MANAV RACHNA INTERNATIONAL UNIVERSITY

(Deemed to be University under section 3 of the UGC Act 1956)

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CURRICULUM

AND

SCHEME OF EXAMINATION

M.TECH - COMPUTER ENGINEERING with specialization in Computer Networking

BATCH: 2016-18

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INDEX

S. No.	Contents	Page Nos.
1	Vision of the Department	1
2	Mission of the Department	1
3	About the Department	1-2
4	Program Educational Objectives	2-3
5	Program Outcomes/Program Specific Outcomes	3-4
6	Semester System and Choice Based Credit System(CBCS)	5
7	Study Scheme	6-7
8	Course contents in Detail	8-71

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MANAV RACHNA INTERNATIONAL UNIVERSITY

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To empower the graduates to be technologically adept, innovative, self-motivated and responsible citizens, possessing human values and contribute significantly towards being a center of excellence in providing global standard education, through a conducive Teaching and Research environment, that responds swiftly to the challenges of the ever-changing world.

MISSION

- To achieve academic excellence by imparting in-depth knowledge to the students through effective pedagogies and hands-on experience on the latest tools and technologies.
- To pursue interdisciplinary research that will serve the needs of the entire global community.
- To prepare students to be continuous learners in a connected world and imbibe professional skills and ethical responsibilities in them.
- To strengthen the Industry-Academia interface that will help the graduates to emerge as leaders in academics or an inspiring revolutionary in entrepreneurship.

ABOUT THE DEPARTMENT

The Department of Computer Science & Engineering was established in 1997. The B. Tech Computer Science & Engineering programme offered by the Department had been accredited twice by the National Board of Accreditation (NBA) in 2003 and in 2007. The Department focuses on mastering the fundamental concepts both theoretically and practically. It motivates for learning, intellectual efficacy and self-reliance, which provides the best foundation for continuing professional achievement. Master of Technology in Computer Engineering programme provides intensive training to the students at advanced level to enable them to take up research and development activities. The course curriculum has been specially tailored to fulfill the growing global outlook and focus on upcoming technologies in the field of Computer Science and Engineering to cater to the needs of the industry and R&D organizations. The Faculty members of the Department are actively involved in research and development activities and continuously participating and contributing in National and International Conferences and Seminars. The faculty members of the Department are well published, experienced, conferred with M. Tech/Ph. D degree.

The Department is having several student chapters of the professional bodies like IEEE, CSI, ACM & ISTE. Students are participating in various activities regularly

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to enhance their technical and interpersonal skills under the banner of these professional societies. The Department also interacts regularly with Information Technology organizations like TCS, IBM, Sun Micro Systems, L&T, Infosys, HCL, Tech Mahindra, Dell-EMC, R Systems International etc. for providing latest technology updates to the students.

MRIU has collaborated with IBM to jointly offer B.Tech-Computer Science & Engineering programmes with specialization in Cloud Computing, Business Analytics & Optimization and Cyber Security & Forensics. The subject matter experts from IBM technology teach the faculty members about the cutting edge technologies through 'Train the Trainer' programmes. IBM provides Learning Management System, Industry Projects for students, Expert Lectures, Industry connectivity for students & teachers to enable them to experience the live IT Environment. This partnership help students to acquire domain skills in the most advanced areas of IT and preferential placements by IT companies. Students enrolled in these programmes have access to an online Eco-system Platform namely Innovation Center for Open Standards enabling them to access course material, discussion forums, student projects, industry mentors and news-clips.

Students enrolled in these programs undertake live projects developed by IBM/other IT majors under the mentorship of industry experts and go for industry visits in software development and testing centers. They also attend one-week extensive training programme at Bangalore in IBM facilities at their cost in which hands-on training is provided by IBM and other IT company experts. IBM shall also issue certificates for various modules after successful completion in addition to the MRIU Degree. The Programmes in association with IBM lead to big increase in job opportunities and industry readiness for the students.

Approximately 25% of the credits shall relate to the specific specialization in a particular programme and replace certain courses covered under normal B. Tech CSE Programmes.

The Department has also collaborated with other leading industries in order to give exposure to the students. TCG Digital solutions private Limited will set up virtual Cyber Security platform lab for training the students in the area of cyber security. The Department also has collaborations with Infosys, Dell-EMC & R-Systems International Ltd. These collaborations help the students to work on the technologies which are currently being used in industry.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Department of Computer Science and Engineering (CSE), in consultation with various stakeholders have formulated the Programme Educational Objectives (PEOs). These are broad statements describing the career and professional accomplishments of the graduates, that the programme is preparing them to achieve, subsequent to receiving the degree. The PEOs of the M.Tech Programme in Computer Engineering and Networking are as follows:

PEO-1: To impart knowledge and skills to analyze, design, test and implement various softwares and be engaged in life-long learning.

PEO-2: To promote the development of innovative systems and optimized solutions by professional practices.

PEO-3: To work collaboratively on multidisciplinary projects and exhibit high levels of professional and ethical values within organization and society globally.

PEO-4: To Enhance skills and adapt new computing technologies for attaining professional excellence and carrying research.

PROGRAMME OUTCOMES (POs)/ PROGRAMME SPECIFIC OUTCOMES (PSOs)

PROGRAMME OUTCOMES (POs)

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. **Environment and Sustainability**: Understand the issues of environmental contexts and
sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-longlearning in the broadest context socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO-1: To apply Software Engineering Principles and Practices to provide software solutions.

PSO-2: To design and Develop Network, Mobile and Web-based Computational systems under realistic constraints.

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MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES TO PROGRAMME OUTCOMES

POs / PEOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
PEO 1	3	2	2	2	2	2	3	3	3
PEO 2	3	2	2	2	2	1	3	2	3
PEO 3	2	3	3	2	2	2	2	3	3
PEO 4	3	2	2	2	2	2	2	3	3

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SEMESTER SYSTEM AND CHOICE BASED CREDIT SYSTEM

Credit based system of study and student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grade obtained by the student, grade point average is calculated

(a) Course credits assignment

Each course has a certain number of credits assigned to it depending upon its duration in periods for lecture, tutorial and laboratory practice in a week.

(b)Earning of credits

At the end of every course, a letter "Grade" shall be awarded in each course for which a student has registered. On obtaining a minimum Pass Grade, student shall accumulate the course credits as Earned Credits. A student's performance shall be measured by the number of credits that he/she has earned and by the weighted grade point average. Grades obtained in all the courses shall be counted for computation of grade point average.

For Award of Degree of a programme M.Tech- Computer Engineering with specialization in Computer Networking, he/she has to earn minimum 83 credits during the 2 year duration of the programme in 4 semesters.

The total credits required to be earned have been further classified under two baskets of courses: "Core Courses", and "Elective Courses". All courses under "Core Courses" and "Elective Courses" are required to be qualified and cleared/pass by each and every students enrolled under the programme and are semester-wise listed in the study scheme along with credits assigned to each course. The student shall have to register for all courses under "Core Courses" basket whereas student shall be required to register one from each basket under "Elective Courses" depending upon his/her interest and capability/pace of learning so as to earn the credits.

STUDY SCHEME

SEMESTER I										
Subject Code	Subject	Periods/Week				Marks			Duration of Exam	Credits
		L	T	P	Total	Int	Ext	Total		
CS-M102	Advanced Computer Networks	4	0	0	4	50	75	125	3 hrs	4
CS-M103	Advanced Operating Systems	4	0	0	4	50	75	125	3 hrs	4
CS-M106	Network Programming	4	0	0	4	50	75	125	3 hrs	4
CS-M201	Advanced Computer Architecture	4	0	0	4	50	75	125	3 hrs	4
CS-M107	Cloud Computing	4	0	0	4	50	75	125	3 hrs	4
CS-M113	Advanced Operating Systems Lab	0	0	2	2	50	50	100	3 hrs	1
CS-M116	Network Programming Lab	0	0	2	2	50	50	100	3 hrs	1
	TOTAL	**20**	**0**	**4**	**24**	**350**	**475**	**825**	**0**	**22**

SEMESTER II										
Subject Code	Subject	Periods/Week				Marks			Duration of Exam	Credits
		L	T	P	Total	Int	Ext	Total		
CS-M205	Virtualization and cloud security	4	0	0	4	50	75	125	3 hrs	4
CS-M206	Routing Algorithms & Protocols	4	0	0	4	50	75	125	3 hrs	4
CS-M202	Network Administration and Security	4	0	0	4	50	75	125	3 hrs	4
CS-M221	Mobile and Wireless Communication	4	0	0	4	50	75	125	3 hrs	4
	Elective -I	4	0	0	4	50	75	125	3 hrs	4
CS-M212	Network Administration and Security lab	0	0	2	2	50	50	100	3 hrs	1
CS-M216	Routing Algorithms and Protocol lab	0	0	2	2	50	50	100	3 hrs	1
CS-M250	Seminar	0	2	0	2	50		50		2
	TOTAL	**20**	**2**	**4**	**26**	**400**	**475**	**875**		**24**

List of Elective-I	
Course No.	**Course Name**
CS-M228	Network Design and Optimization
CS-M223	Web Engineering
CS-M208	Parallel and Distributed Computing
CS-M209	Ethical Hacking
CS-M226	Machine Learning
CS-M227	Grid Computing

Note:

1. One course is to be offered from the list of courses in the Elective-I.

SEMESTER-III										
Subject Code	Subject	Periods/Week				Marks			Duration of Exam	Credits
		L	T	P	Total	Int	Ext	Total		
CS-M302	Intrusion Detection Systems	4	0	0	4	50	75	125	3 hrs	4
	Elective-II	4	0	0	4	50	75	125	3 hrs	4
CS-M360	Project	0	0	8	8	200	100	300	3 hrs	4
CS-M350	Colloquium	0	2	0	2	50	0	50		2
CS-M312	Intrusion Detection Systems Lab	0	0	2	2	50	50	100	3 hrs	1
CS-M300	Dissertation-Phase-I	0	0	4	4	100	0	100		2
	TOTAL	**8**	**2**	**14**	**24**	**500**	**300**	**800**		**17**

List of Elective-II	
CS-M303	Adhoc Networks
CS-M321	Wireless Networks and Mobile Computing
CS-M304	Storage Area Network
CS-M324	Aritificial Neural Networks
CS-M328	VLSI and Embedded Systems
CS-M330	Bio- Informatics
CS-M331	Business Intelligence

Notes:

1. One course is to be offered from the list of courses in the Elective-II.
2. For Course colloquium each Student would be required to give atleast Three Seminars under the supervision of some of faculty member on current emerging areas of Computer Science among which atleast one would be research oriented.

Semester IV							
Subject Code	Subject	Periods/Week	Marks			Duration of Exam	Credits
			Int	Ext	Total		
CS-M400	Dissertation-Phase-II	**20 weeks (minimum)**	400	200	600	3hrs	20

Note:

The Dissertation can be taken up on any emerging areas of Computer Science or on any topic of Industrial Importance related to Computer Science and should include critical review of the literature in the area.

SEMESTER –I

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CS-M102: ADVANCED COMPUTER NETWORKS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of Computer Network.

Course Outcomes: The students will be able to-

CS-M102.1. Develop the basic concept of network & layered architecture of OSI model.
CS-M102.2. Describe various LAN Standards with its protocols.
CS-M102.3. Describe of Internet Protocol with its layer
CS-M102.4. Understand various protocols like TCP, UDP, SCTP and concepts comes under Transport layer.
CS-M102.5. Analyze high speed wide area network ATM, ISDN, B-ISDN.
CS-M102.6. Understanding of Cellular Architecture, Routing and Security, GSM Architecture and various concept of Mobile and Wireless Networks.

Unit-1: Foundation of Computer Networks

1.1 Introduction to Networks,
1.2 Network Reference Models: OSI and TCP/IP,
1.3 Internet Architecture, Framing, Error and Flow Control, Multiple Access techniques, Routing, Congestion Control,
1.4 Networking Devices: Hubs, Switches, Routers and Gateways, Switching techniques,

Unit-2: High Speed Local Area Networks

2.1 Overview of fast Ethernet (IEEE 802.3u),
2.2 Gigabit Ethernet (IEEE 802.3z). Their Layered protocol architectures and Physical Specifications,
2.3 MAC Layer and Frame Format, Design and Deployment,
2.4 Applications of GB Ethernet,
  2.4.1 Its Layered protocol architecture and Physical Specifications,
  2.4.2 Its MAC Layer and Frame Format,
  2.4.3 Design and Deployment,
  2.4.4 Applications,

Unit-3: Internet Suite of Protocols

3.1 Internet Architecture, Overview of IP Protocols, IP datagram,
3.2 Address Resolution Protocol (ARP), RARP,
3.3 Internet Control Message Protocol (ICMP),
3.4 Internet Group Management Protocol (IGMP),
3.5 IP addressing: IP address format, IP address classes, subnet and Supernet,
3.6 IP Routing:
  3.6.1 RIP,
  3.6.2 OSPF,
  3.6.3 BGP,
3.7 Internet Multicasting,
3.8 IPV6, Header format and Addressing,
3.9 IPV4 verses IPV6, Mobile IP,

Unit-4: Transport and Application Layers

4.1 Overview of Transport Protocols, TCP Architecture,
4.2 UDP Architecture, ports and sockets in TCP/UDP,
4.3 SCTP (Stream Control Transfer Protocol) and its Architecture ,
4.4 TCP Connection Management, TCP verses UDP verses SCTP,
4.5 Wireless TCP, congestion controls,

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4.6 Introduction to socket programming,
4.7 Application Layer:
    4.7.1 HTTP,
    4.7.2 E-Mail,
    4.7.3 DNS,
    4.7.4 FTP,SNMP,Voice over IP(VoIP),

Unit-5: High Speed Wide Area Networks
5.1 Overview of Frame Relay, ISDN and B-ISDN ,
5.2 Asynchronous Transfer Mode:
    5.2.1 ATM architecture,
    5.2.2 ATM Cell,
    5.2.3 Cell Structure,
    5.2.4 Virtual Circuits,
5.3 Cell Switching, Layered Protocol Architecture and Frame Format,
5.4 ATM Addressing, ATM Signaling,
5.5 Quality of Services in ATM, Traffic Management, and Congestion control,
5.6 ATM Protocols and LAN Emulation,

Unit-6: Mobile and Wireless Networks
6.1 Overview of Mobile and Wireless networks,
6.2 Wireless LAN Architecture,
6.3 Cellular Networks Architecture,
6.4 Routing and Security,
6.5 GSM Architecture,
6.6 GPRS Architecture,
6.7 CDMA Architecture.

Text Books/Reference Books:

1. William Stallings ,High-Speed Networks and Internets: Performance and Quality of Service, Sixth Edition, Pearson Education.
2. James F. Kurose and K.W. Ross ,Computer networking – A Top Down Approach Featuring the Internet,Third Edition, Pearson Education.
3. Jochen Schiller,Mobile Communications, Second Edition, Pearson Education.
4. Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition,Mc Graw Hill.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M102.1	2	3	1	2	3	2	2	2	3
CS-M102.2	3	2	2	2	2	2	3	2	-
CS-M102.3	2	1	2	1	3	3	1	2	3
CS-M102.4	1	2	3	3	2	1	-	-	2
CS-M102.5	1	1	1	3	1	-	2	2	-
CS-M102.6	1	1	3	1	3	3	3	1	3

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CS-M103 : ADVANCED OPERATING SYSTEMS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of operating systems.

Course Outcomes: The students will be able to-

CS-M103.1. Introduce the distributed computing infrastructure and operating systems, and to provide insight into research based use-cases .

CS-M103.2. Understand issues related to distributed environment and its appropriate solutions.

CS-M103.3. Analyze the distributed shared memory and the advanced model of resources and security.

Unit-1: Introduction to Advanced Operating Systems

1.1 Overview of an operating system,
1.2 Issues in operating systems,
1.3 Functions and Design approaches of advanced operating systems,
1.4 Types of advanced operating systems and their architecture,
1.5 Distributed operating systems. Evolution of different models,
1.6 Definitions, issues and design of DCE,
1.7 Message passing, features of a message passing system,
1.8 Issues in IPC, Synchronization,
1.9 Buffering, Multi-datagram,
1.10 Process addressing, Failure handling,

Unit-2: Remote Procedure Calls

2.1 Introduction, RPC models,
2.2 Transparency of RPC,
2.3 Implementing RPC structures & mechanism,
2.4 Marshalling arguments and results,
2.5 Server management,
2.6 Parameter-passing semantics,
2.7 Communication protocols for RPCs,
2.8 Client-server binding and exception handling,

Unit-3: Processes and Processors in Distributed Systems

3.1 Concept of Processes and Processors in Distributed Systems,
3.2 Threads in distributed systems environment,
3.3 Thread usages and design issues in thread packages,
3.4 Processor allocation, allocation models and algorithms,
3.5 Scheduling in distributed systems,

Unit-4: Distributed Shared Memory

4.1. Introduction, General architecture of DSM systems,
4.2. Design and implementation issues of DSM,
4.3. Granularity, Structure of shared memory space,
4.4. Consistency models,
4.5. Replacement strategy,
4.6. Different approaches to DSM, Advantages of DSM,

Unit-5: Synchronization in Distributed Systems

5.1 Clock synchronization,
5.2 Event ordering,

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5.3 Mutual exclusion,
5.4 Election algorithms – bully and ring algorithms,
5.5 Deadlock, models of deadlocks, conditions of deadlocks Deadlock prevention, avoidance and detection algorithms,
5.6 Models of resources,

Unit-6: Resource Security and Protection
6.1 Concept of resource security,
6.2 Access matrix model,
6.3 Access matrix model implementation and safety,
6.4 Advanced models for protection, Case study of Distributed Computer Environment.

Text Books/Reference Books:

1. Silbershatz and Galvin ,Operating System Concepts,9th edition, Wiley.
2. A. S.,Tannenbaum,2001, Distributed Operating System,Pearson Education.
3. Deitel and Deitel ,Operating Systems,Second Edition, Pearson Education.
4. M. E. Donovan, Operating Systems, First Edition,TMH.
5. Pradeep K .Sinha, Distributed Operating System, First Edition, Wiley publications.
6. M. Singhal and Shivaratri ,Advanced Concepts in Operating Systems, Distributed Databases and Multiprocessor Operating Systems, TMH.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M103.1	3	1	1	1	1	1	2	3	1
CS-M103.2	2	1	1	1	1	1	1	1	1
CS-M103.3	3	1	1	1	1	3	1	1	1

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CS-M106: NETWORK PROGRAMMING

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of Computer Network.

Course Outcomes: The students will be able to:
CS-M106.1. Understand the fundamentals and basics of Unix, unix Models plus various technologies associated with them.
CS-M106.2.Learn how to design the various web server techniques with real time signals
CS-M106.3. Analyze and discuss various system vs. TLI Implementation.
CS-M106.4. Apply the client server model in networking applications.

Unit 1: Introduction to Unix
1.1 Salient features of Unix, Unix system organization
1.2 Types of shells
1.3 Unix commands
1.4 Unix file system
  1.4.1 Creating files
  1.4.2 Listing files and directories
1.5 Processes in Unix
1.6 Shell programming
1.7 Shell Meta characters.

Unit 2: Unix Model and IPC
2.1 Signals, Reliable signals
2.2 Process Control and relationships
2.3 Daemon processes
2.4 File and record locking
2.5 Pipes, FIFO
2.6 Streams and messages
2.7 Namespaces
2.8 System V IPC
  2.8.1 Message queues
  2.8.2 Semaphores
  2.8.3 Shared memory
  2.8.4 Sockets and TLI.

Unit 3: Pipes and FIFO
3.1 Pipes
  3.1.1 Full duplex pipes,
3.2 FIFO
3.3 One server, multiple clients
3.4 Iterative vs concurrent Server
3.5 Streams and messages
3.6 Pipe and FIFO limits
3.7 Posix Message queues
3.8 Posix functions
3.9 Real time signals

Unit 4: Synchronisation
4.1 Mutexes and condition variables
4.2 Producer-consumer problem
4.3 Locking v/s waiting

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4.4 Condition variables
4.5 waiting, signaling and attributes
4.6 Obtaining and releasing read-write locks
4.7 Read-write lock attributes
4.8 Record locking v/s file locking.

Unit 5: Berkeley Sockets
5.1 Unix Domain protocols
5.2 Socket addresses
5.3 Elementary socket system calls
5.4 Advanced socket system calls
5.5 Reserved ports
5.6 Stream pipes
5.7 Passing File descriptors
5.8 Socket options
5.9 Asynchronous I/O
5.10 Input/Output Multiplexing
5.11 Socket Implementation

Unit-6: System V Transport Layer Interface
6.1 Introduction
6.2 Transport Endpoint addresses
6.3 Elementary TLI functions
6.4 Advanced TLI Functions
6.5 Streams
6.6 TLI implementation
6.7 Stream pipes
6.8 Passing file descriptors
6.9 Input/Output multiplexing
6.10 Asynchronous I/O
6.11 Out-of-Band

Text/Reference Books:
1. Sumitabha Das ,2008,Unix Concepts and Applications, 4th Edition, TMH Publications
2. W.RIichard Stevens,1999, Unix Network Programming,3rd Edition, Prentice Hall Publications
3. W.Richard, 1996, Unix Network Programming Inter process Communication, 3rd Edition,Steven Edition
4. W.R.Stevens, Bill Fenner, A.M.Rudoff,2003, UNIX Network Programming the Sockets Networking API, 1st Edition, Pearson Education.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M106.1	3	1	2	1	2		3	1	3
CS-M106.2		1		1	2	3		1	3
CS-M106.3	2	1	2		2		3	2	2
CS-M106.4			2	1		3			2

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CS-M201 : ADVANCED COMPUTER ARCHITECTURE

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of Computer organization.

Course Outcomes: The students will be able to-
CS-M201.1. Understand the Concept of Parallel Processing and its applications
CS-M201.2. Analyze the performance of different scalar Computers.
CS-M201.3. Distinguish the performance of pipelining and non pipelining environment in a processor.
CS-M201.4. Implement the Hardware for Arithmetic Operations.
CS-M201.5. Develop the Pipelining Concept for a given set of Instructions.

Unit-1: Advanced Processor Technology
1.1 Overview of processors, CISC, RISC, Superscalar, Vector, VLIW
1.2 Memory Management systems
1.3 Von Neumann Computational model
1.4 Multiprocessors and Multi-computers,
1.5 Multi-vector and SIMD computers
1.6 MIMD computers.

Unit-2: Parallel Computer Models and Parallel Processing
2.1 Basic concepts: types and levels of parallelism
2.2 Classification of parallel architectures
2.3 Basic parallel techniques: Linear and Non-linear Pipeline processors
2.4 Conditions of parallelism
2.5 Data and resource Dependences
2.6 Hardware and Software parallelism
2.7 Program partitioning and scheduling
2.8 Grain Size and latency
2.9 Program flow mechanisms
2.10 Control flow versus data flow
2.11 Data flow Architecture

Unit-3: Multiprocessor and Multi-Computers
3.1 Multiprocessor system interconnects
3.2 Cache coherence and Synchronization mechanisms
3.3 Cache coherence problem
3.4 Snoopy bus protocols
3.5 Directory-based protocols
3.6 Hardware Synchronization mechanisms
3.7 Message passing mechanism
3.8 Deadlocks and virtual channels
3.9 Multicast routing mechanism

Unit-4: Memory Hierarchy Design
4.1 Memory Hierarchy technology:
4.2 Hierarchical Memory Technology
4.3 Inclusion, Coherence, and Locality
4.4 Memory Capacity Planning
4.5 Virtual Memory Technology
4.6 Virtual Memory Models
4.7 TLB, Paging, and Segmentation
4.8 Memory Replacement Policies

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Unit-5: Pipelining & Superscalar Techniques

5.1 Linear Pipeline Processors
5.2 Asynchronous and Synchronous Models
5.3 Clocking and Timing Control, Speedup, Efficiency, and throughput
5.4 Nonlinear Pipeline Processors
5.5 Reservation and Latency Analysis
5.6 Collision-Free Scheduling
5.7 Pipeline Schedule optimization
5.8 Instruction Pipeline Design
5.9 Instruction Execution Phases
5.10 Dynamic instruction Scheduling
5.11 Arithmetic Pipeline Design

Unit-6: Program and Networks Properties

6.1 The Role of Compilers
6.2 Program Partitioning and Scheduling: Grain Sizes and Latency, Grain Packing and Scheduling,
6.3 Static Multiprocessor Scheduling
6.4 Program Flow Mechanisms: Control Flow Vs Data Flow
6.5 System Interconnect Architectures: Network Properties and Routing

Text Books/Reference Books:

1. Kai Hwang ,Advanced Computer Architecture, TMH.
2. Dezso Sima, Advanced Computer Architecture- A design space approach, Pearson Education.
3. D.A. Patterson, Hennessey, Kaufmann,Computer Organization and Design,5th edition,Newnes.
4. Harvey G. Cragon, Memory Systems and Pipelined Processors, Narosa Publication.
5. V. Rajaranam & C.S.R. Murthy,Parallel Computers: Architecture and Programming, 2nd edition, PHI.
6. R.K. Ghose, Rajan Moona, Foundation of Parallel Computer Processing, Narosa.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:

Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M201.1	2	2	2	-	1	-	2	-	-
CS-M201.2	2	2	1	-	2	-	2	1	2
CS-M201.3	2	2	1	-	3	2	2	1	2
CS-M201.4	2	1	-	2	2	-	2	-	-
CS-M201.5	2	2	2	-	-	-	2	-	-

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CS-M107: CLOUD COMPUTING

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 hours			External	: 75

Pre-requisites: The students must have the knowledge of Computers.

Course Outcomes: The students will be able to-
CS-M107.1 Explain the basic cloud computing concepts and type of virtualization.
CS-M107.2 Understand various data storage strategies in the cloud environment.
CS-M107.3 Apply security policies at different cloud levels.
CS-M107.4 Define cloud migration consideration and backup designs for business continuity.
CS-M107.5 Create the cloud environment using cloud platforms and technologies.

Unit-1: Cloud Computing Fundamentals
1.1 Introduction: Cloud Computing definition, Basic Concepts and terminology
1.2 Cloud characteristics
1.3 Cloud delivery models
1.4 Cloud deployment models
1.5 Benefits and disadvantages of cloud computing
1.6 Risk and Challenges of cloud
1.7 Cloud Computing Reference Model.

Unit-2: Virtualization
2.1 Virtualization and cloud computing
2.2 Need of virtualization.
2.3 Types of virtualization: Server Virtualization
2.4 Full virtualization and para virtualization
2.5 Memory virtualization
2.6 Storage virtualization
2.7 Network virtualization
2.8 Introduction to Virtual Machines.

Unit-3: Data in cloud
3.1 Storage system architecture
3.2 Virtualized Data Centre (VDC) architecture
3.3 VDC environments, concepts, planning and design
3.4 Managing VDC and cloud infrastructures
3.5 Hybrid storage networking technologies (iSCSI, FCIP,FCoE).

Unit-4: Cloud Security
4.1 Cloud security concerns & threats
4.2 Cloud security mechanisms at compute, storage and network levels
4.3 Cloud security: Governance, Risks & Compliance
4.4 Identity and access management (IAM)
4.5 Virtualization security.

Unit-5: Business Continuity & Cloud Migration considerations
5.1 Business Continuity measurement, terminologies, and planning
5.2 Backup designs, architecture, topologies
5.3 Backup technologies in SAN and NAS environments.
5.4 Local and Remote replication using host and array based replication technologies
5.5 Synchronous and Asynchronous replication methods
5.6 Considerations for migration to cloud
5.7 Phases for cloud adoption.

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Unit-6: Computing platforms and technologies

6.1 Cloud Platform Architectures: Amazon AWS
6.2 Simple Storage Service(S3)
6.3 Elastic Cloud Compute(EC2)
6.4 Microsoft Azure
6.5 Google Cloud Infrastructure: Google App Engine, Google File System, Search engine
6.6 MapReduce Yahoo Hadoop
6.7 Manjrasoft Aneka. Aneka: Framework Overview
6.8 Anatomy of the Aneka container
6.9 Building Aneka clouds, Aneka SDK.

Text Books/Reference Books:

1. Cloud Computing: Unleashed Next Gen Infrastructure to Application, Dr. Kumar Saurabh, Third Edition, 2016, Wiley Publication.
2. Cloud Computing Bible, Barrie Sosinky, First Edition, 2011, Wiley Publication.
3. Cloud Computing A practical approach for learning and implementation, A. Srinivasan and J. Suresh, Second Impression, 2017, Pearson Publication.
4. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, First Edition, 2013, McGraw Hill Education (India) Private Limited

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:

Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

COURSE ARTICULATION MATRIX :

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M107.1	2	1	3	1	1	1	2	2	1
CS-M107.2	2	1	1	1	2	2	2	1	2
CS-M107.3	3	1	3	2	3	2	3	2	2
CS-M107.4	2	2	3	2	2	1	2	1	2
CS-M107.5	3	1	2	1	2	2	3	2	3

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CS-M113: ADVANCE OPERATING SYSTEM LAB

Periods/week	Credits		
P: 2	1	Max. Marks	: 100
		Internal	: 50
Duration of Examination: 3 Hrs		External	: 50

Co-Requisites: ADVANCE OPERATING SYSTEM (CS-M103)

Course Outcomes: The students will be able to:

CS-M113.1 Understand evolution, type and function of Operating system
CS-M113.2 Apprehend the concept of processes, threads and Scheduling policies
CS-M113.3 Practice memory management schemes
CS-M113.4 Examine the concepts of DOS like mutual exclusion, resource management etc
CS-M113.5 Implement algorithms for deadlock detection and avoidance
CS-M113.6 Understand process communication, naming, synchronization, consistency and replication

Following are some of the suggested topics for the Lab Practicals:

1. Preliminaries of Operating System managing users, managing systems, file managements, useful commands.
2. Shell scripting shell syntax, executing shell scripts.
3. Process creating new process,counting maximum number of processes a system can handle at a time, handling system calls; inter process communication through pipes and message passing, zombie process, orphan process.
4. Process Synchronization handling threads and semaphores to achieve synchronization among processes using POSIX standard functions.
5. Signal :Study of some POSIX signals (SIGINT, SIGILL, SIGFPE, SIGKILL, SIGHUP, SIGALRM, SIGABRT)
6. Create your own thread library, which has the features of pthread library by using appropriate system calls (UContext related calls). Containing functionality for creation, termination of threads with simple round robin scheduling algorithm and synchronization features.
7. Implement all CPU Scheduling Algorithms using your thread library
8. Study the concept of Synchronization and implement the classical synchronization problems using Semaphores, Message queues and shared memory (minimum of 3 problems)
9. A complete file system implementation inside a disk image file

Text Books /Reference Books:

1. Stephen G. Kochanand Patrick Wood, Shell Programming in Unix, Linux and OS X, 4th Edition, Addison-Wesley
2. Sumitabha Das , 2003, UNIX, concepts and applications, 3rd Edition, Tata Mc-Graw Hill
3. William Shotts, 2012, The Linux Command Line, no starch press
4. Graham Glass, King Ables , UNIX for Programmers and Users,3rd Edition, Pearson Education

Software required/Weblinks:
www.tutorialpoint.com/unix

Assessment Tools:
Experiments in Lab
File Work
Class Performance
Viva
End Semester Practical Examination

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Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M113 .1	3	-	-	-	2	2	2	1	1
CS-M113 .2	2	3	-	2	-	2	1	-	1
CS-M113 .3	3	-	3	-	3	3	3	1	-
CS-M113 .4	1	3	-	2	-	2	-	2	1
CS-M113 .5	3	2	-	3	2	-	1	1	-
CS-M113 .6	2	-	-	2	1	1	-	-	1

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CS-M116: NETWORK PROGRAMMING LAB

Periods/week	Credits		
P: 2	1	Max. Marks	: 100
Duration of Examination: 3 Hrs		Internal	: 50
		External	: 50

Co-Requisites: NETWORK PROGRAMMING (CS-M106)

Course Outcomes: The students will be able to:
CS-M116.1.Demonstrate mastery of main protocols comprising the Internet.
CS-M116.2. Develop skills in network programming techniques
CS-M116.3. Implement network services that communicate through the Internet
CS-M116.4. Apply the client server model in networking applications
CS-M116.5. Practice networking commands available through the operating systems

List of Practicals:

1. **Unix Programming with Pipes**
   - Exercise 1- Creation of a one way pipe in a single process.
   - Exercise 2- Creation of a one way pipe using two processes.
   - Exercise 3- Creation of a two way pipe using two processes.
2. **Unix Programming for IPC**
   - Exercise 4- Inter process communication through FIFO between client and server.
   - Exercise 5- Implement file transfer using Message Queue form of IPC
   - Exercise 6- Write a program to create an integer variable using shared memory concept and increment the variable simultaneously by two processes. Use semaphores to avoid race conditions.
3. **Client- Server Programming**
   - Exercise 7- Design TCP iterative Client and server application to reverse the given input.
   - Exercise 8- Design TCP client and server application to transfer file.
   - Exercise 9- Design a TCP concurrent server to convert a given text into upper case using multiplexing system call "select".
   - Exercise 10- Design a TCP concurrent server to echo given set of sentences using poll functions
   - Exercise 11- Design UDP Client and server application to reverse the given input Sentence.
   - Exercise 12- Design UDP Client server to transfer a file
   - Exercise 13- Design using poll client server application to multiplex TCP and UDP requests for converting a given text into upper case.
4. **RPC**
   - Exercise 14- Design a RPC application to add and subtract a given pair of integers

Text Books / Reference Books:
1. Unix Concepts and Applications, Sumitabha Das, 4th Edition, 2008, TMH Publications
2. Unix Network Programming, W.RIichard Stevens, 3rd Edition, 1999, Prentice Hall Publications
3. Unix Network Programming Inter process Communication, W.Richard, 3rd Edition, 1996, Steven Edition,
4. UNIX Network Programming the Sockets Networking API, W.R.Stevens, Bill Fenner, A.M.Rudoff, 1st Edition, 2003, Pearson Education

Software required/ Weblinks:
Unix or Red Hat Linux Or CentOS

Assessment Tools:
Experiments in lab

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File work/Class Performance
Viva (Question and answers in lab)
End Semester Practical Exam

Course Articulation Matrix :

CO Statement	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CS-M116.1	3	2	2	2	2	2	3	2	3
CS-M116.2	3	2	2	1	2	1	2	2	3
CS-M116.3	3	1	2	1	1	1	1	2	3
CS-M116.4	3	2	2	2	2	1	1	2	3
CS-M116.5	3	1	2	1	2	2	1	2	3

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SEMESTER –II

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CS-M205: VIRTUALIZATION AND CLOUD SECURITY

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 hours			External	: 75

Pre-requisites: The students must have the knowledge of Computers.

Course Outcomes: The Students will be able to-
CS-M205.1: Know the concept of virtualization, and its types.
CS-M205.2: Know the role of virtualized data centers in cloud computing.
CS-M205.3: Understand the cloud security concept.
CS-M205.4: Know the security issues related to multi-tenancy.
CS-M205.5: Know the specific attacks on virtual machines.
CS-M205.6**:** Understand the issues related to virtual networking.

Unit -1: Virtualization
1.1 Need for virtualization
1.2 Types of virtualization
1.3 virtual machines
1.4 physical to virtual conversion
1.5 Storage virtualization, Network virtualization, Memory virtualization and their benefits.
1.6 Classic data center and virtual data center with their components
1.7 Full virtualization, Para virtualization, hardware virtualization etc.

Unit-2: Virtualized Data Centers
2.1 Virtual machine storage
2.2 Block level and file level virtualization
2.3 Thin provisioning,
2.4 Compute virtualization techniques, virtual machines, virtual machines storage,
2.5 Virtual provisioning and automated storage tiering,
2.6 VDC networking overview
    2.6.1 VDC networking components,
2.7 VLAN and VSAN technologies
    2.7.1 Network traffic management.

Unit -3: Cloud Security Concepts
3.1 Cloud security Concept
3.2 Applications of security concepts in the cloud
3.3 Importance of security concepts in PaaS, IaaS and SaaS.
3.4 Cryptographic Systems- Symmetric cryptography
3.5 Stream ciphers
3.6 Block ciphers
3.7 Modes of operation
    3.7.1 Public-key cryptography
    3.7.2 Hashing,
    3.7.3 Digital signatures with public-key infrastructures and key management.

Unit -4: Multi Tenancy Security Issues
4.1 Isolation of users/VMs
4.2 Virtualization System Security Issues- ESX and ESXi Security,
4.3 ESX file system security
4.4 Storage considerations with backup and recovery
4.5 Virtualization System Vulnerabilities.

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Unit -5: Virtualization System Specific Attacks
5.1 Guest hopping
5.2 Attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure)
5.3 VM migration concepts
5.4 Attacks in migrating VM hyperjacking.

Unit -6: Secure Virtual Networking
6.1 Configuration and change management goals
6.2 Guidelines, tools and technologies in virtualized environments;
6.3 Virtual network security architecture
6.4 Network segmentation and traffic isolation to secure a virtual network configuration
Securing VLAN settings.

Text Books / Reference Books:
1. Cloud Security: A Comprehensive Guide to Secure Cloud Computing Paperback – Import, 30 Jul 2010 by Ronald L. Krutz (Author), Russell Dean Vines
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice) 1st Edition by Tim Mather , Subra Kumaraswamy , Shahed Latif
3. Network Security in Virtualized Data Centers by Lawrence C. Miller, CISSP, Wiley Publications
4. Cloud infastructure : EMC2

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement (CS-M205)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M205.1	3	2	-		-	3	2	2	1
CS-M205.2	2	1	-	-	2	3	2	2	2
CS-M205.3	2	1	-	-	-	3	2	2	1
CS-M205.4	3	1	-	-	-	3	2	1	2
CS-M205.5	3	-	-	-	-	3	2	2	1
CS-M205.6	2	-	-	-	-	3	2	2	1

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CS-M206: ROUTING ALGORITHMS AND PROTOCOLS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of Computers.

Course Outcomes: The students will be able to-
CS-M206.1. Understand the fundamentals and requirements for packet routing in computer communication networks.
CS-M206.2. Design the IP addressing scheme of the complex campus network.
CS-M206.3. Decide the routing protocol for any level of complex network design.
CS-M206.4. Deal with the different routing protocols required to be configured in real routers.
CS-M206.5. Gain knowledge about the internal architecture of routers.
CS-M206.6. Draw the interest towards the research in the routing platform

Unit-1: Network Routing
1.1 Addressing and Internet Service: An Overview,
1.2 Network Routing: An Overview,
1.3 IP Addressing,
1.4 on Architectures
1.5 Service Architecture
1.6 Protocol Stack Architecture,
1.7 Router Architecture
1.8 Network Topology Architecture
1.9. Routing Algorithms:
    1.9.1 Shortest Path and Widest Path:
    1.9.2 Bellman–Ford Algorithm
    1.9.3 the Distance Vector Approach,
    1.9.4 Dijkstra's Algorithm
1.10 Comparison of the Bellman–Ford Algorithm and Dijkstra's Algorithm.

Unit-2: Routing Protocols: Framework and Principles
2.1 Routing Protocol, Routing Algorithm
2.2 Routing Information, Representation and Protocol Messages
2.3 Distance Vector Routing Protocol
2.4 Link State Routing Protocol
2.5 Path Vector Routing Protocol,
2.6 Link Cost
    2.6.1 Static Routes, Routing Information Protocol Version 1 (RIPv1)
2.7 Routing Information Protocol Version 2 (RIPv2)
2.8 Interior Gateway Routing Protocol (IGRP),
2.9 Enhanced Interior Gateway Routing Protocol (EIGRP),
2.10 Route Redistribution.

Unit-3: Link State Protocols
3.1 OSPF: Protocol Features,
3.2 OSPF Packet Format,
3.3 Examples of Router LSAs and Network LSAs,
3.4 Integrated IS-IS: Key Features,
3.5 Similarities and Differences Between IS-IS and OSPF

Unit-4: Exterior Gateway Protocol
4.1 A Brief Overview, Basic Terminology,
4.2 BGP Operations:

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4.2.1 Message Operations,
4.2.2 BGP Timers,
4.2.3 BGP Configuration Initialization,
4.3 Two Faces of BGP: External BGP and Internal BGP, Path Attributes,
4.4. BGP Decision Process, Internal BGP Scalability,
4.5 Significance of Route Flap Dampening,
4.6 BGP Additional Features,
4.7 Finite State Machine of a BGP Connection
.

Unit-5: Router Architectures and IP Packet Filtering and Classification

5.1 Functions of a Router,
5.1.1 Types of Routers
5.1.2 Elements of a Router
5.1.3 Packet Flow,
5.1.4 Packet Processing: Fast Path versus Slow Path,
5.2 Router Architectures
5.3 Importance of Packet Classification,
5.4 Packet Classification Problem
5.5 Packet Classification Algorithms.

Unit-6: Towards Next Generation Routing

6.1 QoS Routing,
6.2 MPLS and GMPLS:
6.2.1 Background of QoS and QoS Routing,
6.2.2 QoS Attribues,
6.3 Traffic Engineering Extension to Routing Protocols,
6.4 Multiprotocol Label Switching (MPLS),
6.5 Generalized MPLS,
6.6.MPLS Virtual Private Networks.

Text Books/ Reference Books:

1. Deepankar Medhi, Kartikeyan Ramasamy, "Network Routing – Algorithms, Protocols, Architecture", Morgan Kauffman Series Publication, March 2007.
2. Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, "Ad Hoc Mobile Wireless Networks – Principles, Protocols and Applications", Auerbach publications, November 2016.
3. Dharma Prakash Agrawal and Carlos De Morais Cordeiro, "Adhoc and Sensor Networks – Theory and Applications", World Scientific publication, 2011.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:

Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M206.1	3	2	-	1	-	1	-	-	1
CS-M206.2	2	1	-	1	2	-	2	-	2
CS-M206.3	2	2	1	1	-	-	1	-	-
CS-M206.4	3	2	1		-	-	2	1	2
CS-M206.5	3	-	-	2	-	-	1	-	1
CS-M206.6	2	-	1	3	3	1	-	2	1

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CS-M202 : NETWORK ADMINISTRATION & SECURITY

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of computer networks

Course Outcomes: The students will be able to-
CS-M202.1. Understand the network security, threats and vulnerabilities
CS-M202.2. Design secure network architecture.
CS-M202.3. Explain various network security platforms.
CS-M202.4. Apply the concepts of VPN to design a network.
CS-M202.5. Analyse system breaches via digital forensics.

Unit-1: Introduction to Network Security
1.1 Classical Security Techniques and Computer Network Concepts,
1.2 Confidentiality and Security, Security Policy and Operations,
1.3 Life Cycle, Security System Development and Operations.
1.4 Secure Networking Threats: Attack Processes, Attacker Types, Vulnerability Types,
1.5 Attack Results, Attack Taxonomy,
1.6 Threats to Security: Physical Security, Biometric Systems, Monitoring Controls, and Data Security, Intrusion and Detection Systems.

Unit-2: Designing Secure Networks
2.1 Components of Hardening Strategy. Network Devices, Host Operating Systems,
2.2 Appliance-Based Network Services. Rogue Device Detection, Network Security Technologies,
2.3 Emerging Technologies, Design Considerations, Layer 2 and IP Addressing Security Considerations,
2.4 ICMP Design Considerations, Routing Considerations
2.5 Transport Protocol Design Considerations.

Unit-3: Network Security Platform Options
3.1 Network Security Platform Options,
3.2 Network Security Devices, Common Application Design Considerations,
3.3 E-mail, DNS, HTTP/HTTPS, FTP, Instant Messaging.

Unit-4: IPsec and VPN Design Considerations
4.1 VPN Basics, Types of IPsec VPNs, IPsec Modes of Operation and Security Options,
4.2 Topology Considerations,
4.3 Design Considerations, Site –to Site Deployment Examples.

Unit –5: Network Security Management
5.1 Organization realities, Protocol Capabilities: Telnet/Secure Shell,
5.2 HTTP, SNMP, FTP, Netflow.
5.3 Network security Management Tools, Secure Management Design Options,
5.4 Network Security Management, Best Practices. Case Studies of various Secure Network Management.

Unit-6: Computer & Network Forensics
6.1 Roles and Procedures at Digital Crime Scenes, Role of Responder, Investigator & Technician.
6.2 Investigating windows, Linux and Graphics files, E-mail & Websites Forensic.
6.3 Internet & Network Forensics, Intrusion detection,
6.4 Forensic Analysis Techniques, Tracking a fake E-mail,
6.5 Tracking a hacker, writing Forensic reports.

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Text Books/Reference Books:

1. Sean Convery,2004, Network Security Architecture, 2nd edition, Cisco Press.
2. W. stalling, 2005,Cryptography and Network Security,4th edition, Pearson Education
3. M. Britz,2013, Computer Forensic and Cyber Crime 3rd edition, Prentice Hall
4. C.P. Pfleeger,2015, Security in Computing, 5th edition, PHP
5. J. Crume, Inside Internet Security,1st edition, Addison Wesley
6. Linda Volonino, Computer Forensics, Principals & Practices,1st edition, Pearson.
7. B.A. Forouzan,2010, Cryptography and Network Security, 2nd edition,TMH.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:

Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M202.1	3	2	1	2	1	2	2	2	3
CS-M202.2	3	2	1	2	2	2	2	3	2
CS-M202.3	2	1	2	2	3	2	3	2	2
CS-M202.4	2	2	2	2	2	1	2	3	2
CS-M202.5	2	1	2	1	2	2	3	2	3

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CS-M221 : MOBILE AND WIRELESS COMMUNICATION

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of Computer Networks.

Course Outcomes: The students will be able to-

CS-M221.1. Understand the fundamentals and basic operations of wireless and satellite communication plus various technologies associated with them.
CS-M221.2. Learn how to design and analyze various medium access techniques
CS-M221.3. Analyze and discuss various network, transport and security protocols pertaining to mobile wireless networks.

Unit-1: Introduction

1.1 Introduction to Mobile System, Applications
1.2 Reference model and overview
1.3 Wireless Transmission: Frequencies, signals
1.4 Antennas, signal propagation
1.5 Multiplexing
1.6 Modulation
1.7 Spread spectrum cellular system.

Unit-2: MAC and Telecommunication system

2.1 Specialized MAC
2.2 SDMA, FDMA, TDMA-fixed TDM
2.3 Classical ALOHA, slotted, ALOHA
2.4 CSMA, DAMA
2.5 PRMA, Reservation TDMA
2.6 Collision avoidance: polling inhibit sense multiple access. DMA comparison,
2.7 GSM-mobile services, architecture
2.8 Radio interlace, protocol
2.9 Localization, calling, handover
2.10 Security, new data services
2.11 Introduction to W'LL.

Unit-3: Satellite and Broadcast Systems

3.1 Emergence of Satellite and Broadcast Systems and their Applications
3.2 GEO, LEO, MEO
3.3 Routing, localization
3.4 Handover in satellite system
3.5 Digital audio and video broadcasting
3.6 Wireless LAN: IEEE 802.11-System and protocol architecture, physical layer
3.7 MAC layered management
3.8 Bluetooth -User scenarios, physical layer, MAC layer
3.9 Networking, security and link management.

Unit-4: Mobile Network Layer

4.1 Mobile IP-goals, assumption, requirements
4.2 Entities, terminology, IP Packet delivery
4.2 Agent advertisement and discovery, registration
4.3 Tunneling, encapsulation
4.4 Optimization, reverse tunneling,
4.5 IPV6
4.7 DHCP

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4.8 Adhoc Networks; routing
4.9 Destination sequences distance vector, dynamic source routing
4.10 Hierarchical algorithm, alternative metric.

Unit-5: Mobile Transport Layer
5.1 Traditional TCP
5.2 Indirect TCP
5.3 Snooping TCP, Mobile TCP
5.4 Fast retransmission recovery,
5.5 Transmission/time out freezing, Selective retransmission
5.6 Transaction oriented TCP.

Unit-6: Support for Mobility
6.1 File System, WWW-HTP
6.2 HTML, system architecture
6.3 WAP-architecture
6.4 Wireless datagram
6.5 Protocol, wireless transport layer security
6.6 Wireless transaction protocol
6.7 Application environment, telephony application.

Text Books/Reference Books:
1. Jochen Schiller,2000,Mobile Communication,2nd edition, Pearson .
2. William CY Lee,Mobile Cellular Telecommunications, 2nd edition, TMH.
3. Theodore S Rappaport,2014,Wireless Communications, 2nd edition, Pearson.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M221.1	3	1	2	-	2	2	3	-	3
CS-M221.2	3	1	1	1	2	3	2	1	3
CS-M221.3	2	2	2	-	2	2	3	2	2

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CS-M212: NETWORK ADMINISTRATION AND SECURITY LAB

Periods/week	Credits		
P: 2	1	Max. Marks	: 100
Duration of Examination: 3 Hrs		Internal	: 50
		External	: 50

Co-Requisites: NETWORK ADMINISTRATION AND SECURITY (CS-M202)

Course Outcomes: The students will be able to:
CS-M212.1 Explain the characteristics of Malware and its effects on Computing systems.
CS-M212.2 Practice the given system scenario using the appropriate tools to Identify the vulnerabilities and to perform Malware analysis.
CS-M212.3 State the need and types of Malware Analysis
CS-M212.4 Distinguish the use of Static and Dynamic Analysis in Malware applications.
CS-M212.5 Analyze the given Portable Executable and Non-Portable Executable files using Static and dynamic analysis techniques.

Following are some of the suggested topics for the Lab Practicals:
a) Installing Windows 2000 Server
b) Managing DHCP server
c) Installing & Configuring Active Directory Directory Service
d) Learn to install wine / virtual box or any other equivalent software on the host os.
e) Perform an experiment for port scanning with nmap, superscan or any other software
f) Using nmap 1)find open ports on a system 2) find the machines which are active 3)find the version of remote os on other systems ,find the version of s/w installed on other system
g) Perform an experiment on active and passive finger printing using xprobe2 and nmap.
h) Perform an experiment to demonstrate how to sniff for router traffic by using the tool wireshark.
i) Perform an experiment how to use dumpsec
j) Perform an wireless audit of an access point / router and decrypt wep and wpa.
k) Perform an experiment to sniff traffic using arp poisoning
l) Demonstrate intrusion detection system (ids) using any tool eg . snort or any other s/w
m) Install rootkits and study variety of opt ions
n) Generating password hashes with openssl
o) Setup a honey pot and monitor the honeypot on network

Note: At least 5 more exercises to be given by the teacher concerned.

Assessment Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Semester Practical Exam

Course Articulation Matrix :

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M212.1	3	2	2	2	1	2	3	2	3
CS-M212.2	2	1	2	1	2	1	2	2	3
CS-M212.3	3	1	2	1	1	1	1	2	3
CS-M212.4	2	2	1	1	2	1	2	2	3
CS-M212.5	3	1	2	1	2	2	1	2	3

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CS-M216: ROUTING ALGORITHMS AND PROTOCOL LAB

Periods/week	Credits		
P: 2	1	Max. Marks	: 100
		Internal	: 50
Duration of Examination: 3 Hrs		External	: 50

Pre-Requisite: ROUTING ALGORITHMS AND PROTOCOLS (CS-M206)

Course Outcomes: The students will be able to-
CS-M216.1. Understand the fundamentals and requirements for packet routing in computer communication networks.
CS-M216.2. Design the IP addressing scheme of the complex campus network.
CS-M216.3. Decide the routing protocol for any level of complex network design.
CS-M216.4. Deal with the different routing protocols required to be configured in real routers.
CS-M216.5. Gain knowledge about the internal architecture of routers.
CS-M216.6. Draw the interest towards the research in the routing platform

Following are some of the suggested topics for the Lab Practical's:
1) Perform the basic set up of switch using packet tracert:
    1.1 Configure the password
    1.2 Configure password encryption on the switch
    1.3 Configure CONSOLE access
    1.4 Configure TELNET access
2. Interfaces Configuration For switch
3. To configure VTP and VLAN on a small network of four switches
4. To perform a basic router setup
5. To configure static routing
6. Perform the configuration of RIPv1 (Routing Information Protocol v1)
7. Perform the configuration of RIPv2 (Routing Information Protocol v2)
8. Perform the configuration of EIGRP protocol
9. Perform the configuration of Open Shortest Path First(OSPF) protocol
10. Perform the configuration of NAT with PAT
11. Setting up the TELNET and MOTD banner

Note: At least 5 more exercises to be given by the teacher concerned.

Assessment Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Semester Practical Exam

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M216.1	3	2	-	1	-	1	-	-	1
CS-M216.2	2	1	-	1	2	-	2	-	2
CS-M216.3	2	2	1	1	-	-	1	-	-
CS-M216.4	3	2	1		-	-	2	1	2
CS-M216.5	3	-	-	2	-	-	1	-	1
CS-M216.6	2	-	1	3	3	1	-	2	1

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CS-M250: SEMINAR

Periods/week	Credits		
T: 2	2	Max. Marks	: 50
		Internal	: 50

Duration of Examination: 3 Hrs

Pre-requisites: NIL

Course Outcomes: The students will be able to-
CS-M250.1. Understand contemporary / emerging technology for various applications.
CS-M250.2. Share knowledge effectively via presentation and formulate documents.

Colloquium is a technical seminar for presentations and discussions of discipline specific topics pertaining to the research & development.

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M250.1	3	3	1	1	3	1	3	3	3
CS-M250.2	3	3	1	1	3	1	3	3	3

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Elective-I

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CS-M228: NETWORK DESIGN AND OPTIMIZATION

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of Computer Networks

Course Outcomes: The students will be able to:

CS-M228.1 Understand the basic requirements of network design
CS-M228.2 Identify devices and technologies needed for particular scenarios
CS-M228.3 Analyze the traffic flow, protocol behavior and internetworking technologies
CS-M228.4 Design a network that meets the customer's business requirements.
CS-M228.5 Evaluate the efficiency of the designed network

Unit 1: Identifying Customer Needs and Goals

1.1 Using Top down network methodology
1.2 Structured Network Design, SDLC
1.3 PDIOO network cycle
1.4 Analyzing Business goals and constraints
1.5 Analyzing technical goals,
1.6 Network Performance metrics:
  1.6.1 Throughput, Accuracy, Delay
  1.6.2 Efficiency, Security, Manageability
  1.6.3 Usability, Affordability, Adaptability
  1.6.4 Making Network Design tradeoffs

Unit 2: Characterizing Existing Internetwork and Network Traffic

2.1 Developing a Network Map, Characterizing Large Internetwork
2.2 Characterizing the Logical Architecture
2.3 Developing a Modular Block Diagram
2.4 Characterizing Network Addressing and Naming
2.5 Characterizing Wiring and Media
2.6 Checking Architectural and Environmental Constraints
2.7 Characterizing Traffic flow
  2.7.1. Identifying Major Traffic Sources and Stores
  2.7.2. Characterizing Types of Traffic Flow for New Network Applications
2.8 Characterizing Traffic load
  2.8.1. Calculating Theoretical Traffic Load
  2.8.2. Characterizing Traffic behavior
  2.8.3. Characterizing Quality of Service requirements

Unit 3: Logical Network Design

3.1 Hierarchical Network Design
  3.1.1 Flat Versus Hierarchical Topologies
  3.1.2. Mesh Versus Hierarchical-Mesh Topologies
  3.1.3. Classic Three-Layer Hierarchical Model
3.2 Redundant Network Design Topologies
3.3 Designing a campus network design topology
3.4 Guidelines for Assigning Network Layer Addresses
3.5 Using a hierarchical model for assigning addresses
3.6 Selecting switching and routing protocols
3.7 Developing network Security design strategies
  3.7.1 Components of a security policy
  3.7.2 Security mechanisms

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3.8 Developing network management strategies
3.9 Network management processes and architecture

Unit 4: Physical Network Design

4.1 LAN cablingplant design and technologies
4.2 Selecting internetworking devices for a campus network design
4.3 Selecting technologies and devices for enterprise network
4.4 Remote access technologies
4.5 Selecting remote access devices for an enterprise
4.6 WAN technologies;
- 4.6.1. Systems for Provisioning WAN Bandwidth
- 4.6.2. Leased Lines
- 4.6.3. Synchronous Optical Network
- 4.6.4. Frame Relay
- 4.6.5. ATM
- 4.6.6. Ethernet over ATM .

Unit 5: Testing Network Design

5.1. Using Industry Tests
5.2. Building and Testing a Prototype Network System
- 5.2.1. Determining the Scope of a Prototype System
- 5.2.2. Testing a Prototype on a Production Network

5.3. Writing and Implementing a Test Plan for Your Network Design
- 5.3.1. Developing Test Objectives and Acceptance Criteria
- 5.3.2. Determining the Types of Tests to Run
- 5.3.3. Documenting Network Equipment and Other Resources
- 5.3.4. Writing Test Scripts, Documenting the Project Timeline
- 5.3.5. Implementing the Test Plan

5.4 Tools for Testing a Network Design
- 5.4.1. Types of Tools
- 5.4.2. Examples of Network Testing Tools

Unit-6: Optimizing and Documenting Network Design

6.1. Optimizing Bandwidth Usage with IP Multicast Technologies
6.2. Reducing Serialization Delay
6.3. Optimizing Network Performance to Meet Quality of Service Requirements
6.4. Cisco IOS Features for Optimizing Network Performance Documenting your network design
6.5. Responding to a Customer's Request for Proposal
6.6. Contents of a network design document
- 6.6.1. Network Application
- 6.6.2. Current State of the Network
- 6.6.3. Results of Network Design Testing
- 6.6.4. Implementation Plan
- 6.6.5. Project Schedule
- 6.6.6. Project Budget
- 6.6.7. Return on Investment

Text Books/ Reference Books:

1. Top down Network Design , 3rd edition By Priscilla Oppenheimer, Cisco Press, 2010
2. Designing Addressing Architectures for Routing and Switching. Macmillan Technical Publishing, 1998
3. Network Analysis, Architecture and Design, Elsevier, Third edition
4. Pióro, M., &Medhi, D. (2004). Routing, flow, and capacity design in communication and computer networks, Elsevier..
5. Ahuja, R. K., Magnanti, T. L., & Orlin, J. B. (1993). Network flows: theory, algorithms, and applications..

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

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Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CS-M228.1	3	2	2	2	1	2	3	2	3
CS-M228.2	2	2	2	1	2	1	2	2	3
CS-M228.3	3	1	2	1	2	1	1	2	3
CS-M228.4	3	2	2	1	2	1	1	2	3
CS-M228.5	3	1	2	1	2	2	1	2	3

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Elective-I

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CS-M223: WEB ENGINEERING

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of web technologies.

Course Outcomes: The students will be able to-

CS-M223.1. Understand the fundamentals and basics of web, Internet plus various technologies associated with them.

CS-M223.2. Learn how to design the various web server techniques

CS-M223.3. Analyze and discuss various integration techniques with database and security protocols in web engineering.

Unit-1: Overview of Internet & Web

1.1 Basics of Internet, Networking & Web concepts.
1.2 Network topologies, types & layers.
1.3 Internet & Web protocols: TCP/IP, ARP, RARP, PPP, Telnet, ftp.
1.4 Subnets & Hosts, WWW, Domain Names, Websites
1.5 Browsers, Search Engines, Counters, Internet Chat.
1.6 Hardware & Software requirements for Internet & Web based applications.
1.7 Overview of various Internet & Web technologies.

Unit-2: Browsers and Search Engines

2.1 Architecture of Browser
2.2 Searching process and Search Engines, Architecture of Search Engines
2.3 Crawlers and Types of Crawlers, Crawlers Algorithms.
2.4 Types of search engine:Google, Bing, Yahoo, Baidu, and Yandex

Unit-3: Active Server Pages

3.1 Creating interactive applications using active server pages Language Tools – HTML Essentials
3.2 VBScript Language Elements, VBScript Functions and Objects.
3.3 ASP Concepts: Using Server-Side Includes, Using the Request Object, Using the Response Object, Using Cookies, Using the Application
3.4 Session, and Server Objects, Error Handling.

Unit-4: Integration with Databases

4.1 Database excess: Database programming using JDBC.
4.2 Active Data Objects Essentials, Creating a Data Browser, Adding Data Entry Features, Enhancing the Data Browser
4.3 Advanced Database Integration.
4.4 History of data Integration.

Unit-5: Concept of Web Engineering

5.1. JavaScript: Introduction to Scripting, Controls, Structures, Functions, Arrays and Objects.
5.2. Dynamic HTML: Object Model and Collections Event Model Filters and Transitions Data Binding with Tabular Data Control Structured Graphics ActiveX Control Path, Sequencer and Sprite ActiveX Controls.
5.3. Perl and CGI (Common Gateway Interface) XML
5.4. Python ,PHP

Unit-.6: Web Servers & Security

6.1 Web Servers: IIS
6.2 PWS

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6.3 Apache
6.4 Security and management issues for creating web sites.
6.5 Security prevention techniques

Text Books/Reference Books:

1. Deitel, Deitel & Nieto,2011,Internet & World Wide Web How to Program,5th Edition, Pearson.
2. Shelly Powers ,1997,Dynamic Web Publishing Unleashed,2nd Edition,Sams.
3. Eric A. Smith,2000, ASP 3 Programming Bible,IDG Books India.
4. Rick Dranell ,HTML4 unleashed,1st Edition, Techmedia Publication.
5. C. Xavier, World Wide Web Design with HTML,TMH.
6. Don Gosselin,JavaScript Introductory ,2nd Edition,2001, Vikas Publication
7. Mark Swank & Drew Kittel, World Wide Web Database,Sams.net.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M223.1	3	1	2		2		3		3
CS-M223.2		1		1	2	3		1	3
CS-M223.3	2		2		2		3	2	2

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Elective-I

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CS-M208: PARALLEL AND DISTRIBUTED COMPUTING

Periods/week	Credits		Max. Marks	: 125
L: 4	T: 0	4	Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of computing Ecosystem.

Course Outcomes: The students will be able to:
CS-M208.1 To introduce the parallel and distributed infrastructure, and to provide insight into research based use-cases .
CS-M208.2 To understand issues related to distributed environment and its appropriate solutions.
CS-M208.3 To analyze the distributed shared memory and the analytical model of parallel computing.

Unit-1: Introduction to Parallel Computing
1.1. Parallelism: Basic Concepts& Scope of Parallel Computing,
1.2. Parallel Programming Platforms:
1.2.1 Overview of Serial Architectures,
1.2.2 Implicit Parallelism: Trends in Microprocessor Architectures,
1.2.3 Limitations of Memory System Performance,
1.3. Classification of Parallel Computing Platforms:
1.3.1 Physical and Logical Organization of Parallel Platforms,
1.3.2 Communication Costs in Parallel Machines,
1.3.3 Routing Mechanisms for Interconnection Networks,
1.4 Impact of Process-Processor Mapping and Mapping Techniques

Unit-2: Principles of Parallel Algorithm Design
2.1 Decomposition Techniques,
2.2 Characteristics of Tasks and Interactions,
2.3 Mapping Techniques for Load Balancing,
2.4 Methods for Containing Interaction Overheads,
2.5 Parallel Algorithm Models,
2.6 Threads and Synchronization: Thread Basics: Creation and Termination, The POSIX Thread API, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes,
2.7 Thread Cancellation,
2.8 Composite Synchronization Constructs

Unit 3: Programming Using the Message-Passing Paradigm
3.1 Principles of Message-Passing Programming,
3.2 The Building Blocks: Send and Receive Operations,
3.3 Message Passing Interface,
3.4 Topologies and Embedding,
3.5 Overlapping Communication with Computation,
3.6 Collective Communication and Computation Operations,
3.7 Groups and Communicators,
3.8 OpenMP: a Standard for Directive Based Parallel Programming

Unit-4: Analytical Modelling of Parallel Programs
4.1 Sources of Overhead in Parallel Programs,
4.2 Performance Metrics for Parallel Systems,
4.3 The Effect of Granularity on Performance,
4.4 Scalability of Parallel Systems,
4.5 Minimum Execution Time and Minimum Cost-Optimal Execution Time,
4.6 Asymptotic Analysis of Parallel Programs

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Unit-5: Introduction To Distributed Systems
5.1. Goals of Distributed Systems,
5.2 Types of Distributed Systems:
5.3 Distributed Computing Systems,
5.4 Distributed Information systems,
5.5 Distributed Pervasive Systems;
5.6 Distributed System Architecture;
5.7 Communication in Distributed Systems: Fundamentals,
5.8 Types of Communication: RPC, Message Oriented, Stream Oriented,
5.9 Multicast Communication;
5.10 Case study: Interprocess Communication in UNIX.

Unit-6: Distributed Shared Memory
6.1 Distributed Shared Memory: Introduction,
6.2 Shared Memory Organization: On-Chip Memory,
6.3 Bus-Based Multiprocessors,
6.4 Ring-Based Multiprocessors,
6.5 Switched Multprocessors,
6.6 NUMA Multiprocesors; Consistency Models: Strict Consistency,
6.7 Sequential Consistency,
6.8 Casual Consistency,
6.9 PRAM Consistency and Processor Consistency,
6.10 Weak Consistency, Release Consistency, Entry Consistency.

Text Books / Reference Books:
1. Introduction to Parallel Computing, Second Edition, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kum, Addison Wesley,2014
2. Distributed Systems: Principles and Paradigms, Second Edition,2016 Andrew S Tanenbaum
3. Distributed Operating Systems: Andrew S Tanenbaum, e-book

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M208.1	3	1	1	1	1	1	2	3	1
CS-M208.2	2	1	1	1	1	1	1	1	1
CS-M208.3	3	1	1	1	1	3	1	1	1

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ELECTIVE-I

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CS-M209: ETHICAL HACKING

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of cyber security.

Course Outcomes: The students will be able to:
CS-M209.1 To introduce the principles of ethical hacking, and to provide research-based use-cases .
CS-M209.2 To understand issues related to system hacking and web application based hacks.
CS-M209.3 To analyze the countermeasures, prevention and mitigation of attacks.

Unit-1: Introduction To Ethical Hacking Disclosure
1.1 Introduction: Ethical hacking Terminology,
1.2 Types of hacking technologies
1.3 Phases of ethical hacking
  1.3.1 Foot Printing
  1.3.2 Social Engineering;
  1.3.3 Scanning and enumeration;
1.4 Recognizing the Gray Areas in Security,
1.5 Vulnerability Assessment;
1.6 Ethical Hacking and Legal System;
  1.6.1 The Rise of Cyber laws;
  1.6.2 Electronic Communication Privacy Act;
  1.6.3 Digital Millennium Copyright Act (DCMA):
  1.6.4 Cyber Security Enhancement Act
  1.6.5 Individuals Cyber laws

Unit-2: Port Scanning And System Hacking
2.1 Introduction to port scanning
2.2 Types of port scan
2.3 Port scanning tools :Ping sweeps
2.4 Understanding scripting
2.5 Enumeration: Net BIOS basics-Enumeration tools.
2.6 Understanding the password hacking techniques:
  2.6.1 Rootkits
  2.6.2 Trojans,
  2.6.2 Backdoors,
  2.6.3 Viruses and worms,
  2.6.4 Sniffers,
  2.6.5 Denial of service
  2.6.6 Session hijacking.

Unit-3: Web Server Hacking
3.1 Web Server Attacks : Database Attacks , Password Cracking
3.2 Network Devices & Attacks
3.3 Wireless Network Attacks
3.4 Trojans and Backdoor Applications
3.5 OS Specific Attacks
3.6 Buffer Overflows ,Denial of Service Attacks.

Unit-4: Hacking Malware and Analysis
4.1 Malware: Latest Trends in Honeypot Technology

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4.2 Catching Malware; Initial Analysis of Malware.
4.3 Trends in Malware: De-obfuscating Malware, Reverse Engineering Malware
4.4 Malware Operation Phase
4.5 Automated Malware Analysis.

Unit-5: Penetration Testing And Tools
5.1 Cryptography: Overview of MD5, SHA, RC4
5.2 Penetration Testing Methodologies; Steps: Pen test legal framework;
5.3 Penetration Testing Tools;
5.4 Social Engineering Attacks;
5.5 Common Attacks used in Penetration Testing
    5.5.1 Physical Penetration Attacks
    5.5.2 Reconnaissance; Common ways into a Building
5.6 Defending against physical Penetrations;
5.7 Insider Attacks: Conducting an Insider Attack, Defending Against Insider Attack.

Unit-6: Network Protection Systems And Server OS Vulnerabilities
6.1 Understanding routers;
6.2 Understanding firewalls; Risk analysis tools for firewalls.
6.3 Understanding Intrusion and detection and prevention systems;
6.4 Windows OS vulnerabilities;
6.5 Tools for identifying vulnerabilities in windows;
6.6 Linux OS vulnerabilities;
6.7 Vulnerabilities of embedded OS.

Text Books Reference Books:

1. Patrick Engebretson, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series).
2. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, Terron Williams, Gray Hat Hacking: The Ethical Hackers Handbook : The Ethical Hacker's Handbook, 3rd Edition.
3. Hands-On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James Corley.
4. Official Certified Ethical Hacker Review Guide – By Steven DeFino, Barry Kaufman, Nick Valenteen.
5. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series) [Paperback].
6. Hands-On Ethical Hacking and Network Defense [Print Replica] [Kindle Edition].
7. Ethical Hacking And Network Defense With CD by Michael T Simpson Michael T Simpson. Hands-On Ethical Hacking and Network Defense by James E Corley , Kent· Backman , Michael T Simpson.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M209.1	3	1	1	1	1	1	2	3	1
CS-M209.2	3	1	1	1	2	1	1	1	1
CS-M209.3	3	1	1	1	1	3	1	2	1

ELECTIVE-I

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CS-M226: MACHINE LEARNING

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of computers.

Course Outcomes: The students will be able to-
CS-M226.1. Outline the techniques, mathematical concepts, and algorithms used in machine learning.
CS-M226.2. Describe the basic concepts of statistics and probability theory relevant to machine learning.
CS-M226.3. Understand Linear Machines techniques for classification in machine learning
CS-M226.4. Apply the appropriate machine learning technique using Instance-based Learning for optimization and decision problems
CS-M226.5. Design the algorithms and techniques to solve problems using Artificial Neural Networks.
CS-M226.6. Analyze the complexities of various problems in different domains.

Unit-1: Overview and Introduction to Bayes Decision Theory
1.1 Machine intelligence and applications,
1.2 pattern recognition concepts,
1.3 classification, regression, feature selection,
1.4 supervised learning,
1.5 class conditional probability distributions,
1.6 Examples of classifiers
  1.6.1 Bayes optimal classifier and error,
  1.6.2 learning classification approaches.

Unit- 2: Linear machines
2.1 General and linear discriminants,
2.2 decision regions,
2.3 single layer neural network,
2.4 linear separability,
2.5 general gradient descent,
2.6 perceptron learning algorithm,
2.7 mean square criterion and Widrow-Hoff learning algorithm;
2.8 multi-Layer perceptrons: two-layers universal approximators,
2.9 back propagation learning,
2.10 On-line, off-line error surface, important parameters.

Unit- 3: Learning decision trees
3.1. Inference model,
3.2. general domains,
3.3. symbolic decision trees,
3.4. consistency,
3.5. learning trees from training examples entropy,
3.6. mutual information,
3.7. ID3 algorithm criterion,
3.8. C4.5 algorithm continuous test nodes,
3.9. Confidence, pruning, learning with incomplete data.

Unit- 4: Instance-based Learning, concepts and limitations
4.1. Nearest neighbor classification,
  4.1.1. k-nearest neighbor,
  4.1.2. nearest neighbor error probability,

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4.2. Learning theory,
  4.2.1. formal model of the learnable,
  4.2.2. sample complexity,
  4.2.3. learning in zero-Bayes and realizable case,
  4.2.4. VC- Dimension,
  4.2.5. fundamental algorithm independent concepts,
  4.2.6. hypothesis class, target class,
  4.2.7. Inductive Bias,
    4.2.7.1 Occam's razor, empirical risk,
4.3. limitations of inference machines,
4.4. Approximation and estimation errors, Tradeoff.

Unit- 5: Machine learning assessment and Improvement
5.1. Statistical model selection,
5.2. structural risk minimization,
5.3. bootstrapping,
5.4. bagging, boosting.

Unit- 6: Support Vector Machines
6.1. Margin of a classifier,
6.2. dual perceptron algorithm,
6.3. learning nonlinear hypotheses with perceptron kernel functions,
6.4. implicit non-linear feature space,
6.5. zero-Bayes, realizable infinite hypothesis class,
6.6. finite covering,
6.7. margin-based bounds on risk,
  6.7.1. maximal margin classifier.

Text Books / Reference Books:

1. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006.
2. T. M. Mitchell, Machine Learning, McGraw-Hill, 1997.
3. Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan-Kaufmann, 2003
4. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
5. R. O. Duda, P. E. Hart, and D.G. Stork, Pattern Classification, John Wiley and Sons, 2001.
6. Vladimir N. Vapnik, Statistical Learning Theory, John Wiley and Sons, 1998.
7. Shawe-Taylor J. and Cristianini N., Cambridge, Introduction to Support Vector Machines, University Press, 2000.
8. Marsland, Machine learning: an algorithmic perspective, CRC Press, Taylor and Francis Group.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M226.1	2	2	1	1	1	-	-	1	1
CS-M226.2	2	1	1	1	2	-	-	1	1
CS-M226.3	2	2	2	1	-	-	-	1	1
CS-M226.4	3	3	2	-	1	-	-	1	-
CS-M226.5	2	1	2	1	1	-	1	1	1
CS-M226.6	2	2	1	2	-	1	1	1	1

ELECTIVE-I

MANAV RACHNA INTERNATIONAL UNIVERSITY
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CS-M227: GRID COMPUTING

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of computers.

Course Outcomes: The students will be able to-
CS-M227.1 Explain the basic concepts of Grid Computing, Architecture, Tools and Techniques.
CS-M227.2 Understand Web Service strategies used in Grid Monitoring and services
CS-M227.3 Apply various Grid security and Resource management services.
CS-M227.4 Manage and handle the data on Grid Portals.
CS-M227.5 Discussed Grid Middleware, technologies and their usage in real world problems
CS-M227.6 Outline the requirements of open grid services, infrastructure for various problems in different domains.

Unit-1: Concepts and Architecture
1.1What is a grid
1.2 Introduction-Parallel and Distributed Computing,
1.3 Cluster Computing Grid Computing- Anatomy and Physiology of Grid,
1.4 Web and Grid Services-Grid Standards, OGSA, WSRF
1.5 Trends, Challenges and applications,
1.6 Infrastructure of hardware and software
1.7 Main Projects and Applications
1.8 The Open Grid Forum
1.9 International Grid Trust Federation.

Unit-2: Web services & Grid Monitoring
2.1 Service Oriented Architecture
2.2 Web Service Architecture-XML
2.3 Related Technologies and Their Relevance to Web services
2.3.1 Relationship between Web Service and Grid Service
2.3.2 Grid Monitoring Architecture (GMA)
2.4 An Overview of Grid Monitoring Systems
2.4.1 R-GMA, GridICE
2.4.2 MDS
2.4.3 Service Level Agreements (SLAs)
2.5 Other Monitoring Systems
2.5.1Ganglia
2.5.2 GridMon
2.5.3 Hawkeye and Network Weather Service.

Unit-3: Grid Security And Resource Management
3.1 Grid Security-A Brief Security Primer-PKI-X509,
3.1.1Certificates-Grid Security
3.1.2 Grid Scheduling and Resource Management
3.1.3 Gridway and Grid bus Broker
3.2 Principles of Local Schedulers
3.2.1 Overview of Condor
3.2.2 SGE
3.2.3 PBS, LSF
3.3 Grid Scheduling with QoS,
3.3.1 Scheduling Paradigms & principles of scheduling

Unit-4: Data Management And Grid Portals
4.1 Data Management-Categories
4.1.1 Origins of Structured Data
4.1.2 Data Management Challenges
4.2 Architectural Approaches
4.3 Collective Data Management Services
4.3.1 Federation Services
4.3.2 Grid Portals
4.3.3 Generations of Grid Portals.

Unit-5: Grid Middleware ,grid computing applications and technologies
5.1 List of globally available Middlewares
5.2 Case Studies-Recent version of Globus Toolkit and gLite
5.3 Architecture, Components and Features
5.4 Features of Next generation grid
5.5 Merging the Grid sources
5.6 Architecture with the Web Devices Architecture.

Unit-6: Open Grid Services Infrastructure
6.1 OGSA – Sample use cases
6.2 OGSA platform components – OGSI –
6.3 OGSA Basic Services
6.4 Introduction-Grid Services
6.5 A High Level Introduction to OGSI
6.6 Introduction to Service Data Concepts
6.7 Grid Service: Naming and Change Management Recommendations.

Text Books / Reference Books:
1. Jarek Nabrzyski, Jennifer M. Schopf, Jan Weglarz, Grid Resource Management: State of the Art and Future Trends , (InternationalSeries in Operations Research & Management Science), Springer; First edition, 2003
2. Designing a Resource Broker for Heterogeneous Grids, Software: Practice and Experience, Wiley Press, New York, USA, 2008.
3. Fran Berman , Geoffrey Fox, Anthony J.G. Hey, Grid Computing: Making The Global Infrastructure a Reality,Wiley, 2003
4. Maozhen Li , Mark Baker , The Grid: Core Technologies, Wiley, 2005.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M227.1	2	2	-	-	-	1	-	-	1
CS-M227.2	2	1	-	-	-	1	1	-	1
CS-M227.3	2	2	1	-	-	1	1	-	1
CS-M227.4	3	2	1	-	-	2	2	1	1
CS-M227.5	3	2	2	2	1	2	2	2	2
CS-M227.6	3	2	2	2	1	2	2	2	2

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SEMESTER –III

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MANAV RACHNA INTERNATIONAL UNIVERSITY
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CS-M302: INTRUSION DETECTION SYSTEMS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of computers.

Course Outcomes: The students will be able to-
CS-M302.1- Understand the working of Intrusion Detection System.
CS-M302.2- Explain architecture of IDS.
CS-M302.3-Design the rules of Snort intrusion Detection System.
CS-M302.4- Apply IDS over a network and filter traffic.
CS-M302.5-Justify the intrusion detection and legal issues.

Unit-1: Introduction to Intrusion Detection
1.1 History of Intrusion detection
1.2 Audit Concept and definition
1.3 Internal and external threats to data, Attacks types
1.4 Need and types of IDS
1.5 Information sources Host based information sources, Network based information sources.

Unit-2: Foundation And Architecture
2.1 Taxonomy of anomaly detection system
2.2 Fuzzy logic
2.3 Bayes theorem
2.4 Artificial Neural networks
2.5 Support vector machine
2.6 Evolutionary computation, Association rules
2.7 Clustering, Centralized and Distributed architecture
2.8 Cooperative Intrusion Detection, Tiered architecture.

Unit-3: Intrusion Systems and Types
3.1 Intrusion Prevention Systems
3.2 Network IDs protocol based IDs, Hybrid IDs
3.3 Analysis schemes, thinking about intrusion.
3.4 A model for intrusion analysis, techniques,
3.5 Responses requirement of responses, types of responses mapping to vulnerability analysis, credential analysis and non credential analysis.

Unit-4: Working with Snort
4.1 Introduction to Snort
4.2 Snort Installation Scenarios, Installing Snort
4.3 Running Snort on Multiple Network Interfaces
4.4 Snort Command Line Options
4.5 Step-By-Step Procedure to Compile and Install Snort, Location of Snort Files
4.6 Snort Modes Snort Alert Modes
4.7 Working with Snort Rules, Rule Headers, Rule Options
4.9 The Snort Configuration File etc.
4.10 Plugins, Preprocessors and Output Modules
4.11 Using Snort with MySQL.

Unit-5: Architecture Models
5.1 Using ACID and Snort Snarf with Snort
5.2 Agent development for intrusion detection
5.3 Architecture models of IDs and IPs

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Unit-6: Justifying Intrusion Detection And Legal Issues
6.1 Intrusion detection in security
6.2 Threat Briefing, Quantifying risk
6.3 Return on Investment (ROI Law Enforcement / Criminal Prosecutions, Standard of Due Care, Evidentiary Issues)
6.4 Organizations and Standardizations.

Text Books/Reference Books:

1. Rafeeq Rehman: "Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall, 2003.
2. Paul E. Proctor, "The Practical Intrusion Detection Handbook ", Prentice Hall , 2001.
3. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
4. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.
5. T. Fahringer, R. Prodan, "A text book on grid application development and computing environment". 6th edition, khanna publishers, 2012.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M302.1	3	1	1	1	3	1	2	2	3
CS-M302.2	2	1	1	1	2	2	2	3	2
CS-M302.3	3	1	2	2	3	2	3	2	2

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CS-M360: PROJECT

Periods/week	Credits			
P: 8	4	Max. Marks	:	300
Duration of Examination: 3 Hrs		Internal	:	200
		External	:	100

Pre-requisites: The students must have the knowledge of SDLC.

Course Outcomes: The students will be able to-
CS-M360.1. Understand contemporary / emerging technology for various applications.
CS-M360.2. Inculcate and enhance the technical skills for design, research and development.

The project is guided by a faculty. The projects are to be individual. The work plan is be finalized prior to the semester.

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M360.1	3	2	2	2	2	2	3	2	3
CS-M360.1	3	2	2	1	2	1	2	2	3

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CS-M350: COLLOQUIUM

Periods/week	Credits		
T: 2	2	Max. Marks	: 50
		Internal	: 50

Pre-requisites: NIL

Course Outcomes: The students will be able to-
CS-M350.1. Understand contemporary / emerging technology for various applications.
CS-M350.2. Share knowledge effectively via presentation and formulate documents.

For colloquium each student would be required to give at least three seminars under the supervision of some of faculty member on current emerging areas of computer science among which atleast one would be research oriented.

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M350.1	3	3	1	1	3	1	3	3	3
CS-M350.2	3	3	1	1	3	1	3	3	3

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CS-M312: INTRUSION DETECTION SYSTEMS LAB

Periods/week	Credits	Max. Marks	: 100
P: 2	1	Internal	: 50
Duration of Examination: 3 Hrs		External	: 50

Co-requisites: INTRUSION DETECTION SYSTEMS (CS-M302)

Course Outcomes: The students will be able to-
CS-M312.1-Understand the working window machine and server.
CS-M312.2-Explain the configuration and architecture of Snort IDS
CS-M312.3-Design the rules of Snort intrusion Detection System
CS-M312.4-Create a network and traffic capturing over the network
CS-M312.5-Configure NMAP tool and network management.

Following are some of the suggested topics for the Lab Practicals:
1) Configure Windows 2003 Server as a Router
2) Installation of Snort Sensor in windows Machines
3) a) Installation of Snort Sensor on linux machine(BOSS)
   b) Installation of MYSQL server on linux machine(BOSS)
4) Configuring web console on Windows Server 2003 for analyzing the alerts
5) Write basic rules for Snort
6) Perform packet capturing using Windump and analyse it.
7) Perform packet capturing and analysis using Wireshark tool
8) Installation and Configuration of NMAP

Note: At least 5 more exercises to be given by the teacher concerned.

Assessment Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Semester Practical Exam

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M312.1	3	1	1	1	1	1	2	2	3
CS-M312.2	3	1	1	1	2	2	2	3	2
CS-M312.3	2	1	2	2	3	2	3	2	2
CS-M312.4	2	2	2	2	2	1	2	3	2
CS-M312.5	2	1	2	1	2	2	3	2	3

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CS-M300: DISSERTATION – PHASE-I

Periods/week	Credits			
P: 4	2	Max. Marks	:	100
		Internal	:	100

Pre-requisites: The students must have the knowledge of research methodology

Course Outcomes: The students will be able to-

CS-M300.1. Demonstrate knowledge of contemporary issues in their chosen field of research.
CS-M300.2 Consolidate the literature search to identify and formulate the engineering problem.
CS-M300.3. Design engineering solutions to complex problems utilizing a systems approach.
CS-M300.4. Apply knowledge and abilities in practical activities with regards to relevant scientific professional and social judgments.

The topic of the dissertation of 4th semester is to be approved by the internal committee in the 3rd semester as per ordinance for m.tech programme. The dissertation can be taken up on any emerging areas of computer science or on any topic of industrial importance related to computer science and should include critical review of the literature in the area.

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M300.1	3	3	1	1	3	1	3	3	3
CS-M300.2	3	3	1	1	3	1	3	3	3
CS-M300.3	3	3	1	1	3	1	3	3	3
CS-M300.4	3	3	1	1	3	1	3	3	3

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Elective-II

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CS-M303: ADHOC NETWORKS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of computer networks

Course Outcomes: The students will be able to:

CS-M303.1. Describe and explain the basics of Wireless Communication, cellular technology and Adhoc networks plus various technologies associated with it.

CS-M303.2. Analyze and discuss various Routing ,Transport and Security protocols pertaining to Adhoc Wireless Networks.

CS-M303.3. Apply this knowledge to Adhoc and sensor based networks and compute various parameters associated with it.

Unit-1: Fundamentals of Wireless communication technology

1.1 Electromagnetic spectrum, Radio Propagation spectrum
1.2 Characteristics of Wireless Channels
1.3 Multiple access techniques
1.4 Voice coding
1.5 Error control
1.6 Fundamentals of WLANs, IEEE 802.11 Standard, HIPERLAN Standard
1.7 Bluetooth specifications, Transport Protocol Group, Middleware Protocol Group, Bluetooth policies.

Unit-2: Wireless WANS, MANS and Internet

2.1 The Cellular Concept
    2.1.1 Cellular architecture
    2.1.2 First-Generation Cellular Systems
    2.1.3 Second-Generation Cellular Systems
    2.1.4 Third Generation Cellular Systems
2.2 Wireless in Local Loop
2.3 Wireless ATM, IEEE 802.16 Standard
2.4 HIPERACCESS
2.5 Wireless Internet
2.6 Mobile IP
2.7 TCP in wireless domains
2.8 WAP
2.9 Optimizing Web over Wireless.

Unit-3: Adhoc Wireless Networks and Mac Protocols

3.1 Cellular and Adhoc Wireless Networks
3.2 Applications of Adhoc wireless networks
3.3 Issues in Adhoc Networks, Adhoc Wireless Internet
3.4 Issues in designing a MAC protocol for Adhoc Wireless Networks,
3.5 Design Goals of a MAC protocol for Adhoc Wireless Sensor Networks
3.6 Classifications of MAC protocols
3.7 Contention based protocols
    3.7.1 Contention based protocols with reservation mechanism
    3.7.2 Contention based MAC protocols with scheduling mechanisms
3.8 MAC protocols that use Directional Antennas.

Unit-4: Routing protocols for Adhoc Wireless Networks

4.1 Issues in designing a Routing protocol for Adhoc networks
4.2 Classification of Routing Protocols

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4.3 Table driven Routing protocols
4.4 On demand Routing Protocols
4.5 Hybrid Routing Protocols
4.6 Routing protocols with efficient flooding mechanisms
4.7 Hierarchical routing protocols
4.8 Power aware routing Protocols.

Unit-5: Multicast routing in Adhoc Wireless Networks
5.1 Issues in designing a Multicast Routing Protocols
5.2 Operations of Multicast routing protocols
5.3 Architecture Reference Model
5.4 Classification of Multicast Protocols
5.5 Tree based Routing protocols
5.6 Mesh based Routing protocols
5.7 Energy efficient multicasting
5.8 Multicasting with Quality of Service guarantee
5.9 Application dependent multicast routing.

Unit-6: Transport Layer and Security Protocols for Adhoc Networks
6.1 Issues in designing a Transport layer protocol for Ad hoc wireless networks
6.2 Design Goals
6.3 Classification of Transport layer solutions
6.4 TCP Over Ad hoc networks, Other transport layer protocols for Ad Hoc wireless networks
6.5 Security in Ad hoc wireless networks
6.6 Network Security requirements
6.7 Issues and challenges in security provisioning
6.8 Network Security attacks
6.9 Key management
6.10 Secure routing in wireless networks.

Text/Reference Books:

1. Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy and B.Smanoj, 2004, Low Price Edition, Pearson Education.
2. Wireless Sensor Networks, Feng Zhao and Leonidas Guibas, 2004, Morgan Kaufman Publishers.
3. Ad Hoc Mobile Wireless Networks, C.K.Toh, 2002, Prentice Hall.
4. Wireless Mesh Networking, Thomas Krag and Sebastin Buettrich, 2007, O'Reilly Publishers.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M303.1	3	2	2	2	3	1	1	1	1
CS-M303.2	3	2	3	3	3	1	1	1	1
CS-M303.3	2	3	3	3	2	1	1	1	1

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Elective-II

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CS-M321: WIRELESS NETWORKS AND MOBILE COMPUTING

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of network technologies.

Course Outcomes: The students will be able to-

CS-M321.1. Compare network architecture, protocols and standards of mobile networks.
CS-M321.2. Analyze the characteristics, basic concepts and systems issues in mobile computing.
CS-M321.3. Predict emerging mobile computing ideas and best practices.
CS-M321.4. Describe the important concepts and issues related to WAP.
CS-M321.5. Estimate the techniques and standards available for planning, implementing and managing wireless/internet/computer communications.
CS-M321.6. Integrate Wireless Application Protocol in wireless and mobile network architecture.

Unit-1: Wireless and Mobile Network Architecture

1.1 Principle of Cellular Communication,
  1.1.1 Overview of IG, 2G, 2.5G, 3G and 4G technologies.
  1.1.2 GSM Architecture and Mobility Management,
  1.1.3 Hands off Management,
1.2 Network Signaling,
1.3 Mobile Computing Fundamental Challenges,
  1.3.1 Mobile Devices, PDA, Mobile OS, Palm OS, Win CE and Symbian.

Unit-2: Mobile IP Protocol Architecture

2.1 Mobile IP and IPv6,
  2.1.1 its application in mobile computing,
2.2 Cellular Digital Packet Data CDPD, VOIP, GPRS Services,
2.3 Wireless Local Loop (WLL) System.

Unit-3: Wireless Application Protocol (WAP)

3.1 The WAP Application Environment,
3.2 Wireless Application Protocol Client Software Hardware and Websites,
  3.2.1 WAP Gateways,
  3.2.2 Implementing Enterprise WAP Strategy,

Unit-4: Wireless Markup Language (WML)

4.1 Introduction to Wireless Technologies,
  4.1.1 Markup Languages,
  4.1.2 Introduction to XML,
  4.1.2 Fundamentals of WML, Writing and Formatting Text, Navigating between Cards and Decks,
4.2 Displaying Images, Tables, Using Variables,
  4.2.1 Acquiring User Input
4.3 Introduction: WML Script Control Structures,
  4.3.1 Events, Phone. Com, Extensions,
  4.3.2 Usability,

Unit-5: Applications of Mobile Computing

5.1 ASP and Dynamic WAP Sites,
5.2 XML and XSLT,
5.3 Dynamic WML Generations with ASP and XSLT,

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5.4 Developing WAP Applications using Emulators,

Unit-6: Distributed Mobile Computing
6.1 Distributed OS and file Systems,
6.2 Mobile Computing Software (Pervasive Computing),
6.3 Development Strategies, and tools,
6.4 Data Management for Mobile Computing.

Text Books/Reference Books:

1. Yi Bing Lin , I. Chlamtac,Wireless and Mobile Network Architecture,John Wiley.
2. T. Imielinski,1996, Mobile Computing, Kluwer Academic Press.
3. Wrox, 2000,The Beginning WML and WML Script, Wrox Publication.
4. U. Hansmaann, Pervasive Computing Handbook IEE Publication.
5. Pervasive Computing, Technology and Architecture of Mobile Internet Applications, Addison Wesley

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M321.1	1	1	-	-	-	-	-	1	2
CS-M321.2	-	-	2	3	-	2	-	2	3
CS-M321.3	-	2	3	-	3	-	2	2	2
CS-M321.4	1	-	3	-	-	2	-	-	2
CS-M321.5	2	2	-	-	3	-	-	2	-
CS-M321.6	1	2	3	-	-	-	-	1	2

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Elective-II

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CS-M304: STORAGE AREA NETWORK

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: The students must have the knowledge of Computer Networks

Course Outcomes: The students will be able to:

CS-M304.1. Understand the storage development like SAN, NAS, SAN/NAS accordingly.
CS-M304.2. Analyze the Storage device.
CS-M304.3. Learn different methods of Network components.
CS-M304.4. Solve any problem using different approaches data Center environment and CAP theorem.
CS-M304.5. Learn how to use the storage security.

Unit-1: Introduction To Storage Development

1.1 History: computing, networking, storage
1.2 Need for storage networking
1.3 SAN, NAS, SAN/NAS Convergence
1.4 Distributed Storage Systems
1.5 Mainframe/proprietary vs. open storage
1.6 Storage Industry Organizations and Major Vendors Market
1.7 Storage networking strategy (SAN/NAS or Distributed storage); Impact of Regulations.

Unit-2: Overview Of Technology

2.1. Storage components
2.2. Data organization: File vs. Block
2.3. Object; Data store; Searchable models
2.4. Storage Devices (including fixed content storage devices)
  2.4.1. File System, Volume Managers, RAID System, Caches, Prefetching
2.5. Error Management: Disk Error Mgmt, RAID Error Mgmt, Distributed Systems Error Mgmt

Unit-3: Network Components And Interfaces in Storage Components

3.1. Connectivity: switches, directors, highly available systems, Fibre Channel
3.2. 1GE/10GE, Metro-ethernet
3.3. Aggregation
3.4. Infiniband
3.5. SCSI 1/2/3SNIA model
3.6. Fibre Channel
3.7. IP-based Storage (iSCSI, FCIP, etc.); NAS: NFS, CIFS, DAFS

Unit-4: Data Center Environment

4.1. Application
4.2. Database Management System (DBMS)
4.3. Host (Compute)
4.4. Connectivity
4.5. Storage, Disk Drive Components, Disk Drive Performance
4.6. Host Access to Data, Direct-Attached Storage
4.7. Storage Design Based on Application Requirements and Disk Performance
4.8. Disk Native Command Queuing
4.9. Introduction to Flash Drives, Concept in Practice: VMware ESXi.

Unit-5: Highly Available and Disaster Tolerant Systems

5.1. Ordered writes

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5.2. Soft updates and Transactions
5.3. Paxos commit protocols
5.4. Impossibility Results from Distributed Systems
5.5. CAP Theorem

Unit-6: Archival Systems

6.1. Content addressable storage
6.2. Backup: serverless, LAN free, LAN Replication issues
6.3. Storage Security
6.4. Storage Management
6.5. Device Management
6.6. NAS Management
6.7. Virtualization :Virtualization solutions
6.8. SAN Management : Storage Provisioning
6.9. Storage Migration :SRM

Text Books/Reference Books:

1. Barker, R., & Massiglia, P. (2002) Storage Area Network Essentials (2nd ed.) New York, NY: John Wiley & Sons, Inc. ISBN: 0-471-03445-2.
2. Clark, T. (2001) IP SANs: A Guide to iSCSI, and FCIP Protocols for Storage Area Networks Boston, MA: Addison Wesley (Pearson Education) ©2002 ISBN: 0-201-75277-8

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:

Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M304.1	1	1	-	1	-	-	2	-	-
CS-M304.2	1	-	1	-	1	1	-	1	-
CS-M304.3	2	2	-	1	1	1	-	1	-
CS-M304.4	3	3	1	2	1	2	-	2	1
CS-M304.5	2	-	3	-	-	-	1	1	1

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Elective-II

MANAV RACHNA INTERNATIONAL UNIVERSITY

(Deemed to be University Under Section 3 of the UGC Act 1956)

CS-M324 : ARTIFICIAL NEURAL NETWORKS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: NIL

Course Outcomes: The students will be able to-

CS-M324.1. Define the basic concept of Neural Networks and Learning Processes.

CS-M324.2. Describe the different classification models discrete preceptron, single layer and Multi layer perceptron networks.

CS-M324.3. Judge the architecture of Feedforward and Feedback Networks.

CS-M324.4. Performance analysis of Recurrent Auto associative Memory, Energy Function Reduction, Association encoding & decoding and Stability- considerations.

CS-M324.5. Examine the various Self-Organizing Networks and its optimization.

CS-M324.6. Understand different applications of Neural Networks.

Unit-1: Introduction to Neural Networks and Learning Processes

1.1 Introduction to Neural Networks, Structure of biological neurons,

1.2 Models of ANN: Feed-Forward & Feedback Networks,

1.3 Neural Processing,

1.4 Learning and Adaptation, learning rules: Hebbian learning rule, Perceptron learning rule, delta learning rule, Widrow-Hoff learning rule, Correction learning rule, Winner–take all learning rule,

Unit-2: Single Layer Neural Networks

2.1 Classification Model,

2.2 Features & Decision regions; training & classification using discrete perceptron algorithm,

2.3 Single layer continuous perceptron networks for linearly separable classifications,

2.4 Multi-category Single-Layer Perceptron Networks, linearly non-separable pattern classification,

2.5 Delta learning rule for multi-perceptron layer, generalized delta learning rule,

Unit-3: Feedforward and Feedback Networks

3.1 Single layer perceptron classifiers,

3.2 Discrete and Continuous perceptrons; Feed-Forward Recall and Error back-propagation training: Basic Concepts, Learning factors;

3.3 Single layer feedback networks, Discrete-time Hopfield networks, gradient-type Hopfield networks,

3.4 Training process using Hopfield model,

Unit-4: Associative Memories

4.1 Linear Association,

4.2 Basic Concepts of recurrent Auto associative memory: retrieval algorithm, storage algorithm,

4.3 Performance analysis of Recurrent Auto associative Memory, Energy Function Reduction,

4.4 Capacity of Auto associative Recurrent Memory, Bi-directional associative memory, its Architecture,

4.5 Association encoding & decoding, Stability- considerations, performance evaluations,

Unit-5: Self-Organizing Networks

5.1 Unsupervised learning of clusters, winner-take-all learning, and recall mode.

5.2 Initialization of weights, separability limitations,

5.3 Counter propagation Network, Feature Mapping, and Self Organizing Feature Maps,

Unit-6: Applications of Neural Networks

6.1 Linear Programming Modeling Network,

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6.2 Character Recognition Networks,
6.3 Multi-Layer Feed-Forward Network for Printed Character Classification,
6.4 Character Retrieval using Hopfield Network, Neural Networks Control applications, process identification,
6.5 Non–Dynamic learning control architecture.

Text Books/Reference Books:

1. Jacek M. Zurada,Introduction to Artificial Neural Systems,Jaico Pub.House.
2. Simon Haykin ,Neural Networks :A Comprehensive foundation, Pearson Education.
3. B. Kosko, Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence, PHI.
4. N.K. Bose , P. Liang ,Neural Network Fundamentals,TMH.
5. ,B.Yegnanarayana ,Artificial Neural Networks,PHI.
6. Ivan Nunesda silva, Danilo Hernane Spatii,et al., ,Artificial Neural Networks : A practical Course, Springer.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M324 .1	3	1	2	1	1	1	1	1	1
CS-M324 .2	1	2	3	2	2	1	1	1	1
CS-M324 .3	1	1	1	3	3	1	1	2	1
CS-M324 .4	1	1	1	3	3	1	1	2	1
CS-M324 .5	1	1	1	3	3	1	1	1	1
CS-M324 .6	1	1	1	3	3	1	1	1	1

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Elective-II

MANAV RACHNA INTERNATIONAL UNIVERSITY

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CS-M328 : VLSI AND EMBEDDED SYSTEMS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: NIL

Course Outcomes: The students will be able to-

CS-M328. 1: Understand basic concepts of VLSI and EMBEDDED SYSTEMS.
CS-M328. 2: Apply the concepts of CMOS Circuits on Design and Testing of different Devices.
CS-M328. 3: Understand the Embedded Systems thoroughly.
CS-M328. 4: Understand various Real-Time Design approaches of Embedded Systems.
CS-M328. 5: Understand various programming implementations of Microcontroller.
CS-M328. 6: Learn principles of advanced Embedded System Development.

Unit-1: Introduction to CMOS

1.1 MOS and CMOS Circuits, MOS Device Design Equations
1.2 The Complementary CMOS. Inverter-DC Characteristics
1.3 Static Load MOS Inverters, The Differential Inverter,
1.4 The Transmission Gate, The Tri State Inverter, Bipolar Devices.
1.5 Circuit Characterization and Performance Estimation: Resistance and Capacitance Estimation, Inductance,
1.6 Switching Characteristics, CMOS-Gate Transistor Sizing,
1.7 Power Dissipation, Routing Conductors,
1.8 Design Margining, and Reliability

Unit-2: CMOS Circuit, Logic Design and Testing

2.1 Basic Physical Design of Simple Gate, CMOS Logic Structures, Clocking Strategies,
2.2 I/O Structures, Low Power Design. Design Strategies,
2.3 CMOS Chip Design Options, Design Methods, Design Capture and Verification Tools
2.4 CMOS Testing: Test Principles and Design Strategies for Test,
2.5 Chip Level Test Techniques, System Level Test Techniques,
2.6 Layout Design for Improved Testability.

Unit-3: Embedded Systems

3.1 An Embedded System and Characteristics of Embedded Systems; Software embedded into a system
3.2 Real Time Definitions, Events and Determinism,
3.3 Synchronous & Asynchronous Events, Determinism
3.4 Time-Loading, Real-Time Design Issues

Unit-4: RTOS & Its Overview

4.1 Real Time Operating System: Task and Task States, tasks and data,
4.2 semaphores and shared Data Operating system
4.3 Services-Message queues-Timer
4.4 Function-Events-Memory Management,
4.5 Interrupt Routines in an RTOS environment
4.6 basic design Using RTOS.

Unit-5:Embedded Microcontroller Cores and Architecture

5.1 8051 micro controller; Architecture;
5.2 Instruction sets;
5.3 Assembly language programming; I/O port programming;
5.4 Timer / counter programming
5.5 Serial Communication

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5.6 Interrupts programming.

Unit-6: Embedded System Development
6.1 Embedded system evolution trends.
6.2 Round- Robin, Round-Robin with Interrupts,
6.3 function-One-Scheduling Architecture and Algorithms
6.4 Introduction to assembler-compiler-cross compilers and Integrated Development Environment (IDE).
6.5 Object Oriented Interfacing, Recursion,
6.6 Debugging strategies, Simulators.

Text Books/Reference Books:

1. Principles of CMOS VLSI Design: N. Weste and K. Eshranghian, 4th edition 1994,Addison Wesley
2. Design and Analysis of VLSI, Circuits: (The VLSI systems series)Lance A. Glasser , Daniel Dobberpuhl July 1985 ,Addison-Wesley
3. Embedded Systems Architecture; Programming and Design: Rajkamal, 2nd edition June 2008,TMH
4. Real –Time Systems Design and Analysis: P.A. Laplante, November 2011, Wiley-IEEE Press
5. Introduction to VLSI Systems: C.Mead and L. Conway, 1980, Addison Wesley
6. Real Time Systems: C.M. Krishna, K.G.Shin, Indian edition, Jul 2017,McGraw-Hill
7. Microcontroller 8051 & Embedded Systems: M.A. Mazidi,2nd edition 2005, Pearson Education

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M328.1	3	3	3	2	2	3	2	1	1
CS-M328.2	3	2	2	3	2	1	1	1	1
CS-M328.3	2	3	3	3	3	2	2	2	1
CS-M328.4	2	3	3	3	2	1	1	1	1
CS-M328.5	3	3	3	3	3	3	3	1	3
CS-M328.6	1	1	1	1	1	2	3	3	2

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Elective-II

MANAV RACHNA INTERNATIONAL UNIVERSITY

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CS-M330 : BIOINFORMATICS

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: NIL

Course Outcomes: The students will be able to-

CS-M330.1. Outline the techniques, mathematical concepts of Molecular Biology.

CS-M330.2. Describe the basic concepts of Phylogenetic Structures to identify the pattern of substitution.

CS-M330.3. Understand Phylogenetic Prediction using various methods.

CS-M330.4. Design the algorithms and techniques to solve problems using Protein Structures and Classification.

CS-M330.5. Analyze the complexities of various problems in different applications .

Unit-1: Introduction to Molecular Biology

1.1 Basic Concepts of molecular biology,
1.2 gene structure and information content,
1.3 molecular biology tools, genomic information content,
1.4 data searches and pairwise alignments,
1.5 gaps, scoring matrices,
1.6 Needleman and Wunsch algorithm, global and local alignments, database searches.

Unit-2: Phylogenetic Structures

2.1 Patterns of substitution within genes,
2.2 estimating substitution numbers,
2.3 molecular clocks,
2.4 molecular phylogenetics, phylogenetic trees, distance matrix methods.

Unit-3: Phylogenetic Prediction

3.1 Character-based methods of phylogenetics, parsimony,
3.2 ancestral sequences, searches,
3.3 consensus trees, tree confidence,
3.4 genomics, prokaryotic gene structure, gene density, eukariotic genomes, gene expression.

Unit-4: Protein Structures and Classification

4.1 Protein and RNA structure prediction,
4.2 polypeptic composition, secondary and tertiary structures,
4.3 algorithms for modeling protein folding, structure prediction,
4.4 proteomics, protein classification, experimental techniques, ligand screening, post-translational modificat ion prediction.

Unit-5: **Biological Data Analysis and Applications**

5.1 Data Searches and Pairwise Alignments: Dot Plots, Simple alignments, Scoring, Gaps, Scoring matrices.
5.2 The Needleman and Wunsch algorithm, Local and global alignments, Database searches, Multiple sequence alignments.

Unit-6: Bio-Informatic Patterns

6.1 Concept of Bioinformatic pattern;
6.2 Substitution Patterns:
  6.2.1 Patterns of substitutions within genes,
  6.2.2 Estimating substitution numbers,

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6.2.3 Variations in substitution rates between genes,
6.3 Molecular clocks, Evolution in organelles.

Text Books/Reference Books:

1. Fundamental Concepts of Bioinformatics: D. E. Krane and M. L. Raymer, Pearson
2. Introduction to Bioinformatics: T. K. Attwood and D. J. Parry-Smith, Pearson
3. Biostatistical Analysis: J. H. Zar, 4/e, Pearson Education.
4. Bio-Informatics : David W. Mount, CBS Publication.

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M330.1	3	2	1	1	-	1	-	-	1
CS-M330.2	2	1	1	1	2	-	2	-	2
CS-M330.3	2	2	1	1	-	-	1	-	-
CS-M330.4	3	2	1		-	-	2	1	2
CS-M330.5	3	1	1	2	1	-	1	-	1
CS-M330.6	2	-	1	3	3	1	-	2	1

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Elective-II

MANAV RACHNA INTERNATIONAL UNIVERSITY

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CS-M331: BUSINESS INTELLIGENCE

Periods/week	Credits		Max. Marks	: 125
L: 4 T: 0	4		Internal	: 50
Duration of Examination: 3 Hrs			External	: 75

Pre-requisites: NIL

Course Outcomes: The students will be able to-

CS-M331.1. Learn basics of BI, dashboards design by utilizing key performance indicators that managers can use to improve day-to-day business operations.

CS-M331.2. Learn how to plan and implement BI development projects.

CS-M331.3. Understand & appreciate the use of analytical skills and business principles in operational and strategic decision-making by means of BI**.**

Unit-1: Introduction to Business Intelligence

1.1 Introduction to BI,
- 1.1.1 Definition & Concepts,
- 1.1.2 Business Applications of BI,

1.2 BI Framework,
- 1.2.1 BI Infrastructure Components:
- 1.2.2 BI Process, BI Technology,
- 1.2.3 BI Roles & Responsibilities,

1.3 Role of Data Warehousing in BI,

Unit 2: Managing Digital Data

2.1 Types of digital data:
- 2.1.1 unstructured,
- 2.1.2 quasi structured,
- 2.1.2 semi structured,
- 2.1.3 structured

2.2 Managing data,
- 2.2.1 Managing structured data
- 2.2.2 Managing unstructured data and semi-structured data,

Unit-3: Introduction to OLTP and OLAP

3.1 OLTP, OLAP, OLAP Architectures:
- 3.1.1 MOLAP, ROLAP, HOLAP,
- 3.1.2 Data models for OLAP and OLTP,

3.2 OLAP operations:
- 3.2.1 slice, dice, drill-down,
- 3.2.2 pivot, roll-up, drill-across, drill-through,

Unit-4: Basics of Data Integration (Extraction Transformation Loading)

4.1 Data Warehouse, data mart,

4.2 Concepts of data integration,
- 4.2.1 Needs of data integration,
- 4.2.2 Introduction to common data integration approaches,

4.3 Introduction to ETL using SSIS,

4.4 Introduction to data quality,
- 4.4.1 data profiling concepts and applications

Unit-5: Introduction to Multi-Dimensional Data Modeling

5.1 Introduction to data and dimension modeling,
- 5.1.1 multidimensional data model,

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5.1.2 ER Modeling vs. multi dimensional modeling,
5.1.3 concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema,
5.2 introduction to business metrics and KPIs,
5.2.1 creating cubes using SSAS

Unit-6: Basics of Enterprise Reporting
6.1 Introduction to enterprise reporting,
6.2 Concepts of dashboards, balanced scorecards,
6.3 Introduction to SSRS Architecture,
6.3.1 enterprise-reporting using SSRS

Text Books/Reference Books:

1. RN Prasad and Seema Acharya, 2011,Fundamentals of Business Analytics ,Wiley India
2. David Loshin, Business Intelligence, 2nd edn,Morgan Kaufmann.
3. Mike Biere,2003,Business intelligence for the enterprise, Prentice Hall Professional
4. Larissa Terpeluk Moss, Shaku Atre ,Business intelligence roadmap, Addison-Wesley Longman.
5. Cindi Howson,Successful Business Intelligence: Secrets to making Killer BI Applications, McGraw Hill Professional
6. Brain, Larson,Delivering business intelligence with Microsoft SQL server 2016, 4th edition .
7. Lynn Langit ,Foundations of SQL Server 2005 Business Intelligence, 1st edition ,Apress.
8. Stephen Few, Information dashboard design,2nd edn

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

Assessment Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M331.1	2	1	1	1	1	1	2	1	1
CS-M331.2	3	2	1	1	1	1	2	2	1
CS-M331.3	3	1	1	1	1	1	1	2	1

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SEMESTER –IV

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MANAV RACHNA INTERNATIONAL UNIVERSITY
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CS-M400: DISSERTATION-PHASE-II

Periods/week	Credits	Max Marks: 600
20 weeks (minimum)	20	Internal: 400
Duration of Examination: 3 Hrs		External: 200

Pre-requisites: The students must have the knowledge Dissertation Phase-I

Course Outcomes: The students will be able to-

CS-M400.1. Select the engineering tools/components for solving the identified engineering problem.
CS-M400.2. Apply the identified concepts and engineering tools to arrive at design solution(s) for the identified engineering problem
CS-M400.3. Analyze and interpret results of experiments conducted on the designed solution(s) to arrive at valid conclusions
CS-M400.4. Demonstrate the knowledge, skills and attitudes of a professional engineer.

The dissertation is aimed to train a postgraduate student towards research. This subject is divided into two parts, as follows:

I) Submission and approval of dissertation proposal

The student shall submit dissertation proposal under the guidance of supervisor nominated by Head of the respective Department to the Program Co-coordinator and shall make a presentation before a committee, called Departmental Dissertation Committee (DDC), recommended by concerned Head of Department and approved by Dean Faculty of Engineering and Technology. The student may also have co-supervisor (Internal or External) with the permission of concerned Head of Department. The student shall carry out the dissertation in the fourth semester if the topic is approved by the DDC. The DDC may also reject the proposal if not found feasible and in such case, he /she shall submit the revised proposal. **Dissertation topic needs to be finalized and approved in the III semester only.**

II) Dissertation Work

The student shall carry out his/her real dissertation work in IV semester of M.Tech. on the topic that was approved in III semester. The DDC would sequentially conduct three progress meetings in a semester. Each student pursuing dissertation work shall be expected to make a power-point presentation, documentation about the developments made pertaining to his / her work, having valid references with approval from authorized supervisor. Out of the three expected presentations to be made by the student, one should be just before submission of final dissertation to be named as Pre-submission presentation of dissertation. These details would be recorded by DDC, marked for final compilation in the last semester.

Criteria for Continuous Evaluation by the Committee in the Sequential Dissertation Work:

1. Punctuality and consistency in terms of sticking to the given deadlines by supervisor and the respective Head of Department.
2. Timely submission of progress report with valid references to the respective guides and

committee.

3. Presentation of research progress before committee.
   - Dissertation should be completed preferably within 10,000 – 15,000 words with total of six (6) copies (1 paper back, 5 head hard binding) & Manuscript (as prescribed by DDC) in a CD ROM (Soft copy) should be submitted to the respective Head of Department one month before the final university examinations.
   - Distribution of six (6) copies of dissertation:
     One Paper back Copy for University and Five Head hard copies: one each for Department, Library, Supervisor, Program Coordinator and student himself/herself.
   - Presentation & Viva-voce carrying 200 marks (based on power point presentation & oral defense) with the University appointed External Examiner and internal continuous evaluation of total 400 marks (distributed 100 marks on the basis of work carried out by the student in 3rd semester for approval of dissertation topic & 300 marks in 4th semester) by the DDC.
   - The Overall assessment of the dissertation will be based on the grading system as specified in the ordinance

The candidate with award of D grade or below will have to repeat the dissertation work.

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CS-M400.1	3	3	1	1	3	1	3	3	3
CS-M400.2	3	3	1	1	3	1	3	3	3
CS-M400.3	3	3	1	1	3	1	3	3	3
CS-M400.4	3	3	1	1	3	1	3	3	3

Curriculum and scheme of Examination Booklet of M.Tech- Computer Engineering with specialization in Computer Networking Programme containing 71 pages.

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