analytics, posts and evaluating outcomes. 4. To use standard tools and visualize data. 5. To recognize the features and analyse social media.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the fundamentals in social media analytics and basics in network fundamentals and models. 2. Familiarize in making connections and web analytics tools. 3. Perform analytics based on page audience, engagement analytics, posts and evaluating outcomes. 4. Apply standard tools and visualize data. 5. Recognize the features and analyse social media.
Prerequisites: social media	

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O2	PS O3
CO-1	2	2	1	1	1	-	1	-	-	1	-	2	2	2	1
CO-2	2	2	1	1	1	-	1	-	1	-	-	1	1	1	1

CO-3	**2**	**1**	**1**	**1**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**1**
CO-4	**2**	**1**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**
CO-5	**2**	**2**	**2**	**3**	**3**	**1**	**3**	**2**	**2**	**-**	**1**	**3**	**3**	**3**	**2**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO SOCIAL MEDIA ANALYTICS	**(9L)**
Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization **Suggested Readings:** Usage of Graphs and Metrices	**CO-1BTL-2**
MODULE 2: MAKING CONNECTIONS AND WEB ANALTICS TOOLS	**(9L)**
Making connections:Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity.Web analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis **Suggested Readings:** Using web analytics tool for any application	**CO-2** **BTL-2**
MODULE 3: SOCIAL MEDIA ANALYTICS	**(9L)**
Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB/any social media. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. **Suggested Readings:** Analytics of LinkedIn, Instagram, YouTube Twitter etc.	**CO-3BTL-3**
MODULE 4: VISUALIZING DATA	**(9L)**
Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics **Suggested Readings:** Collective classification for any application	**CO-4BTL-2**
MODULE 5: ANALYZE SOCIAL MEDIA	**(9L)**
Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration **Suggested Readings:** Analyze the social media of any ongoing campaigns and present the findings.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Matthew Ganis, Avinash Kohirkar(2016), "Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media", Pearson Education
REFERENCE BOOKS	

1.	Jim Sterne (2010),"Social Media Metrics: How to Measure and Optimize Your Marketing Investment" Wiley Publishers
2.	Marshall Sponder(2012), Social Media Analytics- Effective Tools for Building, Interpreting and using Metrics, McGraw Hill.
E BOOKS	
1.	https://www.google.co.in/books/edition/Social_Media_Metrics /OkkZhB2Yw7 IC?hl=en&gbpv=1&printsec=frontcover
MOOC	
1.	https://www.coursera.org/learn/social-media-data-analytics
2.	https://www.edx.org/learn/social-media-marketing

COURSE TITLE	**BLOCKCHAIN AND ARTIFICIAL INTELLIGENCE**			**CREDITS**	**3**
COURSE CODE	**CAD02506**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The course will enable the students to understand the basics of Blockchain, use appropriate consensus mechanism for Blockchain applications and apply AI techniques for Blockchain use-cases.
Course Objective	1. To understand the basics of Blockchain 2. To Identify Consensus mechanism for Blockchain Application 3. To apply Artificial intelligence techniques for Blockchain usecases
Course Outcome	Upon completion of this course, the students will be able to 1. Apply Hyperledger Fabric and Ethereum platform to implement the Block Chain Application 2. Identify Consensus mechanism for Blockchain Application 3. Recall the function of Blockchain & AI as a method of securing distributed ledgers. 4. Identify the major research challenges in crypto currency domain. 5. Develop techniques in information science applications by applying Computational intelligence and appropriate machine learning techniques in Blockchain.
Prerequisites: Artificial Intelligence	

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O-	PS O-
CO-1	3	2	2	2	1	-	1	-	-	1	2	2	2	2	1
CO-2	2	1	1	1	1	-	2	-	1	-	2	1	1	1	1

CO-3	**2**	**1**	**1**	**1**	**2**	**-**	**1**	**-**	**-**	**-**	**1**	**2**	**1**	**2**	**1**
CO-4	**2**	**1**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**1**	**2**	**2**	**2**	**2**
CO-5	**2**	**2**	**2**	**3**	**3**	**1**	**3**	**2**	**2**	**-**	**1**	**3**	**3**	**3**	**2**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO BLOCKCHAIN	**(9L)**
Blockchain-Introduction, distributed ledger technology versus distributed databases - Comparing the technologies with examples – Structure of Blockchain, Building blocks of Blockchain,Public versus private, permissionless versus permissioned Blockchain - Comparing usage scenarios - Privacy in Blockchain - Understanding Bitcoin and Ethereum, smartcontracts. Introduction to Hyperledger - Overview of the project - Hyperledger Fabric - Hyperledger Saw tooth - Other Hyperledger frameworks and tools.	**CO-1 BTL-2**
MODULE 2: CONSENSUS ALGORITHMS	**(9L)**
Introduction to Consensus Methods-Proof of Work(PoW)-Proof of Stake(PoS)-Delegated Proof of Stake(DPoS)- Proof of Capacity- Proof of Burn(PoB)-Proof of Activity(PoA)-Proof of Identity- Proof of Authority-Proof of Elapsed Time(PoET)	**CO-2 BTL-2**
MODULE 3: BLOCKCHAIN AND AI	**(9L)**
Domain Specific Applications - Applying AI & Blockchain: Healthcare, Supply chain, Financial Services, Information Security, Document management, AI & Blockchain Driven Databases - Centralized versus distributed data, Big data for AI analysis, Data Management in a DAO, Emerging patterns for Database Solutions	**CO-3 BTL-3**
MODULE 4: CRYPTOCURRENCY AND AI	**(9L)**
Role of AI in Cryptocurrency - Cryptocurrency Trading: Issues & Considerations, Benefits of AI in Crypto Trading - Making Price Predictions with AI: Issues with Price Prediction, Benefits of AI in Prediction, Time series forecasting with ARIMA, Applications of algorithmic or quant trading in Cryptocurrency	**CO-4 BTL-3**
MODULE 5: FUTURE OF AI WITH BLOCKCHAIN	**(9L)**
Applying SDLC practices in Blockchain: Introduction to DIApp - Architecture of a DIApp - Developing a DIApp - Testing a DIApp - Deploying DIApp - Monitoring a DIApp, Implementing DIApp - Evolution of decentralized applications, building a sample DIApp, Developing Smart Contracts, Solution approach with AI, Developing: Client code, Backend, Frontend, Future of converging AI & Blockchain in enterprises & Government.	**CO-5 BTL-3**

TEXT BOOKS

1.	Ganesh Prasad Kumble(2020), “Practical Artificial Intelligence and Blockchain”, First Edition. Packt Publishing Lts, July.
2.	Imran Bashir(2018), “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained”, 2nd Edition, Packt Publishing Ltd.

REFERENCE BOOKS

1.	Andreas M. Antonopoulos(2015) , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc.
2.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder(2016), "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.
E BOOKS	
1.	https://www.velmie.com/practical-blockchain-study
MOOC	
1.	https://www.udemy.com/course/build-your-blockchain-az/
2.	https://www.coursera.org/learn/blockchain-business-models

COURSE TITLE	**MULTIMEDIA ANALYTICS**			**CREDITS**	**3**
COURSE CODE	**CAD02507**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM 06-08-2022**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	In this course, you will learn analytics tools and techniques, how to work with SQL databases, the languages of R and Python, how to create data visualizations, and how to apply statistics and predictive analytics in a business environment.
Course Objective	1. To have Multimedia data is a combination of different discrete and continuous content forms like text, audio, images, videos, animations and interactional data. 2. To work with single continuous media in the transmitted information generates multimedia information 3. To uses data and math to answer business questions, discover relationships, predict unknown outcomes and automate decisions. 4. Social media analytics is the ability to gather and find meaning in data gathered from social channels to support business decisions 5. To do a good way for communication
Course Outcome	Upon completion of this course, the students will be able to 1. Improved Decision Making. 2. Gain insights into data analytics to inform their decisions, leading to better outcomes 3. Perform Effective Marketing 4. Improve Better Customer Service. 5. Perform more Efficient Operations.
Prerequisites: Multimedia	

CO, PO AND PSO MAPPING															
CO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PS**	**PS**	**PS**

	-1	-2	-3	-4	-5	-6	-7	-8	-9	10	11	12	O1	O2	O3
CO-1	2	2	1	1	1	-	1	-	-	1	-	2	2	2	1
CO-2	2	2	1	1	1	-	1	-	1	-	-	1	1	1	1
CO-3	2	1	1	1	2	-	1	-	-	-	-	2	1	2	1
CO-4	2	1	1	2	2	-	2	-	-	1	-	2	2	2	2
CO-5	2	2	2	3	3	1	3	2	2	-	1	3	3	3	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: MULTIMEDIA AND ITS BASIC TOOLS	**(9L)**
Definitions – CD-ROM and the Multimedia highway- where to use multimedia- Introduction to Making Multimedia: The stages of a project- what you need- Multimedia skills and Training: The terms – Macintosh and windows production platforms: Macintosh Versus PC – The Macintosh and Windows Computers- Hardware Peripherals: connection- Memory and storage Devices – Input Devices- Output Hardware- Communication Devices. Multimedia Authoring Tools : Types of Authoring Tools – card and page Based Authoring Tools- Icon – Based Authorised Tools – Time Based Authoring Tools – Object – Oriented Authoring Tools – Cross – Platform Authoring Notes.	**CO-1 BTL-2**
MODULE 2: TEXT ANALYTICS	**(9L)**
The Power of Meaning – About Fonts and Faces –Using Text in Multimedia – Computers and Text – Font Editing and Design Tools – Hypermedia and Hypertext- Text Representation and Compression: Compression Principles, Source Encoders and destination decoders, Lossless and Lossy Compression, Entropy Encoding, Source Encoding, Text Compression, Static Huffman coding, Arithmetic Coding.	**CO-2 BTL-2**
MODULE 3: AUDIO ANALYTICS	**(9L)**
The Power of Sound – Multimedia System Sounds- MIDI Versus Digital Audio – Digital Audio – Making MIDI Audio – Audio file formats – Working with sound on the Macintosh – Notation Interchange File Format (NIFF) – Adding Sound to your multimedia project – Towards professional sound – The Red Books standard production tips. Introduction to Audio Compression, Differential pulse code modulation, Adaptive differential PCM, Adaptive Predictive Coding, Linear Predictive Coding, Code- excited LPG, Perceptual Coding, Sensitivity of the ear, Frequency marking, Temporal marking, G series Voice coding standards, MPEG audio Coders.	**CO-3 BTL-2**
MODULE 4: IMAGE ANALYTICS	**(9L)**
Image Storage and Compression: Introduction to images, Digital image representation, Vector Graphics and Bitmapped images, History and advantages, Bitmap concept, Stored Images, Bitmap versus Vector Graphics, Captured Image Format, Stored Image Format, Graphics Interchange Format (GIF), GIF Coding Standard, Tagged Image File Format (TIFF), Joint Photographic Experts Group (JPEG), Image/Block Preparation, Forward DCT, Quantization, Entropy Encoding, Frame building, JPEG decoding.	**CO-4 BTL-2**
MODULE 5: VIDEO ANALYTICS	**(9L)**

Video : Using video – How video works – Broadcast Video Standards – Integrating Computers and Television – shooting and Editing Video – Video Tips – Recording Formats – Digital video Video Representation and Compression: Video Compression Principles, Frame types, Motion estimation and Compression, Implementation Issues, Performance, Characteristics of Digital Video, Streaming Video, Combining sound and Pictures, H.261 Video Compression Standard, H.263, Digitisation Formats, Motion Pictures Experts Group (MPEG), MPEG-1, MPEG-2, MPEG-4, Audio and Video Compression.	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Tay Vaughan – Multimedia : Making it work – Fourth Edition – Tata McGraw – Hill Edition.
2.	Principles of Multimedia, RanjanParekh TMGH, New Delhi
REFERENCE BOOKS	
1	John F koegel Buford – Multimedia Systems – Addison Wesley – First Indian Reprint.
2	Computer Graphics Multimedia and Animation, Malay K. Pakhira PHI second edition
E BOOKS	
1.	https://webcache.googleusercontent.com/search?q=cache:utHZ2bIDhxcJ:https://www.springer.com/gp/book/9789811594915+&cd=2&hl=en&ct=clnk&gl=in&client=firefox-b-
MOOC	
1.	https://www.coursera.org/lecture/image-processing/1-the-why-and-how-of-compression-duration-14-16-KvLVz
2	https://w.coursera.org/lecture/dsp3/mp3-compression-Lawra.