School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATC30012** Title of the Course: **Digital Image Processing**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Fundamental of Computer graphics and basic knowledge of python/Matlab.
- Students should have basic knowledge of mathematics.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Review the fundamental concepts of a digital image processing system. (Level 2 Understand)
CO-2. Analyze images in the frequency domain using various transforms. (Level 4 Analyze)
CO-3. Apply the techniques for image enhancement and image restoration. (Level 3 Apply)
CO-4. Use morphological techniques on images. (Level 3 Apply)
CO-5. Employ image segmentation and representation techniques on images. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	2	1	1	1	2	3	3	2
CO2	3	2	1	1	1	2	2	3	2	2
CO3	3	2	3	1	1	2	2	3	1	2
CO4	2	3	3	1	2	1	2	1	2	3
CO5	2	3	2	1	1	2	1	1	2	3

PCATC30012: Digital Image Processing

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction: Digital image processing, Applications of digital image processing, Fundamental steps in digital image processing, and Components of an image processing system.

Digital image fundamentals: Image sampling and quantization, some basic relationships between pixels, Linear and nonlinear operation.

Unit 2 **(15 hrs)**

Image enhancement in the spatial domain: Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Image enhancement in the frequency domain: Introduction to the Fourier transform and the frequency domain, Smoothing frequency domain filters, Sharpening frequency domain filters, homomorphic filtering.

Unit 3 **(15 hrs)**

Image restoration: A model of the image degradation/restoration process, Noise models, Restoration in the presence of noise only-spatial filtering, Periodic noise reduction by frequency domain filtering.

Morphological image processing: Preliminaries, Dilation and erosion, Opening and closing, the hit-or-miss transformation, Some basic morphological algorithms.

Unit 4 **(15 hrs)**

Image segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region-based segmentation, Segmentation by morphological watersheds.

Representation and description: Representation, Boundary descriptors, Regional descriptors, Use of principal components for description, Relational descriptors.

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods (2008), *Digital Image Processing*, 3rd Edition, Pearson Education.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle (2014), *Image Processing, Analysis and Machine Vision*, 4Th edition, Cengage Learning.
3. Anil K. Jain (1997), *Fundamentals of Digital Image Processing*, Prentice-Hall of India Pvt. Ltd.
4. Richard O. Duda, Peter E. Hart, David G. Stork (2008), *Pattern Classification*, 2nd Edition, John Wiley & sons.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATC30013** Title of the Course: **Design and Analysis of Algorithms**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have fundamental knowledge of programming and mathematics.
- Students should have knowledge of data structures.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Explain the time and space complexity of algorithms using asymptotic notations. (Level 2 Understand)

CO-2. Discuss on different searching algorithms. (Level 2 Understand)

CO-3. Use an appropriate data structure for a design of algorithms. (Level 3 Apply)

CO-4. Test the correctness of algorithms using inductive proofs and invariants (Level 4 Analyze)

CO-5. Employ indicator random variables and linearity of expectation. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

PCATC30013: Design and Analysis of Algorithms

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction: Fundamentals of the Analysis of Algorithm Efficiency, Brute Force Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem, Types, Fundamental data Structures, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples, Selection Sort and Bubble Sort, Sequential Search and String Matching.

Unit 2 **(15 hrs)**

Divide-and-Conquer, Merge sort, Quick sort, Binary Search, Binary tree Traversals and related properties, Multiplication of large integers, Stressen's Matrix Multiplication Insertion Sort, Depth First and Breadth First Search, Topological sorting, Algorithms for Generating Combinational Objects.

Unit 3 **(15 hrs)**

Space and Time Trade offs, Sorting by Counting, Input Enhancement in String Matching, Hashing. Dynamic Programming, Computing a binomial coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions.

Unit 4 **(15 hrs)**

Greedy Technique Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Knapsack Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, P, NP and NPComplete Problems

Reference Books:

1. Anany Levitin (2008), *Introduction to the Design and Analysis of Algorithms*, 2nd Edition, Pearson.
2. Coremen T.H., Leiserson C.E and Rivest R.L (1998), *Introduction to Algorithms*, PHI.
3. Horowitz E., Sahani S., Rajasekharan S. (2001), *Computer Algorithms,* Galgotia Publication.
4. Michael T Goodrich and Roberto Tamassia (1970), *Algorithm Design*, Wiley.
5. R C T Lee, S S Tseng (1978), *Introduction to Design and Analysis of Algorithms,*

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATC30014** Title of the Course: **Software Engineering**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and image processing techniques.

Course Outcomes (Cos)

After completion of this course successfully, the students will be able to

CO-1. Explain the role of software. (Level 2 Understand)

CO-2. Analyse the software process and project metrics. (Level 3 Apply)

CO-3. Discuss the software project planning, management and principles. (Level 2 Understand)

CO-4. Use the software testing techniques and strategies. (Level 3 Apply)

CO-5. Explain the software configuration management.(Level 2 Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO9**	**PO10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	--	--	3	3
CO4	3	2	2	--	1	1	1	2	2	2
CO5	3	3	3	2	2	--	1	--	--	--

PCATC30014:SOFTWARE ENGINEERING

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

The Product and The Process: Evolving role of software, software characteristics and components, Crisis, Software Myths, Software Engineering-A Layered Technology, Software process, linear sequential model, Prototyping model, RAD model, Evolutionary software process model.

Project Management Concepts: The Management Spectrum, The People, The Product, The Process, and The Project, W5HH Principle.

Software Process and Project Metrics: Measures, Metric Indicators, Metric in process and the Project Domains ,Software Measurement, Metrics for software quality.

Unit 2 **(15 hrs)**

Software Project Planning: Project Planning Objectives, Software Project Estimation, decomposition Techniques, Empirical Estimation Models.

Risk Analysis and Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement and Risk Mitigation, Monitoring, and Management.

Analysis Concepts and Principles: Requirement analysis, communication techniques, analysis principles, software prototyping and specification.

Unit 3 **(15 hrs)**

Analysis Modeling: Elements of analysis model, data modeling, functional modeling, behavioral modeling, the mechanics of structured analysis, data dictionary, other classical analysis methods.

Design Concepts and Principles: Software design and software engineering design process, design principles, design concepts, design methods, data design, architectural design and process, transform and transaction mappings, design post processing, architectural design optimization, interface design, procedural design.

Software Testing Techniques and Strategies: Fundamentals, Test case design, White box testing, Basis path testing, Control structure testing, Black box testing, Software testing strategies.

Unit-4 **(15 hrs)**

Software Configuration Management: Configuration management, maintenance costs, maintenance side effects, maintenance tissues.

Software Quality Assurance: Quality Concepts,

Software Quality Assurance, FTR, ISO 9001, ISO9002, ISO-9003, Introduction to CASE, DOD standard 2167 A.

Reference Books:

1. Software Engineering, Fifth Edition, Roger - Pressman, McGraw Hill.
2. Software Engineering , I Sommerville, International Computer Science, Series
3. Object Oriented Modeling and Design, Rumbaugh. J., Blaha M., Premerlani W., Eddy F and Lorensen W., PHI.
4. Software Engineering, Schooma, McGraw Hill
5. Object Oriented Design and Analysis, Booch, Benjamin / Cummings.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATD30212** Title of the Course: **ICTs in Healthcare**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and image processing technique.

Course Outcomes (Cos)

After completion of this course successfully, the students will be able to

CO-6. Explain of the trans-disciplinary structure and state of the art information (Level 2 Understand)

CO-7. Analyse ICT tools to higher levels. (Level 3 Apply)

CO-8. Create the Electronic Health Monitoring Systems to a real time mode. (Level 3 Apply)

CO-9. Use the machine learning techniques into specific applications. (Level 3 Apply)

CO-10. Create the prototype of novel tools and product. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO9**	**PO10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	---	3	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	---	3

PCATD30212: ICTs in Healthcare

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction of ICT Technologies, Future and Emerging technologies, Simulation Techniques, Computer Aided Manufacturing Methods

Unit 2 **(15 hrs)**

Visualization Techniques, 3D Animation Techniques, Regulatory Science in Medical Safety and Health Care Signal Processing

Unit 3 **(15 hrs)**

Artificial Intelligence (AI), Automation Technologies in Health Care, 3D Printing Applications in Medical Engineering, Micro 3D Printing and Application in Microfluidics

Unit 4 **(15 hrs)**

Robotics and Mechatronics, Motion Capture for Safety and health Care, Design of personalized Devices and Rapid Tooling, Remote Monitoring, Health Care Project.

Reference Books:

1. Nishu Gupta and Sara Paiva (2018), *IoT and ICT for Healthcare Applications,* 1st Edition, Springier.
2. Paul Suetens, (2009) *Fundamentals of Medical Imaging,* 2nd Edition, Cambridge.
3. Deepak M. Kalaskar, (2017), *3D Printing in Medicine,* 1st Edition, Springier.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATD30213** Title of the Course: **ICTs in Agriculture**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have fundamental knowledge of programming and mathematics.

Course Outcomes (Cos)

After completion of this course successfully, the students will be able to
CO-1 understand the role and applications of agriculture ICTs (Level 2 Understand)
CO-2 understand the future computational devices in agriculture ICTs (Level 2 Understand)
CO-3 Explain the application of remote sensing (Level 2 Understand)
CO-4 understand the working mechanic of ICT tools in agriculture (Level 2 Understand)
CO-5 Create small application for agriculture activity monitoring (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	--	2	2	--	1	--	1	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	--	1	--	3	--

PCATD30213: ICTs in Agriculture

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction: Definition, Applications, The Role of ICT in Agriculture: Crop field Analysis, Spreading, Diagnosis of Diseases, Water Stress, Field Monitoring, Variable Rate of Fertility, Soil Erosion.

Making ICT infrastructure, Appliances, and services: Telecommunications, Mobile agriculture services, E-services, ICT for land administration and management.

Unit 2 **(15 hrs)**

Smart Farming towards Agriculture: Introduction to future thinking, Future process design, Using the toolkit: Horizon Scanning Tool, Pest Risk Analysis Tool.

Unit 3 **(15 hrs)**

Environmental Pollution and Applications of Remote Sensing / GIS on Environment: Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution; Solid waste Management: Causes, effects and control measures of municipal and industrial wastes Disaster management: floods, earthquake, cyclone and landslides.

Remote sensing / GIS: Introduction of remote sensing / GIS, definition of remote sensing, applications of the remote sensing on environment (site selection, land use/land cover pattern, water/air/soil quality models, a criteria of environmental information systems)

Unit 4 **(15 hrs)**

Case Study: Precise Navigation of Small Agricultural Robots in Sensitive Areas with a Smart Plant Camera, Using Deep Learning to Challenge Safety Standard for Highly Autonomous Machines in Agriculture, Peach Flower Monitoring Using Aerial Multispectral Imaging, Machine Vision Onboard an Autonomous Vehicle in the RHEA Project.

Reference Books:

1. Dr. Chandan Kumar Panda, Dr. Anil Paswan and Dr. Siya Ram Singh, "Advances in ICT in Agriculture", New Delhi publisher.
2. Valencia-García, R., Alcaraz-Marmol, G., Cioppo-Morstadt, J.D., Vera-Lucio, N., Bucaram-Leverone, M, ICT for Agriculture and Environment, springer, 2019
3. R. Saravanan, Information and Communication Technology for Agriculture and Rural Development, New India Publishing Agency, 2011.
4. A S Sandhu, Textbook Of Agricultural Communication Process And Methods, Oxford & Ibh Publishing, 2017.
5. Gonzalo Pajares Martinsanz and Sciprofile link Francisco Rovira Mas Rovira-Mas, Image Processing in Agriculture and Forestry, MDPI, 2018
6. C. S. Rao, Wiley Eastern Ltd, “Environmental Pollution Control Engineering”, New Age International Ltd, 2001
7. Dr. M. Anji Reddy, “Introduction to Remote Sensing”, B S Publications, 2004.
8. Kurian Joseph and R.Nagendram, “Essentials of environmental studies”, Pearson Education Pt Ltd, Delhi, 2007

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATD30214** Title of the Course: **ICTs in Banking**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have fundamental knowledge of programming and mathematics.

Course Outcomes (Cos)

After completion of this course successfully, the students will be able to
CO-1 Understand the role and applications of ICTs in Banking (Level 2 Understand)
CO-2 Discuss online banking and other bank trasnsactions (Level 2 Understand)
CO-3 Discuss on automated teller machine functions (Level 2 Understand)
CO-4 Understand the structure and behaviour of ATM (Level 2 Understand)
CO-5 Understand the electronic bank transfers and banking security. (Level 2 Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	--	2	2	--	1	--	1	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	--	1	--	3	--

PCATD30214: ICTs in Banking

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

The role and impact of ICT, Applications software used for presentation and communication of data, Relational database concepts, Spreadsheet concepts, Online banking, Online saving, Automated cheque handling, Debit and Credit cards.

Unit 2 **(15 hrs)**

Automated Teller Machines (ATM): Introduction, system architecture: Multiple view of system, Non-Architectural Approach versus Architectural Approach, Definition of System Architecture, Description Language, integrating the system structure and system Behaviours, **Systems behaviour:** Behaviour Coalescence Diagram, Purpose of Structure, Drawing of Structure, Interaction flow diagram.

Unit 3 **(15 hrs)**

Electronic bank transfer: Background and history, The function of APACS, the fundamental role of APACS, APACS structure, Future development in APACS, CHAPS, Security.

Electronic banking documentation: Electronic Data Interchange, Electronic Funds Transfer Act 1978, Computer Misuse Act 1990, Funds transfer laws

Unit 4 **(15 hrs)**

Security on the Internet: Introduction, internet, intranets and extranets, firewalls, cryptography, message authentication codes, secure electronic transaction protocol, challenge and response

EDI security: introduction to EDI, security requirements for EDI, X.435 security

Reference Books:

1. William S. Chao, Systems Architecture of Automated Teller Machines, Createspace Independent Pub; 1st edition, 2017.
2. George C. Sackett, Christopher Metz, " ATM and Multiprotocol Networking," McGraw-Hill, January 1997
3. David E. McDysan, Darren L. Spohn, " ATM Theory and Applications," McGraw-Hill, September 1998
4. Brian Welch, Electronic Banking and Treasury Security, Elsevier Science, 1999

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Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATD30215** Title of the Course: **GIS Applications**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of Operating System.
- Students should have knowledge of networking and database.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Discuss fundamental concepts and practices of Geographic Information Systems. (Level 2 Understand)

CO-2. Demonstrate organizational skills in file and database management. (Level 3 Apply)

CO-3. Explain the address geospatial problems. (Level 2 Understand)

CO-4. Apply mathematical and statistical methods on data to be used in geospatial domain. (Level 3 Apply)

CO-5. Demonstrate project results in oral, written, and graphic forms. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

PCATD30215: GIS Applications

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

The nature of GIS, Some fundamental observations, Defining GIS, GISystems, GISience and GIS application, Spatial data and Geo-informations, Models and modeling, maps, databases, spatial databases and spatial analysis. Geographic phenomena, types of geographic phenomena, Geographic fields, Geographic Objects.

Unit 2 **(15 hrs)**

Regular tessellations, Irregular tessellations, Vector representations, Topology and spatial relationships, scale and resolution. GIS software, GIS architecture and functionality, Spatial Data Infrastructure, spatial data capture and preparation, storage and maintenance, query and analysis.

Unit 3 **(15 hrs)**

GIS and Spatial databases: Linking GIS and DBMS, spatial database functionality. Spatial Referencing and positioning: Reference surfaces for mapping, coordinate system, map projections, coordinate transformations, satellite based positioning: absolute positioning, relative positioning, network positioning.

Unit 4 **(15 hrs)**

Data entry and preparation: spatial data input, data quality, data preparation, Classification of analytical GIS capabilities, Retrieval, classification and measurement. Data Visualization: GIS and MAP, visualization process, cartographic toolbox, map qualitative and quantitative data, map cosmetics.

Reference Books:

1 Otto Huisman and Rolf A. (2009), *Principles of Geographic Information Systems,* Fourth edition, ITC.
2 Ian Heywood, Sarah Cornelius and Steve Carver (2011), *An Introduction to Geographical Information Systems,* fourth edition, Pearson.
3 Aronoff, S. (1989), *Geographic Information Systems: A Management Perspective,* Second edition, WDL.
4 Elangovan, k (2006), *Gis - Fundamentals, Applications and Implementations,* NIPA

School of Computer Sciences
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Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATA30101** Title of the Course: **Neural Networks and Genetic Algorithms**

L-T-P: 3+1+0=4 Credits: 4

Prerequisite Course / Knowledge (If any):

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Memorize the concepts of Neuroscience. (Level 1 Remember)

CO-2. Explain the Memory problem and capacity of stochastic network. (Level 2 Understand)

CO-3. Develop the optimization problems in image processing. (Level 6 Create)

CO-4. Design the theoretical framework for generalization and optimal network architectures for computation problems. (Level 6 Create)

CO-5. Use of the genetic algorithm. (Level 1 Remember)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

PCATA30101: Neural Networks and Genetic Algorithms

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction: Inspiration from Neuroscience, History, The Hopfield Model, The Associative Memory Problem, Statistical Mechanics of Magnetic Systems, Stochastic Networks, Capacity of the Stochastic Network, Correlated Patterns.

Unit 2 **(15 hrs)**

Optimization Problems: The Weighted Matching Problem, The Travelling Salesman Problem, Graph Bipartitioning, Optimization Problems in Image Processing.

Unit 3 **(15 hrs)**

Simple Perceptrons: Feed-Forward Networks, Threshold Units, Linear Units, Nonlinear Units, Stochastic Units, Multi-Layer Networks: Back-Propagation, Variations on Back-Propagation, Examples and Applications, Performance of Multi-Layer Feed-Forward Networks, A Theoretical Framework for Generalization, Optimal Network Architectures.

Unit 4 **(15 hrs)**

Genetic Algorithm – What are Genetic Algorithms, Where to use Genetic Algorithm?,the general idea, How the Genetic algorithm works, survival of the fittest, pictures computations, cross over, mutation, reproduction, rank method, rank space method, application.

Reference Books:

1. John Hertz, Anders Krogh and Richard G. (1991), *Introduction to the theory of neural computation,* Elsevier Science Publishers.
2. Melanie Mitchell,(1999), *An Introduction to Genetic Algorithms*, The MIT Press
3. S. Rajasekaran, G. A. Vijayalakshmi Pai (2012), *Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications*, PHI.

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Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATA30102** Title of the Course: **Fuzzy Sets and Fuzzy Logic**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Explain the difference between crips set and fuzzy set theory. (Level 2 Understand)

CO-2. Analyze statistical data by using fuzzy logic methods. (Level 4 Analyze)

CO-3. Discuss applications of Fuzzy logic membership function and fuzzy inference systems. (Level 2 Understand)

CO-4. Compare statistical methods against fuzzy logic methods. (Level 4 Analyze)

CO-5. Describe the fuzzy statistics applications. (Level 2 Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO1 0**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	2
CO3	3	3	3	2	1	1	1	3	2	3
CO4	2	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

PCATA30102: Fuzzy Sets and Fuzzy Logic

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction: Crisp Sets An Overview, Basic Types, Basic Concepts Characteristics and Significance of the Paradigm Shift.

Fuzzy Sets Versus Crisp Sets: Additional Properties of a-Cuts, Representations of Fuzzy Sets, Extension Principle for Fuzzy Sets.

Unit 2 **(15 hrs)**

Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersections t-norms, fuzzy unions i-conorms, combinations of operations, aggregation operations.

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals Arithmetic Operations on Fuzzy Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations

Unit 3 **(15 hrs)**

Fuzzy Relations: crisp versus fuzzy relations, projections and cylinder extensions, binary fuzzy relations, binary relations on a single set, fuzzy equivalence relations, fuzzy compatibility relations, fuzzy ordering relations.

Fuzzy Relation Equations: General discussion, problem partitioning, solution method, fuzzy relation equations based on sup-i compositions, fuzzy relation equations based on in-fwi compositions, approximate solutions, the use of neural networks.

Unit 4 **(15 hrs)**

Fuzzy logic: Classical, multi valued logic's, fuzzy propositions, fuzzy quantifiers, linguistic hedges, inference from conditional fuzzy propositions, inference from conditional and qualified propositions, information and uncertainty, non specificity of crisp sets, non specificity of fuzzy sets, fuzziness of fuzzy sets, uncertainty in evidence theory, summary of uncertainty measures, principles of uncertainty.

Reference Books:

1. George J. Klir and Bo Yuan (1995), *Fuzzy sets and fuzzy logic: theory and applications*, first edition, Prentice hall.
2. David A. Coley (1999), *An Introduction to Genetic Algorithms for Scientists and Engineers*, World Scientific
3. S.N. Sivanandam, S. Sumathi, S. N. Deepa (2006), *Introduction to Fuzzy Logic using MATLAB,* Springer
4. David Edward Goldberg, Addison(1989), *Genetic Algorithms in Search, Optimization, and Machine Learning,* Wesley Publishing Company.

School of Computer Sciences
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Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATA30103** Title of the Course: **Pattern Recognition**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of basic mathematics.
- Students should have knowledge of Computer Graphics.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Explain the application of pattern recognition. (Level 2 Understand)
CO-2. Discuss the estimation of parameters from samples and minimum risk estimators. (Level Understand)
CO-3. Calculate the unequal costs of error and estimation of error rates. (Level 4 Analyze)
CO-4. Use of clustering techniques on given samples. (Level 3 Apply)
CO-5. Develop the neural network model for pattern recognition (Level 6 Create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO9**	**PO1 0**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	3	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	1	2	2	2
CO5	3	3	3	2	2	2	1	3	3	3

PCATA30103: Pattern Recognition

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Introduction: Applications of pattern recognition, statistical decision theory, image processing and analysis.

Probability: Introduction, probability of events, random variables, Joint distributions and densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

Unit 2 **(15 hrs)**

Statistical Decision Making: Introduction, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, the leaving one out technique. Characteristic curves, estimating the composition of populations. Non-**parametric Decision Making:** Introduction, histograms, Kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminant Functions, minimum squared error discriminant functions, choosing a decision making technique.

Unit 3 **(15 hrs)**

Clustering: Introduction, hierarchical clustering, partitional clustering.

Artificial Neural Networks: Introduction, nets without hidden layers. nets with hidden layers, the back Propagation algorithms, Hopfield nets, an application.

Unit 4 **(15 hrs)**

Processing of Wave-forms And Images: Introduction, gray level sealing transformations, equalization, geometric image and interpolation, Smoothing, transformations, edge detection, Laplacian and sharpening operators, line detection and template matching.

Reference Books:

1. Eart Gose, Richard Johnsonburg and Steve Joust (2003), *Pattern Recognition and Image Analysis*, Prentice Hall, India.
2. Robert J Schalkoff, John (2007), *Pattern recognition: Statistical, Structural and neural approaches*, Wiley.
3. Earl Gose, Richard Johnsonbaugh, Steve Jost (2009), *Pattern Recognition and Image Analysis,* 1st Edition, PHI.
4. Pankaj Sharma,(2008), *Artificial Intelligence,* S K Kataria & Sons

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATA30104** Title of the Course: **Natural Language Processing**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of theoretical computer Science.
- Students should be aware of neural network and machine learning.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Define the regular expression and Automata. (Level 1 Remember)
CO-2. Demonstrate the text to speech model. (Level 3 Apply)
CO-3. Explain the word classes and part-of speech tagging. (Level 2 Understand)
CO-4. Apply the information retrieval model on given sample. (Level 3 Apply)
CO-5. Use of machine translation on natural language processing. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (Pos)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO9**	**PO10**
CO1	3	3	3	3	2	2	1	1	2	2
CO2	2	2	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	2	2	3	1	1	2	2	2	2
CO5	3	3	3	2	2	2	2	3	3	3

PCATA30104: Natural Language Processing

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Regular Expressions and Automata, Morphology and Finite-State Transducers, Computational Phonology and Text-to-Speech.

Unit 2 **(15 hrs)**

Probabilistic Models of Pronunciation and Spelling, N-grams, HMMs and Speech Recognition. Word Classes and Part-of-Speech Tagging, Context-Free Grammars for English, Parsing with Context-Free Grammars, Features and Unification.

Unit 3 **(15 hrs)**

Lexicalized and Probabilistic Parsing, Language and Complexity, Representing Meaning, Semantic Analysis, Lexical Semantics, Word Sense Disambiguation and Information Retrieval, Pragmatics, Discourse, Dialogue and Conversational Agents, Generation.

Unit 4 **(15 hrs)**

Machine Translation, A Regular Expression Operators, The Porter Stemming Algorithm,Training HMMs: The Forward-Backward Algorithm.

Reference Books:

1. Daniel Jurafsky and James H. Martin (2002), *Speech and Language Processing: An Introduction To Natural Language Processing, Computational Linguistics And Speech Recognition*, Pearson Education.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal (1995), *Natural Language Processinga Paninian Perspective*. Prentice Hall India.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCATA30105** Title of the Course: **Machine Learning**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Describe the different forms of learning (Level 1 Remember)
CO-2. Use the provability theory in machine learning. (Level 3 Apply)
CO-3. Examine the classification techniques on given datasets. (Level 4 Analyze)
CO-4. Construct neural network model for machine learning. (Level 6 Create)
CO-5. Design clustering algorithms to classify given sample in machine learning. (Level 6 Create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	2	2	1	1	2	3
CO2	2	3	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	3	2	3	1	1	2	2	2	2
CO5	3	3	3	2	2	2	2	3	3	3

PCATA30105: Machine Learning

Credits: 4 **IA: 40 Marks**
Contact Hrs (L:T:P): 4 (3:1:0) **End Exam: 60 Marks**

Unit 1 **(15 hrs)**

Basics: Introduction to Machine Learning – Different Forms of Learning, Basics of Probability Theory, Linear Algebra and Optimization.

Regression Analysis: Linear Regression, Ridge Regression, Lasso, Bayesian Regression, Regression with Basis Functions.

Unit 2 **(15 hrs)**

Classification Methods: Instance-Based Classification, Linear Discriminant Analysis, Logistic Regression, Large Margin Classification, Kernel Methods, Support Vector Machines, Multi-class Classification, Classification and Regression Trees.

Neural Networks: Non-linear Hypotheses, Neurons and the Brain, Model Representation, Multi-layer Networks, Back-propagation, Multi-class Discrimination, Training Procedures, Localized Network Structure, Deep Learning.

Unit 3 **(15 hrs)**

Graphical Models: Hidden Markov Models, Bayesian Networks, Markov Random Fields, Conditional Random Fields.

Ensemble Methods: Boosting - Adaboost, Gradient Boosting, Bagging - Simple Methods, Random Forest.

Clustering: Partitional Clustering - K-Means, K-Medoids, Hierarchical Clustering, Agglomerative, Divisive, Distance Measures, Density Based Clustering – DBscan,Spectral Clustering.

Unit 4 **(15 hrs)**

Dimensionality Reduction: Principal Component Analysis, Independent Component Analysis, Multidimensional Scaling, and Manifold Learning.

Reinforcement Learning: Q-Learning, Temporal Difference Learning

Reference Books:

1. Christopher M. Bishop (2006), *Pattern Recognition and Machine Learning,* 1st ed, Springer.
2. John Paul Mueller and Luca Massaron (2016), *Machine Learning*, 1st Edition, Dummies
3. U Dinesh Kumar and Manaranjan Pradhan (2020), *Machine Learning using Python*, Wiley.
4. John Paul Mueller and Luca Massaron (2016), *Machine Learning (in Python and R),* Wiley.
5. R.O. Duda, P.E. Hart and D.G. Stork (2001), *Pattern Classification,* Wiley.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCAPC30015** Title of the Course: **Lab based on PCATC30012 and PCATC30013**

L-T-P: 3+1+0=4 Credits: 4

Prerequisite Course / Knowledge (If any):

- Students should have knowledge of Python or Matlab programming.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to……

CO-1. Write a script in Matlab/Python that smoothing sample images. (Level 6 Create)

CO-2. Design the algorithms that detecting the boundary of sample images. (Level 6 Create)

CO-3. Construct model that identify the object from given images. (Level 6 Create)

CO-4. Practice on fundamental data structures. (Level 3 Apply)

CO-5. Demonstrate space and time algorithms. (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**
CO1	3	3	3	3	2	2	1	1	2	3
CO2	2	3	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	3	2	3	1	1	2	2	2	2
CO5	3	3	3	2	2	2	2	3	3	3

Detailed Syllabus:

Laboratory assignment shall be carried out to include the features studied in PCATCC3127 (Digital Image Processing) and PCATCC3128 (Design and Analysis of Algorithms).

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Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCAPC30016**
Title of the Course: **Lab based on PCATD30212-30215**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and software engineering.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Use of ICT in given domain (Level 3 Apply)
CO-2. Demonstrate the ICT models on given sample. (Level 3 Apply)
CO-3. Develop model that solve real time social issues. (Level 6 Create)
CO-4. Develop the module the implement the basic concepts of computers. (Level 6 Create)
CO-5. Sketch the data flow mini-project (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO1 0**
CO1	3	3	3	3	2	2	1	1	2	3
CO2	2	3	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	3	2	3	1	1	2	2	2	2
CO5	3	3	3	2	2	2	2	3	3	3

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Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: **PCAPC30017**
Title of the Course: **Mini-Project**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and software engineering

Mini-Project

Project work will be carried out either in the department. Each student shall carry out the project work individually/group (Max two members) and present the work done in the seminar conducted in the department. The students are required to submit a soft copy of the project report based on the work done by him/her during the project period. The project topics should be approved from the departmental panel. Students must submit a synopsis separately of more than one topic.

Synopsis Template

The write up must adhere to the guidelines and should include the following:

1. Name / Title of the Project
2. Objective and scope of the Project
3. Introduction and Review
4. Applications
5. Conclusions
6. Requirements (Hardware and Software)

Guidelines for preparing the project Report:

A4 size page should be used for typing, Left margin: 3.0cm Right margin: 2.0 cm, Top margin: 2.54 cm, Bottom margin: 2.54 cm, All pages as well as should be numbered at the bottom center of the pages. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above, and below para spacing Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing. Chapter Heading Font Size: 20, Times New Roman, Center Aligned, 30 point above and below spacing. Coding Font size:10, Courier New, Normal

Submission of Project Report

Soft copy of the project report shall be submitted through the Moodle LMS course link provided by the internal project guide.

School of Computer Sciences
Department of Computer Science

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: **PCAIC40018, PCARC40019-20**
Title of the Course: **A: Project: Seminar, Internship: * A: Dissertation / Targeted Project B: Dissertation/ Training and Evaluation, Project Viva voce**
L-T-P: 3+1+0=4 Credits: 4
Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and software engineering.

Course Outcomes (COs)

After completion of this course successfully, the students will be able to

1 Create websites for school, PSU, Industries etc. (Level 6 Create)
2 Generate the documentation of project work. (Level 6 Create)
3 Develop a model that solves real time social issues. (Level 6 Create)
4 Develop the module and implement the concepts of computers. (Level 6 Create)
5 Sketch the data flow of project (Level 3 Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**
CO1	3	3	3	3	2	2	1	1	2	3
CO2	2	3	2	3	2	2	2	2	3	3
CO3	3	3	3	2	2	2	1	3	3	3
CO4	3	3	2	3	1	1	2	2	2	2
CO5	3	3	3	2	2	2	2	3	3	3

Detailed Syllabus:

PROJECT WORK:

Project work will be carried out either in the department or in any Institution / Industry under the supervision of guide (s) approved by the Department of Computer Science.

1 Each student shall carry out the project work individually and present the work done in the seminar conducted in the department at regular intervals (minimum two seminars must be conducted in the semester).
2 The students are required to submit three copies of the project report (dissertation) based on the work done by him/her during the project period. The project topics should be based on the syllabus or beyond.

PROJECT DISSERTATION FORMAT:

SUMMARY/ ABSTRACT:

All students must submit a summary/abstract separately with the
project report. Summary, preferably, should be of about 3,4 pages. The content should be as brief as is sufficient enough to explain the objective and implementation of the project

that the candidate is going to take up. The write up must adhere to the guidelines and should include the following:

1 Name / Title of the Project
2 Statement about the Problem
3 Why is the particular topic chosen?
4 Objective and scope of the Project
5 Methodology (including a summary of the project)
6 Hardware & Software to be used
7 Testing Technologies used
8 What contribution would the project make?

TOPIC OF THE PROJECT:

This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peep into the project to be taken up, candidates are advised to be prudent on naming the project. This being the overall impression on the future work, the topic should corroborate the work.

OBJECTIVE AND SCOPE:

This should give a clear picture of the project. Objective should be
clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

PROCESS DESCRIPTION:

The process of the whole software system proposed, to be developed, should be mentioned in brief. This may be supported by DFD / Flowcharts to explain the flow of the information.

RESOURCES AND LIMITATIONS:

The requirement of the resources for designing and
developing the proposed system must be given. The resources might be in form of the hardware/software or the data from the industry. The limitation of the proposed system in respect of a larger and comprehensive system must be given.

CONCLUSION:

The write-up must end with the concluding remarks briefly describing innovation in the approach for implementing the Project, main achievements and also any other important feature that makes the system stand out from the rest.

The following suggested guidelines must be followed in preparing the Final project Report:

Good quality white executive bond paper A4 size should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

Left margin: 3.0cms
Right margin: 2.0cms
Top margin: 2.54cms
Bottom margin: 2.54cms

Page numbers, All text pages as well as Program source code listing should be numbered at the bottom center of the pages. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above and below para spacing Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing. Chapter Heading Font Size: 20, Times New Roman, Center Aligned, 30 point above and below spacing. Coding Font size:10, Courier New, Normal.

Submission of Project Report to University: The student will submit his/her project report in the prescribed format. The Project Report should include:

1 One copy of the summary/abstract.
2 Soft copy of the project report shall be submitted through the Moodle LMS course link provided by the internal project guide.
3 The Project Report may be about 75 pages (excluding coding)

Chairman
BoS in Computer Science