Solapur University, Solapur

M.Sc. (Computer Science)
Part - II
Syllabus (Semester – III and IV)
(Effective from June 2017)

(Choice Based Credit System)

M.Sc. (Computer Science) Part – II Semester-III

Paper Code	Title of the Paper	Hrs / week	Distribution of Marks for Examination			Credits
			Internal	University	Total	
Hard Core – Theory						
HCT 3.1	Digital Image Processing	04	30	70	100	04
HCT 3.2	Mobile Computing	04	30	70	100	04
Soft Core – Theory (Any One)						
SCT 3.1	Artificial Intelligence	04	30	70	100	04
SCT 3.2	Operations Research	04				
SCT 3.3	Finite Automata	04				
Open Elective (Any One)						
OET 3.1	Procedural Programming Language	04	30	70	100	04
OET 3.2	Internet of Things	04				
Hard core Lab / Project						
HCP 3.1	Practical based on HCT 3.1	04	15	35	50	02
HCP 3.2	Practical based on HCT 3.2	04	15	35	50	02
HCP 3.2	Project – III	02	15	35	50	02
	Tutorial	02	-	-	25	01
Open Elective (Any One)						
OEP 3.1	Practical based on OET 3.1	02	15	35	50	02
OEP 3.2	Practical based on OET 3.2	02				
Total		**-**	**180**	**420**	**625**	**25**

M.Sc. (Computer Science) Part–II Semester-IV

Paper Code	Title of the Paper	Hrs / week	Distribution of Marks for Examination			Credits
			Internal	University	Total	
Hard Core – Theory						
HCT 4.1	.NET Technology	04	30	70	100	04
HCT 4.2	Soft Computing	04	30	70	100	04
HCT 4.3	Data Mining and Warehouse	04	30	70	100	04
Soft Core – Theory (Any One)						
SCT 4.1	Distributed Operating System	04	30	70	100	04
SCT 4.2	Network Security	04				
Hard core Lab / Project						
HCP 4.1	Practical based on HCT 4.1	04	15	35	50	02
HCP 4.2	Practical based on HCT 4.2	04	15	35	50	02
HCP 4.3	Practical based on HCT 4.3	04	15	35	50	02
HCP 4.4	Project – IV	02	15	35	50	02
	Tutorial	01	-	-	25	01
Total		**-**	**180**	**420**	**625**	**25**

HCT 3.1: Digital Image Processing

Unit – I
Introduction: Digital image processing, Applications of digital image processing, Fundamental steps in digital image processing, and Components of an image processing system.   [05]
Digital image fundamentals: Image sampling and quantization, some basic relationships between pixels, Linear and nonlinear operation. [05]
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.   [05]

Unit – II
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.   [07]
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.   [08]

Unit – III
Morphological image processing: Preliminaries, Dilation and erosion, Opening and closing, the hit-or-miss transformation, Some basic morphological algorithms.   [07]
Image segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region-based segmentation, Segmentation by morphological watersheds.   [08]

Unit – IV
Representation and description: Representation, Boundary descriptors, Regional descriptors, Use of principal components for description, Relational descriptors.   [07]
Object recognition: Patterns and pattern classes, Recognition based on decision- theoretic methods, Structural methods.   [08]

Reference books:
1. Digital image processing: Gonzalez and Woods PHI
2. Image Processing, Analysis and Machine Vision: Milan Sonka, Vaclav Hlavac, Roger Boyle (Thomson Brooks / Cole Edition).
3. Fundamentals of Digital Image Processing: Anil K. Jain (Prentice Edition Hall of India).

HCT 3.2: Mobile Computing

Unit – I
Wireless Transmission: Frequencies for radio transmission, Regulations. Signals, Antennas, Signal propagation-Path loss of radio signals, Additional signal propagation effects, Multipath propagation. Multiplexing-Space, Frequency, Time, Code division multiplexing. Modulation- Amplitude, Frequency, Phase Shift Keying, Advanced frequency and phase shift keying, spread spectrum- DSSS, FHSS. Cellular System. [08]
Medium Access Control: CSMA/CD, Hidden and exposed terminals, Near and Far terminals, SDMA, FDMA, TDMA- Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA, Reservation TDMA, MACA, Polling, CDMA. [07]

Unit – II
Telecommunication System: GSM – Mobile services, Architecture of a GSM System, Protocol Architecture, Radio Interface, Localization and calling: MTC, MOC, Handover, Security-Authentication, Encryption. [06]
Wireless LAN: Introduction, Infrared v/s radio transmissions, architecture of an infrastructure based IEEE 802.11 and Ad-hoc networks, Protocol architecture, Physical Layer, Format of an IEEE 802.11 frame using DSS. MAC management- synchronization, power management, roaming. Bluetooth Architecture, simple Bluetooth Pico-net. [09]

Unit- III
Mobile Network Layer: Entities & terminology in Mobile IP, IP packet delivery agent discovery, Registration. Dynamic Host Configuration Protocol (DHCP) [07]
Mobile Transport Layer: Traditional TCP- Congestion control, Slow start, fast retransmit/Fast recovery, implications on mobility. Classical TCP- Indirect TCP, Snooping TCP, Mobile TCP. [08]

Unit – IV
Introduction to ANDROID: Android System Architecture, Creating and Running Android Applications, Types of Android Applications, Building blocks, Application Manifest, Application Life Cycle, Application Priority and Process States, Creating and Using Resources, The Activity Life Cycle, Android GUI architecture, Views, Layouts, Creating simple android GUI based applications with event handling such as Sudoku game and To-do list. [08]

Using Bluetooth and Managing Networks in ANDROID: Using Bluetooth -Introducing the Bluetooth Service, Controlling the Local Bluetooth Device, Discovering and Bonding with Bluetooth Devices, Managing Bluetooth Connections, Communication with Bluetooth.
Managing Networks: Monitoring and Managing Your Internet Connectivity, Managing Active Connections, Managing Your Wi-Fi. [07]

Reference Books:
1. Mobile communication (2nd Edition): John Schiller (Pearson Edition)
2. Wireless LAN: Peter T Davis, Craig R McGuffin (MGH International)
3. Professional Android Development: Reto Meier (Wrox Publication)
4. Hello Android: Ed Burnette (Pragmatic Bookshelf)
5. Android Application Development: Rick Rogers, John Lombardo (O'Reilly Publication).

SCT 3.1: Artificial Intelligence

Unit – I
What is Artificial Intelligence: The AI Problems, The underlying Assumption, What is an AI Technique? [04]
Problems, Problem Spaces and Search: Defining the problem, as a state space search, production systems, problem characteristics, production system characteristics, Issues in the design of search programs. [04]
Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction Means-Ends Analysis. [07]

Unit – II
Using Predicate Logic: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural deduction. [10]
Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Forward Versus Backward Reasoning, Matching. [05]

Unit – III
Statistical Reasoning: Probability and Bayes' Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. [05]
Weak Slot-and Filler Structures: Semantic Nets, Frames. [05]
Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts. [05]

Unit – IV
Game Playing: Overview, The Minmax Search Procedure, Adding Alpha-Beta Cutoffs, Additional Refinements, Iterative Deepening. [05]
Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing. [05]
Expert Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition. [05]

Reference Books:
1. Artificial Intelligence: Elaine Rich, Kevin Knight, TMH, 2nd Edition.
2. Artificial Intelligence: Structures and Strategies for Complex Problem solving: George F Luger, 4th Ed., Pearson Education, Asia.
3. Introduction to Artificial Intelligence and Expert Systems: D W Patterson, PHI, 2nd Edition.

SCT 3.2: Operations Research

Unit - I
Introduction of Linear Programming: Various definitions, statements of basic theorems and properties, Advantages, Limitations and Application areas of Linear Programming.   [05]
Linear Programming Problems: The Graphical method – Graphical Solution methods of Linear Programming problem, Phase II of the Simplex Method, Primal and Dual Simplex Method, Big –M method, Transportation Problem and its solution, Assignment Problem and its solutions by Hungarian Method.
[10]
Unit – II
Non-Linear programming: Kuhn-Tucker conditions, Convex functions and convex regions, Convex programming problems, Algorithms for solving convex programming problems.   [15]

Unit – III
PERT and CPM: Basic differences between PERT and CPM, Arrow Networks, time estimates, Earliest expected time, Latest – allowable occurrences time, Forward Pass Computation, Backward Pass Computation, Representation in Tabular Form, Critical Path, Probability of meeting scheduled date of completion, Calculation on CPM network. Various floats for activities, Critical path updating projects. Operation time cost trade off Curve project, Time cost – trade off Curve, Selection of schedule based on Cost.   [15]

Unit – IV
Network Flow Problem: Formulation, Max-Flow Min-Cut theorem, Ford and Fulkerson's algorithm. Exponential behavior of Ford and Fulkerson's algorithm.
[10]
Matroids: Definition, Graphic and Cographic matroids, Matroid intersection problem.   [05]

Reference Books:
1. Linear Programming: G. Hadley, Addison Wesley, 1969.
2. Operations Research an Introduction: H. A. Taha, Macmillan N. Y., 1971.
3. Operations Research: Kanti Swaroop, Gupta and Manmohan, Sultan Chand and Co., 1985.
4. Operations Research Theory and Applications: J. K. Sharma, 2nd Ed. Macmillan India ltd, 2003.
5. Mathematical Models Operations Research: J. K. Sharma, McGraw Hill, 1986.

SCT 3.3: Finite Automata

Unit – I

Introduction to Finite Automata: Introduction to Finite Automata, the central concepts of Automata theory, deterministic finite automata, non-deterministic finite automata, and application, Finite automata with Epsilon-transition. [07]

Regular Expressions and Languages, Properties of Regular Languages.: Regular Expression, Finite Automate and Regular Expressions, Applications of Regular Expressions, Proving languages not to be regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and minimization of automata. [08]

Unit – II

Context-Free Grammars and Languages: Context-free grammars, Parse trees, Applications, Ambiguity in grammars and languages. [07]

Pushdown Automata: Definition of the Pushdown automata, the languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata. [08]

Unit – III

Properties of Context Free Languages: Normal forms for CFGs, The pumping lemma for CFGs, Closure properties of CFLs. [06]

Introduction to Turing Machines: Problems that computers cannot solve, The Turing Machine, Programming techniques for Turing machines, extension to the basic Turing machine, Restricted Turing Machine, Turing Machine and Computers. [09]

Unit – IV

Undecidability: A Language that is not recursively enumerable, AN undecidable problem that is RE, Post's Correspondence problem, other undecidable problems. [15]

References

1. Introduction to Automata Theory, Languages and Computation: J.P. Hopcroft, Rajeev Motwani, J.D. Ullman, II Edition, Pearson Education, 2001.
2. John Martin, Introduction to Languages and Theory of Computation, Tata McGraw Hill, 2003.
3. Daniel I. A., Cohen, Introduction to Computer Theory, 2nd Edition, John Wiley and Sons, Inc, 2000.
4. Peter Linz, An Introduction to Formal Languages and Automata, II Edition, Narosa Publishing House, 1997.

OET 3.1: Procedural Programming Methodology

Unit – I
Algorithm Development: Problem redefinition, Writing step by step procedure, representation in terms of Flow chart/Decision Trees, Tracing, Testing. Sequential flow of Logic, Control structures, Iterative method to reach the solution. [15]

Unit – II
Solutions to the simple problems: Pseudo code generation, variables, constants and their data types, Implementation of sequential, selection and iterative structures. [15]

Unit – III
Coding: Syntax and semantics, documentation and debugging of a program, Device (Files) interfacing.
Solutions to the complex problems: Structured programming, Modular programming, TOP DOWN / BOTTOM UP approach, Recursive algorithms, Examples, Illustrating structured program development methodology and use of block structured algorithmic language to solve specific problem. [15]

Unit – IV
Advanced Data Types and their implementation: Arrays, Records, pointers, Applications in the record keeping of real life system.
Searching and Sorting: various sorts, search algorithms and their complexities. [15]

Emphasis should be given on better programming styles and implementation is expected through C++ compiler.

Reference Books:
1. Programming with C++: D. Ravichandran, MGH.
2. How to solve it by computer: Dromey, HI-85.
3. Fundamentals of Computer Algorithms: Horowiz and Sahani, Galgotia-95.
4. Algorithms + Data structures = Program: N.Wirth, HI.
5. Algorithms and data structures: Wirth, HI

OET 3.2: Internet of Things

Unit – I
Building IoT: Characterization of IoT, Physical design, IoT protocols, Functional blocks, Communication model, Communication APIs, Enabling technologies, Wireless sensor networks, Cloud Computing, Big data analytics, Communication Protocols, Embedded Systems, M2M, Difference between IoT and M2M.   [15]

Unit – II
Architecture for IoT: Domain model specification, Information Model Specification, Service specification, IoT Level specification, Functional view specification, Operational view specification, Device and Component Integration, User centered design, Open source development, End user programming, Tools for IoT.   [15]

Unit – III
IoT to web of things: Platform design methodologies, Servicing through uniform interface, Syndicating things, Web enabling, Constrained devices, Future Web of things.
IoT physical devices and End points: IoT devices, Examples, Raspberry PI interfaces, Arduino interfaces, programming Raspberry Pi with Python, Other IoT devices, Domain specific IoTs.   [18]

Unit – IV
Data analytics for IoT: MapReduce Programming model, Ozie workflow for IoT data analysis, Setting up a Strong, Cluster, REST - based approach, Web Socket - based approach, Case studies.   [12]

Reference Books:
1. Internet of Things - A Hands-on Approach: Arshdeep Bahga, Vijay Madisetti, Arshdeep Bahga and Vijay Madisetti, First Edition, September 2014.
2. Architecting the Internet of things: Dieter Uckelmann, Mark Harrison Florian, Michahelles, Springer-Verlag Berlin Heidelberg, First Edition, April 2011.

HCT 4.1: .NET Technology

Unit – I
Microsoft .NET framework: Structure, the common language runtime, JIT, CTS, Metadata. [05]
C#: Introduction to C#, Programming structure of C#, editing, compiling & executing C# programs, namespace, comments, using aliases for namespace classes, using command line argument, math functions, scope of variables, boxing & unboxing, file operations, indexes, delegates, events, preprocessor, attributes, [10]

Unit – II
Advanced concepts in C#: Creating winform applications, COM interoperability, using COM / COM+, reflection, components in C#, Handling databases using ADO.net. [09]
Introduction to ASP.Net: Introduction, difference between ASP & ASP.Net Application, Web Architecture Model, Introduction to Visual Studio for Web Application. [06]

Unit – III
Application and Page Frameworks: Application Location Options, The ASP.NET Page Life Cycle, The ASP.NET Page Structure Options, ASP.NET Page Directives, ASP.NET Page Events, Dealing with PostBacks, ASP.NET Application Folders, Global.asax [07]
ASP.NET Server Controls and Validation Controls: ASP.Net Server Controls, Understanding Validation, Client-Side versus Server-Side Validation, Turning Off Client-Side Validation. [08]

Unit – IV
Working with Master Pages: Need and basics of Master Pages, Master Page and Content Page, Programmatically Assigning the Master Page, Nesting Master Pages, Master Page Events. [07]
ASP.Net State Management: Application State, Session State, Client & server storing, View state, Cache, Hidden Variable, Session object, Profiles, Overview of HTTP Handler & Modules. [08]

References books:
1. Microsoft Visual C#.NET Step-By-Step Version 2003: Sharp, Jagger, Publisher: Microsoft Press (Published: 3/2003)
2. Programming in C#: E. Balagurusamy, TMH
3. C# a beginners guide: Herbert Schildt, TMH
4. Professional ASP.NET 2.0: Bill Evjen, Scott Hanselman, Farhan Muhammed, Sirnivasa Sivakumar, Devin Rader, Wrox Publication.
5. MS ASP.NET 2.0 Step by Step: George Shepherd, Microsoft Press.

HCT 4.2: Soft Computing

Unit – I
Fundamentals of Neural Networks: Basic concepts, models of artificial neuron, neural network architectures, characteristics, learning methods.
[06]
Backpropagation networks: Architecture, backpropagation learning: input, hidden and output layer computation, error calculation, training of neural network, method of steepest descent, effect of learning rate, backpropagation algorithm. [09]

Unit – II
Crisp Sets: an Overview, Fuzzy Sets: Basic Types, Basic Concepts, Fuzzy Sets Vs Crisp Sets, Additional Properties of alpha cuts, Presentation of fuzzy sets, Extension principle for fuzzy sets. [15]

Unit – III
Operations on Fuzzy Sets: Types of operations, Fuzzy complements, Fuzzy Intersections, Fuzzy Unions, Crisp and Fuzzy Relation, Binary Fuzzy Relations, Binary Relation on single set, Fuzzy Equivalence Relations, Fuzzy Compatibility Relation. [15]

Unit – IV
Basic concepts, working principle, Genetic representations, Encoding: binary, octal, hexadecimal encoding, permutation encoding, value encoding, tree encoding, Fitness function, Reproduction: Roulette-wheel selection, Tournament selection, Rank selection, Mutation operator, Generational Cycle, applications. [15]

Reference books:
1. Neural Networks, Fuzzy Logic and Genetic Algorithms: S. Rajasekaran, G. A. Vijayalakshmi Pai, PHI.
2. Fuzzy Sets and Fuzzy Logic Theory and Application: George J. Klir, Bo Yuan, PHI.
3. Fuzzy Sets Uncertainty and Information: George J. Klir, Tina A. Floger, PHI.
4. Introduction to the Theory of Neural Competition John hertz, Krogh and Richard, Addison Wesley.
5. Introduction to Artificial Neural Network: Jaeck M. Zurada, Jaico Publishing House.
6. Neural Network and Fuzzy System A Dynamic System: Koska, PHI.

HCT 4.3: Data Mining and Warehouse

Unit – I
Introduction: What is Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data cube Technology, From Data Warehousing to Data Mining, Data Mining Functionalities, Data Cleaning, Data Integration and Transformation, Data Reduction.   [07]
Data Mining Primitives, Languages, and System Architectures: Data Mining Primitives, Presentation and Visualization of discovered patterns, A Data Mining Query Language.   [08]

Unit – II
Mining Association Rules in Large Databases Translation: Association Rule Mining Single-Dimensional Boolean, Association Rules from Transactional Databases, Mining Multilevel Association Rules From Transactional Databases.   [15]

Unit – III
Classification and Predication: Issues regarding Classification and Predication, Classification by Decision tree induction, Bayesian Classification, Classification by Back propagation, Classification Based on the concepts from association rule mining, Other classification methods, Prediction.   [15]

Unit – IV
Clustering: What is Cluster Analysis? Types of data in Cluster Analysis, A Categorization of Major Clustering Methods. Partitioning Methods, Hierarchical Methods, Density-Based Methods, Model-Based Clustering Methods: Statistical Approach, Neural Network Approach, Outlier Analysis.   [08]
Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining, Data Mining and Intelligent Query Answering, Trends in Data Mining.   [07]

Reference Books:
1. Data Mining Concepts and Techniques: Jiawei Han and Micheline Kamber, Morgan Kauf Mann Publishers.
2. Modern Data Warehousing, Mining and Visualization: George M. Marakas, Pearson Education, 2003.
3. Building the Data Warehouse: W.H.Inmon, Wiley Dreamtech, Third Edition.

SCT 4.1: Distributed Operating Systems

Unit – I
Overview of Operating System: Concept, need and requirements of operating system, Processor, Memory, Device and File management, Virtual memory, Pipes, Deadlocks and Protection issues, Comparative study of Various types of operating systems. [06]
Introduction to Distributed system: Goal, Hardware Concepts, Software concepts, Design issues. [09]

Unit – II
Communication in distributed system: Layered protocols, client server model, remote procedure call, group communication. [06]
Synchronization in distributed system: Clock synchronization, mutual exclusion, election algorithms, atomic transaction, deadlocks in distributed systems. [09]

Unit – III
Processes and processors in distributed systems: Threads, System models, processor allocation, Scheduling in distributed systems. [15]

Unit – IV
Distributed file system: Distributed file system, Design and Implementation trends in distributed file system. [09]
Case study: Detail and comparative study of MS-windows NT and Novel Netware, Windows programming concepts. [06]

References books:
1. Distributed Operating Systems: A. S. Tanenbaum, Pearson.
2. Distributed Operating System-Concepts and Design: P. K. Sinha.
3. Modern Operating Systems: A. S. Tanenbaum, HI.
4. Operating System: Donovan Madnick.
5. Operating System: Peterson.
6. Operating systems principles: Hansen Per Brinch.
7. Windows NT 4 - Server and Workstation unleashed: Cowart, Techmedia.
8. Inside Windows NT: Helen Custer, Microsoft press.
9. Advanced Windows NT: The Developer's Guide to the WIN32 application Interface: Jeffery Richter.
10. Peter Norton's maximizing Windows NT server 4, Techmedia.
11. Peter Norton's complete guide to Windows NT workstation, Techmedia.
12. Programming windows 3.1: Charleset old, Microsoft Press.
13. Novel Netware Manuals.

SCT 4.2: Network Security

Unit – I
Introduction: Security Concepts, Threats and Risks, Attacks – Passive and Active Security Services, Confidentiality, Authentication, Non-Repudiation, Integrity, Access Control, Availability, Model for Internetwork Security, Internet Standards and RFCs.   [08]
Access Control Mechanisms: Access Matrix, HRU, TAM, ACL and capabilities, Access Control Models, Chinese Wall, Clark-Wilson, Bell-LaPadula, Non-Interference and Role Base Model.   [07]

Unit – II
Cryptography: Secret Key and Public Key Cryptosystems, Symmetric Ciphers, Block Ciphers and Stream Ciphers, DES, IDEA and Key Escrow, RSA and ElGamal, Secure Hash and Key management, Digital Signature and Non-repudiation, cryptanalysis   [15]

Unit – III
Network Security: Objectives and Architectures, Internet Security Protocols, IP encapsulating Security Protocol, Network and Transport Layer Security.   [07]
Network Security Applications: Authentication Mechanisms – Passwords, Cryptographic authentication protocols, Smart Card, Biometrics, Digital Signatures and seals, Kerberos, X.509 LDAP Directory. Web Security - SSL Encryption, TLS, SET, E-mail Security, PGPs / MIME, IP Security.   [08]

Unit – IV
Access and System Security: Intruders, Intrusion Detection and Prevention. Firewalls - Hardware Firewall, Software Firewall, Application Firewall, Packet Filtering, Packet Analysis. Proxy Severs - Firewall setting in Proxy, ACL in Proxy   [15]

Reference Books:
1. Network Security Essentials: William Stallings, Prentice-Hall.
2. Fundamentals of Computer Security Technology: Edward Amoroso, Prentice-Hall.
3. Cryptography and Data Security: Dorothy E. Denning, Addison-Wesley.
4. Computers under Attack: Peter J. Denning, Addison-Wesley.
5. Cryptography - Theory and Practice: Douglas R. Stinson, CRC Press.
6. Building Internet Firewalls: D. Brent Chapman and Elizabeth D. Zwicky, O'Reilly and Associates.

Chairman
Ad hoc BOS in Computer Science