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

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
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Syllabus
of
M. Sc. (Information Technology)
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Pre-requisites to enrol for the M. Sc. (Information Technology) Programme:

The student who has completed the B. Sc. Course with 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 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 enrol directly to 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							
								Theory				Practical			
				(Th)	TU	P		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
4	RM	Research Methodology	MIT1T04	4	-	-	4	3	80	20	40	-	-	-	100
5	DSC	Practical Based on Paper MIT1T01 and MIT1T02	MIT1P01	-	-	6	3	-	-	-	-	50	50	50	100
6	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							
								Theory				Practical			
				(Th)	TU	P		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
3	DSE	Elective 2	MIT2T07	4	-	-	4	3	80	20	40	-	-	-	100
4	OJT	Apprenticeship/Mini Project (Related to DSC)	MOJ2P01	-	-	8	4	3	-	-	-	50	50	50	100
5	DSC	Practical Based on Paper MIT2T05 and MIT2T06	MIT1P03	-	-	6	3	-	-	-	-	50	50	50	100
6	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
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) 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

Course Objectives:

1. To impart artificial intelligence principles, techniques and its history.
2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.
3. To develop intelligent systems by assembling solutions to concrete computational problems

Course Outcomes:

- Evaluate Artificial Intelligence (AI) methods and describe their foundations.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
- Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.
- Analyze and illustrate how search algorithms and planning play vital role in problem solving.

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.

UNIT II

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

Course Objectives:

1. To Understand the different types of vulnerability scanning
2. To know the different network defense tools and web application tools
3. To understand the different types of cyber crimes and laws
4. To understand the different tools for cyber crime investigation

Course Outcomes:

- Apply regulation of cyberspace and know the issue and challenges of cyber security.
- Legal perspectives of cyber crime, IT act 2000 and its amendments.
- Social media monitoring : Challenges, opportunities and pitfalls in online social network, Security issues related to social media

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 Media Overview 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

Course Objectives:

1. To become familiar with client server architecture and able to develop a web application using various technologies.
2. To understand and develop a web-based application using a framework concept.
3. To gain the skills and project-based experience needed for entry into web application and development careers

Course Outcomes:

- Able to Installing and Configuring PHP on Windows and Linux Platforms
- Web page development using PHP

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 Rasmus Lerdorf and Kevin Tatroe, Orilly Publications.

M. Sc. (Information Technology)
Semester I

Elective 1: MIT1T03
Paper III: DISCRETE MATHEMATICS

Hours/Week : 4
Credits : 4

Course Objectives:

1 To cover certain sets, functions, relations and groups concepts for analyzing problems that arise in engineering and physical sciences.
2 To imparting to analyze the problems connected with combinatorics and Boolean algebra.
3 To solve calculus and integral calculus problems.

Course Outcomes:

- Observe the various types of sets, functions and relations.
- Understand the concepts of group theory.
- Understand the concepts of combinatorics.
- Understand the concepts of graph theory and its applications.
- Learning logic and Boolean algebra. Using these concepts to solve the problems

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

Course Objectives:

1. To study and understand the research issues & challenges, research goals, scientific methods
2. To study processing and analysis of data, Quantitative and Qualitative data analysis.
3. Reviewing Literature and research papers, writing research papers, Thesis reports.

Course Outcomes:

- The basic concept of research and its methodologies, Identify appropriate research topics, select and define appropriate research problem and parameters.
- Prepare a project (to undertake a project)
- Organize and conduct research in a more appropriate manner, writing research report and thesis.

UNIT I

Introduction: Meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done, research processes, criteria of good research, **Defining Research Problem:** necessity of defining the problem, techniques involved in defining a problem, **Research Design**: meaning of research design, need for research design, features of good design, different research designs, basic principles of experimental design.

UNIT II

Methods of Data Collection: Collection of primary data, Observation method, Methods of Data collection, Interview Method, Collection of data through questionnaire, Collection of data through schedules, Difference between questionnaire and schedules, **Processing and Analysis of Data:** Processing operations, Problems in processing, Types of Analysis, Statistics in Research, Simple Regression analysis, multiple correlation and regressions, Partial correlation. **Quantitative Data analysis:** Types of quantitative data, data coding, visual aids for quantitative data analysis using statistics for quantitative data analysis, Interpretation data analysis result, evaluating quantitative data analysis, **Qualitative Data analysis:** Analyzing textual data, analyzing non-textual qualitative data, Grounded theory, computer aided qualitative analysis, evaluating qualitative data analysis.

UNIT III

Interpretation and Report Writing: Techniques of Interpretation, Significance of Report Writing, Different steps in Writing report, Layout of research report, type of report, oral presentation, mechanics of writing a research report **Python Tools:** File Handling, Introduction, Handling Binary data and CSV files, Zipping and Unzipping files, Directory **Regular Expression and Web scraping:** Introduction, Function of Re Module, web scraping.

UNIT IV

LaTeX: Writing scientific report, structure and components of research report, revision and Refining, writing project proposal, paper writing for international journals, submitting to editors conference presentation, preparation of effective slides, pictures, graphs and citation styles.

Books:

1. C. R. Kothari, Research Methodology Methods and Techniques, 2nd. ed. New Delhi: New Age International Publishers, 2009.
2. Briony J. Oastes, Researching Information Systems and Computing, SAG Publication India Pvt. Ltd., New Delhi.
3. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, Python Programming: A Practical Approach, First edition published 2022 by CRC Press.
4. F. Mittelbach and M. Goossens, The LATEX Companion, 2nd. ed. Addison Wesley, 2004.

M. Sc. (Information Technology)
Semester II

MIT2T05
Paper I: CLOUD COMPUTING

Hours/Week : 4
Credits : 4

Course Objectives:
1. To Understand fundamentals of cloud computing
2. To acquire good working knowledge of the essentials of Cloud Micro Services
3. To implement business specific cloud applications

Course Outcomes:
- Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
- Compare the advantages and disadvantages of various cloud computing platforms.
- Program data intensive parallel applications in the cloud.
- Analyze the performance, scalability, and availability of the underlying cloud technologies and software.
- Identify security and privacy issues in cloud computing.

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, 1st 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

Course Objectives:

1. Ability to comprehend the concept of supervised and unsupervised learning techniques
2. Differentiate regression, classification and clustering techniques and to implement their algorithms.
3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

Course Outcomes:

- Understand the concepts of various machine learning strategies.
- Handle computational data and learn ANN learning models.
- Solve real world applications by selecting suitable learning model.
- Boost the performance of the model by combining results from different approaches.

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: Markov Chain 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 Data, 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

Course Objectives:
1. To understand ASP.NET structure
2. To understand Error handling, Component based programming.

Course Outcomes:
- Able to Installing and Configuring .NET framework
- Web development using ASP.NET

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.

UNIT III

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.

UNIT IV

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. Introducing MicrosoftDot 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

Course Objectives:

1. To introduce the fundamental processes data warehousing and major issues in data mining
2. To impart the knowledge on various data mining concepts and techniques that can be applied to text mining, web mining etc.
3. To develop the knowledge for application of data mining and social impacts of data mining.

Course Outcomes:

- Interpret the contribution of data mining to the decision-support systems.
- Prepare the data needed for data mining using preprocessing techniques and apply the various visualization techniques.
- Discover interesting patterns from large amounts of data using Association Rule Mining
- Extract useful information from the labeled data using various classifiers and Predictors

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

M. Sc. (Information Technology)
Semester III

MIT3T08
Paper I: ADVANCED SOFTWARE ENGINEERING

Hours/Week : 4
Credits : 4

Course Objective:
The course offers students to develop the ability to design software systems and analyse and test their performance.

Course Outcomes:
On successful completion of this subject students should be able to:

- To demonstrate an understanding of advanced knowledge of the practice of software engineering, design, validation, test and deployment.
- Use modern engineering principles, processes, and technologies to solve difficult engineering issues and tasks.
- Demonstrate leadership and the ability to participate in teamwork in an environment with different disciplines of engineering, science and business.
- Identify the proper ethical, financial, and environmental effects of their work.

Unit I
Introduction to Software Engineering, Software Engineering as a Layered Technology, Software Development Life Cycle, Generic View of process, A process framework, Process Model – Waterfall, Incremental, Evolutionary, Unified Process Model, Agile Process Model, Scrum, Dynamic System development model, CMMI.

Unit II
System Models: Context Model, Behavioural Model, Data Model, Object Model, Modelling with UML, Design Engineering: Design Process, Design Quality. Design Concepts: Abstraction, Architecture, Patterns, Information Hiding, Functional Independence, Modularity. Design Model: OO Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Unit III
Testing Strategies, Strategic Approach to software testing: Verification, Validation, Error, Fault, Bug, Failure. Types of software testing: Unit Testing, White Box Testing, Black Box Testing, Software Quality Assurance: Software Reliability. Risk Management: Reactive, Proactive risk, Risk Identification, Risk Projection, Risk Refinement, RMMM plan.

Unit IV
Software Metrics: Software Sizing, LOC, FP Based estimations, estimation model, COCOMO Model, Project Scheduling, Time Line Chart, Software Configuration Management: Change Control and version control, software Reuse, Software Re-engineering, Reverse Engineering.

Books:
1. Software Engineering: A Practitioner's Approach, Roger Pressman, Macgraw Hill International Edition.
2. Fundamentals of Software Engineering, Carlo Gheezzi, Mehdi Jazayeri, Dino Mandrioli, PHI Publication.

M. Sc. (Information Technology)
Semester III

MIT3T09
Paper II: NETWORK SECURITY

Hours/Week : 4
Credits : 4

Course Objective: The course offers to impart knowledge on Network security, various encryption techniques, and intrusion detection and the solutions to overcome the attacks.

Course Outcomes:

On successful completion of this subject students should be able to:

- Classify the symmetric encryption techniques
- Illustrate various Public key cryptographic techniques
- Evaluate the authentication and hash algorithms.
- Basic concepts of system level security

Unit - I

Introduction to Security Security Goals, Different Types of Attacks on Networks, Threats, Vulnerabilities, Attacks, Data Integrity, Confidentiality, Anonymity Message and Entity Authentication Authorization, Nonrepudiation, Cryptographic Techniques.

Unit – II

Principles of Cryptography Symmetric Key Cryptography: DES, Block Cipher Modes of operation, Advanced Encryption Standard. Key distribution, Attacks. Public key Cryptography RSA, Cryptographic Hash functions, Authentication, Message Authentication Code (MAC), Digital Signatures, DSA Signatures.

Unit - III

PKI and Security Practices Digital Certificates, MD5, SHA, Challenge Response protocols-Authentication applications, Kerberos, X.509, Securing Email, Web Security.

Unit - IV

Software Vulnerabilities Buffer Overflow, Cross Site Scripting, SQL Injection, Case Studies on worms and viruses, Virtual Private Networks, Firewalls **Wireless Security** Security in Wireless Local Area Networks, Security in Wireless Ad Hoc and Sensor Networks, Security of the Internet of Things

Books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 7th edition, 2016.
2. Behrouz A. Forouzan, Cryptography and networksecurityMCGrawHill3rdEdition
3. C. Kaufman, R. Perlman, M. Speciner, "Network Security: Private Communication in a Public World", Pearson Education, 2nd edition, 2002.

Reference Books:

1. Applied Cryptography - Schnier
2. J. Edney, W.A. Arbaugh, "Real 802.11 Security: Wi-Fi Protected Access and 802.11i", Pearson Education, 2004.
3. E. Rescorla, "SSL and TLS: Designing and Building Secure Systems", Addison-Wesley, 2001.
4. B.L. Menezes, "Network Security and Cryptography", Wadsworth Publishing Company Incorporated, 2012.
5. Handbook of Applied Cryptography - Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone: Online Version

M. Sc. (Information Technology)
Semester III

MIT3T10
Paper III: INTERNET OF THINGS (IoT)

Hours/Week : 4
Credits : 4

Course Objective: The course offers to impart knowledge on IoT and protocols, it expose the student to some of the electrical application areas where Internet of Things can be applied..

Course Outcomes:

On successful completion of this subject students should be able to:

- Able to understand the application areas of IoT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics.

UNIT I

Introduction to IOT , Understanding IoT fundamentals, IOT Architecture and protocols, Various Platforms for IoT, Real time Examples of IoT, Overview of IoT components and IoT, Communication Technologies, Challenges in IOT.

UNIT II

Arduino Simulation Environment, Arduino Uno Architecture, Setup the IDE, Writing Arduino Software , Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD

UNIT III

Sensor & Actuators with Arduino , Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino

UNIT IV

Basic Networking with ESP8266 WiFi module, Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server- introduction, installation, configuration

Posting sensor(s) data to web server

Books:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

Referenced Book:

1.Vijay Madisetti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition
2. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", Pearson Education 2015
3. Cuno Pfister, "Getting Started with the Internet of Things", O"Reilly Media 2011

M. Sc. (Information Technology)
Semester III

Elective 3: MIT3T11
Paper IV: NEURAL NETWORK

Hours/Week : 4
Credits : 4

Course Objectives:
1. To introduce the foundations of Artificial Neural Networks
2. To learn various types of Artificial Neural Networks

Course Outcomes:
- Ability to understand the concepts of Neural Networks.
- Ability to select the Learning Networks in modeling real world systems

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

UNIT III

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

UNIT IV

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.

M. Sc. (Information Technology)
Semester III

Elective 3: MIT3T11
Paper IV: COMPUTER VISION

Hours/Week : 4
Credits : 4

Course Objective: The course offers to introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving.

Course Outcomes:

On successful completion of this subject students should be able to:

- Implement fundamental image processing techniques required for computer vision.
- Develop computer vision applications.

Unit - I

Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, Matching. Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components.

Unit - II

Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation.

Unit - III

Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting,Curve fitting (Least-square fitting). **Region Analysis**: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.

Unit - IV

Facet Model Recognition: Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consisting labeling problem, Back-tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry - from 2D to 3D, Image matching: Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching.

Books:

1. David A. Forsyth, Jean Ponce,"Computer Vision: A Modern Approach"
2. R. Jain, R. Kasturi, and B. G. Schunk, "Machine Vision", McGraw-Hill.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision" Thomson Learning.
4. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison- Wesley, 1993.

M. Sc. (Information Technology)
Semester IV

MIT4T12
Paper I: BIG DATA ANALYTICS

Hours/Week : 4
Credits : 4

Course Objective: The course offers students to develop understanding towards the basic concepts of Big Data, adaptation and planning of Big Data and Business Intelligence

Course Outcomes:

On successful completion of this subject students should be able to:

- Classify and categorize different types of Data Analytics
- frame Business Architecture
- Understand the use of Information and Communication Technology
- Differentiate Between Traditional data Analysis and Big Data Analytics
- Evaluate different Enterprise Technologies and Big Data Business Intelligence

Unit – I

Concepts and terminology: Data Sets, Data Analysis, Data Analytics - Descriptive, Diagnostic, Predictive, Prescriptive Analytics, Business Intelligence, Big Data Characteristics - Volume, Velocity, Variety, Veracity and Value. Different types of Data - Structured, Unstructured, Semi-Structured, Meta Data Business Motivations and Drivers for Big Data Adoption.

Unit - II

Big Data Analytics Life cycle - Business Case Evaluation, Data Identification, Data Acquisition and Filtering, Data Extraction, Data Validation and Cleansing, Data Aggregation and Representation, Data Analysis, Visualization, Utilization of Analysis Results.

Unit - III

Enterprise Technologies - OLTP, OLAP, ETL Big Data BI, Clusters, Big Data Storage Concepts, Big Data Processing Concepts, Big Data Storage Technology - On Disk Storage Devices, NOSQL Databases, In-Memory Storage Devices.

Unit - IV

Big Data Analysis Techniques - Quantitative, Qualitative, Statistical Analysis, Semantic Analysis, Visual Analysis, Introduction to Hadoop, Map Reduce, Hive, Pig, Spark and Big Data Analytics.

Books:

1. Big Data Fundamentals Concepts, Drivers & Techniques Thomas ErL, Wajid Khattak and Paul Buhler, Pearson Publication 2022.
2. Big Data Analytics Introduction to Hadoop, Spark and Machine- Learning, RajKamal, Preeti Saxena, McGraw Hill Publication, 2019.

M. Sc. (Information Technology)
Semester IV

MIT4T13
Paper II: BLOCK CHAIN TECHNOLOGY

Hours/Week : 4
Credits : 4

Course Objective: To understand the technology behind blockchain, comprehend the issues related to blockchain and study the real-world applications of blockchain

Course Outcomes:
On successful completion of this subject students should be able to:

- Understand the requirements of the basic design of blockchain
- Identify the need of blockchains to find the solution to the real-world problems
- Summarize the working of blockchain
- Recognize the underlying technology of transactions, blocks, proof-of-work,
- and consensus building
- Design and implement new ways of using blockchain for applications other than cryptocurrency
- Categorize and implement the various platforms

Unit I
Blockchain concepts, evolution, structure, characteristics, a sample blockchain application, the blockchain stack, benefits and challenges, What is a Blockchain? Public Ledgers, Blocks in a Blockchain, Blockchain as public ledgers, Transactions, Distributed consensus.

Unit II
Building a block: Elements of Cryptography-Cryptographic Hash functions, Merkle Tree, Elements of Game Theory, Building a block: Elements of Cryptography-Cryptographic Hash functions, Merkle Tree, Elements of Game Theory, Design methodology for Blockchain applications, Blockchain application templates, Blockchain application development, Ethereum, Solidity, Sample use cases from Industries, Business problems.

Unit III
Smart contract, structure of a contract, interacting with smart contracts using Geth client and Mist wallet, smart contract examples, smart contract patterns, Dapps, implementing Dapps, Ethereum Dapps, case studies related to Dapps

Unit IV
Byzantine fault tolerance, proof-of-work vs proof-of-stake, Security and Privacy of Blockchain, smart contract vulnerabilities, Scalability of Blockchain

Books:
1. Blockchain applications: a hands-on approach, Bahga A., Madisetti V., VPT, 2017.

Reference Book:

1. Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions, Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress, 2018.
2. Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara and Paul R. Allen, McGraw Hill, 2018.
3. Blockchain enabled Applications Vikram Dhillon, David Metcalf and Max Hooper, Apress, 2017,
4. The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology, William Mougayar, Wiley, 2016.
5. Blockchain Science: Distributed Ledger Technology, Roger Wattenhofer, Inverted Forest Publishing; 3rd edition, 2019.

M. Sc. (Information Technology)
Semester IV

MIT4T14
Paper III: DEEP LEARNING

Hours/Week : 4
Credits : 4

Course Objectives: The course offers to understand major deep learning algorithms and to identify deep learning techniques suitable for a given problem.

Course Outcomes:

On successful completion of the course students will be able to:

- Solve various deep learning problems
- Apply autoencoders for unsupervised learning problems
- Implement Convolutional Neural Networks to image classification problems
- Apply recurrent neural network to sequence Learning Problem.

Unit - I

Introduction to Neural Networks: Feed Forward Neural Networks, Backpropagation , Gradient Descent (GD) Principal Component Analysis: Eigenvalues and eigenvectors, Eigenvalue Decomposition Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition.

Unit – II

Autoencoders: Under complete Auto encoders, Regularization in auto encoders, De-noising auto encoders, Sparse auto encoders, Contractive auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Noise Robustness

Unit - III

Convolutional Neural Networks: The Convolution Operation, Motivation, Pooling, Le Net, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation.

Unit - IV

Recurrent Neural Networks: Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, LSTMs, GRUs, The Challenge of Long-Term Dependencies, Attention Mechanism.

Books:

1. Neural Networks and Deep Learning A Textbook, Charu C. Aggarwal, Springer
2. Deep Learning from Scratch, Building with Python from First Principles, Seth Weidman, O'Reilly

Reference Books:

1. Deep Learning by Ian Good fellow, Yoshua Bengio and Aaron Courville MIT press

M. Sc. (Information Technology)
Semester IV

Elective 4: MIT4T15
Paper IV: REINFORCEMENT LEARNING

Hours/Week : 4
Credits : 4

Course Objectives:

- Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.
- Understand and work with tabular methods to solve classical control problems.
- Recognize current, advanced techniques and applications in RL.

Course Outcome:

- Implement in-code common algorithms following code standards and libraries used in RL.
- Understand and work with approximate solutions.
- Explore imitation learning tasks and solutions.
- Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.
- Understand and work with tabular methods to solve classical control problems.
- Recognize current advanced techniques and applications using RL.

Unit I

Reinforcement Learning Primitives: Introduction and Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms, Random Variables, Probability Mass Function, Probability Density Function, Cumulative Distribution Function and Expectation. Introduction to Agents, Intelligent Agents – Problem Solving – Searching, Logical Agents.

Unit II

Markov Decision Process and Dynamic Programming: Markov Property, Markov Chains, Markov Reward Process (MRP), Bellman Equations for MRP, Dynamic Programming: Polices (Evaluation, Improvement, Iteration, Value Iteration), Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming.

Unit III

Monte Carlo Methods and Temporal Difference Learning: Monte Carlo: Prediction, Estimation of Action Values, Control and Control without Exploring Starts, Off-Policy Control, Temporal Difference Prediction: TD(0), SARSA: On-Policy TD control, Q-Learning: Off-Policy TD control, Games, After states, and Other Special Cases.

Unit IV

Deep Reinforcement Learning: Deep Q-Networks, Double Deep-Q Networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay). Introduction to Policy-based Methods, Vanilla Policy Gradient, REINFORCE Algorithm and Stochastic Policy Search.

Books:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson Education Limited, 2016.
3. Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley, 2002

M. Sc. (Information Technology)
Semester IV

Elective 4: MIT4T15
Paper IV: CYBER FORENSICS

Hours/Week : 4
Credits : 4

Course Objective: The course offers to Identify, gather, and preserve the proof of a law-breaking and to track and prosecute the perpetrators in an exceedingly court of law.

Course Outcomes:

On successful completion of this subject students should be able to:

- To learn investigation tools and techniques, analysis of data to identify evidence.
- To analyze the technical Aspects & Legal Aspects related to cyber crime.

Unit – I

Recent amendments in IT Act, internet & web technologies, web hosting and development, attributes in cyberspace and legal framework of cyberspace, hacking, virus, obscenity, pornography, programme manipulation, Copyright, Patent, software piracy, intellectual property rights, trademark, domain disputes, and computer security, etc., Encryption and Decryption methods. Search and seizures of evidence. Investigation of cyber crimes and tools for analysis.

Unit – II

Information security: Domains, Common Attacks, Impact of Security Breaches. Protecting Critical Systems (Information Risk Management, Risk Analysis etc) Information Security in Depth Physical security (Data security Systems and network security) Program Security: Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats File protection mechanism, Authentication: Authentication basics, Password, Challenge response, Biometrics. Network Security: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec. Principles of network forensics, Attack Trace-back and attributes, Critical Needs Analysis. IDS: Network based Intrusion Detection and Prevention Systems, Host based Intrusion Prevention System. Cloud Computing-Its Forensic and Security Aspects.

Unit – III

Cyber Crime Investigations: Where Evidence Resides on Windows systems, Conducting a Windows investigation, File Auditing and Theft of information, Handling the Departing Employee, Steps in a Unix Investigation, Reviewing Pertinent Logs, Performing Keywords Searches, Reviewing Relevant Files, Identifying Unauthorized User Accounts or Groups, Identifying Rogue Processes, Checking for Unauthorized Access Points, Analyzing Trust Relationships, Detecting Trojan Loadable Kernel Models. Finding Network based Evidence, Generating Session data with TCP Trace, Reassembling sessions using TCP flow and Ethereal.

Unit – IV

Open source tools for digital forensics and Registry Forensic- Open source, Open source examination platform, preparing the examination system, using LINUX and Windows as host, Study of Sleuth Kit: Installing Sleuth Kit, Sleuth Kit tools (Volume layer tools, File system Layer tools, Data unit Layer tools, Metadata Layer Tools) Registry Analysis, Understanding Windows Registry and Registry Structure.

Books:

1. C. P. Pfleeger, and S. L. Pfleeger, "Security in Computing", Pearson Education.
2. Computer Forensic Investigating Data and Image Files, EC Council Press
3. Robert Jones, Internet Forensics Using Digital Evidence to Solve Computer Crimes, O'Reilly Media Publication
4. Forouzan Data Communication and Networking McGraw Hill
5. Stallings, "Cryptography And Network Security: Principles and practice"
6. Kevin Mandia, Chris Prosise and Matt Pepe, Incident response and computer forensics, McGraw Hill Publication
7. Cory Altheide, Harlan Carvey, Digital Forensics with Open source Tools, Syngress Publication
8. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003
9. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.