

M Sc – Artificial Intelligence & Machine Learning  
Sardar Patel University

# Semester 1

## Course Structure

	PAPER CODE & TITLE	CREDITS
Fundamental	PS01FAIML11: Mathematical and Statistical Foundations	4
Core Courses	PS01CAIML11: Introduction to Artificial Intelligence -1	4
	PS01CAIML12: Python Programming	4
	PS01CAIML13: Data Mining	4
	PS01CAIML14: Natural Language Processing	4
	PS01CAIML15: Practicals	5
	Total Credits	25

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks: 100

## PS01FAIML11: Mathematical and Statistical Foundations

### Unit 1 Matrices and Logic

- Row/Column operations
- Gaussian elimination
- Decomposition, Inverse
- Logic operators AND, OR etc., Truth tables
- Theory of inference and deduction
- Mathematical inductions
- Metrics and basics of graph theory

### Unit 2 Differential Equations

- Differential equations of first order and first degree
- Homogeneous differential equations, Equations
- Linear differential equations
- Applications of first order
- Linear differential equations of higher order
- Homogeneous and non-homogeneous linear differential equations with constant coefficients

### Unit 3 Basic Statistical Techniques – I

- Frequency distributions.
- Measures of central tendency & Measures of dispersion
- Least square fit
- Hypothesis testing and techniques such as chi square testing

### Unit 4 Basic Statistical Techniques – II

- Axiomatic definition of probability and properties, conditional probability, multiplication rule. Theorem of total probability, Bayes' theorem and independence of events.
- Probability mass function, probability density function and cumulative distribution functions, distribution of a function of a random variable.
- Bivariate data: Definition, box plot, scatter diagram, simple, partial and multiple correlation

## MAIN REFERENCE BOOKS:

1. Hans Schneider and George P Barker: Matrices and Linear algebra, Holt Rinehart, 1968.
2. Deo. N: Graph Theory with Application to Engineering, PHI, 1974.
3. Murray R Spiegel: Theory and Problem of Statistics McGraw-Hill Schaum's Outline Series, 1981.

4. Trembley J. P. and Manohar R. P. : Discrete Mathematical Structures with Applications to Computer Science. McGraw Hill, 1975.
5. Harary F. : Graph Theory , Addison-Wesley Publ. Comp. 1972.
6. Shanti Narayan, Integral Calculus, S. Chand & Co. Ltd., 1999.
7. Lectures on Probability Theory and Mathematical Statistics - 3rd Edition, by Marco Taboga, CreateSpace Independent Publishing Platform, 2017.

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks: 100

## PS01CAIML11: Introduction to Artificial Intelligence -1

### Unit 1 Introduction to Artificial Intelligence

- Natural and Artificial intelligence
- Narrow AI and General AI
- Testing intelligence with Turing test, and Chinese room experiment,
- Nature of AI solutions
- Application domains
  - o Expert tasks
  - o Mundane tasks
  - o Formal tasks
- DIKW chain and Evolution of AI based system
- Application areas of artificial intelligence

### Unit 2 Production Systems

- Problem analysis
- Problem characteristics
- Production states of problem
- Search space
- Time and space efficiency
- Production system and its characteristics
- Applications of production system with examples

### Unit 3 Weak Searches

- Weak and Blind Searches
- Breadth first search
- Depth first search
- Forward & backward chaining
- Heuristic search, Generate-and-test, Hill climbing, and Steepest ascent hill climbing
- A\* algorithm application and uses

### Unit 4 Agent Based Systems

- Definition of agent
- Characteristics of agent
- Typology
  - o Collaborative agent
  - o Interface agent
  - o Mobile agent
  - o Information agent
  - o Intelligent agent
  - o Hybrid agent

- Agent communication language
- Agents, objects and intelligent systems
- Multi agent system architectures and examples

#### **MAIN REFERENCE BOOKS:**

1. Russell and Norvig, Modern Approach to Artificial Intelligence, Prentice Hall of India Ltd., 2006
2. Rich and Knight, Artificial Intelligence, Tata McGraw Hill Publishing Co. Ltd., 21<sup>st</sup> Indian Reprint, 2001
3. Akerkar RA and Sajja P S, Knowledge-Based Systems, Jones & Bartlett Publishers, Sudbury, MA, USA, 2009

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

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Total Marks: 100

## PS01CAIML12: Python Programming

### Unit 1 Introduction

- Basic elements of python,
- Branching process
- Control structure
- String manipulation and iteration

### Unit 2 Class, Objects, and Functions

- Abstract data types
- Inheritance, Encapsulation
- Functions, and Scoping, Recursions
- Global variables, Modules
- System functions, and Parameters

### Unit 3 Exception Handling, and Assertions

- Types of testing
- Handling exception
- Debugging
- Assertions

### Unit 4 Application Algorithms

- Searching and sorting algorithms
- Hash tables
- Neural networks
- Feed forward
- K-nearest neighbour
- Recurrent

## MAIN REFERENCE BOOKS:

1. John V Guttag, Introduction to Computer Programming using Python, 2<sup>nd</sup> Edition, PHI, 2017.
2. R. Nageswara Rao, Core Python Programming, Dreamtech Press; Second edition, 2018.
3. N. Karumanchi, Data Structures and Algorithmic Thinking with Python, Wiley; Reprint edition, 2016.

# M Sc – Artificial Intelligence & Machine Learning

*w.e.f. June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 100*

## **PSO1CAIML13: Data Mining**

### **Unit 1 Introduction to Data Mining**

- Introduction to data warehouse
- Characteristics of data warehouse
- Data warehouse delivery method
- Introduction to data mining
- Data mining Vs Query tools
- Data Learning
- Benefits of data mining

### **Unit 2 Data Warehouse Architecture**

- System Process (Data Pre-processing)
  - o Process flow within an data warehouse
  - o Extract and Load Process
  - o Clean and Transform data
  - o Backup and Archive Process
  - o Query Management Process
- Process Architecture
  - o Load and Warehouse Manager
  - o Query Manager
  - o Detailed and Summary Information
  - o Metadata
  - o Data Marting

### **Unit 3 Database Design – Logical**

- Database Schema – Starflake
- Partitioning strategy
- Aggregations
- System and Data Warehouse Process Manager

### **Unit 4 Database Design – H/W and Operational**

- H/W Architecture
- Physical Layout
- Security
- Backup and Recovery
- Service Level Agreement
- Operating Data Warehouse for Data Mining

## MAIN REFERENCE BOOKS:

1. Han, J., Kamber, M., & Pei, J., Data mining: Concepts and techniques (3rd ed.). Waltham: Morgan Kaufmann, 2010.
2. S. Anahory & D. Murray: Data Warehousing in the real world – Addison Wesley, 1997
3. M. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education, 2002.
4. G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, Wiley India, 2010.
5. Ian H. Witten , Eibe Frank, et al, Data Mining: Practical Machine Learning Tools and Techniques (Morgan Kaufmann Series in Data Management Systems), 2016



# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks: 100

## PS01CAIML14: Natural Language Processing

### Unit 1 Introduction to NLP

- Introduction to NLP and its terminologies
- Components of NLP
- Natural language generation
  - o Text planning, sentence planning, and text realization
- Natural language understanding
  - o Representation mapping and analyzing
- Phases of NLP

### Unit 2 Parsing of NLP

- Introduction and uses of context free grammar
- Grammatical features
- Constituency and dependency trees
- Probabilistic approach to parsing
- Parsing techniques

### Unit 3 Part of Speech

- Part of Speech (POS) tagging
- Different perspective of POS tagging
- POS tag set
- Using Hidden Markov Model (HMM) for POS tagging
- The Viterbi algorithm

### Unit 4 Text summarization

- Extractive and abstractive summarization
- Multiple-document summarization
- Query-based summarization
- Evaluation of summarization systems
- Applications

## MAIN REFERENCE BOOKS:

1. Jurafsky, D., Martin, J. Speech and language processing: An introduction to speech recognition, computational linguistics and natural language processing. – Prentice Hall, 2008.
2. Sarkar, D. Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data, Apress, 2016.
3. Dan Jurafsky and James H. Martin, Speech and Language Processing, 3<sup>rd</sup> edition, (web.stanford.edu), standford University, 2018

# M Sc – Artificial Intelligence & Machine Learning

*w.e.f. June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 100*

**PS01CAIML15: Practicals based on theory subjects**

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M Sc – Artificial Intelligence & Machine Learning  
Sardar Patel University

## Semester 2

### Course Structure

	PAPER CODE & TITLE	CREDITS
Fundamental	PS02FAIML11: Systems Analysis and Design	4
Core Courses	PS02CAIML11: Introduction to Artificial Intelligence -2	4
	PS02CAIML12: Matrix Programming using Mathematical Software	4
	PS02CAIML13: Artificial Neural Networks	4
	PS02CAIML14: R Programming	4
	PS02CAIML15: Practicals	5
	Total Credits	25

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks: 100

## PS02FAIML11: Systems Analysis and Design

### Unit 1 Introduction

- General architecture of systems with basic components,
- Open and close systems,
- TPS, MIS, DSS and ES types of systems,
- Examples of real-life systems,
- System analyst: Role & needs,
- Various users of systems.

### Unit 2 Systems Development Life Cycle and Requirements Determinations

- Phases of the classical systems development life cycle (SDLC) Method
  - Preliminary investigation,
  - Determination of requirements,
  - Design of system,
  - Development of system,
  - System testing,
  - Implementation, etc.
- Requirement anticipation, Requirements investigation with fact finding techniques,
- Decision trees, Decision table, and Structured English.

### Unit 3 Structured Systems Development Strategy

- Function decomposition diagrams(FDD),
- Symbols of data flow diagrams,
- Data flow diagrams (DFD),
- Data dictionary,
- Application prototype development strategy.

### Unit 4 Computer-Aided Systems Tools and Software Quality Introduction

- Tools, Computerized tools, Front end and Back end tools, Integrated tools
- Computer Aided Systems Engineering (CASE) tools, Advantages and weakness of CASE,
- Software quality parameters, Approaches to reliability, Quality assurance and various types of testing and test data: live data, Artificial data, Test libraries
- Training Users, Objectives for Training, Conversion Methods, Documentation
- Follow-up and maintenance, Post Implementation Review,
- Advanced Concepts of Systems Analysis and Design.

## MAIN REFERENCE BOOKS:

1. James A Senn: Analysis and Design of Information System, McGraw Hill International, 2003.
2. Kendall and Kendall: Systems analysis and Design, 5<sup>th</sup> Edition, Prentice-Hall of India Private Limited, 2003.
3. Sajja, P.S., Essence of Systems Analysis and Design: A Workbook Approach, Springer International Publishing, 2017.

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks: 100

## PS02CAIML11: Introduction to Artificial Intelligence - 2

Unit 1	<b>Knowledge Based Systems</b> <ul style="list-style-type: none"><li>- Definitions</li><li>- Structure of knowledge Based Systems</li><li>- Components of knowledge based systems</li><li>- Types of knowledge based systems such as<ul style="list-style-type: none"><li>o Expert decision support systems</li><li>o Intelligent DBMS systems</li><li>o Intelligent tutoring systems</li><li>o Intelligent transportation system with IOT</li></ul></li><li>- Knowledge based shell</li><li>- Advantages and applications of KBS</li></ul>
Unit 2	<b>Knowledge Types and Characteristics</b> <ul style="list-style-type: none"><li>- Source of knowledge</li><li>- Nature of knowledge</li><li>- Types of knowledge<ul style="list-style-type: none"><li>o Commonsense knowledge, Informed common sense knowledge, Heuristic knowledge, Domain knowledge, and Meta knowledge</li></ul></li><li>- Classification of knowledge</li><li>- Desirable characteristics of knowledge</li></ul>
Unit 3	<b>Knowledge Discovery and Representations</b> <ul style="list-style-type: none"><li>- Knowledge acquisition limitations</li><li>- Knowledge acquisition techniques</li><li>- Knowledge representation<ul style="list-style-type: none"><li>o Predicate logic,</li><li>o Rules,</li><li>o Frames,</li><li>o Semantic net, and</li><li>o Hybrid structures</li></ul></li><li>- Knowledge based systems tools</li></ul>
Unit 4	<b>Knowledge Management</b> <ul style="list-style-type: none"><li>- Perspectives of knowledge management</li><li>- Drivers of knowledge management</li><li>- Evolution of knowledge management</li><li>- Elements of knowledge management</li><li>- Typical cycle of knowledge management</li><li>- Knowledge management roles and responsibilities</li><li>- Knowledge management tools, models,</li><li>- kCommerce</li><li>- Benefits and applications of knowledge management</li></ul>

## MAIN REFERENCE BOOKS:

1. Rushell and Norvig, Modern Approach to Artificial Intelligence, Prentice Hall of India Ltd., 2006
2. Rich and Knight, Artificial Intelligence, Tata McGraw Hill Publishing Co. Ltd., 21<sup>st</sup> Indian Reprint, 2001
3. Akerkar RA and Sajja P S, Knowledge-Based Systems, Jones & Bartlett Publishers, Sudbury, MA, USA, 2009
4. Amrit Tiwan, The Knowledge Management Toolkit, Pearson Education Inc., Third Impression, 2008

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks: 100

## PS02CAIMI.12: Matrix Programming using Mathematical Software

### Unit 1 Basic features

- Matlab workspace, Variables, Comments, punctuation and aborting execution, complex numbers, floating point arithmetic, built-in functions.
- Arrays and array operations: Simple array, Array indexing, Construction and orientation, Scalar-array and Array-array mathematics, Standard arrays, sorting techniques.
- Inline functions and user defined functions. Script M-files

### Unit 2 Control Statements

- Control flow: For loops, While loops, If-else-end, Switch-case Statements,
- Function M-files: M-files constructions rules, input and output arguments, function workspaces, debugging tools

### Unit 3 Graph Plotting

- Two-dimensional graphics: Plot function, line styles, markers and colors,
- Plot grids, Axes box, Labels, Customizing plot axes,
- Multiple plots, Multiple figures, Subplots.

### Unit 4 Numerical Methods

- System of linear equations, Matrix functions, Special matrices, Eigen values and Eigen vectors of a square matrix.
- Polynomials: Roots, Addition, Multiplication, Division, Evaluation, Derivatives and Integrals, Curve fitting by interpolation and least square.

## MAIN REFERENCE BOOKS:

1. Brian R. Hunt, Ronald L. Lipsman, Jonathan M Rosenberg etc, A Guide to MATLAB for beginners and Experienced Users, Cambridge University press, 2008.
2. Duane Hanselman and Bruce Littlefield, Mastering Matlab-7, Pearson Education, 2005.
3. E. V. Krishnamurthy and S K Sen, Programming in MATLAB, East-West Press, 2003.
4. Stormy Attaway, MATLAB: A Practical Introduction to Programming and Problem Solving, 5e, Cengage Learning, 2019.



# M Sc – Artificial Intelligence & Machine Learning

*w.e.f. June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 100*

## PS02CAIM13: Artificial Neural Networks

- Unit 1 Introduction to Artificial Neural Network (ANN)**
- Symbolic learning methods and their limitations
  - Biological neuron and artificial neuron
  - Artificial neural network and its characteristics
- Unit 2 ANN Models – I**
- Hopfield model and parallel relaxation
  - Perceptron model and linearly separable problems
  - Multilayer perceptron and non-linearly separable problems
  - Back-propagation algorithms and supervised learning
  - Applications like classification, forecasting, and decision making, etc.
- Unit 3 ANN Models – II**
- Unsupervised learning
  - Self organizing maps,
  - Reinforcement learning
  - ANN tools and utilities
  - Applications of unsupervised learning and SOM
- Unit 4 Applications of Neural Network in Business**
- Various applications and case studies in domains such as forecasting, pattern matching, classification, recognition etc.

### MAIN REFERENCE BOOKS:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Rajendra Akerkar, Priti Srinivas Sajja, Intelligent Techniques for Data Science, Springer International Publishing, 2016.
3. Akerkar RA and Sajja P S, Knowledge-Based Systems, Jones & Bartlett Publishers, Sudbury, MA, USA, 2009
4. Material available on Web

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

Lectures & 1 Seminar/Tutorial per week

Total Marks: 100

## PS02CAIML14: R programming

### Unit 1 Introduction

- Introduction to R and RStudio. Using the help facility.
- Data structures: vectors, matrices, lists and data frames.
- Reading data into R from various data sources.
- Merging data across data sources.
- Exploratory data analysis and graphical displays.

### Unit 2 Descriptive Statistics & Intro to Probability

- Samples, measures of center and spread, percentiles, odds ratio.
- Outliers and robustness.
- Independence, conditional probability, Bays formula.
- Distributions, population mean and population variance, Binomial, Poisson, and Normal distribution.
- Central Limit theorem and the Law of large numbers.
- Continuity correction.
- Sampling with and without replacement.
- Correction for finite population size

### Unit 3 R: Statistical Inference

- Significance and confidence level, p-value.
- One-sided and two-sided tests and confidence intervals.
- Sampling distribution, estimators, standard error.
- Normal probabilities in application to p-value.
- One-sample and two-sample tests for independent and matched samples
- The case of unknown variance and Student t-distribution, assumption of normality.
- Pooled variance and equal variances assumption.
- Estimation of variance.
- Fisher test for variance equality.
- Chi-square test for goodness of fit, chi-square test for independence.
- Sample size estimation.
- The concept of hypothesis testing, type I and type II error, false discovery rate.
- Iterating with simulation

### Unit 4 Statistical and Data Mining techniques using R

- Simple linear regression model, residuals, degrees of freedom, least squares method, correlation coefficient, variance decomposition, determination coefficient
- Interpretation of the slope, correlation, and determination

- coefficients
- Standard error and statistical inference in simple linear regression model
- Analysis of variance (ANOVA). One-way and two-way ANOVA
- Beyond simple regression models: multiple regression, logistic regression
- Correction for multiple testing, Family-wise error rate distribution, Test of Hypothesis of Small and Large Samples- Standard Normal distribution, Chi-square distribution, Student's t distribution, F distribution, Analysis of Variance
- Applications in data mining and case studies

### **MAIN REFERENCE BOOKS:**

1. Biostatistics (9 Ed.) by Wayne W. Daniel, Wiley 2004.
2. Schaum's Outlines - Introduction to Probability and Statistics by Seymour Lipschutz and John Schiller., TATA McGraw-Hill edition. 1998.
3. Statistical Methods by N. G. Das, Vol: I and II., The McGraw-Hill Companies. 2009.
4. Fundamentals of Biostatistics (6th Ed.), Bernard Rosner., Thomson Brooks/Cole. 2006.
5. Colin Gillespie, Robin Lovelace, Efficient R Programming: A Practical Guide to Smarter Programming, O'reilly Media, Inc, 2016

# M Sc – Artificial Intelligence & Machine Learning

*w.e.f. June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 100*

**PS02CAIML15: Practicals based on theory subjects**

M Sc – Artificial Intelligence & Machine Learning  
Sardar Patel University

## Semester 3

### Course Structure

	PAPER CODE & TITLE	CREDITS
Elective	PS03EAIML11: Big Data Analytics	4
	OR PS03EAIML12: Advanced Python Programming	
Core Courses	PS03CAIML11: Intelligent Applications in ICT	4
	PS03CAIML12: Machine Learning and Deep Learning	4
	PS03CAIML13: Soft Computing and Fuzzy Logic	4
	PS03CAIML14: Multimedia Processing	4
	PS03CAIML15: Practicals	5
Total Credits		25

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks 100

## PS03EAIML11: Big Data Analytics

### Unit 1

#### Introduction to Data Science

- Importance of data science in modern business
- Data science activities in three dimensions
  - o Managing data flow
  - o Managing data curation
- Relationship of data science with other fields
- Domains of applications

### Unit 2

#### Data Analytics

- Cross industry standard process
- Data analytics life cycle
- Data science project life cycle
- Complexity of analytics
- Data quality
- Communicating outcomes of analytics
- Applications, Tools and techniques

### Unit 3

#### Analytics and Big Data -1

- Traditional vs. big data analytics
- Large scale parallel processing
  - o Map reduce
  - o Comparison with RDBMS
  - o Shared memory parallel programming
  - o Apache Hadoop ecosystem
  - o Hadoop distributed file system

### Unit 4

#### Analytics and Big Data -2

- NoSQL and key-value model
- Introduction to SAPRK
- Data in motion
  - o Data stream processing
  - o Real time data streams
  - o Data streams and DBMS
- Privacy, security and ethics in big data and data science
- Applications

## MAIN REFERENCE BOOKS:

1. Akerkar R.A. and Sajja, P.S. "Intelligent techniques for data science", Springer International Publishing, Switzerland, 2016
2. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
3. Chris Eaton, Dirk deroos et al. "Understanding Big data ", McGraw Hill, 2012.

# M Sc – Artificial Intelligence & Machine Learning

Year I June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks 100

## PS03EAIML12: Advanced Python Programming

### Unit 1 Pythonic Programming

- The Zen of Python
- Common idioms
- Lambda functions
- List comprehensions
- Generator expressions
- String formatting

### Unit 2 Meta Programming and Analysis

- Implicit properties
- globals() and locals() and Attributes
- The inspect module
- Decorators
- Monkey patching
- Analyzing programs Using pylint and unittest
- Testing and Debugging

### Unit 3 Database access using python

- The DB API
- Available Interfaces
- Connecting to a server
- Creating and executing a cursor
- Fetching data
- Parameterized statements
- Metadata
- Transaction control

### Unit 4 Advance python application in deep learning and neural network

- Implementation of forward propagation algorithm.
- Coding of various activation functions like linear, triangular, trapezoidal etc
- Coding of deep learning network with suitable examples.
- Implementing supervised and un-supervised neural networks using python.

## MAIN REFERENCE BOOKS:

1. Python: The Complete Reference by Martin C. Brown, McGraw Hill Education; Forth edition, 2018
2. Python Machine Learning By Example by Yuxi (Hayden) Liu, Packt Publishing Limited, 2017.
3. Python Cookbook, Third edition by David Beazley and Brian K. Jones, O'REILLY publication, 2013
4. Data Structure and Algorithmic Thinking with Python by Narasimha Karumanchi, Careermonk Publications, 2015.

# M Sc – Artificial Intelligence & Machine Learning

*w.e.f. June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 100*

## PS03CAIML11: Intelligent Applications in ICT

### Unit 1

#### **Intelligent Technologies for Web**

- Components and characteristics of typical Web
- Web intelligence
  - o Semantic web
  - o Social intelligence
  - o Introductory Search engine techniques
  - o Web knowledge management, retrieval and filtering
  - o Web mining and web agents
- Levels of web intelligence
  - o Infrastructure, knowledge, interface and application levels
- Characteristics of web intelligence

### Unit 2

#### **Web Knowledge Management**

- Knowledge management fundamental
- Introduction to Web ontology
  - o Ontology examples, classifications, parameters to build ontology
  - o Standards and interoperability of ontology
  - o Ontology on Web

### Unit 3

#### **Internet of Things and Everything Applications**

- History of IoT
- Key features of IoT
- IoT technologies and protocols
  - o NFC and RFID
  - o Low energy bluetooth
  - o Low energy wireless
  - o Radio protocols
  - o Wifi- Direct
- Common IoT frameworks
- Advantages and disadvantages of IoT
- IoT applications in various domains such as education, healthcare, Governance, etc.

### Unit 4

#### **AI in Digital Learning**

- eLearning and learning objects
  - o Forms of eLearning
  - o Technology used for eLearning
  - o Components of learning objects
  - o Standards of learning objects
- Learning object schema
- Learning object repository



- Development life cycle of eLearning applications
- Knowledge based access of learning object repository
- Applications

#### MAIN REFERENCE BOOKS:

1. Sajja, P.S. and Akerkar, R.A. "Intelligent Technologies for Web Applications", CRC Press (Taylor & Francis Group), Boca Raton, FL, USA, 2012
2. Harrison Hao Yang, Steve Chi-Yin Yuen, Handbook of Research on Practices and Outcomes in E-Learning: Issues and Trends, IGI Global, 2010
3. Samuel Greengard, The Internet of Things, MIT Press Essential Knowledge series, 2015

# M Sc – Artificial Intelligence & Machine Learning

*week June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 100*

## PS03CAIM12: Machine Learning and Deep Learning

### Unit 1 Clustering Algorithms

- Clustering definition and need
- K-means clustering
- Hierarchical clustering
- Introduction to fuzzy c means clustering
- Applications

### Unit 2 Swarm Intelligence

- Introduction, need and characteristics of swarm intelligence
- Self organization in swarm intelligence
- Swarm intelligence techniques
  - o Ant colony algorithms, honey bee algorithms, etc.

### Unit 3 Introduction to Deep Learning

- AI, machine learning, neural network and deep ANN
- Generic deep artificial neural network
- Deep learning tools
- Deep learning applications in domains such as text analysis and image processing and big data

### Unit 4 Deep Learning Architectures

- Convolutional neural networks
- Deep belief net
- Autoencoders
- Recurrent deep networks

## MAIN REFERENCE BOOKS:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Rajendra Akerkar, Priti Srinivas Sajja, Intelligent Techniques for Data Science, Springer International Publishing, 2016.
3. Akerkar RA and Sajja P S, Knowledge-Based Systems, Jones & Bartlett Publishers, Sudbury, MA, USA, 2009
4. Material available on Web

# M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2019

3 Lectures & 1 Seminar/Tutorial per week

Total Marks 100

## PS03CAIML13: Soft Computing and Fuzzy Logic

### Unit 1 Fuzzy Logic Based Systems

- Fuzzy sets and fuzzy logic
- Fuzzy membership functions,
- Fuzzification and defuzzification
- Fuzzy logic based system architecture
- Applications

### Unit 2 Genetic Algorithms

- Introduction to evolutionary algorithm
- Encoding, genetic operators, fitness functions
- Edge-recombination and scheduling problem
- Applications

### Unit 3 Introduction to Soft Computing

- Soft computing and hard computing
- Constituents of soft computing
- Need of soft computing
- Characteristics of soft computing
- Applications

### Unit 4 Hybrid Soft Computing Systems

- Need of hybrid soft computing systems
- Neuro-fuzzy systems
- Neuro-Genetic systems
- Fuzzy-Genetic systems
- Applications

## MAIN REFERENCE BOOKS:

1. SN Sivanandam, SN Deepa, Principles of Soft Computing, John Wiley & Sons, 2007.
2. Roy Samir, Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Pearson Education India 2013.
3. Akerkar R.A. and Sajja, P.S., Knowledge-based systems, Jones & Bartlett Publishers, Sudbury, MA, USA, 2010.
4. Material available online related to the domain.

# M Sc – Artificial Intelligence & Machine Learning

*Year: June 2019*

*3 Lectures & 1 Seminar Tutorial per week*

*Total Marks: 100*

## PS03CAIM14: Multimedia Processing

### Unit 1 Introduction to Multimedia and Virtual Reality

- Introduction to Multimedia with its applications
- Multimedia hardware & software
- Introduction of digital medium and various facets of multimedia: digital audio, multimedia texts, hypermedia, Graphics
- Animation: two-dimensional and three-dimensional animation techniques and digital video and basic concept for color display
- Multimedia project design / development concepts
- Multimedia authoring, characteristics of authoring tools, authoring methodologies and multimedia programming

### Unit 2 Digital Image Processing - 1

- Applications of Digital Image Processing
- Human vision system
- Light and the Electromagnetic Spectrum
- Image Sensing and Acquisition
- Digitization: Sampling & Quantization
- Components of Image Processing System
- Visual Preliminaries: Brightness, Adaptation and Contrast, Acuity and Contour, Texture and Pattern Discrimination, Shape Detection and Recognition
- Image Representation: Graphics Formats (GIF (Graphics Interchange Format), Microsoft Windows Bitmap (BMP), JPEG File Interchange Format, MPEG, TIFF (Tag Image File Format), PNG (Portable Network Graphic Format))

### Unit 3 Digital Image Processing - 2

- Image Enhancement: Contrast Intensification (with examples), Smoothing (with examples), Image Sharpening
- Introduction to Image Restoration
- Image Compression: Error Criterion, Lossy Compression, Lossless Compression
- Introduction to Image Registration
- Color Image Processing: Color Fundamentals, Color Models (RGB, CMY, YIQ, YCbCr and HSI) and conversion between different models, Pseudocolor Image Processing, Smoothing and Sharpening, Noise in Color Images, Color Image Compression
- Multi-Valued Image processing with applications

### Unit 4 Image Analysis

- Segmentation: Pixel-based Approach, Region-based Approach, Color Image Segmentation

- Edge and Line Detection : introduction to Edge, Line and Corner detection
- Feature Extraction: Topological Attributes, Geometrical Attributes, Spatial Moments, Texture
- Description: Boundary-based Description, Region-based Description, Intensity-based Description
- Introduction to Image Recognition

#### **MAIN REFERENCE BOOKS:**

1. S. Gokul: Multimedia Magic, BPB Publication, 1998
2. Rafael C. Gonzalez & Richard E. Woods: Digital Image Processing, Third Edition, Addison-Wesley Publishing Company, Sixth Impression, 2012
3. B. Chanda, D. Dutta Majumder: Digital Image Processing and Analysis, Second Edition ,PHI, Thirteenth Reprint, 2011.

# M Sc – Artificial Intelligence & Machine Learning

*w.e.f. June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 100*

**PS03CAIML15: Practicals based on theory subjects**

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M Sc – Artificial Intelligence & Machine Learning  
Sardar Patel University

## Semester 4

### Course Structure

	PAPER CODE & TITLE	CREDITS
Core	PS04CAIML11: Project	25
	Total Credits	25

# M Sc – Artificial Intelligence & Machine Learning

*w.e.f. June 2019*

*3 Lectures & 1 Seminar/Tutorial per week*

*Total Marks: 600*

## **PS04CAIML11: Project**

### **COURSE CONTENT:**

It is a full time project work of one semester duration. Students are supposed to get the project definition as well as analyze and understand the problem and/or understand the design and develop the system function(s).

The work done in the documented form is to be submitted at the end of the project duration.