Paper code- CSME301 **Paper Name- Image Processing and Pattern Recognition**		**Marks: 100**
Module	**Topics**	**Hours**
Module-1: **Image Fundamentals**	Analog and digital images, image sensing and acquisition: Image formation, Sampling and quantization, Color space: Color (RGB, CMYK, HSI) vs gray level images, Matrix representation and intensity modification of digital images, Pixel adjacency and distance measure, Arithmetic, logical and set operations, Image file formats, Fundamental steps in DIP, Applications and state of the art in DIP.	6
Module-2: **Transformation and Filtering**	Point processing: Identity, image negatives, log transform, power law, contrast stretching, histogram equalization and specification. Spatial filtering: Linear filters: max, min, mean, median; order statistics filters. Frequency based transforms: Low and high pass filter, DFT Image restoration concept: Noise models, Image denoising and deblurring	10
Module-3: **Image segmentation**	Segmentation techniques, Threshold based segmentation, Importance of derivative and gradients in edge detection, Masks: Roberts, Prewitt, Sobel; Canny edge detection, Region growing and Split-Merge algorithms, Clustering based techniques, basics of Hough transform.	9
Module-4: **Image Compression**	Compression basics: Lossless, lossy, compression ratio, image compression models, evaluation criteria of a compression scheme, compression techniques: Huffman encoding, Run length, Arithmetic encoding.	5
Module-5: **Pattern recognition**	Introduction and applications. Feature extraction and reductions: Histogram of Gradient (HoG), Principal Component Analysis (PCA). Learning: Supervised and unsupervised; Clustering and Classification techniques: K-Nearest Neighbor Classifier, Support Vector Machine, K-means algorithm, Density-based Clustering.	10

Textbooks:

1. Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods; Pearson; 4th edition (2017)
2. Image Processing: Principles and Applications by by Tinku Acharya, Ajoy K.Ray; Wiley-Interscience; 1st ed. (2005)
3. Digital Image Processing by William K. Pratt; John Wiley & Sons; 4th Edition (2007)
4. Digital image processing with MATLAB and LabView, Vipula Singh, Elsevier, 2013.
5. Pattern Classification by Richard O. Duda, David G. Stork, Peter E.Hart, Wiley; Second edition (2007)
6. Pattern Recognition by Sergios Theodoridis and Konstantinos Koutroumbas, Academic Press, 2008.
7. Pattern Recognition and Machine Learning by Christopher M. Bishop and Nasser M. Nasrabadi., New York: Springer, 2006.
8. Pattern recognition principles, Tou and Gonzalez, Addison Wesley, 1974.

Paper code- CSMC304 **Paper Name- Artificial Intelligence**		**Marks: 100**
Module	**Topics**	**Lectures**
I. Introduction to AI	Turing Test and Rational Agent approaches to AI; Distributed AI; Applications	2
II. Introduction to state Space search	Agents & environment, nature of environment, structure of agents, goal-based agents, utility-basedagents, learning agents. Problems, Problem Space & search: Defining the problem as state space search, Water Jug Problem; production system, problem characteristics, issues in the design of search programs. Solving problems by searching: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies	6
III. Heuristic search	Greedy best-first search, A* search, AO* algorithm; memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	6
IV. Knowledge representation and Reasoning	Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation Predicate logic: Representing simple fact in logic, Modus ponen and tollen; Common Sense; representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction; Representing knowledge using rules: Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.	8
V. Soft Computing Approaches	Overview, Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster- Shafer theory, Fuzzy vs Crisp; Fuzzy sets & fuzzy logic. Rough set; Genetic Algorithm: Multi-objective optimization, Pareto optimal front	6
VI. Neural Network Learning	Biologically Inspired model, Various activation functions; Perceptron; Backpropagation: Gradient Decent; MAXNET; ADALINE, MADALINE, SOM, ART	8
VII. Expert system	Definition; Features of an expert system; Organization; Characteristics; Prospector; Knowledge Representation in expert systems; Expert system tools Representing and using domain knowledge; expert system shells, knowledge acquisition	4

Books:

1. Dan.W. Patterson, Introduction to AI and Expert Systems – PHI, 2007
2. Stuart Russel and Peter Norvig, 'Artificial Intelligence - A Modern Approach', Second Edition, Pearson Education, 2003 / PHI.
3. George F. Luger, 'Artificial Intelligence – Structures and Strategies for Complex Problem Solving', Fourth Edition, Pearson Education, 2002.
4. Elain Rich and Kevin Knight, 'Artificial Intelligence', Second Edition Tata McGraw Hill, 1995.
5. Simon Haykin, "Neural Networks and Learning Machines", Prentice Hall, 2009
6. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Prentice-Hall (1995).

CSMP305: Artificial Intelligence (Practical)

Programming language - Small / tiny models will be developed from the scratch to study the method in Python language without build-in library for the technique.
Results will be compared with build-in library.

1. Assignments on Heuristic searches
2. Assignments on Constraints Satisfaction like CNF etc.
3. Assignments on branch and bound problems
4. Assignments on Gradient Descendent Search
5. Assignments on Genetic Algorithm to simple LLP Problems.
6. Assignments on Classification Algorithms – KNN, ANN
7. Assignments on Clustering Algorithms - Kmeans, Kmedoides, Density Based Clustering