PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Name of the Faculty: Science and Technology

Syllabus: M. Sc. (CS) Part-II

(NEP – 2020)

Name of the Programme: M. Sc. (CS) (Sem.–III and IV)

Level 6.0

(Syllabus to be implemented w.e.f. June 2024)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology NEP Structure of the Syllabus- M.Sc. (Computer Science) - II (Sem.-III and IV) NEP-2020									
Level 6.0									
Subject/ Core Course	**Name and Type of the Paper**		**Hrs./week**			**Total Marks Per**	**UA**	**CA**	**Credits**
	Type	**Name**	**L**	**T**	**P**	**Paper**			
M.Sc.(Computer Science)-II Sem-III									
Discipline Specific Course Theory (DSC)									
Major	DSC5	Digital Image Processing	4	--	--	100	60	40	4
	DSC6	Data Warehousing and Data Mining	4	--	--	100	60	40	4
Discipline Specific Elective Theory (DSE) (Any One)									
Elective	DSE3	Open Source Technologies (PHP, MySql) Artificial Intelligence Cloud Computing	4	--	--	100	60	40	4
Practical									
DSC-P-5	Practical based on DSC5		--	--	4	50	30	20	2
DSC-P-6	Practical based on DSC6		--	--	4	50	30	20	2
DSE-P-3	Practical based on DSE6		--	--	4	50	30	20	2
Field Project / Research Project(RP) / Internship / Apprenticeship / Community Engagement and Services									
Research Project	RP-1	Literature Review	--	--	4	100	60	40	4
Semester-III Total			**12**	**0**	**16**	**550**	**330**	**220**	**22**

M.Sc.(Computer Science)-II Sem-IV									
Discipline Specific Course Theory (DSC)									
Major	DSC7	Machine Learning	4	--	--	100	60	40	4
	DSC8	Network Security	4	--	--	100	60	40	4
Discipline Specific Elective Theory (DSE) (Any One)									
Elective	DSE4	.Net Technology Block Chain Technology Soft Computing	4	--	--	100	60	40	4
Practical									
DSC-P-7	Practical based on DSC7		--	--	4	50	30	20	2
DSE-P-4	Practical based on DSE4		--	--	4	50	30	20	2
Field Project / Research Project(RP) / Internship / Apprenticeship / Community Engagement and Services									
Research Project	RP-2	Dissertation	--	--	4	150	90	60	6
Semester-IV Total			**12**	**0**	**12**	**550**	**330**	**220**	**22**
Grand Total			**24**	**0**	**28**	**1100**	**660**	**440**	**44**

Type: DSC5

M.Sc(CS)-II (Semester III)

Course Title: Digital Image Processing

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: Processing color and grayscale images or other two-dimensional signals has become an important tool for research and investigation in many areas of science and engineering. Digital Image Processing is designed to give students a powerful collection of fundamental and advanced image processing tools on the desktop.

Unit-I	**Introduction**	**15**

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.

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.

Unit-II	**Image enhancement in the frequency domain**	**15**

Introduction to the Fourier transform and the frequency domain, Smoothing frequency-domain filters, Sharpening frequency domain filters, homomorphic filtering.

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.

Unit-III	**Morphological image processing**	**15**

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

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

Unit-IV	**Representation and description**	**15**

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

Object recognition:Patterns and pattern classes, Recognition based on decision- theoretic methods,Structural methods.

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).

Fundamentals of Digital Image Processing: Anil K. Jain (Prentice Edition Hall of India).

Type: DSC6

M.Sc(CS)-II (Semester III)

Course Title: Data Mining and Warehouse

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L): 4**

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: To introduce students to basic applications, concepts, and techniques of data mining. To develop skills for using recent data mining software to solve practical problems in a variety of disciplines. To gain experience doing independent study and research.

Unit-I	**15**

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.

Data Mining Primitives, Languages, and System Architectures:Data Mining Primitives, Presentation and Visualization of discovered patterns, A Data Mining Query Language.

Unit-II	**15**

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.

Unit-III	**15**

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.

Unit-IV	**15**

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.

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.
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.

Type: DSE-3

M.Sc(CS)-II (Semester III)

Course Title: Artificial Intelligence

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L): 4**

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: To develop semantic-based and context-aware systems to acquire, organize process, share and use the knowledge embedded in multimedia content. Research will aim to maximize automation of the complete knowledge lifecycle and achieve semantic interoperability between Web resources and services. The field of Robotics is a multi disciplinary as robots are amazingly complex system comprising mechanical, electrical, electronic H/W and S/W and issues germane to all these.

Unit-I	**15**

The AI Problems, the Underlying Assumption, AI Technique, Problems.

Problem Spaces and Search: Problem definition, state space search, production systems, problem characteristics, production system characteristics, Issues in the design of search programs.

Unit-II	**15**

Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Search techniques, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Forward Versus Backward Reasoning, Matching.

Unit-III	**15**

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

Unit-IV	**15**

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing. Expert Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Reference Books:

1. Artificial Intelligence by Elaine Rich, Kevin Knight, S Nair TMH, 3rd Edition.

2. Artificial Intelligence: A Modern Approach, S. Russel and P. Norvig, 3rd edition, Pearson. 3. Introduction to Artificial Intelligence and Expert Systems by D W Patterson, PHI, 2nd Edition.

Type: DSE-3

M.Sc(CS)-II (Semester III)

Course Title: Cloud Computing

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L): 4**

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. The topic introduces students with various concepts like cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multi-core operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft etc.

Unit-I	**15**

Introduction to Cloud Computing What is a cloud, Definition of Cloud Computing, Characteristics of Cloud Computing, Driving factors towards cloud,Architecture, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models: IaaS, PaaS, SaaS, NaaS, Cloud Clients, Deployment Models: Public Clouds, Community Clouds, Hybrid Cloud, Private Cloud, Issues in Cloud Computing, Applications.

Unit-II	**15**

Infrastructure as a Service(IaaS) IaaS definition, Introduction to virtualization, Different approaches to virtualization, Resource Virtualization- Server, Storage, Network, Hypervisors, Machine Image, Virtual Machine(VM), Data storage in cloud computing(storage as a service), Examples like Amazon EC2-Renting, EC2 Compute Unit, Platform and Storage, pricing, customers.

Unit-III	**15**

Platform as a Service(PaaS) What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Examples like Google App Engine. Module IV: Software as a Service(SaaS) Introduction to SaaS, Web services, Web 2.0.

Unit-IV	**15**

Overview of Security Issues, Infrastructure Security: Network level security, Host level security, Application level security, Data security and Storage, Challenges and Risks of Cloud Computing Platforms and Cloud Services.

Reference Books:

1. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Cloud Computing: Principles and paradigms, 2011
2. Michael Miller, Cloud Computing, 2008
3. Cloud Computing, A Practical Approach By Toby Velte, Anthony Velte, Robert C. Elsenpeter, 2009.

Type: DSE-3

M.Sc(CS)-II (Semester III)

Course Title: Open Source Technologies (PHP, MySql)

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: This course is aimed to provide a fundamental understanding of dynamic web site creation. PHP is the language used for development of most common web sites. Syllabus includes basic and advanced features of PHP which includes detailed introduction of PHP and MYSQL, Arrays, Loops and variables etc. It also gives an overview open source framework like JOOMLA, ZEND etc.

Unit-I	**15**

Introduction to Open Source and PHP programming Introduction to Open Sources Technologies, Introduction to PHP, installation and configuration, Advantages and Disadvantages of PHP, Client Side Scripting, Server Side Scripting, Variables, data types, various types of function, creating your own function, Strings in PHP, String Functions.

Unit-II	**15**

Operator, Loops, Array, Exception and Error Handling Operators, Conditions, Loops, Using for each, Creating and Using Arrays, Multidimensional Array, Associative array. Error Handling in PHP, Errors and Exceptions, Exception class, try/catch block, throwing an exception, defining your own Exception subclass.

Unit-III	**15**

Classes, File system, Passing Information between pages Object oriented programming with PHP, Working with Datetime, code re-use, require(), include(), and the include_path; Understanding PHP file permissions, File reading and writing functions, File system functions, File uploads, Sending mail & use of email server. HTTP, GET arguments, POST arguments, Using Session in PHP, cookies, The setcookie() function, Deleting Cookies and Reading Cookies.

Unit-IV	**15**

Working with database HTML Tables and Database tables, Database manipulation(Select, Insert, Update, Delete), validating User Input using Java script. MYSQL, Introducing MySQL; database design concepts; the Structured Query, Language (SQL); communicating with a MySQL back end via the PHP, MySQL API Building Database Applications,

Reference Books:

1. The Complete Reference PHP, by Steven Holzner, TAYA McGraw-Hill Publication
2. Beginning PHP and MYSQL, by W. Jason Gilmore, Apress Publication
3. Beginning PHP, Apache, MySQL Web Development, Michael K. Glass, Yann Le Scouarnec, Elizabeth Naramore, Gary Mailer, Jeremy Stolz, Jason Gerner.

Type: RP-1

M.Sc(CS)-II (Semester III)

Course Title: Literature Review

Credits: Theory – (4) Practical – (2)

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 2

University Evaluation: 60 Marks **Internal Evaluation:**40 Marks

Course Objective:

1. To familiarize students with the fundamentals of research.
2. To help students to make appropriate grammatical and lexical choices while writing research articles and organize information effectively.
3. To integrate theoretical research knowledge with practical skills that will help students to undertake research.

Guideline regarding Literature Review:

1. Group of students : Maximum two.
2. Selection of topic for literature review : Student has to select a topic/area for literature review with the help of a teacher guide allotted to the student. The topic must be relevant to current trends and advancements in computer science.
3. Conducting Literature Review : Student has to use academic databases, journals, conference proceedings, reputed online sources etc for searching the research articles / materials related to the selected topic / area. Student has to study at least 20 recent research articles related to the selected topic/area.
4. Prepare review article : While studying these research articles student has to consider the objectives, methodolgoies, comparative study of these methodologies, research gaps etc. used by various researchers. After this students has to prepare a literature review article in the following format –

Title for Review paper

First Author[*], Second Author[**], Third Author[**]

[*] Department, Institute Name
[**] Department, Institute Name

Abstract- Mention the abstract for the article. An abstract is a brief summary of a research article, thesis, review, conference proceeding or any in-depth analysis of a particular subject or discipline, and is often used to help the reader quickly ascertain the paper's purpose. When used, an abstract always appears at the beginning of a manuscript, acting as the point-of-entry for any given scientific paper or patent application.

Keywords - About four key words or phrases in alphabetical order, separated by commas. Keywords are used to retrieve documents in an information system such as an online journal or a search engine. (Mention 4-5 keywords)

I. INTRODUCTION

This article guides a stepwise walkthrough by Experts for writing a successful journal or a research paper starting from inception of ideas till their publications. Research papers are highly recognized in scholar fraternity and form a core part of curriculum.

Essentially an article consists of five major sections. The number of pages may vary depending upon the topic but generally comprises up to 5 to 7 pages. These are:
[1] Abstract
[2] Introduction
[3] Research Elaborations/Methodologies used by various researcher
[4] Comparative study
[5] Conclusions

II. RESEARCH ELABORATIONS/METHODOLOGIES USED BY VARIOUS RESEARCHER

It's the foremost preliminary step for proceeding with any research work writing. While doing this go through a complete thought process of the topic selected by the student by following means:
[1] Read already published work in the same field.
[2] Goggling on the topic of research work.
[3] Understand the scientific terms and jargon related to your research work.

III. COMPARATIVE STUDY

Prepare the comparative study. Wherever necessary use the tabular form for this study. Identify the research gap.

IV. CONCLUSION

Conclusion may review the main points of the papers used for review, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Acknowledgment

Use the singular heading even if you have many acknowledgments.

References

G. O. Young, "Synthetic structure of industrial plastics (Book style with paper title and editor)," in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.
W.-K. Chen, *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.
H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.
B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.
E. H. Miller, "A note on reflector arrays (Periodical style—Accepted for publication)," *IEEE Trans. Antennas Propagat.*, to be published.

Type: DSC-7

M.Sc(CS)-II (Semester IV)

Course Title: Machine Learning

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: The course is spearhead for Machine Learning models and uncover hidden insights to problems that were once thought impossible. Student could become a leader in the ML & AI by learning about its breakthroughs achieved and future that it holds. The student could gain solid awareness of the key concepts of AI, ML, Deep Learning, Data Mining & Data Science. Make strategically important decisions in students professional domain with ML techniques, models, and various algorithms Leverage your innovative ability to develop intelligent ML & AI-based solutions using the required platforms and languages.

Unit-I	**15**

Introduction- Machine Learning Definitions, Artificial Intelligence Definitions, Machine Learning vs AI Machine Learning vs Deep Learning, Most Common ML Algorithms, Types of Machine Learning Supervised Unsupervised Reinforcement, General Steps or Process of Machine Learning, Data cleaning, data transform/fitting Overfitting, Under fitting, Variance, Bias, Required Maths- Linear Algebra - In Numpy, Probability, Stats, Calculus (Derivates), Tool Kit, Python Basics, Python Advance, Numpy, Pandas, Matplotlib, Scikit-learn or sklearn Library

Unit-II	**15**

Supervised Learning, Classification, Random Forest, Decision Trees, Logistic Regression, Support Vector Machines, KNN, Naïve Bayes, Usage, Regression, Linear Regression, Regularization Techniques (LASSO), Polynomial Regression, Usage, Case Study (Classification).

Unit-III	**15**

Unsupervised Learning, Clustering, K-Means, K Nearest Neighbours, Association Rule Learning, Dimensionality Reduction, PCA, SVD, tSNE, Case Study (Clustering/Anomaly/Fraud Detection).

Unit-IV	**15**

Reinforcement Learning, Markov Decision Monte Carlo Prediction, Case Study (next best offer, dynamic pricing), Natural Language Processing, Text Mining Generation, Case Study (Generation) Predictive Analytics – Forecasting, Logistic, Time Series (ARIMA), Case Study

(Time Series), Ensemble Techniques Boosting, Bagging, Machine Learning Applications across Industries Healthcare, Retail, Financial Services, Manufacturing, Hospitality
Reference Books: 1. Introduction to Machine Learning, 2nd Edition, by Ethem Alpaydin. 2. Machine Learning, Tom Mitchell, First Edition, McGraw Hill, 1997. 3. C. Bishop, Pattern Recognition and Machine Learning. Berlin: Springer-Verlag, 2006.

Type: DSC-8

M.Sc(CS)-II (Semester IV)

Course Title: Network Security

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: The objective here is to acquaint the students with the application of networking. Detail description of the various protocols and the working of security policy and its performance, Network security and authentication, and various algorithms related to it has been dealt, to get a practical approach.

Unit-I	**15**

Introduction:Security Concepts, Threats and Risks, Attacks – Passive and Active Security Services, Confidentiality, Authentication, Non-Repudiation, Integrity, Access Control, Availability, Model for Internet work Security, Internet Standards and RFCs.

Access Control Mechanisms:Access Matrix, HRU, TAM, ACL and capabilities, Access Control Models

Unit-II	**15**

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

Unit-III	**15**

Network Security:Objectives and Architectures, Internet Security Protocols, IP encapsulating Security Protocol, Network and Transport LayerSecurity.

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,IPSecurity.

Unit-IV	**15**

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, ACLinProxy.

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.

Type: DSE-4

M.Sc(CS)-II (Semester IV)

Course Title: .NET Technology

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: To create web based applications using ASP.NET.

Unit-I	**15**

Structure, the common language runtime, JIT,CTS,Metadata. 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.

Unit-II	**15**

Creating winform applications, COMinteroperability, using COM / COM+, reflection, components in C#, Handling databases using ADO.net. Introduction to ASP.Net:Introduction, difference between ASP & ASP.Net Application, Web Architecture Model, Introduction to Visual Studio for WebApplication.

Unit-III	**15**

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 ApplicationFolders,Global.asax

ASP.NET Server Controls and Validation Controls: ASP.Net Server Controls,Understanding Validation, Client-Side versus ServerSide Validation, Turning OffClient-Side Validatio

Unit-IV	**15**

Need and basics of Master Pages, Master Page and Content Page, Programmatically Assigning the Master Page, Nesting Master Pages, MasterPageEvents.

ASP.Net State Management:Application State, Session State, Client & server storing, View state, Cache, Hidden Variable, Session object, Profiles, Overview of HTTP Handler & Modules.

Reference Books:

1. MicrosoftVisual C#.NET Step-By-Step Version 2003:Sharp,Jagger, Publisher: Microsoft Press

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.

Type: DSE-4

M.Sc(CS)-II (Semester IV)

Course Title: Block Chain Technology

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: To understand fundamentals of blockchain technology. To understand how blockchain systems (mainly Bitcoin and Ethereum) work. To impart strong understanding of Blockchain technologies. To introduce application areas, current practices, and research activity. To integrate ideas from blockchain technology into their own projects. .

Unit-I	**15**

Introduction Need for Distributed Record Keeping Modeling faults and adversaries Byzantine Generals problem Consensus algorithms and their scalability problems Why Nakamoto Came up with Blockchain based cryptocurrency? Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc, Basic Distributed Computing Atomic Broadcast, Consensus, Byzantine Models of fault tolerance.

Unit-II	**15**

Basic Crypto primitives Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems. Blockchain 1.0 Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use .

Unit-III	**15**

Blockchain 2.0 Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts.

Blockchain 3.0 Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain.

Unit-IV	**15**

Privacy, Security issues in Blockchain Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks advent of algorand, and Sharding based consensus algorithms.

Reference Books:

1. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

2. Mastering Blockchain, Second Edition Distributed ledger technology, decentralization, and smart contracts explained, Packt- BIRMINGHAM – MUMBAI.

Type: DSE-4

M.Sc(CS)-II (Semester IV)

Course Title: Soft Computing

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: To develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. To introduce students to artificial neural networks and fuzzy theory from an engineering perspective .

Unit-I	**15**

Fundamentals of Neural Networks:Basic concepts, models of artificial neuron, neural network architectures, characteristics, learning methods.

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, back propagation algorithm.

Unit-II	**15**

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 forfuzzysets.

Unit-III	**15**

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.

Unit-IV	**15**

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.

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 PublishingHouse.

6. Neural Network and Fuzzy System A Dynamic System: Koska,PHI.

Type: RP-2

M.Sc(CS)-II (Semester IV)

Course Title: Dissertation

Credits: Theory – (4) **Practical – (2)**

Total Lectures: 60 Hrs. **Contact Hrs. (L):** 4

University Evaluation: 60 Marks **Internal Evaluation:** 40 Marks

Course Objective: To enhance the practical knowledge and result analysis skills. To enable the students experience a real-life problem solving under the supervision of faculty members.
To prepare the students perform functions that demand higher competence in national/international organizations. To train the students in scientific research. Develop research/ experimentation skills as well as enhancing project writing and oral presentation skills. Inculcate team spirit and time management.

Guideline to prepare the Dissertation

An acceptable M.Sc. thesis in Computer Science should attempt to satisfy one or more of the following criteria:

- Original research results are explained clearly and concisely.
- The thesis explains a novel exploratory implementation or a novel empirical study whose results will be of interest to the Computer Science community in general and to a portion of the Computer Science community in particular.
- Novel implementation techniques are outlined, generalized, and explained.
- Theoretical results are obtained, explained, proven, and (worst, best, average) case analysis is performed where applicable.
- The implementation of a practical piece of nontrivial software whose availability could have some impact on the Computer Science community.

A good methodology to follow, immediately upon completion of the required courses, is to keep a paper or electronic research notebook and commit to writing research-oriented notes in it every day. From time to time, organize or reorganize your notes under headings that capture important categories of your thoughts. This journal of your research activities can serve as a very rough draft of your thesis by the time you complete your research. From these notes to a first M.Sc. thesis draft is a much less painful experience than to start a draft from scratch many months after your initial investigations. To help structure an M.Sc. thesis, the following guide may help.

Chapter 1. Introduction: This chapter contains a discussion of the general area of research which you plan to explore in the thesis. It should contain a summary of the work you propose to carry out. Describe the general problem that you are working towards solving and the specific problem that you attempt to solve in the thesis.

Chapter 2. Theory/Solution/Algorithm/Program: This chapter outlines your proposed solution to the specific problem described in Chapter 1. The solution may be an extension to, an improvement of, or even a disproof of someone else's theory / solution / method / ...).

Chapter 3 Description of Implementation or Formalism: This chapter describes your implementation or formalism. Depending on its length, it may be combined with Chapter 2. Not every thesis requires an implementation. Prototypical implementations are common and quite often acceptable although

the guiding criterion is that the research problem must be clearer when you've completed your task than it was when you started!

Chapter 4 Results and Evaluation: This chapter should present the results of your thesis. You should choose criteria by which to judge your results, for example, the adequacy, coverage, efficiency, productiveness, effectiveness, elegance, user friendliness, etc., and then clearly, honestly and fairly adjudicate your results according to fair measures and report those results.

Chapter 5 Conclusions and future scope: This chapter should summarize the achievements of your thesis and discuss their impact on the research questions you raised in Chapter 1. If you solved the specific problem described in Chapter 1, you should explicitly say so here. If you did not, you should also make this clear. You should indicate open issues and directions for further or future work in this area with your estimates of relevance to the field, importance and amount of work required.

References : Complete references for all cited works. This should not be a bibliography of everything you have read in your area.

Appendices include technical material (program listings, output, graphical plots of data, detailed tables of experimental results, detailed proofs, etc.) which would disrupt the flow of the thesis but should be made available to help explain or provide details to the curious reader.