Deccan Education Society's

FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

Academic Year 2018-2019

Syllabus for M.Sc. (Industrial Mathematics with Computer Applications)

SEMESTER - V

Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE 411004
Scheme of Course Structure (Faculty of Science)
2018-2019

M.Sc. - Industrial Mathematics with Computer Applications (IMCA)

Semester	Course Code *	Title	Paper	Credits	Exam (I / E)	Marks (50 / 50)
V	MTS6501	Digital Image Processing	Compulsory	5	(I / E)	(50 / 50)
	MTS6502	UNIX	Compulsory	5	(I / E)	(50 / 50)
	MTS6503	Data Mining	Compulsory	5	(I / E)	(50 / 50)
	MTS6504	Coding Theory	Elective	5	(I / E)	(50 / 50)
	MTS6505	Dot Net Technologies	Elective	5	(I / E)	(50 / 50)
	MTS6506	Machine Learning	Elective	5	(I / E)	(50 / 50)
	MTS6507	Theoretical Computer Science	Elective	5	(I / E)	(50 / 50)
	MTS6508	Soft Computing	Elective	5	(I / E)	(50 / 50)
	MTS6509	Lab Course : Project Lab	Compulsory	5	(I / E)	(50 / 50)
VI	MTS6601	Industrial Training	Compulsory	15	(I / E)	(50 / 50)

M.Sc. (IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - I
TITLE: DIGITAL IMAGE PROCESSING
PAPER CODE: MTS6501

[CREDITS - 5]

	Title and Contents	No. of Lectures
Unit - I	**Introduction** 1. What is Digital Image Processing? 2. The origins of Digital Image Processing 3. Examples of Fields that use Digital Image Processing • Gamma-Ray Imaging • X-Ray Imaging • Imaging in the Ultraviolet Band • Imaging in the Visible and Infrared Bands • Imaging in the Visible and Infrared Bands • Imaging in the Visible and Infrared Bands • Imaging in the Microwave Band • Imaging in the Radio Band 4. Fundamental steps in Digital Image Processing 5. Components of an Image Processing System	3
Unit - II	**Digital Image Fundamentals** 1. Elements of Visual Perception 2. Light and the Electromagnetic Spectrum 3. Image sensing and Acquisition 4. Image Sampling and Quantization 5. Some Basic Relationships between Pixels 6. An Introduction to the Mathematical Tools Used in Digital Image Processing • Array versus Matrix Operations • Linear versus Nonlinear Operations • Arithmetic Operations • Set and Logical Operations	6
Unit - III	**Intensity Transformation and Spatial Filtering** 1. Background 2. Some Basic Intensity Transformation Functions 3. Histogram Processing 4. Histogram Equalization and Normalization • Histogram Matching (Specification) • Local Histogram Processing 5. Fundamentals of Spatial Filtering • Smoothing Spatial Filters 6. Sharpening Spatial Filters 7. Combining Spatial Enhancement Methods	7
Unit - IV	**Filtering in the Frequency Domain** 1. Background 2. Preliminary Concepts 3. Sampling and the Fourier Transform of Sampled Functions	10

	4. The Discrete Fourier Transform (DFT) of One variable 5. Extension to Functions of Two Variables • Some Properties of the 2-D Discrete Transform • The Basics of Filtering in the Frequency Domain • Image Smoothing Using Frequency Domain Filters • Image Sharpening Using Frequency Domain Filters • Selective Filtering	
Unit - V	**Image Restoration and Reconstruction** 1. A Model of the Image Degradation / Restoration Process 2. Noise Models 3. Restoration in the Presence of Noise Only-Spatial Filtering 4. Periodic Noise Reduction by Frequency Domain Filtering 5. Band reject Filters • Band pass Filters • Notch Filters 6. Estimating the Degradation Function 7. Inverse Filtering 8. Minimum Mean Square Error (Wiener) Filtering 9. Geometric Mean Filter	6
Unit - VI	**Morphological Image Processing** 1. Preliminaries 2. Erosion and Dilation 3. Opening and Closing 4. The Hit-or-Miss Transformation 5. Basic Morphological Algorithms • Boundary Extraction • Hole Filling • Extraction of Connected Components • Convex Hull • Thinning • Thickening • Skeletons • Pruning • Morphological Reconstruction	5
Unit - VII	**Image Segmentation** 1. Fundamentals 2. Point, Line, and Edge Detection • Background • Detection of Isolated Points • Line Detection • Edge Models • Basic Edge Detection • Edge Linking and Boundary Detection 3. Thresholding • Foundation • Basic Global Thresholding • Optimum Global Thresholding Using Otsu's Method • Using Image Smoothing to Improve Global Thresholding	6

	• Using Edges to Improve Global Thresholding 4. Region-Based Segmentation	
Unit - VIII	**Representation and Description** 1. Representation • Boundary (Border) Following • Chain Codes • Polygonal Approximations Using Minimum-Perimeter Polygons • Other Polygonal Approximation Approaches • Signatures • Boundary Segments • Skeletons 2. Boundary Descriptors • Some Simple Descriptors • Shape Numbers • Fourier Descriptors 3. Regional Descriptors • Some Simple Descriptors • Topological Descriptors • Texture	5

Note:
12 Lectures are assigned to Laboratory Course on MATLAB / Open CV

Text Book:
Gonzalez, R. C. and Woods, R. E. [2002 / 2008], Digital Image Processing, 3rd ed., Prentice Hall

Reference Books:

1. Sonka, M., Hlavac, V., Boyle, R. [1999]. Image Processing, Analysis and Machine Vision (2nd edition), PWS Publishing, or (3rd edition) Thompson Engineering, 2007
2. Gonzalez, R. C., Woods, R. E., and Eddins, S. L. [2009]. Digital Image Processing Using MATLAB, 2nd edition, Gatesmark Publishing, Knoxville, TN.
3. Anil K. Jain [2001], Fundamentals of digital image processing (2nd edition), Prentice-Hall, NJ.
4. Willian K. Pratt [2001], Digital Image Processing (3rd Edition), John Wiley & Sons, NY.
5. Burger, Willhelm and Burge, Mark J. [2008]. Digital Image Processing: An Algorithmic Introduction Using Java, Springer
6. Kropatsch, Digital Image Analysis (With CD-ROM), Springer, ISBN: 978038795066
7. Jähne, Digital Image Processing, 6e (With CD), Springer, ISBN: 978-3-540-24035-8 2
8. B. Chanda and D. Dutta Mujummder, Digital Image Processing and Analysis, PHI Learning Private Limited, ISBN-978-81-203-1618-8

M.Sc. (IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - II
TITLE: UNIX
PAPER CODE: MTS6502

[CREDITS - 5]

	Title and Contents	No. of Lectures
Unit - I	**General overview of the System** • History, System structure, User perspective, Operating System services, Assumptions about hardware	4
Unit - II	**Introduction to the kernel** • Architecture of the Unix operating System, Introductions to System concepts, Kernel data structures, System administration	7
Unit - III	**The buffer cache** • Buffer headers, Structure of the buffer pool, Scenarios for retrieval of a buffer, Reading and writing disk blocks, advantages and disadvantages of the buffer Cache	7
Unit - IV	**Internal representation of files** • Inode, Structure of a regular file, Directories, Conversion of a path name to an inode, Super block, inode assignment to a new file, Allocation of disk blocks, other file types	8
Unit - V	**System calls for the file System** • Open, read, write, File and record locking, Adjusting the position of file i/o lseek, close, File creation, Creation of special files, Change directory and change root. Change owner and change mode, stat and fstat, pipes, dup, mounting and unmounting file Systems, link, unlink, File System abstractions, File System maintenance	5
Unit - VI	**The structure of processes** • Process states and transitions, Layout of System memory, the context of a process, Saving the context of a process, Manipulation of the process address Space, sleep	7
Unit - VII	**Process control** • Process creation, Signals, Process termination, Awaiting process termination, Invoking other programs, The user id of a process, Changing the size of a process, The shell, System boot and the init process	8

Reference Book:
Maurice J. Bach, The design of Unix Operating System, Published by PHI Publication

For Lab Work:
W. Richard Stevens & Stephen A. Rago, Advance Programming in UNIX environment, Pearson Publication, Second Edition

M.Sc. (IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - III
TITLE: DATA MINING
PAPER CODE: MTS6503

[CREDITS - 5]

	Title and Contents	No. of Lectures
Unit - I	**Introduction to Data Mining** • Introduction to Data Mining • Importance of Data Mining • Data Mining functionalities • Related technologies - Machine Learning, DBMS, OLAP, Statistics • Classification of Data mining systems • Data mining architecture • Major Issues in Data Mining • Data mining metrics • Applications of Data Mining • Social impacts of Data Mining **Data Warehouse and OLAP** • Data warehouse: Introduction to Data warehouse • Difference between operational database systems and data warehouses • Data warehouse Characteristics • Data warehouse Architecture and its Components • Extraction - Transformation - Loading • Data Modelling • Schema Design, Star and Snow - Flake Schema, Fact Consultation • Fact Table • Fully Addictive, Semi - Addictive, Non Addictive Measures • OLAP Cube, OLAP Operations, OLAP Server Architecture - ROLAP, MOLAP and HOLAP.	8
Unit - II	**Data preprocessing** • Data cleaning • Data transformation • Data reduction • Discretization and generating concept hierarchies	4
Unit - III	**Data mining knowledge representation** • Task relevant data • Background knowledge • Interestingness measures • Representing input data and output knowledge • Visualization techniques	4
Unit - IV	**Attribute-oriented analysis** • Attribute generalization	4

	• Attribute relevance • Class comparison • Statistical measures	
Unit - V	**Data mining algorithms: Association rules** • Motivation and terminology • Example: mining weather data • Basic idea: item sets • Generating item sets and rules efficiently • Correlation Analysis • Apriori Algorithm • FP growth Algorithm • Sampling Algorithms	4
Unit - VI	**Data mining algorithms: Classification** • Definition of classification • Model construction, Model Usage • choosing algorithm • Decision tree Induction • Information gain, gain ratio, gini index • Measuring performance of classifiers, Precision, recall, F-measure, confusion matrix, cross-validation, bootstrap • Inferring rudimentary rules: 1R algorithm	6
Unit - VII	**Data mining algorithms: Prediction** • The prediction task, Statistical (Bayesian) classification • Bayesian networks • Instance-based methods (nearest neighbor)	5
Unit - VIII	**Clustering** • Basic issues in clustering • First conceptual clustering system: Cluster / 2 • Partitioning methods: k-means, expectation maximization (EM) • Hierarchical methods: distance-based agglomerative and divisible clustering • Conceptual clustering: Cobweb • Neural networks approach	6
Unit - IX	**Advanced techniques, Data Mining software and applications** • Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing) • Bayesian approach to classifying text • Web mining: classifying web pages, extracting knowledge from the web • Data Mining software and applications	5

Text Book:

1. Alex Berson and Stephen, J. Smith, "DataWarehousing, DataMining & OLAP", Tata McGraw Hill Edition, Tenth Reprint 2007.
2. Jiawei Hanand Micheline Kamber," DataMining Concepts and Techniques", Second Edition, Elsevier, 2007.

References:

1. Pang Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction To Data Mining", PersonEducation, 2007.

2. K. P. Soman, Shyam Diwakar and V. Ajay "Insight into Datamining Theory and Practice, "Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, "Introduction to DataMining with Case Studies, "Easter Economy Edition, Prentice Hall of India, 2006.
4. Daniel T. Larose,"DataMining Methods and Models, "Wile-Interscience, 2006.
5. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005, ISBN: 0-12-088407-0.
6. Arun K Pujari, Data Mining Techniques, 3rd Edition, Universities Press.
7. Pualraj Ponnaiah, Data Warehouse Fundamentals, Wiley Student Edition.
8. P. Radha Krishna, Data Mining, Vikaram Pudi, Oxford University Press

M.Sc. (IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - IV
TITLE: CODING THEORY
PAPER CODE: MTS6504

[CREDITS - 5]

	Title and Contents	No. of Lectures
Unit - I	**Error detection: correction and decoding**: Communication channels, Maximum likelihood decoding, Hamming distance, Nearest neighbour / minimum distance decoding, Distance of a code. (Section 2.1, 2.2, 2.3, 2.4, 2.5 from Coding Theory A First Course by Ling and Xing)	5
Unit - II	**Finite fields** (Section 3.1, 3.2, 3.3, 3.4, theorems without proof from Ling and Xing) with examples.	10
Unit - III	**Linear codes**: Vector spaces over finite fields, Linear codes, Hamming weight, Bases of linear codes, Generator matrix and parity check matrix, Equivalence of linear codes, Encoding with a linear code, Decoding of linear codes, Cosets, Nearest neighbour decoding for linear codes, Syndrome decoding. (Section 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8 from Ling and Xing)	15
Unit - IV	**The main coding theory problem** Idea of bounds Gilbert - Varshamov bound, Hamming bound (Definition only), Binary Hamming codes, q-ary Hamming codes (Section 5.1, 5.2, 5.3.1, 5.3.2 From Ling and Xing)	10
Unit - V	**Cyclic codes**: Definitions, Generator polynomials, Generator and parity check matrices, Decoding of cyclic codes, Burst-error-correcting codes. (Section 7.1, 7.2, 7.3, 7.4, 7.5 by Ling and Xing)	10
Unit - VI	**Some special cyclic codes**: BCH codes, Definitions, Parameters of BCH codes, Decoding of BCH codes, Reed Solomon codes, quadratic residue codes (definition and examples only) (sections 8.1, 8.2, 8.3 by Ling and Xing)	10

Reference Books:

1. San Ling and Chaoing Xing, Coding Theory - A First Course.
2. Lidl and Pilz, Applied Abstract Algebra - 2nd Edition
3. J. H. Van Lint Introduction to Coding Theory, Third Edition

M.Sc. (IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - IV
TITLE: DOT NET TECHNOLOGIES
PAPER CODE: MTS6505

[CREDITS - 5]

	Title and Contents	No. of Lectures
Unit - I	**Introduction to MS.NET Framework** The .NET Framework - an Overview, Framework Components, Framework Versions, Types of Applications developed using MS.NET, MS.NET Namespaces, MS.NET Base Class Library, Common Language Runtime (CLR), Managed Code, MS.NET Memory Management / Garbage Collection, Common Type System (CTS), Common Language Specification (CLS), Types of JIT Compilers, Security Manager.	6
Unit - II	**Visual Studio .NET and Entry Point Method - Main** Introduction to Project and Solution in Studio, Entry point method - Main, Compiling and Building Projects, Using Command Line Arguments, Importance of Exit code of an application, Different valid forms of Main.	2
Unit - III	**Introduction to C # Language** Data Types, Reference Type and Value Type, Global, Stack and Heap Memory, Variables and Expressions, Implicit and Explicit Casting, Casting between other Data Types, Checked and Unchecked Blocks - Overflow Checks, Boxing and Unboxing, Enum and Constant, Operators, Control Statements, Working with Methods, Working with Arrays. Class, Object, Component, Encapsulation, Inheritance, Polymorphism, Object Creation and Instantiation, Operator Overloading, Partial Classes and Methods.	6
Unit - IV	**Inheritance, Polymorphism and Interface** Types of Inheritance, Constructor and Inheritance, Type casting of Reference Types, Static and Dynamic Binding, Abstract Class, Overview of Interface, Interface with examples.	2
Unit - V	**Collections and Generics** Introducing Collections, Benefits of Collection Classes, Understanding and using commonly used Collections, Generics, Advantages of Generics, How Generics work at runtime? Constraint on Type Parameters, Generic Methods, Generic Collections, Selecting a Collection Class.	5
Unit - VI	**Assemblies and GAC** What is a DLL and how is it different from EXE?, Types of DLL, Assembly, Types of Assemblies, Building a Class Library, Using a Class Library in another Application, Global Assembly Cache.	5
Unit - VII	**Exception Handling** Defining Exception, try, catch, finally, "using" statement, throwing exceptions, Creating User defined/Custom Exception class	1
Unit - VIII	**IO Streams** What is a Stream?, Types of Stream, Standard I/O Streams - Console, Handling text and binary files, Serialization / De-serialization	3
Unit - IX	**Delegates & Events** Introduction to Delegates, Events Declaration, Event handling using Delegates, Anonymous Methods.	3

Unit - X	**Developing GUI Applications using WINFORMS** Window Controls -Common Controls, Container Controls, Menus and Toolbars, Dialog Boxes	4
Unit - XI	**Web Programming Introduction** Role of Web Server and Web Browser, HTTP Protocol, HTTP Request Structure, HTTP Response Structure, Form Tag and comparison between Get and Post methods.	2
Unit - XII	**ASP.NET Introduction & Sample Programs** "Hello World" ASP.NET application, Understanding the code generated by Visual Studio .NET, Example Programs, Understanding Auto Post Back, HTML Controls, Web Server Controls, Exploring Server Controls.	5
Unit - XIII	**Validation Controls** BaseValidator, ValidationSummary, RequiredFieldValidator, CompareValidator, RangeValidator, RegularExpressionValidator, CausesValidation Property of Button Grouping Controls for Validation.	3
Unit - XIV	**ASP.NET Architecture** What is AppDomain?, Life cycle of a WebForm when requested by a client, How does a control manages its state?, EnableViewState property, Event Handling in WebForms, Writing / Using Custom Classes in WebApplication.	4
Unit - XV	**ASP.NET State Management** Need for state management, Static members in WebForm, Global Class in App_Code folder, Cookie, Session, ViewState.	3
Unit - XVI	**Introduction to Web Services** What is a Web Service? Building ASP.NET Web Service, Consuming a Web Service.	2
Unit - XVII	**ASP. NET MVC Architecture** Fundamentals of ASP.NET MVC (Model View Controller Architecture), MVC benefits, ASP.NET MVC Web application -First MVC application, Adding the Controller, Creating and Rendering the View	4

Reference Books:

1. Andrew Troelsen, 2013, Pro C# 5.0 and the .Net 4.5 Framework, 6th Edition, Apress.
2. Christian Nagel, Karli Watson, 2008, Professional C# 2008, 1st Edition, Wrox.
3. Karli Watson, 2013, Beginning Visual C# 2012 Programming, 1st Edition, Wrox.
4. Tom Archer, Andrew Whitechapel, 2007, Inside C#, 2nd Edition, Woodpecker.
5. Imar Spaanjaars, 2010, Beginning ASP.NET 3.5 in C# and VB, 1st Edition, Wrox.
6. Jason N. Gaylord, 2013, Professional ASP.NET 4.5 in C# and VB, 1st Edition, Wrox.
7. Jess Chadwick, 2012, Programming ASP.NET MVC 4, 1st Edition, O'REILLY.

M.Sc.(IMCA) SEMESTER –V
M.Sc. (IMCA) PAPER – IV
TITLE :MACHINE LEARNING
PAPER CODE: MTS6506

[CREDITS - 5]

	Title and Contents	**No. of Lectures**
Unit – I	**Introduction, Regression Analysis and Gradient Descent** • Introduction • What is Machine Learning • Supervised Learning • Unsupervised Learning • Linear Regression- Implementation (cost function) • Linear Regression with Gradient Descent • Case Study based on Regression	8
Unit - II	**Logistic Regression** • Classification • Hypothesis Representation • Decision Boundary • Non Linear Decision Boundaries • Cost function • Simplified Cost function using Gradient Descent • Multi class problems • Case Study based on the chapter	8
Unit - III	**Support Vector Machines** • Introduction • Cost function for SVM • Large Margin Intuition • Kernels: Adapting SVM to non Linear Classifiers • SVM Implementation and use • Multi class classification • SVM Vs Logistic Regression • Case Study based on SVM	8
Unit - IV	**Dimension Reduction** • What is Data Compression • Visualization • Principal Component Analysis • PCA Algorithm • Reconstruction from Compressed Representation • Choosing number of Principal Components • Advice for applying PCA • Case study based on PCA	8
Unit - V	**Regularization** • Problem of Over fitting • Problem of Under fitting • Cost function optimization using Regularization • Regularized Linear Regression • Case Study based on Regularization	8

Unit - VI	**Advice for applying Machine Learning** • Debugging an Algorithm • Evaluating a hypothesis • Model Selection, training and testing validation test sets • Diagnosis: bias vs variance • Linear Regression with Regularization • Learning Curves • Case study	10
Unit - VII	**Anomaly Detection** • Problem Motivation • Gaussian Distribution • Anomaly Detection Algorithm • Developing and Evaluating a system • Anomaly Detection vs Supervised Learning • Multivariate Gaussian Distribution • Applying Multivariate Gaussian Distribution to anomaly detection	10
Reference: Andrew Ng , Machine Learning Course, Stanford University		

M.Sc.(IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - IV
TITLE :THEOROTICAL COMPUTER SCIENCE
PAPER CODE: MTS6507

[CREDITS - 5]

	Title and Contents	**No. of Lectures**
Unit - I	**Preliminaries** • Sets, operations on sets, finite and infinite sets. • Symbol, alphabet, string, prefix and suffix of strings. • Formal language.	3
Unit - II	**Formal languages** • Chomsky hierarchy • Validating machines for languages • Kleene closure and positive closure • Operations on languages (Union, Intersection and Concatenation)	4
Unit - III	**Regular Languages** • Regular Expressions: Definition, example and identities. • Finite automata: concept • DFA: definition and examples. • NFA: definition and examples. • Language accepted by FA and NFA with _ moves. • Regular Expression to FA: method and problems. • NFA to DFA: method and problems. • Minimization of DFA: problems using table methods. • FA with output: moore and mealy machines: Definition and their equivalence. • Applications of FA: Pumping lemma and examples. • Closure Properties: Union, Intersection, Concatenation, Complement and Kleene closure	15
Unit - IV	**Context free languages** • CFG: Definition and examples. • Ambiguous grammar: concept and example. • Simplification of CFG: removing useless symbols, removing unit productions and removing nullable symbols: method and problems. • Normal forms: CNF and GNF: method and problems. • Regular grammar: definition equivalence of FA and regular grammar. • PDA: Basic concept, definition, DPDA and NPDA. • Construction of PDA using empty stack and final state method: examples using stack method. • Equivalence between acceptance by final state and empty stackmethod and examples. • Equivalence between PDA and CFG (in GNF): method and examples	15
Unit - V	**Properties of CFL** • Pumping Lemma for CFL: methods and problems	3

	• Closure properties of CFLs: Union, Concatenation and Kleene closure: methods and examples	
Unit - VI	**Turing Machines** • Recursive and recursively enumerable languages • Introduction to LBA (Basic model) and CSG. • Definition of TM • Basic Model • Design of TM for language recognition • Types of TM (Multitape TM, Non-Deterrministic TM, UniversalTM, Restricted TM). • Undecidable Problem, Halting Problem of TM	8

Reference Books:

1. Thomas A. Sudkamp, Languages and Machines Third Edition
2. John E. Hopcroft, Jeffery D. Ullman. Introduction to Automata theory, languages and computation
3. Principles of Compiler Design Alfred V. Aho, Jeffery D. Ullman.

M.Sc.(IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - IV
TITLE: SOFT COMPUTING
PAPER CODE: MTS6508

[CREDITS - 5]

	Title and Contents	No. of Lectures
Unit - I	**Introduction to Soft Computing** • What is soft computing? Differences between soft computing and hard computing, Soft Computing constituents, • Methods in soft computing, Applications of Soft Computing	2
Unit - II	**Genetic Algorithms (GA)** • What are GA's, Why GA's? Brief introduction to traditional optimization and search Techniques, GA and search space, Steps in GA, Operators in GA, Genetic AlgorithmsVs. Traditional Methods, • Basic terminologies in GA, Schema Theorem, Problem solving Using GA, Application of Genetic Algorithm: Travelling salesman problem, Genetic Algorithm based Internet Search Technique	6
Unit - III	**Fuzzy Set Theory** • Introduction to Classical Sets and Fuzzy sets, Classical Relations and Fuzzy Relations, Tolerance and Equivalence Relations, Non-interactive Fuzzy sets, Membership Functions: • Fuzzification, Methods of Membership Value Assignments, Defuzzification, Lambda-Cuts for Fuzzy sets and Fuzzy Relations, Defuzzification Methods.	6
Unit - IV	**Fuzzy rule base system** • Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic, Fuzzy Propositions, Formation of Rules, Decomposition and Aggregation of rules, Fuzzy Reasoning, Fuzzy Inference Systems (FIS), Fuzzy Decision • Making, Fuzzy Logic Control Systems and application of fuzzy logic	6
Unit - V	**Artificial Neurons, Neural Networks and Architectures** • Neuron abstraction, Neuron signal functions, Definition of Neural Networks, Architectures: feed forward and feedback, Salient properties and application domains, learning rules - Hebbian, Delta, Percepron learning and Windrow- Hoff, winner-take-all	6
Unit - VI	**Associative Memories** • Description, Auto-associative Memory, Bi-directional Hetero-associative Memory.	4
Unit - VII	**Supervised learning** • Perceptron learning, single l layer/multilayer Perceptron, linear separability, hidden layers, back propagation algorithm, Radial Basis Function network;	5
Unit - VIII	**Unsupervised learning** • Kohonen, SOM, Counter-propagation, ART, Reinforcement	5

	learning, adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in image processing	
Unit - IX	**Neuro Fuzzy Modeling** • Adaptive Neuro-Fuzzy Inference Systems - Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN	5

Text Book:

1. J. S. R. Jang, C. T. Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education.
2. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing (With CD) Wiley India, ISBN: 9788126527410
3. S. Rajasekaran and G. A. Vijayalaksmi Pai, Neural Network, Fuzzy Logic and Genetic Algorithms - Synthesis and Applications", (2005), Prentice Hall

References:

1. Timothy J. Ross, Fuzzy Logic: With Engineering Applications Wiley India, Third Edition ISBN: 978-81-265-3126-4
2. Kumar Satish, Neural Networks: A Classroom Approach, 1/e TMH, ISBN: 9780070482920
3. David E. Goldberg, Genetic Algorithms in search, Optimization & Machine Learning by, Pearson Education, ISBN: 81-7808-130-X
4. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Edition: Pearson Edn., 2003.
5. V. Kecman, Learning and Soft Computing, MIT Press, 2001.

M.Sc. (IMCA) SEMESTER - V
M.Sc. (IMCA) PAPER - V
TITLE: LAB COURSE
PAPER CODE: MTS6509

[CREDITS - 5]

Lab Based on Project

Variety of domains and platform can be used to develop / design projects.

Deccan Education Society's

FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

Academic Year 2018-2019

Syllabus for M.Sc. (Industrial Mathematics with Computer Applications)

SEMESTER - VI

M.Sc. (IMCA) SEMESTER - VI
M.Sc. (IMCA) PAPER - I
TITLE: FULL TIME INDUSTRIAL TRAINING
PAPER CODE: MTS6601

[CREDITS - 15]

Period - Minimum 4 months

1. There will be a teacher coordinator for a group of 10 students. A teacher coordinator will take care of joining letters from students along with other necessary submissions.

2. Evaluation for internal 50 Marks will be done according to Progress Report written by Teacher Coordinator.

Evaluation for external 50 Marks will be done by Industrial Expert, Academic Expert and One Internal Examiner.

Internal 50 Marks Evaluation:

Description	Marks
UML Diagrams	10
Technology And Design Based First Demo	15
Review on Project Manager's Feedback (from Industry)	10
Internal Second Demo	15

External 50 Marks Evaluation:

Description	Marks
Report	15
Presentation	25
Viva	10

3. A student will have to report every week for the work done during the period of ITP, to the Department of the college. The teacher coordinator will access the work done by the student and prepare a progress report of the student. She/he will also guide the students in case of any difficulty in their ongoing work.

4. After the completion of the ITP, a student will have to submit a project report along with the project completion certificate from the respective industry / research institute / educational institute.

5. A student will submit one hard copy (Student Copy) and preferably 2 CDs of the work carried out towards ITP.

6. The project work will be graded by the panel of three experts (one internal examiner, one external examiner (academic expert from other college) and one industrial expert) for external 50% evaluation and final grade for Industrial Training will be given as follows:
(As per SPPU guidelines)

Marks	Grade	Grade Point
90-100	O: Outstanding	10
80-89	A+: Excellent	9
70-79	A: Very Good	8
65-69	B+: Good	7
60-64	B: Above Average	6

55-59	C+ : Average	5
50-54	C: Below Average	4
45-49	D : Satisfactory	3
40-44	E:Pass	2
0-39	F : Fail	0
	Absent	0

Note:

1. Grade F: Students will have to carry out project once again for a complete semester.
2. There would be 3 mentors for 30 students.
3. A teacher is supposed to:
   i. Maintain a weekly status report of the student.
   ii. Keep in touch with the mentors from industry.
   iii. Help the students in case of any difficulty.
   iv. Arrange the meeting and presentations as per requirement.

Industrial Training workload:

For (2) - 5 hours / week per 10 students.