Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-422**	**Title of the Course**	**Artificial Intelligence**	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	**VII**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	**1.** Explain the basic problem-solving techniques, knowledge representation methods and learning methods of Artificial Intelligence. **2.** Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems. **3.** Understand the role of knowledge representation, problem solving, and learning in intelligent system engineering. **4.** Develop intelligent systems by assembling solutions to concrete computational problems. **5.** Develop an interest in the field sufficient to take more advanced subjects.						

Course Outcomes	
CO1	Design an intelligent agent to solve real world problems.
CO2	Identify the best heuristic for problem solving that will lead to find the optimal solution within constraints and adverse conditions.
CO3	Represent knowledge using logic programming, create knowledge base and apply inference mechanisms.
CO4	Apply statistical and probabilistic machine learning techniques for a real-world problem in order to solve it.
CO5	Design and develop an expert system, solve problems using evolutionary programming, using swarm intelligence and develop programs using PROLOG

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**INTRODUCTION**	Introduction to AI, Current Trends in AI, Intelligent Agents: - Agents and Environments, Nature of Environments, Structure of Agents, Problem-Solving, Problem-Solving Agents, Example Problems, Searching for Solutions, Uniformed Search Strategies (BFS, DFS, DLS, IDS)	8	1
2	**SEARCHING TECHNIQUES**	Informed (Heuristic) Search Strategies: - Heuristic Function, Greedy best first search, A* search, Local Search Algorithms and Optimization Problems (Hill Climbing & Genetic Algorithm), Introduction to Constraint Satisfaction Problems (CSP), Adversarial Search: - Optimal Decisions in Games (Minimax algorithm), Alpha – Beta Pruning.	8	2
3	**KNOWLEDGE AND REASONING**	Introduction to logical Agents, Propositional Logic: - Representation, Syntax and Semantics, Forward Chaining, Backward Chaining, CNF, Resolution, First Order Logic: – Representation, Syntax and Semantics, Inference in First Order Logic: – Unification, Forward Chaining, Backward Chaining, Resolution.	8	3
4	**LEARNING**	Forms of Learning, Inductive Learning: - Learning Decision Trees, Statistical learning methods: - Naïve bayes models, Bayesian network, EM algorithm, HMM, Instance based learning:-nearest neighbor models	8	4
5	**INTELLIGENT SYSTEMS**	Expert System- Stages in the Development of an Expert System, Difficulties in Developing Expert System, Application of Expert System, Introduction to Evolutionary Programming, Swarm Intelligent Systems, Introduction to PROLOG.	8	5

Reference Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 2nd Edition, Pearson Education / Prentice Hall of India, 2004.

2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 2002.

3. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.

4. N.P. Padhy, "Artificial Intelligence and Intelligence systems", Oxford Press.

e-Learning Source:

https://nptel.ac.in/courses/106105077

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	1		2						1	2	3		
CO2	3	3	3	2		2						3			2	1
CO3	3	2	3	2	3							3	1	2		
CO4	3	2	2	2	3	3						2		2	2	2
CO5	3	3	3	3	3	2	1	1	1			2		3		1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	**CS-410**	**Title of the Course**	**Distributed Systems**	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	**VII**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	1. The aim of this course is to introduce the student to the areas of cryptography and cryptanalysis. 2. This course develops a basic understanding of the algorithms used to protect users online and to understand some of the design choices behind these algorithms. 3. Aim is to develop a workable knowledge of the mathematics used in cryptology in this course. 4. Reveal different types of cipher generation method to solve engineering and other problems. 5. Understand the theory and applications of cryptography and network security.						

Course Outcomes	
CO1	Understand the software and hardware concepts of distributed systems
CO2	Evaluate and analyze the issues and implementations of deadlock detection and the agreement problems.
CO3	Analyze the RMI, RPC and security issues, replication and fault tolerance in the distributed systems.
CO4	Compare and analyze the flat and nested transactions, applications and analysis of locks in view of distributed systems, File systems and recent advances.
CO5	Implement and analyze distributed multimedia, CORBA RMI, Java RMI, CORBA services.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**CHARACTERIZATION OF DISTRIBUTED SYSTEMS:**	Introduction: Examples of Distributed Systems, Resource Sharing and the Web Challenges. System Models Architectural Models, Fundamental Models, Theoretical Foundation for Distributed System: Limitation of Distributed System, Absence of Global Clock, Shared Memory, Logical Clocks, Lamports & Vectors Logical Clocks, Causal Ordering of Messages, Global State, Termination Detection. Distributed Mutual Exclusion: Classification of Distributed Mutual Exclusion, Requirement of Mutual Exclusion Theorem, Token Based and Non-Token Based Algorithms, Performance Metric for Distributed Mutual Exclusion Algorithms.	8	1
2	**DISTRIBUTED DEADLOCK DETECTION:**	System Model, Resource vs Communication Deadlocks, Deadlock Prevention, Avoidance, Detection & Resolution, Centralized Dead Lock Detection, Distributed Dead Lock Detection, Path Pushing Algorithms, Edge Chasing Algorithms. Agreement Protocols: Introduction, System Models, Classification of Agreement Problem, Byzantine Agreement Problem, Consensus Problem, Interactive Consistency Problem, Solution to Byzantine Agreement Problem, Application of Agreement Problem, Atomic Commit in Distributed Database System.	8	2
3	**DISTRIBUTED OBJECTS AND REMOTE INVOCATION:**	Communication Between Distributed Objects, Remote Procedure Call, Events and Notifications, Security: - Overview of Security Techniques, Cryptographic Algorithms, Cryptography Pragmatics, Needham Schroeder, Kerberos, SSL & Millicent, Replication: System Model and Group Communication, Fault – Tolerant Services, Highly Available Services, Transactions with Replicated Data.	8	3
4	**TRANSACTIONS AND CONCURRENCY CONTROL:**	Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Comparison of Methods for Concurrency Control. Distributed Transactions: Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery, Distributed File Systems: File Service Architecture, Sun Network File System, The Andrew File System, Recent Advances.	8	4
5	**DISTRIBUTED SHARED MEMORY(DSM):**	Architecture, Algorithms for implementing DSM, Client- Server Algorithm, Migration Algorithm, Read Replication Algorithm, Full Replication Algorithm. Distributed Multimedia Systems: Introduction, Characteristics of Multimedia data, Quality of service management, Resource management, Stream Adaption. Case Study: CORBA RMI, CORBA Services, Java RMI.	8	5

Reference Books:

1. Couloris, Dollimore, Kindberg," Distributed systems: Concepts and Design". PearsonEducation Asia, 3ed.

2. Sighal and Shivratri," Advanced Concepts in Operating Systems", Mc Graw Hill.

e-Learning Source:

https://nptel.ac.in/courses/106106168

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**3**	**2**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**1**	
CO2	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**2**	**1**	
CO3	**3**	**2**	**1**	**1**	**2**	**3**	**2**	**2**	**3**	**1**	**1**	**3**	**1**	**2**	**2**	
CO4	**3**	**2**	**2**	**2**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	
CO5	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-412**	**Title of the Course**	**Cryptography and Network Security**	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	**VII**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	Understand the theory and applications of cryptography and network security. The aim of this course is to introduce the student to the areas of cryptography and cryptanalysis. This course develops a basic understanding of the algorithms used to protect users online and to understand some of the design choices behind these algorithms. Aim is to develop a workable knowledge of the mathematics used in cryptology in this course. Reveal different types of cipher generation method to solve engineering and other problems.						

Course Outcomes	
CO1	Compare and analyze various Cryptographic Techniques
CO2	Understanding various Symmetric Key Distribution techniques
CO3	Apply, analyze and compare various public key cryptography techniques
CO4	Implement Digital Signature techniques
CO5	Understand the various Security Applications

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to OSI Security Architecture:**	Security Attacks, Services and Mechanisms, Introduction to Cryptology. Conventional Encryption: Conventional Encryption Model, Classical Encryption Techniques – Substitution Ciphers: Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One-Time Pad; Transpositions Ciphers: Rail Fence Technique; Rotor Machines, Cryptanalysis, Steganography. Modern Block Ciphers- Block Ciphers Principles: Stream & Block Ciphers, Fiestal Cipher, Shannon's Theory of Confusion and Diffusion, S-DES, Data Encryption Standards (DES): DES Encryption and Decryption, Strength of DES.	8	1
2	**Block Cipher Modes of Operation:**	ECB, CBC, CFB, OFB, CTR, Triple DES: Double DES, TDES with Two Keys, TDES with Three Keys. Symmetric Key Distribution using KDC, Random Number Generation: Use of Random Numbers, Pseudo Random Number Generators, Cryptographically Generated Random Numbers, Blum BlumShub Generator. Introduction to Graph, Ring and Field, Prime and Relative Prime Numbers, Modular Arithmetic, Fermat's & Euler's Theorem, Primality Testing, Euclid's Algorithm.	8	2
3	**Principles of Public Key Cryptosystems:**	Introduction, Application & Requirement; RSA Algorithm: Computational Aspects, Security of RSA; Diffie-Heilman Key Exchange Algorithm, Introductory Idea of Elliptic Curve Cryptography. Message Authentication & Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes (MAC), Hash Functions: Requirement for a Hash Function, Simple Hash Functions, Security of Hash Function & MAC, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA-1).	8	3
4	**Digital Signatures:**	Requirements, Direct & Arbitrated Digital Signature, Protocols: Mutual & One way Authentication; Digital Signature Standard (DSS): DSS Approach, Digital Signature Algorithm. Authentication Applications: Kerberos Version 4 & Difference between Kerberos v4 & v5, Kerberos Realms; X.509 Authentication Service: Authentication Procedures, Directory Authentication Service; Electronic Mail Security – Pretty Good Privacy (PGP): Operational Description, Cryptographic Keys, Key Rings, Public Key Management.	8	4
5	**IP Security:**	Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management; Web Security: Secure Socket Layer & Transport Layer Security, Secure Electronic Transaction (SET). System Security: Intruders, Viruses and Related Threats: Malicious Programs, The Nature of Viruses, Types of Viruses, Macro Viruses, Email Viruses; Firewall: Firewall Design Principles, Trusted Systems.	8	5

Reference Books:

1. William Stallings, "Cryptography and Network Security: Principles and Practice" Prentice Hall, New Jersey.

2. Johannes. A. Buchmann, "Introduction to cryptography", Springer Verlag. Bruce Schiener, "Applied Cryptography".

e-Learning Source:

https://nptel.ac.in/courses/106105031

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**2**	**2**								**3**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**								**2**	**2**	**1**
CO3	**3**	**2**	**2**	**1**	**2**								**3**	**2**	**1**
CO4	**3**	**2**	**2**	**2**	**1**	**2**	**1**						**3**	**2**	**1**
CO5	**3**	**2**	**3**	**2**	**2**	**1**	**1**	**1**					**3**	**2**	**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-415**	**Title of the Course**	**Fuzzy Logic & Neural Networks**	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	**VII**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	**1.** To give the knowledge of TCP/IP protocol. **2.** To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logic-based systems, genetic algorithm-based systems and their hybrids. **3.** Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. **4.** Reveal different applications of these models to solve engineering and other problems. **5.** Understand the theory and applications of artificial neural network and fuzzy systems to engineering applications with emphasis on image processing and control. **6.** Discuss neural networks and fuzzy systems, architectures, algorithms and applications, including Back-propagation, Competitive Learning, Fuzzy inference methods and expert systems etc.						

Course Outcomes	
CO1	Learn about soft computing techniques and their applications.
CO2	Analyze various neural network architectures.
CO3	Enable students to understand different Clustering Algorithms.
CO4	Define the fuzzy systems.
CO5	Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	History of Neural Networks, Structure and Function of a Single Neuron, Architectures and Their Applications, Supervised Learning: Single Layer Networks: Perceptron's, Linear Separability, Perceptron Training Algorithms and Their Modifications: Pocket Algorithm and Adaline. Supervised Learning: Multiplayer Networks: Multilevel Discrimination, Preliminaries, and Backpropagation Algorithm, Setting the Parameters Values, Accelerating the Learning Process.	8	1
2	**Adaptive Multilayers Networks:**	Network Pruning Algorithms, Marchand Algorithm, Upstart Algorithm, Cascade Correlation. Prediction Networks: Feed Forward Networks for Forecasting, Recurrent Networks (Partially, Fully), Radial Basis Functions and Probabilistic Neural Networks.	8	2
3	**Unsupervised Learning:**	Winner-Take-All Networks: Hamming Networks, Maxnet. Learning Vector Quantization, Counter Propagation Networks (Forward Only Counter Propagation networks), Adaptive Resonance Theory (ART1), K-Means Clustering Algorithms, Kohonens Self Organization Maps, Principal Component Analysis.	8	3
4	**Fuzzy Logic:**	Fuzzy Sets, Properties, Operation on Fuzzy Sets, Fuzzy Relations, Operation on Fuzzy Relations, Fuzzy IF-THEN Rules, Variable Inference Techniques, Fuzzification and Defuzzification Methods, Fuzzy System Design.	8	4
5	**Associative Models:**	Auto-Association, Hetro-Association, Hopefield Networks, Brain State-In-ABox Networks, and Boltzman Machines. Optimization Methods: Optimization Using Hopefield Networks, Introduction to Simulated Annealing and Ant Colony Optimization and Evolutionary Computation, Introduction to Hybrid Systems, Introduction to Deep Learning.	8	5

Reference Books:

1. Kishan Mehrotra, Chilukuri K. Mohan, Sanjay Ranka, Elements of Artificial Neural Networks, MIT Press/Penram International.
2. Simon Haykin, Neural Network a comprehensive Foundation, Macmillan College, proc, Con, Inc.
3. Ross T.J., Fuzzy Logic with Engineering Applications, McGraw-Hill.
4. Zurada J.M., Introduction to Artificial Neural Systems, Jaico Publishers.
5. Riza C. Berkiu and Trubatch, Fuzzy system Design Principles, Building Fuzzy IF-THEN Rule Bases, IEEE Press.
6. Goldberg D.E., Genetic Algorithms in Search Optimization and Machine Learning, Addison Wesley.
7. Intelligent Hybrid Systems, SuranGoonatilake and Sukhdev Khebbal (Eds.), Intelligent Hybrid Systems, John Wiley.
8. Dorigo and Thomas Stützle, Ant Colony Optimization, MIT Press.

e-Learning Source:

https://nptel.ac.in/courses/108104157

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	1	3						2	1	1
CO2	3	2	3	2	1	1						1		
CO3	3	2	1	2		2	3					3	2	
CO4	3	2	2	2	3	3						2		3
CO5	3	1	1	1	1	2	1					2	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-417**	**Title of the Course**	**Mobile Computing**	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	**VII**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	1. To give the knowledge of TCP/IP protocol. 2. To give the knowledge of packet switching and message switching. 3. To give the knowledge of sliding window protocol. 4. To give the knowledge of the CDMA. 5. To give the knowledge of network layer protocols viz. Ipv4, ARP, RARP. 6. To give the knowledge of routing. 7. To give the knowledge of TCP & UDP. 8. To give the knowledge of congestion control. 9. To give the knowledge of quality of service. 10. To give the knowledge of DNS, FTP, TELNET and remote logging.						

Course Outcomes	
CO1	To understand and compare the various wireless communication technologies.
CO2	To visualize the various important steps in GSM communication.
CO3	To specify and identify the requirement the mobile IP and Transport Protocol.
CO4	To examine and simulate the important aspects of Mobile Ad hoc Networks.
CO5	To apply the knowledge gained to design and develop a mobile application.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Wireless Communication:**	Application, Frequencies for radio transmission, Signals, Antennas, Signal propagation, Multiplexing: Space division multiplexing, Frequency division multiplexing, Time division multiplexing, Code division multiplexing, Modulation: Amplitude shift keying, Frequency shift keying, Phase shift keying, Advanced frequency shift keying, Advanced phase shift keying, spread spectrum: Direct sequence spread spectrum, Frequency hopping spread spectrum, Cellular systems.	8	1
2	**Channel Allocation:**	Motivation for a specialized MAC, Hidden and exposed terminals, Near and far terminals, SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Carrier sense multiple access with collision detection, Multiple access with collision avoidance.	8	2
3	**Telecommunications Systems:**	GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security; Satellite systems: History, Applications, Basics of GEO, LEO and MEO, Routing, Localization, Handover, Examples; GPRS.	8	3
4	**Wireless LAN:**	Infra-red vs radio transmission, Infrastructure and ad-hoc network, IEEE 802.11: System architecture, Protocol architecture, Physical layer, medium access control layer, MAC management, 802.11b, 802.11a, Bluetooth: User scenarios, Architecture, Radio layer, Baseband layer. Introduction to WAP architecture and Protocol stack.	8	4
5	**Mobile network layer:**	Mobile IP: Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimizations, Reverse tunneling, IPv6, Dynamic host configuration protocol.	8	5

Reference Books:

1. Jochen Schiller, "Mobile Communications, Pearson Education, 2nd Edition, 2003.

2. Dharma Prakash Agrawal & Qing-A Zeng "Introduction to Wireless & Mobile Systems", Thomson Brooks/Cole, 2nd Edition 2003.

3. Krzysztof Wesolowski, "Mobile Communication Systems ", John Wiley & Sons, Ltd.

4. Ron Olexa, "Implementing 802.11, 802.16 and 802.20 Wireless Networks, Elsevier

e-Learning Source:

https://nptel.ac.in/courses/106106147

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	3						3	1	1	
CO2	3	3	3	2	1	1						2			3
CO3	3	2	1	1	2	2	3					3	2		3
CO4	3	2	2	2	3	3						2		4	
CO5	3	1	1	1	1	2	1					2	1		4

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CS-424	**Title of the Course**	SciLab	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	2	1
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The aim of this unit is to obtain the necessary knowledge to solve numerical problems through SciLab capacities.						

Course Outcomes	
CO1	Given a problem, would be able to analyze the problem and design an efficient algorithm to solve it by using & modifying classical design techniques or creating a new solution technique
CO2	For an algorithm given all the required parameters, would be able to analyze the algorithm and evaluate its utility in the given situation
CO3	Given more than one solution for the problem, would be able to evaluate and compare them using standard mathematical techniques and select the best solution
CO4	For a design problem given, would be able to compare and evaluate different Data Structures available and modify or create new them for the same

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	**Installing**, Expressions: Show mathematical expressions with numbers Variables, Diary command, Define symbolic constants. Basic functions, suppressing output (;), help, clc		
2	**Vector Operations**, define vector, Calculate length of a vector. Perform mathematical operations on Vectors such as addition, subtraction and multiplication. Define a matrix, calculate size of a matrix, Perform mathematical operations on Matrices such as addition, subtraction and multiplication.		
3	**Matrix Operations,** Access the elements of Matrix, Determine the determinant, inverse and eigen values of a matrix, define special matrices, perform elementary row operations, Solve the system of linear equations.		
4	**Conditional Branching,** 'if' and 'then' with the example, use of the 'else' keyword use of the 'else if' keyword, example for select		
5	**Iteration,** explain syntax of 'for' statement- tell that the variable iterates over a list/vector/matrix.		
6	**Scripts and Functions,** Introduction to the file formats in Scilab.		
7	**Plotting 2D graphs,** Aboutlinspace: linspace is a linearly spaced vector. Plot a simple graph: x=linspace (12,34,10), y=linspace (-.1,2,10), plot (x, y) plot2d Use of "clf ()". Configure the title for the plot Configure a legend Divide a graphic window into a matrix of sub-windows using subplot(mnp)		
8	**Xcos introduction** What is XCOS. What is palette. To collect the blocks from the palette and connect them to construct the block diagram. Set the parameters of diff erent blocks. To setup the simulation parameters. Simulate the constructed block diagram.		
Reference Books:			

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CS-423	**Title of the Course**	AI Lab	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	2	1
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	**1.** Explain the basic problem-solving techniques, knowledge representation methods and learning methods of Artificial Intelligence. **2.** Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems. **3.** Understand the role of knowledge representation, problem solving, and learning in intelligent system engineering. **4.** Develop intelligent systems by assembling solutions to concrete computational problems. **5.** Develop an interest in the field sufficient to take more advanced subjects.						

Course Outcomes	
CO1	Design an intelligent agent to solve real world problems.
CO2	Identify the best heuristic for problem solving that will lead to find the optimal solution within constraints and adverse conditions.
CO3	Represent knowledge using logic programming, create knowledge base and apply inference mechanisms.
CO4	Apply statistical and probabilistic machine learning techniques for a real-world problem in order to solve it.
CO5	Design and develop an expert system, solve problems using evolutionary programming, using swarm intelligence and develop programs using PROLOG

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	To understand & solve Tower of Hanoi problem		
2	To understand Uninformed search techniques (BFS)		
3	To understand Uninformed search techniques (DFS)		
4	To understand Uninformed search techniques (IDS)		
5	To understand Uninformed search techniques (DLS)		
6	To understand Informed search techniques (A*)		
7	To understand artificial neural networks & their basic working principle Learning Through		
8	To understand Optimizing Informed search techniques		
9	To understand the Machine learning concept & implementation of Example based learning		
10	To understand & solve Tower of Hanoi problem		

Reference Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 2nd Edition, Pearson Education / Prentice Hall of India, 2004.
2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 2002.
3. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
4. N.P. Padhy, "Artificial Intelligence and Intelligence systems", Oxford Press.

e-Learning Source:

https://nptel.ac.in/courses/106105077

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	1		2						1	2	3		
CO2	3	3	3	2		2						3			2	1
CO3	3	2	3	2	3							3	1	2		
CO4	3	2	2	2	3	3						2		2	2	2
CO5	3	3	3	3	3	2	1	1	1			2		3		1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-418**	**Title of the Course**	**Data Warehouse and Data Mining**	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	**VII**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	Understand the concepts of Data Warehouse and its building blocks. Study the architecture of Data Warehouse and the essential processes in building a data warehouse. Study of data mining functionalities, related technologies and its techniques. Study of various classification and prediction algorithms. Study of major clustering techniques and current trends in data mining.						

Course Outcomes	
CO1	Develop a strong foundation of knowledge about data warehouse and related techniques.
CO2	Design and build a data warehouse from the available historical data and perform OLAP operations to discover knowledge.
CO3	Pre-process the data using cleaning, integration, transformation and reduction and find associations and correlations among that data.
CO4	Classify the given dataset by using statistical and probabilistic models to predict the class labels of new data.
CO5	Perform cluster analysis by using some major clustering methods and work on the recent advancements on text and web mining.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Overview & Concepts**	The Compelling Need for Data Warehousing: Introduction to Data Warehousing, Failures of Past Decision Support System, Data Warehouse Building Blocks: -Nature of data in Datawarehouse, OLAP in the Data Warehouse: Major Features and Functions, OLAP Models, Comparison between operational Data Base Systems & Data warehouse.	8	1
2	**Data Warehouses and Data Marts**	Overview of Components, Meta data & its types, Multidimensional Data Model: - Data cubes, Schemas for multidimensional databases, concept hierarchies, OLAP operations in multidimensional data models, Data Warehouse Architecture: - 3-tier architecture, Data Extraction, Transformation, and Loading, Data Quality: Why is data Quality Critical? Data Quality Challenges.	8	2
3	**Data Mining**	Introduction, Data Mining Functionalities, Classification of Data Mining System; Major Issues in Data Mining, Data Preprocessing: Preprocess, Descriptive Data Summarization, Data Cleaning, Data Integration & Transformation, Data Reduction, Mining Frequent Patterns, Association, and Correlations, Basic Concept, Efficient & Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules.	8	3
4	**Classification & Prediction**	Issues, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Associative Classification, nearest neighbor classification, Prediction.	8	4
5	**Cluster Analysis**	What is Cluster Analysis, Types, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods- cure and chameleon, Density-Based Methods: DBSCAN &OPTICS, Wave Cluster, CLIQUE. Current trends: Text mining, web mining.	8	5

Reference Books:

1. "Data Warehousing Fundamental" by PaulrajPonniah, John Wiley & Sons INC.
2. Data Mining Concepts & Techniques by Jiawei Han &MichlineKamber.
3. Mallach," Data Warehousing System", McGraw Hill
4. M.H. Dunham, "Data Mining: Introductory and Advanced Topics" Pearson Education

e-Learning Source:

https://nptel.ac.in/courses/106106168

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2			2	1					2		2			
CO2		2		1			2							1		
CO3	2		1			1		1				1	1			3
CO4	2			2												
CO5	3		2			1				1				2		

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**CS-419**	**Title of the Course**	**Pattern Recognition**	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	**VII**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	This course introduces fundamental statistical methods for pattern recognition and covers basic algorithms and techniques for analyzing multidimensional data, including algorithms for classification, feature selection, and dimensionality reduction of the data. The course will also introduce students to active research topics.						

Course Outcomes	
CO1	Understand basic concepts in pattern recognition along with its mathematical foundation.
CO2	Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
CO3	Gain knowledge about state-of-the-art algorithms used in pattern recognition research.
CO4	Know basic concepts in other major approaches including syntactic methods.
CO5	Get acquainted with recent developments in pattern recognition and its applications.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test	8	1
2	**Statistical Pattern Recognition**	Statistical Pattern Recognition: Bayesian Decision Theory, Classifiers, Normal density and discriminant functions.	8	2
3	**Parameter Estimation Methods**	Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.	8	3
4	**Non Parametric Techniques**	Nonparametric Techniques: Density Estimation, Parzen Windows, K-Nearest Neighbour Estimation, Nearest Neighbour Rule, Fuzzy classification.	8	4
5	**Unsupervised Learning and Clustering**	Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square - error partition clustering – K-means, agglomerative hierarchical clustering, Cluster validation.	8	5

E resources

https://www.coursera.org/learn/machine-learning (Machine Learning by Andrew Ng on Coursera)

https://scikit-learn.org/stable/documentation.html

https://www.tensorflow.org/guide/keras/sequential_model

https://skim.math.msstate.edu/LectureNotes/Machine_Learning_Lecture.pdf

Reference Books:

Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, 2nd Edition, John Wiley, 2006.

C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2009.

S. Theodoridis and K. Koutroumbas, “Pattern Recognition”, 4th Edition, Academic Press, 2009.

PO-PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO4
CO 1	**3**	**3**	**2**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**1**	
CO 2	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**2**	**1**	
CO 3	**3**	**2**	**1**	**1**	**2**	**3**	**2**	**2**	**3**	**1**	**1**	**3**	**1**	**2**	**2**	
CO 4	**3**	**2**	**2**	**2**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	

CO 5	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	

Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation