M.Sc Computer Science

(For the students admitted from the academic year 2021 - 2022 onwards)

Programme Outcomes

PO1: To provide advanced and in-depth knowledge of computer science and its Applications.

PO2: To provide knowledge and ability to develop the creativity, critical thinking, analysis, programming skill and research skill in Computer Science.

PO3: To enable professional career in Information and Communication Technology.

PO4: To develop skills to learn new technology.

PO5: To inculcate social, moral and ethical values.

Programme Specific Outcomes

A graduate with a M.Sc. in Computer Science will have the ability to,

PSO1: Develop programming skills to implement research projects.

PSO2: Understand and solve emerging research problems.

PSO3: Apply ethical principles and commit to professional responsibilities.

Course Outcomes

Sem	Course Title	Course Code	Course Outcome
I	Core I- Advanced Operating System	21MS01	CO1: Define the general concepts of Operating Systems like System Architecture, Resource Management , Kernel Data Structures , Computing Environments, Free and Open-Source systems. CO2: Explain the concepts using Interacting with the bash Manual, Navigating the File system, Managing Directories, Viewing File Contents, Monitoring Disk Space and Working with Data Files. CO3: Describe the Linux Security, Decoding File Permissions, Exploring Linux File Systems, the copy-on-write filesystems - Working with File Systems and Managing Logical Volumes. CO4: Explain the concepts of Memory management like Contiguous Memory Allocation, Paging, Demand Paging, Demand Paging, Copy-on-Write, Thrashing and Memory Compression. CO5: Summarize on the Communication Structure, Network and Distributed Operating Systems, Distributed File Systems, Remote File Access, Network and Distributed Systems.

	Core II- Advanced Java Programming	21MS02	CO1: Define the model of object oriented programming, exceptions, Object Construction, Static Fields, Multiple Catch Blocks, Methods, Thread Priority and multi threading. CO2: Explain the concepts such as Streams, File I/O, Pipes, Swings, AWT Class Hierarchy, Containers and Adding Components. CO3: Describe the Remote Method Invocation, Generating Stub Classes, Dynamic Object Activation, Applets, Generating Class File, Event Handling, Document Base and Code Base. CO4: Explain the features of JavaMail API, Sending Emails, Email with HTML Content, List of SMTP, POP3, IMAP Servers, XML-RPC versus Java Data Types and Java XML-RPC using Java program. CO5: Summarize the concept of Java beans, The Bean Writing, Naming patterns for Bean Properties, XML-RPC Messages, Bytecode Verification, Security Managers and Events using Java program
	Core III- Data Mining and Warehousing	21MS03	CO1: Describe the process, applications and techniques of data mining and basics of WEKA and R along with data preprocessing. CO2: Illustrate about classification, its various techniques and the application of classification algorithm in WEKA and R. CO3: Explain the various clustering algorithms and the implementation of algorithms in WEKA and R. CO4: Describe the types of association mining algorithms and its implementation in WEKA and R. CO5: Discuss about data warehousing, data mart, different warehouse schemas and Online analytical processing.
	Core IV- Object Oriented Analysis and Design with UML	21MS04	CO1: Describe the evolution, foundations, elements and application of the object model. CO2: Explain the nature of objects, classes, relationships among objects, key abstractions and mechanisms. CO3: Illustrate the unified modeling language, conceptual, logical and physical models along with package, class, component, activity, use case, deployment and sequence diagrams. CO4: Describe the software development lifecycle, activities, products and levels of abstraction. CO5: Enumerate the role of management, staff, quality assurance and metrics, documentation and apply the knowledge in control system.
	Core Practical I- Advanced Java Programming	21MSP1	Co1: Write a Java program to implement the structure and model of the Java programming language. CO2: Design Java programs to add class into package, handling file operations, AWT controls and frames. CO3: Create an Online application, login forms, product listing and display the selected items from list using Java

	Elective I- Enterprise Resource Planning / Parallel Processing	21MSE1/ 21MSE2	CO1: Define the concepts, characteristics, modules, evolution of ERP system and its implementation. CO2: Explain about supply chain management, business intelligence, cloud ERP, its types and forecast. CO3: Describe ERP market, vendors, features, packages and various methodology and implementation of business process reengineering. CO4: Illustrate the plan, requirements, implementation, design and lifecycle of ERP. CO5: Explain the risk and failure factors, maintenance and management of ERP implementation.
			CO1: Explain the basic construction and use of parallel computers and distributed systems. CO2: Interpret the content and the use of terminology to measure the performance of parallel algorithms and parallel computers. CO3: Describe the concepts of parallel computing architectures with shared memory and message passing architectures. CO4: Examine different parallel computing paradigms including stream processing architecture and parallel computing programming basics. CO5: Define the basic parallel programming principles in shared or distributes memory environment using OpenMP and MPI.
II	Core V-Research Methodologies	21MS05	CO1: Define the objectives of research process, characteristics and types of a research with its design, planning and reviews. CO2: Express the basic knowledge on formulating research problems and construct hypothesis techniques. CO3: Interpret the research design and selecting a methods of data collection. CO4: Examine the basic awareness of creating a sample, writing a research proposal and ethical issues. CO5: Identify the overall processing and displaying the data in a research study from the methodology and practice evaluation.
	Core VI- Data Science with Python	21MS06	CO1: Describe about bigdata ecosystem, the uses and benefits of datascience with its process steps. CO2: Explain the concepts of supervised learning and processing frameworks. CO3: Illustrate the concepts of machine learning with Python for Data Analysis Process. CO4: Getting and processing data by online and internal data sources and use visualization tools asmatplotlib. CO5: Interpret Classification, Clustering and Linear Regression techniques using Pandas, Numpy, Scipy.
	Core VII- Internet of Things	21MS07	Co1: Explain about various protocols for IoT applications in real time scenario. CO2: Describe the knowledge of service discovery architecture and web of things in cloud platform.

			CO3: Explore security issues and authorization mechanisms for IoT services in effective web of things platform. CO4: Examine the data analytics and cloud offerings in the context of IoT. CO5: Enumerate the platforms for IoT applications with next generation clouds and smart use cases of IoT.
	Core VIII- Design and Analysis of Algorithms	21MS08	CO1: Define algorithms and estimate their best-case, worst-case and average-case behaviour in terms of time and space and execute the same through programming. CO2: Explain the different searching and sorting algorithms. CO3: Examine the tree traversals and their related properties. CO4: Describe the algorithmic design paradigms and methods of analysis using Dynamic programming and Greedy techniques. Co5: Illustrate the String matching, Finger Print Techniques, Graph and Geometric algorithms.
	Core Practical II- Advanced Python Programming	21MSP2	CO1: Aquire the knowledge of manipulating arrays using Numpy concept. Co2: Implement the concept of data visualization using Pandas, Matplotlib and Scipy CO3: Interpret the concepts of classification, linear regression and decision tree for data plots.
	Core Practical III- R Programming	21MSP3	CO1: Construct and execute basic programs in R using elementary programming techniques CO2: Interpret techniques related to Data mining for the given application. CO3: Write program to visualise data and results of statistical calculations
	Elective II- Embedded Systems / Network Security and Cryptography	21MSE3/ 21MSE4	CO1: Describe the differences between the general computing system and the embedded system and recognize its classification. CO2: Discuss the general architecture, network devices, communication protocols and functions of the embedded systems CO3: Describe the analog and digital components and also the Embedded firmware design and development. CO4: Design real time embedded system using the concepts of RTOS. CO5: Explore the Embedded system development environment, product development life cycle and trends in the Embedded industry.
			CO1: Describe the concepts and features of classical encryption algorithm and its transposition techniques with the principles of block cipher design. CO2: Explain about the pseudo random number and advanced encryption standard along with block cipher operation. CO3: Discuss the principles of public-key cryptosystems - The RSA Algorithm and elliptic curve arithmetic-elliptic curve cryptography-PRNG based on an asymmetric cipher

			CO4: Describe the requirements for message authentication codes and public key infrastructure with elliptic curve digital signature algorithm-key management and distribution CO5: Examine the remote user-authentication using symmetric encryption remote user along with its authentication principles and transport level security.
	Advanced Learners Course I-Nano Computing / Online Course	21MGCA	CO1: Explain the fundamentalconcepts of nanocomputing CO2: Impart the techniques for defect and faulttolerancesystems CO3: Describereliable manufacturing and tolerate variations in behaviour by performing self - checking computations CO4: Examine the quantum computing operations and dot cellular with QCA automata. CO5: Summarize about the background concepts and challenges of molecular computing with the current use and roles of optics.

M.Sc Computer Science

Semester III

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Core IX - Wireless Communication	**Course Code:17MS09**
Semester: III	**No. of Credits: 4**
No. of hours :75	**C:T:S - 65:5:5**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

Syllabus:

Unit I: Transmission Fundamentals:	**(12 hrs)**
Introduction **- Transmission Fundamentals:** Signals for Conveying Information - Analog and Digital Data Transmission - Channel Capacity- Transmission Media - Multiplexing. **Communication Networks:** LANs, MANs and WANs - Switching Techniques - Circuit Switching - Packet Switching - Asynchronous Transfer mode. [Book 1: Chapters: 2,3]	

Unit II: Cellular Wireless Networks:	**(14 hrs)**
First Generation Analog - Second Generation TDMA - Second Generation CDMA - Third Generation Systems. Antennas & Wave Propagation: Antennas - Propagation modes. **Modulation Techniques:** Digital Data, Analog Signals - Analog Data, Analog Signals - Analog data, Digital Signals - Spread Spectrum Modulation. [Book 1: Chapters: 5,6,7]	

***Unit III: Wireless Link Improvement Techniques:**	**(13 hrs)**
Error Detection - Block Error Correction codes - Automatic Repeat Request. **Multiple Access in Wireless System:** Multiple Access Scheme - Frequency Division Multiple Access - Time Division Multiple Access - Code Division Multiple Access - Space Division Multiple Access - Packet Radio Access - Multiple Access with Collision Avoidance. Satellite Systems [Book 1: Chapters: 8,9] [Book 2: Chapter: 5]	

Unit IV: Wireless LAN Technology:	**(14 hrs)**
Overview - Infrared LANs - Spread Spectrum LANs - Narrowband Microwave LANs. **Wireless System Operations & Standards:** Wireless Local Loop. Mobile IP and Wireless Application Protocol. [Book 1: Chapters: 11,12,13]	

Unit V: Wireless LAN:	**(12 hrs)**

Infrared Vs Radio Transmission - Infrastructure and ad-hoc network - **IEEE 802.11:** System Architecture - Protocol Architecture - Physical layer - Medium access Control layer - MAC Management - HiperLAN2 - Bluetooth. [Book 2: Chapter: 7]

***Starred unit is a self study unit.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-IV	Wireless communications and networks	William Stallings	Pearson Education, Second Edition, Eighth Impression, 2012
V	Mobile communications and networks	Jochen schiller	Pearson Education, Second Edition, Twelfth Impression, 2013

Book for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Wireless Communications: Principles and Practice	Theodore S.Rappaport	Prentice Hall, 2nd Edition, 2015

E-Resources : (Web resources & E-books)

1. http://ee.sharif.edu/~pr.wireless.comm/references/Goldsmith.pdf
2. https://wsl.stanford.edu/~andrea/Wireless/Book.pdf

M.Sc Computer Science
Semester III

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Core X - Digital Image Processing	**Course Code:17MS10**
Semester: III	**No. of Credits: 4**
No. of hours : 75	**C:T:S - 65:5:5**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

Syllabus:

Unit I: Digital Image Fundamentals: **(13 hrs)**
Introduction: What is Digital Image Processing? - Fundamental Steps in Digital Image Processing - Components of an Image Processing System. **Digital Image Fundamentals:** Elements of Visual Perception - Light and Electromagnetic Spectrum - Image Sensing and Acquisition - Image Sampling and Quantization - Some basic

relationships between Pixels - An Introduction to the Mathematical Tools used in Digital Image Processing.
[Chapters: 1,2]

Unit II: Intensity Transformations and Spatial Filtering: (13 hrs)

Background - Some Basic Intensity Transformation Functions - Histogram Equalization - Smoothing Spatial Filters - Sharpening Spatial Filters.
Filtering in the Frequency Domain: Preliminary Concepts - Sampling and the Fourier Transform of Sampled functions - Image Smoothing Using Frequency Domain Filters - Image Sharpening Using Frequency Domain Filters.
[Chapters: 3,4]

Unit III: Image Restoration and Reconstruction: (13 hrs)

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 - Inverse Filtering - Minimum Mean Square Error (Wiener) Filtering - Constrained Least Squares Filtering - Geometric Mean Filter.
Color Image Processing: Color Fundamentals - Color Models - Smoothing and Sharpening.

[Chapters: 5,6]

Unit IV: Image Compression: (13 hrs)

Fundamentals - Coding redundancy - Spatial and Temporal Redundancy - Image Compression Models - Some Basic Compression Methods - Huffman Coding - Arithmetic coding - LZW Coding - Run Length Coding.
Morphological Image Processing: Preliminaries - Erosion and Dilation - Some Basic Morphological Algorithms.
[Chapters: 8,9]

***Unit V: Image Segmentation: (13 hrs)**

Fundamentals - Point, Line and Edge Detection - Background - Detection of Isolated Points - Line Detection - Edge Models - Thresholding - Foundation - Basic Global Thresholding - Multiple Thresholds - Variable Thresholding - Multivariable Thresholding - Segmentation using Morphological Watersheds - Dam Construction - Watershed Segmentation Algorithm.
Representation and Description: Representation - Boundary Following - Chain Codes - Signatures - Boundary Descriptors - Regional Descriptors.
[Chapters: 10,11]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Digital Image Processing	Rafael C.Gonzalea, Richard E.Woods	Pearson India Education First Impression, Third Edition, 2016

Books for Reference:

S.No	Name of the Book	Authors	Publisherswith Edition
1.	Digital Image Processing and Analysis	B. Chanda, D. DuttaMajumder	PHI, Second Edition, 2013
2.	Digital Image Processing Using MATLAB	Rafael C Gonzale, Richard E Woods,StevenL.Eddins	McGraw Hill Education, Eighth Reprint, Second Edition, 2013

E-Resources : (Web resources & E-books)

1. https://www.cis.rit.edu/class/simg361/Notes_11222010.pdf
2. http://een.iust.ac.ir/profs/Beheshti/Digital%20Image%20Processing/Addison%20Wesley%20-%20Digital%20Image%20Processing,%203rd%20Edition.pdf

M.Sc Computer Science
Semester III

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Core XI - Android Programming	Course Code:17MS11
Semester: III	No. of Credits: 4
No. of hours : 60	C:T:S : A- 52:4:3:1
CIA Max. Marks: 25	ESE Max. Marks: 75

Syllabus:

Unit I: Android Application: (10 hrs)
Getting Started with Your First Android Application: Developing Spectacular Android Applications: Why Develop for Android?- Android Development Basics- Hardware Tools-Software Tools- Pepping Your Development Headquaters.**Building and Publishing Your First Application: Your First Android Project:** Starting a New Project in Android Project-Setting up an Emulator-Running the hello Android App- Understanding Project Structure. [Chapters: 1,2,3]

Unit II:Building and Publishing Application: (10 hrs)

Creating the User Interface: Creating the silent mode Toggle Application- Laying Out the Application - Adding an image to your Application- Creating a Launcher Icon for the Application - Coding Your Application: Understanding Activities and the Activity Lifecycle-Creating Your First Activity-Working with the Android Framework Classes- Installing Your Application.**Understanding Android Resources:** Understanding Resources- Working with Resources -Different Strokes for Different Folks: Using Resource.
[Chapters: 4,5,6]

Unit III: Turning Application into an APP Widget: (12 hrs)

Working with App Widgets in Android-Working with Intents and Pending Intents-Creating the App Widget-Placing your Widget on the Home Screen-Publishing Your App to the Google Play Store: Creating a Distributable File-Creating a Google Play Developer Profile-Getting Screen Shots for Your Application- Uploading Your Application to the Google Play Store-Watching the Number of Installs Soar- Creating a Feature. **Rich Application: Designing the tasks Application:** Reviewing the basic Requirements. **Creating the Application's Screens-Handling User Input:** Creating the User Input Interface-Getting Choosy with Dates and Times-Creating an alert Dialog-Validating Input.
[Chapters: 7,8,9,12]

Unit IV: Creating a Feature -Rich Application: (10 hrs)

Getting Persistent with Data Storage: Finding Places to Put Data- Creating Your Application's SQLite Database- Using Content Provider URIs- Dealing With CRUD -Implementing the Save Button- Implementing the List view- Reading Data into the Edit Page. **Android is more than Phones:** Developing for Tablets -Considering the Differences between Phones and Tablets-Tweaking the tasks App for Tablets- Configuring a tablet Emulator- Creating an Android Manifest For phones- Creating an Android Manifest For Tablets- Building the tablet App.
[Chapters: 13,16]

***Unit V: Wearing the tasks App: (10 hrs)**

Preparing Your Development Environment-Creating a New Wear App- Publishing the Data from Your phone-Running the App without Android Studio- Builiding TV Apps- Moving Beyond Google.**The Parts of Tens:** Ten Free Sample Applications and SDKs-Ten Tools to Simplify Your Development Life.
[Chapters: 18,19,20,21,22]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Author	Publishers with Edition
I-V	Android App Development for Dummies	Michael Burton	A Wiley Brand, third Edition, Reprint 2017

Book for Reference:

S.No	Name of the Book	Author	Publishers with Edition
1.	Beginning Android ™ 4 Application Development	Wei - Meng Lee	Wiley India Pvt. Ltd, Kindle Edition 2012

E-Resources : (Web resources & E-books)

1. http://www.kmvportal.co.in/Course/MAD/Android%20Book.pdf
2. https://x.coe.phuket.psu.ac.th/warodom/242-320/ebook/9781785883262-ANDROID_PROGRAMMING_FOR_BEGINNERS.pdf

M.Sc Computer Science
Semester III

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Core XII - Big Data Analytics	Course Code:17MS12
Semester: III	No. of Credits: 4
No. of hours : 75	C:T:S :A - 65:4:4:2
CIA Max. Marks: 25	ESE Max. Marks: 75

Syllabus:

Unit I: Getting an Overview of Big Data: (13 hrs)
What is Big Data? - History of Data Management - Evolution of Big Data - Structuring Big Data - Elements of Big Data - Big Data Analytics - Careers in Big Data - Future of Big Data. **Exploring the Use of Big Data in Business Context:** Use of Big Data in Social Networking - Use of Big Data in Preventing Fraudulent Activities - Use of Big Data in Detecting Fraudulent Activities in Insurance Sector - Use of Big Data in Retail Industry. [Chapters: 1,2]

Unit II: Storing Data in Databases and Data Warehouses: (13 hrs)
RDBMS and Big Data - Non-Relational Database - Polyglot Persistence - Integrating Big Data with Traditional Data Warehouses - Big Data Analysis and Data Warehouse - Changing Deployment Models in Big Data Era. **Understanding Analytics and Big Data:** Comparing Reporting and Analysis - Types of Analytics - Points to Consider during Analysis - Developing an Analytic Team - Understanding Text Analytics. [Chapters: 7,18]

Unit III: Big Data Technology Foundations: (13 hrs)

Exploring the Big Data Stack - Virtualization and Big Data - Virtualization Approaches. **Introducing Technologies for Handling Big Data:** Distributed and Parallel Computing for Big Data - Introducing Hadoop - Cloud Computing and Big Data - In-Memory Computing Technology for Big Data.
[Chapters: 6,3]

***Unit IV: Hadoop Ecosystem: (13 hrs)**

Hadoop Ecosystem - Hadoop Distributed File System - Map Reduce - Hadoop YARN - Introducing HBase - Combining HBase and HDFS - Hive - Pig and Pig Latin - Sqoop - ZooKeeper - Flume - Oozie. **UnderstandingMapReduce Fundamentals and HBase:** The Map Reduce Framework - Techniques to Optimize Map Reduce Jobs - Uses of Map Reduce - Role of HBase in Big Data Processing.
[Chapters: 4,5]

Unit V: NoSQL Data Management: (13 hrs)

Introduction to NoSQL - Types of NoSQL Data Models - Schema-Less Databases - Materialized Views - Distribution Models - Sharding. **Introduction to Mahout:** What is Mahout? - Machine Learning - Collaborative Filtering (Recommendation) - Clustering - Classification - Mahout Algorithms - Environment for Mahout.
[Chapters: 15, 17]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	BIG DATA, Black Book	DT Editorial Services	Dreamtech Press, 2016.

Book for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Big Data for Dummies	Judith Hurwitz, Alan Nugent, Fern Halper and Marcia Kaufman	Wiley India, New Delhi 2013

E-Resources : (Web resources & E-books)

1. ftp://public.dhe.ibm.com/software/pdf/at/SWP10/Big_Data_Analytics.pdf
2. https://www.fujitsu.com/rs/Images/WhiteBookofBigData.pdf

M.Sc Computer Science
Semester III

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Core Practical IV - Digital Image Processing	Course Code:17MSP4
Semester: III	No. of Credits: 4

No. of hours : 45	**T:P - 7:38**
CIA Max. Marks: 40	**ESE Max. Marks: 60**

Syllabus:

List of Programs:	**(38 hrs)**

1. Write a program for Histogram Display and Equalization.
2. Create a Program for Contrast Stretching.
3. Write a Program to Sharpen an image.
4. Create a Program to process an Image Enhancement mechanism.
5. Write a Program for Color Processing.
6. Write a Program for Compressing an Image.
7. Perform a program using Morphological Image Processing.
8. Write a Program for Image Segmentation.
9. Write a Program for Edge Detection algorithm.
10. Write a Program to classifying the various object of an image.

M.Sc Computer Science
Semester III

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Core Practical V - Android Programming	**Course Code:17MSP5**
Semester: III	**No. of Credits: 4**
No. of hours : 30	**T:P - 3:27**
CIA Max. Marks: 40	**ESE Max. Marks: 60**

Syllabus:

List of Programs:	**(27 hrs)**

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application using database.
5. Create an application that implements Multi-threading.
6. Develop a native application that uses GPS location information.
7. Implement an application that writes data to the SD card.
8. Implement an application that creates an alert upon receiving a message.
9. Design a mobile application that creates alarm clock.
10. Develop a native calculator application.

M.Sc Computer Science
Semester III

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Elective III - Soft Computing	**Course Code:17MSE5**
Semester: III	**No. of Credits: 4**
No. of hours :90	**C:T:S :A-75:10:4:1**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

Syllabus:

Unit I: Fundamentals of Artificial Neural Network:	**(15 hrs)**
Introduction: Introduction to Soft Computing - Evolutionary Computing - Hard Computing Vs Soft Computing - Soft Computing Methods - Recent Trends in Soft Computing. **Fundamentals of Artificial Neural Network:** Introduction - Model of Biological Neuron - Mathematical Model of Neuron - ANN Architecture - Learning Rules - Learning Paradigms - Perceptron Network - Adaline and Madaline Networks - Applications of Neural Network. **Feedforward Neural Network:** Introduction - Back Propagation Network - Parameter Selection in BPN - Local Minima and Global Minima - Merits and Demerits of Back Propagation - Variants of Back Propagation - Applications of BPN - Radial Basis Function-Applications of RBF. **Associative Memory:** Introduction - Autoassociative Memory - Hetero-associative Memory - Bidirectional Associative Network - Applications of Associative Memory. [Chapters: 1,2,3,4]	

Unit II: Unsupervised Learning:	**(15 hrs)**
Introduction - Winner-Takes-All Network - Learning Vector Quantization - Self-Organization Map - Adaptive Resonance Theory - Neocognitron - Applications of Unsupervised Learning.**Associate Models:** Hopfield Network - Boltzmann Network - Simulated Annealing - Applications of Networks. **Classical Sets and Fuzzy Sets:Fuzzy Sets:** History and Origin - **Fuzzy Sets:** Basic Concepts - Paradigm Shift - Representations of Fuzzy Sets - Alpha-cuts - Basic Operations on Fuzzy Sets - Fuzzy Complements, Intersections and Unions - Extension Principle for Fuzzy Sets. **Crisp Relations and Fuzzy Relations:** Fuzzy Relations - Binary Fuzzy Relations. [Chapters: 5,6,7,8]	

Unit III: Classical Logic and Fuzzy Logic:	**(15 hrs)**
Logic - Interval Analysis - Fuzzy Numbers - **Fuzzy Logic.Fuzzy Rule-Based Systems:** Linguistic Variables and Linguistic Hedges - Rule-Based Systems - Conventional Programs Versus Rule-Based Systems - Fuzzy Propositions - Fuzzification and Defuzzification.**Fuzzy Decision Making:** Introduction - Individual Fuzzy Decision Making - Multiperson Decision Making - Multicriteria Decision Making - Multistage Decision Making. [Chapters: 9,10,11]	

Unit IV: Particle Swarm Optimization:	**(15 hrs)**

Introduction - Implementation of PSO - Variants of PSO - Hybrid Model of PSO - Applications. **Genetic Algorithms:** History of Evolutionary Computing - Crossover and Mutation Properties - Genetic Algorithm Cycle - Fitness Function - Applications of Genetic Algorithm.**Rough Sets:** Fundamentals of Rough Set Theory - Rough Approximations - Properties of Approximations - Measures of Accuracy - Topological Characterization of Imprecision - Rough Membership Function - Attribute Reduction - Approximation of Classification - Dependency of Knowledge.
[Chapters: 12,13,14]

***Unit V: (15 hrs)**

Rough Sets, Rule Induction and Discernibility Matrix: Knowledge Representation - Knowledge Representation Systems - Decision Tables - Rule Induction - Discernibility Matrix. **Integration of Soft Computing Techniques:** Introduction - Fuzzy Neural Networks - Fuzzy Rough Sets - Rough Fuzzy Sets - Intuitionistic Fuzzy Rough Sets - Rough Intuitionistic Fuzzy Sets - Neuro Fuzzy Systems - Fuzzy Genetic Algorithms. **Applications of Soft Computing Techniques:** Pattern Recognition - Image Processing - Application of Soft Computing in Real Estate - Soft Computing in Mobile Ad hoc Network - Soft Computing in Information Retrieval and Semantic Web - Soft Computing in Software Engineering.
[Chapters: 15,16,17]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Soft Computing Advances and Applications	B.K.Tripathy and J.Anuradha	Cengage Learning India Pvt.Ltd, 2015

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Principles of Soft Computing	S.N.Sivanandam and S.N.Deepa	Wiley India (P) Ltd, Reprint 2010
2	Introduction to Soft Computing Neuro-Fuzzy and Genetic Algorithms	Samir Roy and UditChakraborty	Dorlink Kindersley (India) Pvt.Ltd, 2013

E-Resources : (Web resources & E-books)

1. http://lib.mdp.ac.id/ebook/Karya%20Umum/Soft_Computing_for_Knowledge_Discovery.pdf
2. http://users.du.se/~jwe/fuzzy/NFL/F9.PDF

M.Sc Computer Science
Semester III
(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Elective III - Data Compression	**Course Code:17MSE6**
Semester: III	**No. of Credits: 4**
No. of hours : 90	**C:T:S :A - 75:10:4:1**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

Syllabus:

Unit I: Mathematical Preliminaries for Lossless Compression: (**15 hrs)**
Introduction: Compression Techniques - Modeling and Coding. **Mathematical Preliminaries for Lossless Compression:** Overview - A Brief Introduction to Information Theory - Models - Coding. **Huffman Coding:** Overview - The Huffman Coding Algorithm - Nonbinary Huffman Codes - Adaptive Huffman Coding - Applications of Huffman Coding. [Chapters: 1,2,3]

Unit II: Arithmetic Coding: **(15 hrs)**
Overview - Introduction - Coding a Sequence - Generating a Binary Code - Comparison of Huffman and Arithmetic Coding - Adaptive Arithmetic Coding - Applications.**Context based Compression:** Overview - Introduction - Prediction with Partial Match - Dynamic Markov Compression. **Lossless Image Compression:** Overview - Introduction - CALIC - JPEGG-LS - Multiresolution Approaches - Facsimile Encoding. [Chapters: 4,6,7]

Unit III:Scalar Quantization: **(15 hrs)**
Overview - Introduction - The Quantization Problem - Uniform Quantifier - Adaptive Quantization - Nonuniform Quantization - Entropy-Coded Quantization. **Vector Quantization:** Overview - Introduction - Advantages of Vector Quantization over Scalar Quantization - The Linde-Buzo-Gray Algorithm - Tree structured vector Quantizers - Structured Vector Quantizers. [Chapters: 9,10]

***Unit IV: Transform Coding:** **(15 hrs)**
Overview - Introduction - The Transform - Transform of Interest - Applications to Image Compression-JPEG - Applications to Audio Compression-the MDCT. **Subband Coding:** Filters - The Basic Subband Coding Algorithm - Design of Filter Banks. **Wavelet Based Compression:** Wavelets - Multiresolution Analysis and the Scaling Function - Implementation Using Filters - Image Compression. [Chapters: 13,14,15]

Unit V: Audio Coding:	**(15 hrs)**
Introduction - MPEG Audio Coding - MPEG Advanced Audio Coding. **Analysis/Synthesis and Analysis by Synthesis Schemes:** Speech Compression - Wideband Speech Compression. **Video Compression:** Motion Compensation - Video Signal Representation - ITU-T Recommendation H.261 - Model Based Coding - Asymmetric Applications - The MPEG1 Video Standard - The MPEG2 Video Standard-H.262 - ATM Networks. [Chapters: 16,17,18]	

***Starred unit is a self study unit.**

Book for study:

Unit	**Name of the Book**	**Author**	**Publishers with Edition**
I-V	Introduction to Data Compression	Khalid Sayood	Elsevier and Morgan Kaufmann Publishers, Third Edition, Reprinted 2012

Book for Reference:

S.No	**Name of the Book**	**Author**	**Publishers with Edition**
1	Data Compression: The Complete Reference	David Salomon	Springer Publication, Fourth Edition, Second Indian Reprint 2014

E-Resources : (Web resources & E-books)

1. http://rahilshaikh.weebly.com/uploads/1/1/6/3/11635894/data_compression.pdf
2. http://index-of.co.uk/Information Theory/The% 20Data%20Compression%20 Book% 202nd% 20Ed%20-% 20Mark%20Nelson.pdf

M.Sc Computer Science
Semester IV

(For the students admitted during the academic year 2017 - 2018 and onwards)

Course: Advanced Learners Course II - Wireless Sensor Networks	**Course Code:17MSA2**
Semester: IV	**No. of Credits: 4**
No. of hours : --	**C:T:S--**
CIA Max. Marks: --	**ESE Max. Marks: 100**

Syllabus:

Unit I:Canonical Problem:
Introduction: Unique Constraints and Challenges - Advantages of Sensor Networks - Sensor Network Applications - Collaborative Processing - Key Definitions of Sensor Networks. **Canonical Problem:** Localization and Tracking: A Tracking Scenario - Problem Formulation -

Distributed Representation and Inference of States - Tracking Multiple Objects - Sensor Models - Performance Comparison and Metrics.
[Chapters: 1,2]

Unit II: Networking Sensors:

Key Assumptions - Medium Access Control: The S-MAC Protocol - IEEE 802.15.4 Standard and ZigBee - General Issues - Geographic, Energy-Aware Routing: Unicast Geographic Routing - Routing on a Curve - Energy-Minimizing Broadcast - Energy-Aware Routing to a Region - Attribute-Based Routing: Directed Diffusion - Rumor Routing - Geographic Hash Tables.
[Chapter: 3]

Unit III: Infrastructure Establishment:

Topology Control - Clustering - Time Synchronization: Clocks and Communication Delays - Interval Methods - Reference Broadcasts - Localization and Localization Services: Ranging Techniques - Range-Based Localization Algorithms - Other Localization Algorithms - Location Services.
[Chapter: 4]

Unit IV: Sensor Tasking and Control:

Task-Driven Sensing - Roles of Sensor Nodes and Utilities - Information-Based Sensor Tasking: Sensor Selection - IDSQ: Information-driven sensor querying - Cluster leader based protocol - Sensor tasking in tracking relations.
[Chapter: 5]

Unit V: Sensor Network Platforms and Tools:

Sensor Node Hardware: Berkeley motes - Sensor Network Programming Challenges - Node-Level Software Platforms: Operating system: TinyOS - Imperative language: nesC - Dataflow-style language: TinyGALS - Node-Level Simulators: The ns-2 simulator and its sensor network extensions - The Simulator TOSSIM.
[Chapter: 7]

[It is a Self Study Portion]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Wireless Sensor Networks- An Information Processing Approach	Feng Zhao and Leonidas J. Guibas	Morgan Kaufmann Publishers, Elsevier, 2015

Book for Reference:

S.No	Name of the Book	Author	Publishers with Edition
1	Wireless Sensor Networks: Principles, Design and Applications	Shuang-Hua Yang	Signals and Communication Technology, Springer-Verlag London 2014

E-Resources : (Web resources & E-books)

1. http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02
http://doktora.kirbas.com/Kitaplar/Wireless%20Sensor%20Networks%20(Akyildiz).pdf