SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2026

Programme Code: MIT

Programme Name: M.Sc. (Information Technology)

(Semester I-II)

Examinations: 2024-2026

P.G. Department of Computer Science & Applications

Khalsa College, Amritsar

Programme name: M.Sc. (Information Technology)
Programme code: MIT
Programme Duration :2years

Programme Objectives

1.	To impart sound knowledge in Information Technology and to enable students to apply the acquired skills creatively in computer and related technologies in practical scenarios.
2.	To effectively utilize knowledge of computing principles to develop sustainable solutions to the present and the prospective computing problems.
3.	To effectively initiate, create and to communicate innovation through social, legal, ethical, and cultural issues inherent in the discipline of computing concepts and solutions to bridge the gap between computing industry experts and business leaders.
4.	To exhibit computing expertise through corporate leadership and entrepreneurship;
5.	To address in the broad areas of multi-disciplinary in nature, and to keep pace with advances in Information Technology.

Program Specific Outcomes (PSOs):

PSO-1	This programme provides understanding about techniques, technologies and methods used in managing and implementing information technology systems.
PSO-2	Widens and deepens the understanding of computing technologies and covers high level concepts that enable the effective management and planning of IT projects and services.
PSO-3	Students gain knowledge in the areas like Artificial Neural Netwoks, image processing, Programming languages, Database Technologies, Advanced Operating System, Mobile Technologies and core computing subjects. This make students employable according to current demand of IT Industry as they understand all dimensions of the concepts of software application and projects.

M.Sc. (Information Technology)

Semester I

SN	Course Code	Course Name	Distribution of The Marks				Lectures Per week			Credit Distribution			Total Credit L+T+P	Page No.
			Theory	Internal Assessment	Practical	Total	L	T	P	L	T	P		
Discipline Specific Course(DSC)														
1	MIT-411	Internet Of Things (IOT)	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**4-5**
2	MIT-412	Distributed Computing	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**6-7**
3	MIT-413	Advanced Computer Organization and Architecture	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**8-9**
4	MIT-414	Network Operating System	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**10-11**
5	MIT-415	R Programming	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**12-13**
Skill Enhancement Course(SEC)														
6	MIT-416P	Programming Laboratory-I(R Programming)	**0**	**13**	**37**	**50**	**0**	**0**	**6**	**0**	**0**	**2**	**2**	**14**
													22	

M.Sc. (Information Technology)

SEMESTER-I
MIT-411: Internet of Things (IoT)
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. Medium of Examination is English Language.
2. There will be five sections.
3. Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.
4. Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.

Course Objectives:

1.	Understand the definition and significance of the Internet of Things.
2.	Discuss the architecture, operation, and business benefits of an IoT solution.
3.	Examine the potential business opportunities that IoT can uncover.
4.	Explore the relationship between IoT, cloud computing, and big data.
5.	Identify how IoT differs from traditional data collection systems.

UNIT-I

M2M to IoT: M2M to IoT, The Vision, Introduction: Machine to Machine (M2M),IoTfrom M2M to IoT, M2M towards IoT, the global context, differing characteristics, M2M value chains, IoT value chains, An emerging industrial structure for IoT, The international-driven global value chain and global information monopolies, M2M to IoT, An Architectural Overview-Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, Standards considerations.

UNIT-II

IoT Architecture: State of the Art, Introduction, Architecture Reference Model, Reference model and architecture, IoT reference model, IoT Reference Architecture, Functional view, Information view, Deployment and operational view, Other relevant architectural views.

UNIT-III

IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems.

OpenSource Prototyping Platformsfor IoT: Basic Arduino Programming, Extended Arduino Libraries, Arduino, Based Internet Communication, Raspberry PI, Sensors and Interfacing.

UNIT-IV

Business Process in IoT: IoT Analytics, Creative Thinking Techniques, Modification, Combination Scenarios, Decentralized and Interoperable, Approaches, Object, Information Distribution, Architecture, Object Naming Service (ONS), Service Oriented Architecture, Network of Information, Etc.

Course Outcomes:

At the end of this course the student shall be able :

1.	To understand the application areas of IOT.
2.	To realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3.	To understand building blocks of Internet of Things and characteristics.

Reference:

1. From Machine-to-Machine to the Internet of Things: Introduction to a New Ageof Intelligence, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, StamatisKarnouskos, Stefan Avesand, David Boyle, Academic Press.
2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT,2014.
3. The Internet of Things: Connecting Objects to the Web. HakimaChaouchi (Editor). ISBN: 978-1-848-21140-7 June 2010, Wiley.
4. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications,2013.

M.Sc. (Information Technology)
SEMESTER-I
MIT-412: Distributed Computing
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

1	This course is an introduction to the design of distributed systems and algorithms that support distributed computing.
2	It aims to provide a practical exposure into the design and functioning of existing distributed systems.
3	Understanding of security techniques for security authentication.
4	Understanding of cryptographic algorithms, authentication and access control.

UNIT -I

Introduction: Characterization & classification of distributed systems, Resource Sharing, Web Challenges, Distributed system models. Hardware & software issues.

Communication: Inter-process communication, Layered protocols, Client server protocols, RPC, group communication.

UNIT -II

Coordination, synchronization & consistency: Logical clocks, Physical clocks, mutual exclusion, election algorithms, atomic broadcast, sequential consistency transaction distributed consensus,

Threads: Thread synchronization, implementation issues, and threads vs. RPC. Models of distributed computing: Client server and RPC, RPC architecture, External data representation and marshalling.

UNIT -III

Group models and peer to peer: Groups for service replication/ reliability, groups for parallelism / performance, client/ server vs. peer-to-peer, multicast, atomic broadcast.

Distributed file system: File system architecture, Security, Naming/ location transparency, R/W semantics, cache coherence, replication.

UNIT -IV

Distributed shared memory: DSM architecture, consistency models and relation to caching, release consistency, comparison with message passing and RPC.

Security: Introduction, overview of security techniques, cryptographic algorithms, digital signatures, authentication and access control.

Case study: CORBA, MACH

References:

1. Distributed systems, concepts and design, 3rd Edition, Addison Wesley by George Colouris, Jean Dollimore and Tim Kinder berg, 2006.
2. Distributed system, 2nd Edition, Addison Wesley by SapeMullender, 2006.
3. Distributed Computing: Fundamentals, Simulations, and Advanced Topics, Wiley, by Jennifer Welch HagitAttiya 2nd Edition (2006).
4. "Distributed Systems – Principles and Paradigms" by Andrew S Tanenbaum and Maaten Van Steen (2016).

Course Outcomes:

At the end of this course the student shall be able to:

CO-1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies.
CO-2	Demonstrate knowledge of the core architectural aspects of distributed systems.
CO-3	Design and implement distributed applications.
CO-4	Overview of security techniques
CO-5	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems).
CO-6	Apply important methods in distributed systems to support scalability and fault tolerance.
CO-7	Digital signatures, authentication and access control.

M.Sc. (Information Technology)
SEMESTER-I
MIT-413: Advanced Computer Organization and Architecture
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

1.	To make students know about the Parallelism concepts in Uniprocessor systems.
2.	To give the students an elaborate idea about the different memory systems and buses.
3.	To introduce the advanced processor architectures to the students.
4.	To make the students know about the importance of multiprocessor and pipeline computers.
5.	To give students idea about pipeline designing.
6.	To study about data flow computer architectures.

UNIT -I

Paradigms of Computing: Hardware taxonomy: Flynn's classification, Software taxonomy: Kung's taxonomy, SPMD, Instruction set architectures-CISC and RISC, Inter processor communication

Parallel Computational Models: Combinational circuits, PRAM Models, VLSI Models, conditions for Parallelism-Program Partitioning and Scheduling-program flow Mechanisms-Speed up performance laws-Amdahl's law, Gustafson's law-Memory bounded speedup Model.

UNIT -II

Parallelism in Uniprocessor Systems: Trends in parallel processing, Basic Uniprocessor Architecture, Parallel Processing Mechanism.

Parallel Computer Structures: Pipeline Computers, Array Computers, Multiprocessor Systems Architectural Classification Schemes: Multiplicity of Instruction-Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining

UNIT –III

Pipelining : An overlapped Parallelism, Principles of Linear Pipelining, Classification of Pipeline Processors.

Principles of Designing Pipelined Processors: Instruction Prefetch and Branch Handling, Data Buffering and Busing Structures, Internal Forwarding and Register Tagging, Hazard Detection and Resolution, Instruction pipeline design, Arithmetic pipeline design.

UNIT -IV

Superscalar and Super pipeline Design: Superscalar Pipeline Design, Super pipelined Design Structures and Algorithms for Array Processors: SIMD Array Processors, SIMD Computer Organizations, Masking and Data Routing Mechanisms, Inter-PE Communications Parallelism .

Text Book:

1. Kai Hwang,‖Advanced Computer architecture Parallelism ,scalablity ,Programmablity ‖, Mc Graw Hill,N.Y, 2003

References:

1. Computer Architecture and Parallel Processing, Faye A. Briggs, McGraw-Hill International Editions, 2003
2. Computer Systems Organization & Architecture, John d. Carpinelli, Addison Wesley, 2002
3. David A. PaΣerson and John L. Hennessey, ―Computer organizaΘon and design‖ Elsevier, Fifth edition, 2014.

Course Outcomes:

At the end of this course the student shall be able to:

CO-1.	Demonstrate concepts of parallelism in hardware/software.
CO-2.	Understanding the parallel computational models.
CO-3.	Understanding the parallel processing mechanism in uniprocessor systems.
CO-4.	Describe the architectural features of advanced processors.
CO-5.	Interpret performance of different pipelined processors.
CO-6.	Design instruction pipeline and arithmetic pipeline.
CO-7.	Familiar with the concept of pipeline, array and multiprocessor systems.

M.Sc. (Information Technology)
SEMESTER-I
MIT-414: Network Operating Systems
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

At the end of the course, the students will be able to:

1.	Make students learn about basics of Network and Operating system concepts that will help them to understand the requirements of Network Operating System.
2.	Make student learn about Active Directory.
3.	Learn the functions which are unique to network operating systems.
4.	Install and configure a network operating system on different platforms.
5.	Install and configure common network utilities such as DNS.
6.	Install and configure common network servers such as SMTP and FTP servers.

Unit-I

Introduction of various Network Operating Systems: Types of Operating system, My SQL, Unix/Linux.

Introduction to Computer Networks: Reference Model: OSI and TCP/IP reference model, IP routing.

Overview of Network Operating System: Introduction, Characteristic, Types, Architecture, Shell, Kernel, File System, Hardware requirements.

Unit-II

Introduction to Active Directory: Role of Active Directory DS Server, Features of Active Directory, Common Terminologies and Active Directory Concepts, Active Directory Schema, Active Directory

Objects, Active Directory concepts, Active Directory Data structure and storage architecture, DNS support for Active Directory, Active Directory DNS support components.

Unit-III

Disk Management: Terminology and Concepts, Managing Disks, Disk Quotas, Disk Fragmentation, Remote Storage, RAID and Mirroring.

Servers: Managing DHCP, DNS and Proxy servers.

User, Group and Computer Accounts: Creating and Managing user, Group and Computer Accounts, Managing Access Controls, Troubleshooting Accounts.

Unit-IV

Performance Monitoring and Security: Task Management, System Monitoring, Performance Logs and Alerts, Monitoring Memory, Network and Process Objects, Auditing Security Events, Audit Policy and Event Viewer.

Introdcution to Microsoft Network Monitoring Tool: Introduction to netmon tool, Installation and configuration of Netmon.

Case and Comparative Studies of MySQL, Unix/Linux OR any other OS.

References:

1. MCSA/MCSE; Exam 70-291, Implementing, Managing and Maintaining a Windows Server 2003 Network Infrastructure by Shinder Deborah Littlejohn, Shroff Publishers, 7th Reprint, 2005.
2. Networking: The Complete Reference by Craig Zacker, Tata McGraw-Hill, Seventh Reprint, 2004.
3. Unix Concepts and Applications, Sumitabha Das,4th Edition, Tata McGraw Hill, 2017.
4. Unix and Shell Programming: A Text Book, Behrouz A. Forouzen, Cengage India Private Limited, 2005.
5. Linux: A Practical Approach, B.Mohamad Ibrahim, Lakshmi Publications, Ist Edition, 2017.
6. Linux Security, R. J. Hontanon, Sybex publishers, 2001.
7. The Internet: Douglas E. Comer, 4thEdition, 2006.
8. MCTS- Guide to Microsoft Windows Server 2008 Network Infrastructure Configuartion, Micheal Bender, Course Technology Cengage Learning,1st edition, 2009.

Course Outcomes:

On completion of this course students will able to:

CO-1.	Recall basic concepts of Network and Operating System.
CO-2.	Learn about Network Operating System.
CO-3.	Understand real life applications and manage Network Operating System.
CO-4.	Acquire the knowledge about active directory.
CO-5.	Understand protection and security provided to systems and various permission available to different types of users and admin.
CO-6.	Understand Telnet and FTP, Distributed Systems. Case and Comparative Studies of MySQL, Unix/Linux OR any other OS.

M.Sc. (Information Technology)
SEMESTER-I
MIT-415: R Programming
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Objectives:

1	This course introduces R, which is a popular statistical programming language. The course covers data reading and its manipulation using R, which is widely used for data analysis internationally.
2	Understand and implement functions that support linear modelling, non-linear modelling, classical statistics, classifications, clustering and more. The course also covers different control structures and design of user-defined functions.
3	Learn how to develop the program in R Programming. Learn how to develop an open-source scripting language for predictive analytics and data visualization.

UNIT-I

Introduction to R, Installation of R interpreter, overview of R, features of R, major R data structures, Vectors, matrices, arrays, lists and data frames, Common Vector Operations,subletting of vector. Creating matrices, matrix operations, Applying functions to matrix Rows and Columns, Adding and deleting rows and columns.

UNIT-II

Creating list, list operations, applying list functions. Creating Data Frames, Merging Data Frames, Applying functions to Data Frames, Factors and Tables, factors and levels, Common functions used with factors, Control statements: Loops, looping Over Non-vector Sets, if-else , writing user defined function, scope of the variable, Rscriptfile.

UNIT-III

Input/ Output: scan (), read line () Function, recursion, replacement functions, Printing to the Screen Reading and writing CSV and text file. Math functions, function for statistical distributions, linear algebra operations on vector and matrices, Basics of simulation, simulation programming in R: Built random variable generator.

UNIT-IV

Data visualization in R**:** Plot() function and line plot, pie chart / 3D pie chart, Scatter plot, Box plot. Stringr package**:**Important functions in stringr, Regular expressions. Load data into dataframe, Viewing the data, selecting columns, selecting rows, Reordering the rows, Pipe operator, Group operations.

References:

1. Dennis,B.(2012):The R Student Companion,Taylor & Francis Group.

2. Matloff,N.(2011):TheArtofRProgramming:ATourofStatisticalSoftwareDesign,

3. William.Lander,J.P.(2014):RforEveryone:AdvancedAnalyticsandGraphics,Addison-WesleyData&AnalyticsSeries.

Course Outcomes:

At the end of this course the student shall be able to:

CO-1	Develop an R script and execute on R Programming Environment.
CO-2	Build new packages for sharing and reusability.
CO-3	Install, load and deploy the required packages.
CO-4	Join columns and rows in a data frame using bind functions
CO-5	Utilize R Data types for developing programs and learn all the basics of R-Programming (Data types, Variables, and Operators.
CO-6	Applying string manipulation functions.
CO-7	Developing packages, data frames
CO-8	Learning with different file systems and CSV file systems.

M.Sc. (Information Technology)
SEMESTER-I
MIT-416P
Programming Laboratory – I
(R Programming)
Skill Enhancement Course (SEC)

Time: 3 Hrs. **Total Marks: 50**

Credits		
L	**T**	**P**
0	**0**	**2**

Practical Marks: 37

Practical Internal Assessment Marks:13

Course Objectives:

1.	Understand and implement functions that support linear modelling, non-linear modelling, classical statistics, classifications, clustering and more.
2.	Learn how to develop the program in R Programming.
3.	Learn how to develop an open-source scripting language for predictive analytics and data visualization.

Programming laboratory based on R Programming

Course Outcomes:

At the end of this course the student shall be able to:

CO-1.	Show the installation of the R Programming Environment.
CO-2.	Utilize R Data types for developing programs and Learn all the basics of R-Programming (Data types, Variables, and Operators.
CO-3.	Implementation of R-loops with different examples, learn the basics of functions in R and implement with example.
CO-4.	Join columns and rows in a data frame using bind functions, developing packages, data frames, and string manipulation functions.
CO-5.	Learning with different file systems and CSV file systems.

M.Sc. (Information Technology)
Semester II

SN	Course Code	Course Name	Distribution of The Marks				Lectures Per week			Credit Distribution of The Course			Total Credit Per Course L+T+P	Page No.
			Theory	Internal Assessment	Practical	Total	L	T	P	L	T	P		
Discipline Specific Course(DSC)														
1	**MIT-421**	Mobile Computing	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**16-17**
2	**MIT-422**	Optional Paper Option (i): Distributed Databases Option (ii): Cloud Computing	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**18-21**
3	**MIT-423**	Image Processing	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**22-23**
4	**MIT-424**	Fuzzy Systems	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**24-26**
5	**MIT-425**	Advanced Operating System	**75**	**25**	**0**	**100**	**5**	**1**	**0**	**3**	**1**	**0**	**4**	**27-29**
Skill Enhancement Course(SEC)														
6	**MIT-426P**	Programming Laboratory-II	**0**	**13**	**37**	**50**	**0**	**0**	**6**	**0**	**0**	**2**	**2**	**30**
													22	

M.Sc. (Information Technology)
SEMESTER-II
MIT-421: Mobile Computing
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	T	P
3	1	0

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

1.	To provides complete knowledge of mobile communication process.
2.	To provide leaning about various components used in mobile telephony such as mobile station, base station, switching centres etc.
3.	To teach working model used behind the mobile communication and elaborating the relation between wired and wireless systems of communications.
4.	To deeply study about the mobile network layer and platforms of mobile applications.

UNIT-I

INTRODUCTION TO MOBILE COMPUTING: Introduction and need for Mobile Computing Mobility and portability, Mobile and Wireless devices, Applications, Brief History of wireless communication. Current Wireless Systems: Overview of Paging Systems, Cordless Phones, Cellular Telephone Systems, Satellite Communication, Wireless LANs, Bluetooth, Modern

WIRELESS TRANSMISSION: General Concepts of multiplexing and modulation, Spread Spectrum, Cellular Systems.

MOBILE NETWORK LAYER:

Mobile IP — DHCP — AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols — DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) – MANET Vs VANET — Security.

UNIT-II

MEDIUM ACCESS CONTROL LAYER: Why specialized MAC- hidden and exposed terminals, near and far terminals, General Concepts and comparison of SDMA, FDMA, TDMA, CDMA

MOBILE PLATFORMS AND APPLICATIONS:

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

UNIT -III

Mobile TCP: Traditional TCP , Congestion Control, Slow start, Fast retransmit / Fast recovery , Implications on mobility , Classical TCP improvements , Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit / Fast recovery, Transmission / Timeout freezing, Selective Retransmission, Transaction oriented TCP , TCP over 2.5/3G wireless networks

GSM: Mobile Services (Bearer, Tele-and-supplementary services),

System Architecture –(Radio subsystem , Network and switching subsystem , Operation subsystem), Protocols –(Localization and calling , Handover), Value Added Services –(SMS: Architecture, Mobile Originated and Mobile Terminated procedures) , Cell Broadcast Service:(Architecture, Message Transfer Procedure) , MMS:(Architecture, Protocol framework, Message Transfer Procedure) , Location Services:(Logical Reference Model, Control Procedures, Network, Architecture, determination of Location Information, Location based services), GPRS.

UNIT-IV

INTRODUCTION TO 3G MOBILE NETWORKS: UMTS - System architecture, radio interface, UTRAN – (Architecture, Functions of RNC, Core network), Handover – (Hard and soft handover)

WIRELESS APPLICATION PROTOCOL-Architecture, Wireless datagram protocol, Wireless transport layer security. Wireless transaction protocol, Wireless session protocol, Wireless application environment, WAP Push Architecture, protocols

References:

1. Mobile Communications: Jochen Schiller, Pearson Education, 2nd Edition
2. Mobile Computing: Implementing Pervasive Information and Communications Technologies by ShambhuUpadhyaya, Kevin Kwiat, AbhijitChaudhury, Springer First Edition,2008
3. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
4. William.C.Y.Lee,“Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition,TataMcGraw Hill Edition ,2006.
5. Theodore S. Rappaport “Wireless Communication-Principles and Practice”, Second Edition, Pearson Education

Course Outcomes:

At the end of this course the student shall be able to:

CO-1.	Imparting knowledge about working process of wireless communications.
CO-2.	Implementation knowledge of mobility, portability through various Wireless Communication Medias.
CO-3.	Study of mobile network layer including different types of protocols to handle network layer.
CO-4.	Deal with real world applications of mobile platform like iOS, Android, BlackBerryand Windows.
CO-5.	Exhibits complete understanding about cellular networks and mobile adhoc networks.
CO-6.	Adapting TCP/IP extensions in mobile and cellular technology.

M.Sc. (Information Technology)

SEMESTER-II

MIT-422
Option (i)
Distributed Databases
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

1.	To get acquaint students with the basics of Distributed DBMS, different Architectural Models for DDBMS, Data allocation, Relational Database Design, Information Requirements for Data allocation, Query Processing & Optimization in context of distributed databases.
2.	Students will learn about data distribution, data distribution mechanism/ techniques along with its pros/cons.
3.	The key goal is to prepare students for a professional career in the field of data administration and database design.
4.	To learn about Distributed Relational Database Query Processing & Optimization
5.	To get acquaint students with Query Decomposition and Distributed Concurrency Control issues, methods and their merits and demerits.

UNIT -I

Introduction

Concepts, Advantages and Disadvantages of Distributed database management system (DDBMS), Promises of DDBMS, Homogenous and Heterogeneous DDBMS. Functions of a DDBMS. Distributed Database Management System Architecture , Multidatabase management system(MDBS)

UNIT-II

Architectural Models for DDBMS (Distributed Database Management System): Autonomy, Distribution, Heterogeneity factors; Client Server Systems,Two-tier, three-tier and multi -tier Peer-to-Peer Distributed Systems, Global Directory Issues, Inheritance.

Distributed Relational Database Design

Fragmentation: Reasons, Alternatives, Degree, Information requirement. Horizontal, Vertical, Hybrid Fragmentation.

UNIT -III

Allocation: Allocation Problem, Information Requirements for allocation.

Distributed Relational Database Query Processing & Optimization, Objectives & Phases of distributed query language

Query Decomposition: Global and Local Query Optimization, Localization of Distributed Data, Query Optimization, Introduction to Distributed Query Optimization Algorithms, characterization of Query process, Layers of Query process, Query decomposition.

UNIT-IV

Distributed Concurrency Control, Objectives, Distributed Serializability, centralized two phase locking, Centralized two phase locking, Distributed two-phase locking: Majority locking Protocol, Biared Protocol,Quorum consensus Protocol

References:

1. M.TamerOzsu, Patrick Valdureiz, *'Principles of Distributed Database Systems'* Second Edition, Prentice Hall, 2002.
2. RomezElmasri, ShamkantB.Navathe, *'Fundamentals of Database Systems'* Pearson Education, 2005.
3. Silberschatz, Korth, Sudershan "Database System Concepts" 4th Ed. McGraw Hill,2006.
4. Connolly &Begg "Database Systems – A practical approachto design, Implementation and Management, 3rd Ed. Pearson Education, 2005.
5. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Distributed Systems: Concepts and Design, Fifth Edition, Pearson Education, 2017.

Course Outcomes:

CO-1.	Knowledge & Understanding: Distributed Databases and their design & development
CO-2.	Intellectual Cognitive/ analytical skills: Data Distribution and Allocation strategies
CO-3.	Practical Skills: Algorithmic knowledge about distributed database design and allocation.
CO-4.	Transferable skills: Usage of DDBMS design and allocation models
CO-5.	Be able to apply methods and techniques for distributed quey processing and optimisation

M.Sc. (Information Technology)
SEMESTER-II
MIT-422
Option (ii)
Cloud Computing
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

1.	The fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges.
2.	The basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations.
3.	Cloud computing risks, challenges and threats to infrastructure, data and access control. Cloud computing security architectural issues, Identity management and Autonomic security.
4.	Different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage (SDS).

UNIT -I

Introduction: Definition, Vision, Reference Model, Benefits, Limitations, Terminology, Open Challenges.

Virtualization: Definition, Type of Virtualization, Benefits, Limitations, Virtualization and Cloud, Virtual Appliance.

UNIT-II

Cloud Computing Architecture: Service Models, Deployment Models, Cloud Entities, Cloud Clients, Service Level Agreement (SLA) and Quality of Service (QoS) in Cloud Computing.

Programming Models in Cloud: Thread Programming, Task Programming and Map–Reduce Programming.

UNIT-III

Cloud Security: Infrastructure Security, Data Security, Identity and Access Management, Privacy Management, Security as a Service on Cloud.

UNIT-IV

Advance Topic in Cloud: Energy Efficiency in cloud, Centeralizing e-mail communications, Cloud Computing for the community, Cloud Computing for corporation, Federated Cloud Computing.

References:

1. RajkumarBuyya, Christian Vecchiola and ThamaraiSelvi, Mastering Cloud Computing: Foundation and Application Programming, Tata McGraw Hill, ISBN–13: 978–1–25–902995–0, New Delhi, India, Feb 2013.
2. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy, O'Reilly,ISBN–13: 978–8–18–404815–5.
3. Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd., ISBN–13: 978–8–12–652980–3, New Delhi, India, 2011.
4. Dr.Saurabh Kumar, Cloud Computing: Insights Into New–Era Infrastructure, Wiley India Pvt. Ltd, ISBN–13: 978–8–12–652883–7, New Delhi, India, 2011.
5. Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Cloud Computing for Dummies, Wiley India Pvt. Ltd, ISBN–13: 978–0–47–059742–2, New Delhi, India, 2011.
6. John W. itinghousejamesF.Ransome, "Cloud Computing Implementation, Management and Security" , CRC Press.

Course Outcomes:

Students will be able to:

CO-1.	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
CO-2.	Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient.
CO-3.	Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.
CO-4.	Illustrate the fundamental concepts of cloud storage
CO-5.	Analyze the core issues of cloud computing such as security, privacy, and interoperability.

M.Sc. (Information Technology)
SEMESTER-II
MIT-423: Image Processing
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

1.	To study the image fundamentals and mathematical transforms necessary for image processing.
2.	To understand the image enhancement techniques
3.	To study image restoration procedures.
4.	To Learn the image compression procedures.
5.	Understanding of image enhancement and Image restoration techniques.

UNIT –I

Digital Image Processing Systems: Introduction, Structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, Image sampling and quantization, Basic relationships between pixels

Image Enhancement in the Spatial Domain: Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters.
Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering

UNIT-II

Image Enhancement in the Frequency Domain: Frequency domain filters: Smoothing and Sharpening filters, Homomorphic filtering, Introduction to Fourier transform, DFT and 2- D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard transform, Karhunen - Loeve (Hotelling) transform.

Techniques of Colour Image Processing: Colour image signal representation, colour system transformations, extension of processing techniques to colour domain.

UNIT- III

Image Data Compression: Fundamentals, Redundancies: Coding, Interpixel, Psychovisual, Fidelity criteria, Image compression models, Error free compression, Lossy compression.

Morphological Image Processing: Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Thinning, Thickening, Skeleton, Morphological operations on gray-scale images

UNIT- IV

Image Segmentation: Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Region based segmentation

Image Representation and Description: Representation schemes, Boundary descriptors, Regional descriptor

References:

1. Digital Image Processing by Gonzalez & Wood, Addison Wesley,Pearson; 4th edition (10 May 2017)
2. Rosenfield, A and Kak, A.C., Picture processing, Academic PressN.Y., 1982.
3. Jain, A.K., Fundamentals of Digital Image Processing, Englewood Cliffs, Prentice Hall, Pearson (23 September 1988).
4. Chris Soloman, Stuart Gibson, Fundamentals of Digital Image Processing: A Practical Approach using MatLab, John Wiley 1st edition (20 December 2010).
5. Pratt, W.K. Digital Image Processing, John Wiley, 4th EditionN.Y./1978.
6. Solomon Chris , Toby Breckon Fundamentals of Digital Image Processing :A Practical Approach with Examples in Matlab1st edition (January 4, 2011)

Course Outcomes:

At the end of this course the student shall be able to:

CO-1.	Evaluate the techniques for image enhancement and image restoration.
CO-2.	Analyse images in the frequency domain using various transforms.
CO-3.	Review the fundamental concepts of a digital image processing system.
CO-4.	Categorize various compression techniques.
CO-5.	Interpret image compression standards.

M.Sc. (Information Technology)
SEMESTER-II
MIT-424: Fuzzy Systems
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

The objective of this course is:

1.	To explain few applications of both Neural Networks and Fuzzy Logic in different fieldsReasoning.
2.	To introduce the various learning rules of Neural Networks both supervised and unsupervised.
3.	To introduce the concept of Fuzzification & Defuzzification.
4.	To provide knowledge on associative memories and their applications.
5.	To introduce Fuzzy Logic, Fuzzy relations and Fuzzy mathematics.
6.	To explain the concept of Fuzzy control and also help to design FLC.

UNIT -I

Introduction: The Case for Imprecision, A Historical Perspective, The Utility of Fuzzy Systems, Limitations of Fuzzy Systems

The Illusion: Ignoring Uncertainty and Accuracy, Uncertainty and Information, The Unknown, Fuzzy Sets and Membership, Chance Versus Fuzziness

Classical Sets and Fuzzy Sets: Classical Sets: Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions, Fuzzy Sets: Fuzzy Set Operations, Properties of Fuzzy Sets, Alternative Fuzzy Set Operations

UNIT -II

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations: Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition, Fuzzy Relations: Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Tolerance and Equivalence Relations: Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations: Value Assignments, Max–Min Method

Properties of Membership Functions, Fuzzification and DeFuzzification:Features of the Membership Function, Various Forms, Fuzzification, Defuzzification to Crisp Sets, λ-Cuts for Fuzzy Relations, Defuzzification to Scalars

Logic and Fuzzy Systems: Part I Logic: Classical Logic, Fuzzy Logic, Approximate Reasoning, Other Forms of the Implication Operation

UNIT -III

Fuzzy Systems: Natural Language, Linguistic Hedges, Fuzzy (Rule-Based) Systems, Graphical Techniques of Inference

Development of Membership Functions: Membership Value Assignments: Intuition, Inference, Rank Ordering, Neural Networks, Genetic Algorithms, Inductive Reasoning

Decision Making with Fuzzy Information: Fuzzy Synthetic Evaluation, Fuzzy Ordering, Non-transitive Ranking, Preference and Consensus, Multiobjective Decision Making

Fuzzy Classification: Classification by Equivalence Relations, Crisp Relations, Fuzzy Relations, Cluster Analysis, Cluster Validity, *c*-Means Clustering, Fuzzy *c*-Means (FCM), Fuzzy *c*-Means Algorithm

UNIT -IV

Introduction to MATLAB: Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos.

MATLAB simulation: Fuzzy Logic Controller (FLC) implementation. Simulink Fuzzy Logic Controller (FLC) implementation.Applications of FLC to Control System. Develop Fuzzy Inference System for various applications.

References:

1. Fuzzy Logic wit Engineering Applications by Timothy J. Ross, Wiley, Third Edition
2. Fuzzy logic intelligence, Control and Information by John Yen and Reza Langari, Pearson Education, 2003.
3. Uncertain Rule-based Fuzzy Logic System: Introduction and New Directions by Jerry M. Mendel, PrenticeHall.
4. Fuzzy Sets, Fuzzy Logic and Fuzzy System – edited by George J. Keir& Bo Yuan 1996. World Scientific Press.
5. Fuzzy Set Theory: Foundations and Applications by George J. Klir, Ute. St. Clair, Bo Yuan, Prentice Hall,1997.
6. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers by RudraPratap, Oxford University Press, 2010.

Course Outcomes: After the completion of the course, students should be able to:

CO-1.	Apply basic and advanced differences between Classical Sets versus Fuzzy sets, Classical Relations versus Fuzzy relations.
CO-2.	Design Membership functions.
CO-3.	Analyse Fuzzy rule-based systems, Graphical techniques of inference and develop these membership functions.
CO-4.	Apply decision making techniques with fuzzy information like fuzzy rank ordering, Preference & consensus or Fuzzy c means clustering etc.

M.Sc. (Information Technology)
SEMESTER-II
MIT-425: Advanced Operating Systems
Discipline Specific Course (DSC)

Time: 3 Hrs. **Total Marks: 100**

Credits		
L	**T**	**P**
3	**1**	**0**

Theory Marks: 75

Theory Internal Assessment Marks:25

Note for paper setter and students:

1. **Medium of Examination is English Language.**
2. **There will be five sections.**
3. **Section A is compulsory and will be of 15 marks consisting of 8 short answer type questions carrying 2.5 mark each covering the whole syllabus. The answer should not exceed 50 words. The students will have to attempt any 6 questions in this section.**
4. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 15 marks each from the respective unit. The students are required to attempt one question from each of these sections.**

Course Objectives:

1.	The aim of this course is to study, learn, and understand the main concepts of advanced operating systems.
2.	To get a comprehensive knowledge of the architecture of distributed systems.
3.	To understand the deadlock and shared memory issues and their solutions in distributed environments.
4.	To know the security issues and protection mechanisms for distributed environments.

UNIT I

Architectures of Distributed Systems: System Architecture types, issues in distributed operating systems, communication networks, communication primitives. Theoretical Foundations, inherent limitations of a distributed system, lamp ports logical clocks, vector clocks.

Casual ordering of messages: global state, cuts of a distributed computation, termination detection. Distributed Mutual Exclusion, introduction, the classification of mutual exclusion and associated algorithms a comparative performance analysis.

Distributed Deadlock Detection: -Introduction, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, control organizations for distributed deadlock detection, centralized and distributed deadlock detection algorithms, hierarchical deadlock detection algorithms. Agreement protocols, introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, and applications of agreement algorithms. Distributed resource management: introduction-architecture, mechanism for building distributed file systems, design issues, log structured file systems.

UNIT -II

Distributed shared memory-Architecture:algorithms for implementing DSM, memory coherence and protocols, design issues. Distributed Scheduling, introduction, issues in load distributing, components of a load distributing algorithm, stability, load distributing algorithm,performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing, task migration and associated issues. Failure Recovery and Fault tolerance: introduction, basic concepts, classification of failures, backward and forward error recovery, backward error recovery- recovery in concurrent systems, consistent set of check points, synchronous and asynchronous check pointing and recovery, check pointing for distributed database systems, recovery in replicated distributed databases.

UNIT III

Protection and security–preliminaries: the access matrix model and its implementations-safety in matrix model, advanced models of protection. Data security, cryptography: Model of cryptography, conventional cryptography, modern cryptography, private key cryptography, data encryption standard, public key cryptography, multiple encryption, authentication in distributed systems.

Multiprocessor operating systems: basic multiprocessor system architectures, inter connection networks for multiprocessor systems, caching, hypercube architecture. Multiprocessor Operating System, structures of multiprocessor operating system, operating system design issues, threads- process synchronization and scheduling.

UNIT –IV

Database Operating systems: Introduction, requirements of a database operating system Concurrency control : theoretical aspects, introduction, database systems, a concurrency control model of database systems, the problem of concurrency control, serializability theory, distributed database systems, concurrency control algorithms, introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms, concurrency control algorithms, data replication.

References:

1. MukeshSinghal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001.
2. Andrew S.Tanenbaum, "Modern operating system", PHI, 2003
3. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI, 2003.

Course Outcomes:
At the end of this course the student shall be able to

CO-1.	Analyze the design issues of distributed operating systems.
CO-2.	Evaluate design issues of multi-processor operating systems.
CO-3.	Identify the requirements Distributed File System and Distributed Shared Memory.
CO-4.	Formulate the solutions to schedule the real time applications.

M.Sc. (Information Technology)
SEMESTER-II
MIT-426P
Programming Laboratory-II
Skill Enhancement Course (SEC)

Time: 3 Hrs. **Total Marks: 50**

Practical Marks: 37

Practical Internal Assessment Marks:13

Credits		
L	**T**	**P**
0	**0**	**2**

Course Objectives:
The objectives of this course is:

1.	To explain few applications of both Neural Networks and Fuzzy Logic in different fields Reasoning.
2.	To introduce the various learning rules of Neural Networks both supervised and unsupervised.
3.	To introduce the concept of Fuzzification & Defuzzification.
4.	To provide knowledge on associative memories and their applications.
5.	To introduce Fuzzy Logic, Fuzzy relations and Fuzzy mathematics.
6.	To explain the concept of Fuzzy control and also help to design FLC.

Programming Laboratory based on Image Processing or Fuzzy Systems or Mobile Computing.
Course Outcomes:
After the completion of the course, students should be able to:

CO-1.	Basic Use of MATLAB.
CO-2.	Applications of Major Concepts used in Fuzzy in MATLAB.
CO-3.	Implementation of Fuzzy Logic Controller (FLC).