RashtrasantTukadojiMaharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Computer Science)
Choice Based Credit System (Semester Pattern)
wef. 2023-24 as per NEP 2020

RashtrasantTukadojiMaharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Computer Science)
Choice Based Credit System (Semester Pattern), wef. 2023-24 as per NEP 2020

Pre-requisites to enrol for the M. Sc. Computer Science Programme:

The student who has completed the B. Sc. Coursewith Computer Science as one of the optional subject or Bachelor of Computer Application (BCA)or B. Sc. (IT) or B. Sc. (Data Science) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enrol for M. Sc. (Computer Science)Part I (Semester I). However, the student who has completed four-year B. Sc. course [B. Sc. (Honours)/(Research) as per NEP- 2020] with Computer Science/Information Technology/Data Science as the major subject or Bachelor of Computer Application (BCA) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enroldirectly to M. Sc. (Computer Science) Part II (Semester III).

Credit distribution structure for two years Post Graduate Programme in Computer Science*

Year (2 Yr PG)	Level	Sem. (2 Yr)	Major		RM	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem. I	12 (3 theory + 2 Practical)	4	4			20	OneYear PG Diploma
		Sem. II	12 (3 theory + 2 Practical)	4		4		20	
Cum. Cr. For PG Diploma/ I year of PG			24	8	4	4	-	40	
Exit option: One Year PG Diploma 40 credits									
II	6.5	Sem. III	12 (3 theory +2 Practical)	4			4	20	PG Degree After 3 Yr UG or PG degree after 4-Ys UG
		Sem. IV	12 (3 theory +2 Practical)	4			6	22	
Cum. Cr. For II year of PG			24	8			10	42	
Cum. Cr. For 2 year of PG degree			48	16	4	4	10	82	

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Semester I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Artificial Intelligence	MCS1T01	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Compiler Construction	MCS1T02	4	-	-	4	3	80	20	40	-	-	-	100
3	DSE	Elective 1	MCS1T03	4	-	-	4	3	80	20	40	-	-	-	100
5	RM	Research Methodology	MCS1T04	4	-	-	4	3	80	20	40	-	-	-	100
6	DSC	Practical Based on Paper MCS1T01 and MCS1T02	MCS1P01	-	-	6	3	-	-	-	-	50	50	50	100
7	DSC	Practical Based on Paper MCS1T03 and MCS1T04	MCS1P02	-	-	6	3	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

CIE = Continuous Internal Evaluation and SEE = Semester End Examination

Semester II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Cloud Computing	MCS2T05	4	-	-	4	3	80	20	40	-	-	-	100
	DSC	Machine Learning	MCS2T06	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 2	MCS2T07	4	-	-	4	3	80	20	40	-	-	-	100
5	OJT	Apprenticeship/Mini Project (Related to DSC)	MOJ2P01	-	-	8	4	3	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MCS2T05and MCS2T06	MCS1P03	-	-	6	3	-	-	-	-	50	50	50	100
7	DSC	Practical Based on Paper MCS2T07	MCS1P04	-	-	6	3	-	-	-	-	50	50	50	100
Total				12	-	20	**22**		**240**	**60**		**150**	**150**		**600**

Semester III

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Advanced Software Engineering	MCS3T08	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Network Security	MCS3T09	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Digital Image Processing	MCS3T10	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 3	MCS3T11	4	-	-	4	3	80	20	40	-	-	-	100
5	RP	Research Project/ Dissertation (Core)	MRP3P01	-	-	8	4	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MCS3T08 ,MCS3T09,MCS3 T10 and MCS3T11	MCS1P05	-	-	4	2	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

Semester IV

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Big Data Analytics	MCS4T12	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Computer Vision	MCS4T13	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Deep Learning	MCS4T14	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 4	MCS4T15	4	-	-	4	3	80	20	40	-	-	-	100
5	RP	Research Project/ Dissertation (Core)	MRP4P02	-	-	12	6	-	-	-	-	100	100	100	200
Total				16	-	12	22		**320**	**80**		**100**	**100**		**600**

Total Credits for Four Semesters (Two Year Course): = 88

Total Marks for Four Semesters (Two Year Course):= 2400

Abbreviations:

DSC: Discipline Specific Course, **DSE:** Discipline Specific Elective **SEE:** Semester End Examination, **CIE:** Continuous Internal Evaluation, **OJT:** On the Job Training (Internship/Apprenticeship), **FP:**Field Project, **RM:**Research Methodology, **RP:** Research Project

Elective papers:

In addition to the mandatory papers, the student has to opt for ONE elective paper in each semester from the basket of elective papers mentioned in the following table.

Basket for Elective Courses (4 Credits each)

Semester	Course Category	Name of the course	Course Code
I	Elective 1	a) Computer Architecture & Organization b) Discrete Mathematics c) Equivalent MOOC course	MCS1T03
II	Elective 2	a) R Programming b) Neural Network c) Equivalent MOOC course	MCS2T07
III	Elective 3	a) Computer Graphics b) Internet of Things (IOT) c) Equivalent MOOC course	MCS3T11
IV	Elective 4	a) Design and Analysis of Algorithm b) Cyber Forensics a) Equivalent MOOC course	MCS4T15

The students can opt either the elective paper taught in the department in offline mode or any other equivalent online course of at least 4 credits offered by MOOC or any other such platform. The student should submit the passing certificate to the College in order to include the marks in the marksheet. **The MOOCs which is identical to courses offered in this scheme of M.Sc. Computer Science (in terms of contents) and are accessible to the student shall not be allowed for credit transfer.**

M. Sc. (Computer Science)
Semester I

MCS1T01
Paper I :ARTIFICIAL INTELLIGENCE

Hours/Week :4
Credits :4

UNIT I

AI problems, AI Techniques, Tic-tac-toe, Question Answering, Problem as a state space search, A water jug problem, production system, Control strategies, Heuristic Search, Problem Characteristics, Production system characteristics, Design of search programs AI Search techniques :- Depth-first, Breadth-first search, Generate-and-test, Hill climbing, Best-first search, Constraint satisfaction, Mean-ends-analysis, A* Algorithm, AO* algorithm.

UNITII

Knowledge Representation:- Representations and mappings, Knowledge Representations, Issues in Knowledge Representation, Predicate Logic:- Representing Instance and Isa Relationships, Computable Functions and predicates, Resolution, Natural Deduction, Logic programming, Forward versus Backward Reasoning, Matching, Control knowledge, Expert System.

UNIT III

Games playing: Minimax search procedure , adding alpha-beta cutoffs, additional refinements, Planning :- Component of a planning system, Goal task planning, Nonlinear planning, Hierarchical Planning.

UNIT IV

Understanding, Understanding as Constraint satisfaction, Natural Language Processing, Syntactic Processing, Unification grammars, Semantic Analysis, Introduction to pattern recognition, Parallel and Distributed AI, Psychological Modeling, Distributed Reasoning Systems,

Books

1. Artificial Intelligence by Elaine Rich, Mcgrawhill Inc.
2. Artificial Intelligence and Expert Systems – Jankiraman, Sarukes (M)
3. Lisp Programming – RajeoSangal – (TMH)
4. Artificial Intelligence – Russell-Pearson- Ist Text book.
5. Principles of AI- Nils Nilson
6. A.I. by R.J.Winston - Pearson

M. Sc. (Computer Science)
Semester I

MCS1T02
Paper II :COMPILER CONSTRUCTION

Hours/Week :4
Credits :4

UNIT I

Introduction: Language Processors, the structure of a compiler, Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol Table Management, The Grouping of Phases into Passes, Compiler-Construction Tools.Evolution of Programming Languages: The Move to High-Level languages, Impact on Compilers. Applications of Compiler Technology, Programming Language Basics

UNIT II

A Simple Syntax-Directed Translator: Introduction, Syntax Definition, Syntax-Directed Translation, Parsing:Top-Down Parsing, Predictive Parsing.
Lexical Analysis: The role of the lexical analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens: Transition Diagrams, Recognition of Reserved Words and Identifiers. The Lexical-Analyzer Generator 'Lex'.

UNIT III

Syntax Analysis: Introduction, Context-free grammars: The Formal Definition, Notational Conventions, Derivations and parse trees, Ambiguity. Writing a Grammar, Top-Down Parsing: Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) Grammars, Nonrecursive Predictive Parsing. Bottom-Up Parsing: Reductions, Handle Pruning, Shift-Reduce Parsing.
Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations: Type Expressions, Type Equivalence, Declarations. Type Checking: Rules, Type Conversions. Control Flow: Boolean Expressions, Short-Circuit Code, Flow-of-Control Statements, Control-Flow Translation of Boolean Expressions. Backpatching.

UNIT IV

Run-Time Environments: Storage Organization, Stack Allocation of Space, Heap Management.
Code Generation: Issues in Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs: Basic Blocks, Flow Graphs, Representation of Flow Graphs. Optimization of Basic Blocks: The DAG Representation of Basic Blocks, Finding Local Common Subexpressions, Dade Code Elimination, The use of Algebraic Identities, Representation of Array References. Peephole Optimization: Eliminating Redundant Loads and Stores, Eliminating Unreachable Code, Flow-of-Control Optimization.

Books

1. Principles of Compiler Design - A.V. Aho, M. S. Lam, Ravi Sethi, J. D. Ullman. Second Edition, Pearson Education Inc.
2. Principles of Compiler Design - A.V. Aho, J. D.Ullman : Pearson Education.
3. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
4. Engineering a Compiler-Cooper & Linda, Elsevier.
5. Compiler Construction, Louden, Thomson.

M. Sc. (Computer Science)
Semester I

Elective 1 : MCS1T03
Paper III :COMPUTER ARCHITECTURE AND ORGANIZATION

Hours/Week :4
Credits :4

UNIT I

Principle of computer design : Software, hardware interaction, layers in computer architecture, central processing and machine language instruction, addressing modes, instruction types, instruction set selection, instruction and execution cycle.

UNITII

Control Unit: Data path and control path design, microprogramming v/s hardwired control, pipelining in CPU design, RISC v/s CISC, superscalar processors.

UNIT III

Memory subsystem: Storage technologies, memory array organization, memory hierarchy, interleaving, cache memory and virtual memory including architectural aids to implement these.

UNIT IV

Input/ Output Processing: Bus Interface, Data transfer techniques, I/O interrupts and channels,. Performance evaluation:SPECmarks, Transaction Processing Benchmarks.

Books

1. Computer Architecture and Organization by Tenenbaum
2. Computer Architecture and Organization by J. P. Hayes.
3. Parallel Processing by Hwang
4. Computer Organization by Hamacher, Vranesic, Zaky (TMH)

M. Sc. (Computer Science)
Semester I

Elective 1 : MCS1T03
Paper III :DISCRETE MATHEMATICAL STRUCTURE

Hours/Week :4
Credits :4

UNIT I

Mathematical Logic: Propositional Calculus: Connectives, statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, duality law, Tautological Implications, functionally complete set of connectives, other connectives.**Normal Forms**: CNF, DNF, PCNF, PDNF.

UNIT II

Fundamentals: Sets and Subsets, operations on sets, sequences, Division of the integer, Matrices, Methods of Proof, Mathematical Induction.
Counting: Permutations, Combinations, The pigeonhole Principle, Recurrence Relations.

UNIT III

Relations and Digraphs: Product sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of Relations, Equivalence Relations, Operations of Relations, Transitive Closure and Warshall's Algorithms.
Functions: Definition and Introduction, Permutation Functions, Growth of Functions.

UNIT IV

Order Relations and Structures: Partially Ordered Sets, Lattices.
Graph Theory: Basic Concept of Graph Theory, Euler Paths and Circuits, Hamiltonian Paths and Circuits.
Tree: Introduction, Undirected Tree, Minimal Spanning Trees.
Semigroups and Groups: Binary Operations Revisited, Semigroups, Products and Quotients of Groups.

Books

1. Discrete Mathematical Structures By Bernard Kolman, Busby & Sharon Ross [PHI].
2.Discrete Mathematical Structures with Application to computer science By J. P. Tremblay & R. Manohar [Tata McGraw –Hill]
3. Discrete Mathematics with Graph Theory by Goodaire[PHI]
4. Discrete Mathematics by J.K.Sharma(McMillan)
5. Discrete Mathematics and its Applications by Kenneth Rosen (TMH)

M. Sc. (Computer Science)
Semester I

MCS1T04

Paper IV :RESEARCH METHODOLOGY

Hours/Week :4
Credits :4

M. Sc. (Computer Science)
Semester II

MCS2T05
Paper I :CLOUD COMPUTING

Hours/Week :4
Credits :4

UNIT I

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology. Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT II

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Understanding Core OpenStack Ecosystem. Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, Customer Relationship Management).

UNIT III

Basic Terms and Concepts, Threat Agents, Cloud Security Threats and Attacks, Additional Considerations. Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images. Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability. Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud.

UNIT IV

Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking. How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Books

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1
st Edition.
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
5. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
6. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.

M. Sc. (Computer Science)
Semester II

MCS2T06
Paper II :MACHINE LEARNING

Hours/Week :4
Credits :4

UNIT I

Learning: Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II

Multi-layer Perceptron: Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perceptron in Practice – Examples of using the MLP – Overview – Deriving BackPropagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III

Learning with Trees: Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms –Vector Quantization – Self Organizing Feature Map

UNIT IV

Dimensionality Reduction: Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process. Graphical Models:MarkovChain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models –Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Method

Books

1. Introduction to Machine Learning (Adaptive Computation and Machine Learning Series), EthemAlpaydin,Third Edition, MIT Press
2. Machine learning – Hands on for Developers and Technical Professionals, Jason Bell, Wiley
3. Machine Learning: The Art and Science of Algorithms that Make Sense of Datal, Peter Flach,Cambridge University Press.
4. Deep Learning , Rajiv Chopra, Khanna Publi.
5. Machine Learning, V. K. Jain, Khanna Publi

M. Sc. (Computer Science)
Semester II

Elective 2 : MCS2T07

Paper III :R PROGRAMMING

Hours/Week :4
Credits :4

UNIT I

Introduction , How to run R, R Sessions, Introduction to Functions, Important R Data - Variables, Data Types, Vectors ,Conclusion , Advanced Data Structures , Data Frames ,Lists ,Matrices ,Arrays , Classes.

UNIT II

R Programming Structures , Control Statements ,Loops ,Looping Over Non, vector Sets ,If Else , Arithmetic and Boolean Operators and values , Default Values for Argument ,Return Values , Deciding Whether to explicitly call return Returning Complex Objects ,Functions are Objective , No Pointers in R Recursion , A Quicksort Implementation Extended , Example: A Binary Search Tree.

UNIT III

Doing Math and Simulation in R , Math Function , Extended Example Calculating Probability Cumulative Sums and Products Minima and Maxima Calculus , Functions Fir Statistical Distribution ,Sorting , Linear Algebra Operation on Vectors and Matrices , Extended Example: Vector cross Product Extended Example: Finding Stationary Distribution of Markov Chains , Set Operation , Input /Output , Accessing the Keyboard and Monitor , Reading and writer Files.

UNIT IV

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files. Probability Distributions, Normal Distribution Binomial Distribution Poisson Distributions other Distribution, Basic Statistics, Correlation and Covariance.

Books :

1.The Art of R Programming, Norman Matloff, Cengage Learning
2. Cotton, R., Learning R: a step by step function guide to data analysis. 1st edition.O'reilly Media Inc.
3. R for Everyone, Lander, Pearson Siegel, S. (1956), Nonparametric Statistics for the Behavioral Sciences, McGrawHill International, Auckland.

M. Sc. (Computer Science)
Semester II

Elective 2 : MCS2T07

Paper III :NEURAL NETWORK

Hours/Week : 4
Credits :4

UNIT I

Introduction: Feedforward Neural Networks: Artificial Neurons, Neural Networks and Architectures: Neuron Abstraction, Neuron Signal Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feed forward and Feedback, Salient Properties and Application Domains of Neural Network Geometry of Binary Threshold Neurons and Their Network: Patterns Recognition and Data Classification, Convex Sets, Convex Hulls and Linear Separability, Space of Boolean Functions, Binary Neurons are pattern Dichotomizes, Non□linearly separable Problems, Capacity of a simple Threshold Logic Neuron, Revisiting the XOR Problem, Multilayer Networks.

UNIT II

Supervised Learning I: Perceptrons and LMS: Learning and Memory, From Synapses to Behaviour: The Case of Aplysia, Learning Algorithms, Error Correction and Gradient Descent Rules, The Learning Objective for TLNs, Pattern space and Weight Space, Perceptron Learning Algorithm, Perceptron Convergence Theorem, Perceptron learning and Non□separable Sets, Handling Linearly Non□Separable sets, α□Least Mean Square Learning, MSE Error Surface and its Geometry, Steepest Descent Search with Exact Gradient Information, μ□LMS: Approximate Gradient Descent, Application of LMS to Noise Cancellation

UNITIII

Supervised Learning II: Backpropagation and Beyond: Multilayered Network Architectures, Backpropagation Learning Algorithm, Structure Growing Algorithms, Fast Relatives of Backpropagation, Universal Function Approximation and Neural Networks, Applications of Feedforward Neural Networks, Reinforcement Learning

UNITIV

Neural Networks: A Statistical Pattern Recognition Perspective: Introduction, Bayes Theorem, Classification Decisions With Bayes Theorem, Probabilistic Interpretation Of A Neuron Discriminant Function, Interpreting Neuron Signals As Probabilities, Multilayered Networks, Error Functions And Posterior Probabilities, Error Functions For Classification Problems

Generalization: Support Vector Machines and Radial Basis Function Networks: Learning from Examples and Generalization, Statistical Learning Theory Briefer, Support Vector Machines, Radial Basis Function Networks, Regularization Theory Route to RRBFNs, Generalized Radial Basis Function Network, Learning In RRBFNs, Image Classification Application, Other Models for Valid Generalization

Books

1. Neural Network□ A Classroom Approach, Satish Kumar, Tata McGraw Hill
2. Introduction to neural networks using MATLAB 6.0 by Sivanandam, S Sumathi, S N Deepa, Tata Mcgraw Hill
3. Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition 2004
4. Artificial neural networks □ B.Yegnanarayana, Prentice Hall of India P Ltd 2005.
5. Neural networks in Computer intelligence, Li Min Fu, TMH 2003.
6. Neural networks James A Freeman David M S kapura, Pearson education 2004.

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Pre-requisites to enrol for the M. Sc. (Information Technology) Programme:

The student who has completed the B. Sc. CoursewithComputer Science as one of the optional subject or Bachelor of Computer Application (BCA)orB. Sc. (IT) or B. Sc. (Data Science) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enroll for M. Sc. (Information Technology)Part I (Semester I). However, the student who has completed four-year B. Sc. course [B. Sc. (Honours)/ (Research) as per NEP- 2020] with Computer Science/Information Technology/Data Science as the major subject or Bachelor of Computer Application (BCA) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enroldirectlyto M. Sc. (Information Technology) Part II (Semester III).

Credit distribution structure for two years Post Graduate Programme in Information Technology*

Year (2 Yr PG)	Level	Sem. (2 Yr)	Major		RM	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem. I	12 (3 theory + 2 Practical)	4	4			20	One Year PG Diploma
		Sem. II	12 (3 theory + 2 Practical)	4		4		20	
Cum. Cr. For PG Diploma/ I year of PG			24	8	4	4	-	40	
Exit option: One Year PG Diploma 40 credits									
II	6.5	Sem. III	12 (3 theory + 2 Practical)	4			4	20	PG Degree After 3 Yr UG or PG degree after 4-Ys UG
		Sem. IV	12 (3 theory +2 Practical)	4			6	22	
Cum. Cr. For II year of PG			24	8			10	42	
Cum. Cr. For 2 year of PG degree			48	16	4	4	10	82	

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Semester I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Artificial Intelligence	MIT1T01	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Cyber Security	MIT1T02	4	-	-	4	3	80	20	40	-	-	-	100
3	DSE	Elective 1	MIT1T03	4	-	-	4	3	80	20	40	-	-	-	100
5	RM	Research Methodology	MIT1T04	4	-	-	4	3	80	20	40	-	-	-	100
6	DSC	Practical Based on Paper MIT1T01 and MIT1T02	MIT1P01	-	-	6	3	-	-	-	-	50	50	50	100
7	DSC	Practical Based on Paper MIT1T03 and MIT1T04	MIT1P02	-	-	6	3	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

CIE = Continuous Internal Evaluation and SEE = Semester End Examination

Semester II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Cloud Computing	MIT2T05	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Machine Learning	MIT2T06	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 2	MIT2T07	4	-	-	4	3	80	20	40	-	-	-	100
5	OJT	Apprenticeship/Mini Project (Related to DSC)	MOJ2P01	-	-	8	4	3	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MIT2T05 and MIT2T06	MIT1P03	-	-	6	3	-	-	-	-	50	50	50	100
7	DSC	Practical Based on Paper MIT2T07	MIT1P04	-	-	6	3	-	-	-	-	50	50	50	100
Total				12	-	20	**22**		**240**	**60**		**150**	**150**		**600**

Semester III

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Advanced Software Engineering	MIT3T08	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Network Security	MIT3T09	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Internet of Things (IoT)	MIT3T10	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 3	MIT3T11	4	-	-	4	3	80	20	40	-	-	-	100
5	RP	Research Project/ Dissertation (Core)	MRP3P01	-	-	8	4	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MIT3T08 ,MIT3T09,MIT3T10 and MIT3T11	MIT1P05	-	-	4	2	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

Semester IV

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Big Data Analytics	MIT4T12	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Block Chain Technology	MIT4T13	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Deep Learning	MIT4T14	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 4	MIT4T15	4	-	-	4	3	80	20	40	-	-	-	100
	RP	Research Project/ Dissertation (Core)	MRP4P02	-	-	12	6	-	-	-	-	100	100	100	200
Total				16	-	12	22		**320**	**80**		**100**	**100**		**600**

Total Credits for Four Semesters (Two Year Course): = 88

Total Marks for Four Semesters (Two Year Course): = 2400

Abbreviations:

DSC: Discipline Specific Course, **DSE:** Discipline Specific Elective **SEE:** Semester End Examination, **CIE:** Continuous Internal Evaluation, **OJT:** On the Job Training (Internship/Apprenticeship), **FP:** Field Project, **RM:** Research Methodology, **RP:** Research Project

Elective papers:

In addition to the mandatory papers, the student has to opt for ONE elective paper in each semester from the basket of elective papers mentioned in the following table.

Basket for Elective Courses (4 Credits each)

Semester	Course Category	Name of the course	Course Code
I	Elective 1	a) PHP b) Discrete Mathematics c) Equivalent MOOC course	MIT1T03
II	Elective 2	a) ASP.NET b) Data Mining c) Equivalent MOOC course	MIT2T07
III	Elective 3	a) Neural Network b) Computer Vision c) Equivalent MOOC course	MIT3T11
IV	Elective 4	a) Reinforcement Learning b) Cyber Forensics c) Equivalent MOOC course	MIT4T15

The students can opt either the elective paper taught in the department in offline mode or any other equivalent online course of at least 4 credits offered by MOOC or any other such platform. The student should submit the passing certificate to the College in order to include the marks in the mark sheet. **The MOOCs which is identical to courses offered in this scheme of M.Sc. Information Technology (in terms of contents) and are accessible to the student shall not be allowed for credit transfer.**

M. Sc. (Information Technology)
Semester I

MIT1T01
Paper I :ARTIFICIAL INTELLIGENCE

Hours/Week :4
Credits :4

UNIT I

AI problems, AI Techniques, Tic-tac-toe, Question Answering, Problem as a state space search, A water jug problem, production system, Control strategies, Heuristic Search, Problem Characteristics, Production system characteristics, Design of search programs AI Search techniques :- Depth-first, Breadth-first search, Generate-and-test, Hill climbing, Best-first search, Constraint satisfaction, Mean-ends-analysis, A* Algorithm, AO* algorithm.

UNITII

Knowledge Representation:- Representations and mappings, Knowledge Representations, Issues in Knowledge Representation, Predicate Logic:- Representing Instance and Isa Relationships, Computable Functions and predicates, Resolution, Natural Deduction, Logic programming, Forward versus Backward Reasoning, Matching, Control knowledge, Expert System.

UNIT III

Games playing: Minimax search procedure , adding alpha-beta cutoffs, additional refinements, Planning :- Component of a planning system, Goal task planning, Nonlinear planning, Hierarchical Planning.

UNIT IV

Understanding, Understanding as Constraint satisfaction, Natural Language Processing, Syntactic Processing, Unification grammars, Semantic Analysis, Introduction to pattern recognition, Parallel and Distributed AI, Psychological Modeling, Distributed Reasoning Systems,

Books

1. Artificial Intelligence by Elaine Rich, Mcgrawhill Inc.
2. Artificial Intelligence and Expert Systems – Jankiraman, Sarukes (M)
3. Lisp Programming – RajeoSangal – (TMH)
4. Artificial Intelligence – Russell-Pearson- Ist Text book.
5. Principles of AI- Nils Nilson
6. A.I. by R.J.Winston - Pearson

M. Sc. (Information Technology)
Semester I

MIT1T02

Paper II :CYBER SECURITY

Hours/Week :4
Credits :4

UNIT I

Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

UNIT II

Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes-cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organisations dealing with Cybercrime and Cyber security in India, Case studies.

UNIT III

Social MediaOverview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

UNIT IV

Digital Devices Security, Tools and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions

Books

1. Cyber Crime Impact in the New Millennium, by R. C Mishra ,Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by SumitBelapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

M. Sc. (Information Technology)
Semester I

Elective 1 : MIT1T03
Paper III :PHP

Hours/Week :4
Credits :4

UNIT I

Introduction to PHP: What Does PHP Do, A Brief History of PHP, Installing PHP, A Walk Through PHP Language Basics: Lexical Structure, Data Types, Variables, Expressions and Operators, Flow-Control Statements, Including Code, Embedding PHP in Web Pages, Installing and Configuring PHP on Windows and Linux Platforms

UNIT II

Functions: Calling a Function, Defining a Function, Variable Scope, Function Parameters, Return Values, Variable Functions, Anonymous Functions, Strings: Quoting String Constants, Printing Strings, Accessing Individual Characters, Cleaning Strings, Encoding and Escaping, Comparing Strings, Manipulating and Searching Strings, Regular Expressions, POSIX-Style Regular Expressions, Perl-Compatible Regular Expressions, **Arrays:** Indexed Versus Associative Arrays, Identifying Elements of an Array, Storing Data in Arrays, Multidimensional Arrays, Extracting Multiple Values, Converting Between Arrays and Variables, Traversing Arrays, Sorting, Acting on Entire Arrays, Using Arrays

UNIT III

Classes and Objects: Terminology, Creating an Object, Accessing Properties and Methods, Declaring a Class, Introspection, Serialization, Web Techniques: HTTP Basics, Variables, Server Variables, Server Information, Processing Forms, Setting Response Headers, Session, cookies, files, Maintaining State, SSL, Using PHP to Access a Database: Relational Databases and SQL, Mysql database Basics, Advanced Database Techniques

UNIT IV

Graphics: Embedding an Image in a Page, The GD Extension, Basic Graphics Concepts, Creating and Drawing Images, Images with Text, Dynamically Generated Buttons, Scaling Images, Color Handling, **PDF:** PDF Extensions, Documents and Pages, Text, Images and Graphics, Navigation, Other PDF Features

XML : Lightning Guide to XML, Generating XML, Parsing XML, Transforming XML with XSLT, Web Services, **Security:** Global Variables and Form Data, Filenames, File Uploads, File Permissions, Concealing PHP Libraries, PHP Code, Shell Commands, Security Redux, Application Techniques, Code Libraries, Tinplating Systems, Handling Output, Error Handling, Performance Tuning.

Books :

1. PHP 5.1 for beginners by Evan Bayross and Sharman Shah, SPD Publications 2. Programming PHP by RasmusLerdorf and Kevin Tatroe, Orilly Publications

M. Sc. (Information Technology)
Semester I

Elective 1 :MIT1T03
Paper III :DISCRETE MATHEMATICAL STRUCTURE

Hours/Week :4
Credits :4

UNIT I

Mathematical Logic: Propositional Calculus: Connectives, statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, duality law, Tautological Implications, functionally complete set of connectives, other connectives.**Normal Forms**: CNF, DNF, PCNF, PDNF.

UNIT II

Fundamentals: Sets and Subsets, operations on sets, sequences, Division of the integer, Matrices, Methods of Proof, Mathematical Induction.
Counting: Permutations, Combinations, The pigeonhole Principle, Recurrence Relations.

UNIT III

Relations and Digraphs: Product sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of Relations, Equivalence Relations, Operations of Relations, Transitive Closure and Warshall's Algorithms.
Functions: Definition and Introduction, Permutation Functions, Growth of Functions.

UNIT IV

Order Relations and Structures: Partially Ordered Sets, Lattices.
Graph Theory: Basic Concept of Graph Theory, Euler Paths and Circuits, Hamiltonian Paths and Circuits.
Tree: Introduction, Undirected Tree, Minimal Spanning Trees.
Semigroups and Groups: Binary Operations Revisited, Semigroups, Products and Quotients of Groups.

Books

1. Discrete Mathematical Structures By Bernard Kolman, Busby & Sharon Ross [PHI].
2.Discrete Mathematical Structures with Application to computer science By J. P. Tremblay & R. Manohar [Tata McGraw –Hill]
3. Discrete Mathematics with Graph Theory by Goodaire[PHI]
4. Discrete Mathematics by J.K.Sharma(McMillan)
5. Discrete Mathematics and its Applications by Kenneth Rosen (TMH)

M. Sc. (Information Technology)
Semester I

MIT1T04

Paper IV :RESEARCH METHODOLOGY

Hours/Week : 4
Credits :4

M. Sc. (Information Technology)
Semester II

MIT2T05
Paper I :CLOUD COMPUTING

Hours/Week :4
Credits :4

UNIT I

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology. Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT II

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Understanding Core OpenStack Ecosystem. Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, Customer Relationship Management).

UNIT III

Basic Terms and Concepts, Threat Agents, Cloud Security Threats and Attacks, Additional Considerations. Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images. Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability. Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud.

UNIT IV

Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking. How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Books

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1
st Edition.
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
5. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
6. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.

M. Sc. (Information Technology)
Semester II

MIT2T06
Paper II :MACHINE LEARNING

Hours/Week :4
Credits :4

UNIT I

Learning: Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II

Multi-layer Perceptron: Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perceptron in Practice – Examples of using the MLP – Overview – Deriving BackPropagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III

Learning with Trees: Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms –Vector Quantization – Self Organizing Feature Map

UNIT IV

Dimensionality Reduction: Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process. Graphical Models:MarkovChain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models –Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Method

Books

1. Introduction to Machine Learning (Adaptive Computation and Machine Learning Series), EthemAlpaydin,Third Edition, MIT Press
2. Machine learning – Hands on for Developers and Technical Professionals, Jason Bell, Wiley
3. Machine Learning: The Art and Science of Algorithms that Make Sense of Datal, Peter Flach,Cambridge University Press.
4. Deep Learning , Rajiv Chopra, Khanna Publi.
5. Machine Learning, V. K. Jain, Khanna Publi

M. Sc. (Information Technology)
Semester II

Elective 2 : MIT2T07

Paper III :ASP.NET

Hours/Week :4
Credits :4

UNIT I

Introduction to ASP .NET – The .NET Framework, The .NET Programming Framework, .NET Languages, The .NET Class Library, About ASP .NET, Basic difference between C# and VB .NET, Data Types, Declaring Variables – Initializers, Arrays, Enumerations. Variable Operations –Advanced Math Operations, Type Conversions. Delegates.

UNIT II

The Basics about Classes - Shared Members, A Simple Class, Adding properties, Basic Method, Basic Event, Constructors. Value Types & Reference Types – Assignment Operations, Equality Testing. Advanced Class Programming – Inheritance, Shared Members, Casting. Understanding Namespaces and Assemblies – Importing Namespaces, Assemblies.

UNITIII

Web Server and user - Installing US. US Manager - Creating a virtual Director, Virtual Directories and Applications, Folder Settings, Adding virtual directory to your Neighborhood.Installing ASP .NET. ASP.NET Applications - ASP .NET file Types, The bin directory, Code- Behind, The Global .asax Code-Behind, Understanding ASP. Net Classes, ASP .NET Configuration,**Web Controls** - Basic Web Control classes, Auto PostBack and Web Control Events, A Web page Applets. Validation and Rich Controls.

UNITIV

State Management Tracing, Logging and Error Handling - Common errors, .NET Exception Object, Handling Exceptions, Throwing your own Exceptions, Logging Exceptions, Error pages, Page tracing. **Advanced ASP.NET -Component-Based Programming** - Creating Simple Component, Properties and State, Database Components, Using COM Components. Custom Controls-User Controls, Deriving Custom controls.

Books

1. The Complete Reference - ASP .NET by Matthew MacDonald - Tata McGraw- Hill
2. IntroducingMicrosoftDot Net,DavidPlatt,PHIPublication.
3. ASP .NET 4.5(Covers C# and VB codes),Black Book, Dreamtech Publication

M. Sc. (Information Technology)
Semester II

Elective 2 :MIT2T07

Paper III :DATA MINING

Hours/Week :4
Credits :4

UNIT I

Introduction to Data Mining: What is Data Mining? Motivating Challenges, Definitions, Origins of Data Mining, Data Mining Tasks, Data: Types of Data- Attributes and Measurement and Types of data sets, Data Quality-Measurement and Data Collection Issues, Issues Related to Applications, Data Preprocessing- Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Variable Transformation.

UNIT II

Exploring Data: The Iris Data Set, Summary Statistics- Frequencies and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Multivariate Summary Statistics, Visualization: Representation, Arrangement, Selection, Visualization Techniques: Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Visualizing Higher-Dimensional data, OLAP and Multidimensional data Analysis, Classification: Basic Concepts, Decision Trees, and Model Evaluation: Preliminaries, General Approach to Solving Classification Problem, Decision Tree Induction, Evaluating the Performance of a Classifier, Methods for Comparing Classifiers.

UNIT III

Classification: Alternative Techniques: Rule-Based Classifier, Rule Ordering Schemes, Building Rules-Based Classifier, Nearest Neighbor Classifiers, Bayesian Classifiers, Naive Bayes Classifier, Artificial Neural Networks (ANN), Support Vector Machines. Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Itemset Generation-Apriori Principle, Candidate Generation and Pruning, Support Counting, Computational Complexity, Rule Generation, Compact Representation of Frequent Itemsets, Alternative Methods for Generating Frequent Itemsets, FP-Growth Algorithm, FP-Tree Representation.

UNIT IV

Cluster Analysis: Basic Concepts and Algorithms: What is Cluster Analysis? Different Types of Clustering, Types of Clusters, Clustering Algorithms: K-means and its variants, Hierarchical clustering, Density based clustering. Graph-Based Clustering, Shared Nearest Neighbor Approach, Jarvis Patrick Clustering, SNN Density-Based Clustering, Anomaly Detection: Causes of Anomaly Detection, Approaches to Anomaly Detection, Statistical Approaches, Proximity-Based Outlier Detection, Density-based Outlier Detection, Clustering-Based Techniques.

Books

1. Introduction to Data Mining, Tan, Steinbach, Kumar.
2. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber, Morgan Kaufmann
3. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten and Eibe Frank, Morgan Kaufmann
4. Principles of Data Mining: David Hand, HeikkiMannila and Padhraic Smyth, PHP