

# **Kerala Technological University**

CET Campus, Thiruvananthapuram  
Kerala -695016

## **Ernakulam West Cluster- 06**



## **SCHEME AND SYLLABI**

M. Tech. DEGREE IN  
Computer Science & Engineering  
With specialization in  
**NETWORK COMPUTING**  
(2015 ADMISSION ONWARDS)

## SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN NETWORK COMPUTING

### Semester I

Exam Slot	Course No:	Name	L- T – P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	06NC6011	Mathematical Foundations of Computer Science	3/4-0-0	50	50	3	4
B	06NC6021	Advanced Database Management System	3/4-0-0	50	50	3	4
C	06NC6031	Computer Networks	3/4-0-0	50	50	3	4
D	06NC6041	Parallel and Distributed Computing	3-0-0	50	50	3	3
E	06NC6x51	Elective I	3-0-0	50	50	3	3
	06NC6061	Research methodology	1-1-0	100	0	0	2
	06NC6071	Seminar 1		100	0	0	2
	06NC6081	Network Programming Lab	0-0-2	100	0	0	1
						Total	<b>23</b>

Elective I ( 06NC6x51)	
06NC6151	Theory of Computation
06NC6251 *	Virtualization Techniques
06NC6351	Multimedia Networking
06NC6451	Advanced Data Mining

\*- common with MITNE 105-2

**Semester II**

Exam Slot	Course No:	Name	L- T – P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	06NC6012	Modern Operating Systems	4-0-0	50	50	3	4
B	06NC6022	Cryptography and Network Security	3-0-0	50	50	3	3
C	06NC6032	Wireless and Mobile Computing	3-0-0	50	50	3	3
D	06NC6x42	Elective II	3-0-0	50	50	3	3
E	06NC6x52	Elective III	3-0-0	50	50	3	3
	06NC6062	Mini Project	0-0-4	100	0	0	2
	06NC6072	Network Simulation Lab	0-0-2	100	0	0	1
						Total	<b>19</b>

Elective II - (06NC6x42)		Elective III- (06NC6x52)	
06NC6142 *	Internet Routing Design	06NC6152**	Cyber Physical Systems
06NC6242	Big Data Analysis	06NC6252	Wireless Sensor Networks
06NC6342	Ethical Hacking and Computer Forensics	06NC6352	High Performance Embedded Computing

\*- Common with MITNE 204 – 1

\*\* - Common with MITNE 205– 1

**Semester III**

Exam Slot	Course No:	Name	L- T – P	Internal Marks	End Exam		Credits
					Marks	Duration (hrs)	
A	06NC7x11	Elective IV	3-0-0	50	50	3	3
B	06NC7x21	Elective V	3-0-0	50	50	3	3
	06NC7031	Seminar 2	0-0-2	100	0	0	2
	06NC7041	Project (Phase 1)	0-0-8	50	0	0	6
						Total	<b>14</b>

Elective IV - (06NC7X11)		Elective V- (06NC7X21)	
06NC7111	Soft Computing	06NC7121	Software Defined Networking
06NC7211	Web Technologies	06NC7221	Web Security
06NC7311	Cloud Computing	06NC7321	Network Flow Algorithms

**Semester IV**

Exam Slot	Course No:	Name	L- T – P	Internal Marks	End Exam		Credits
					Marks	Duration (hrs)	
	06NC7012	Project (Phase 2)	0-0-21	100	0	0	12
						Total	<b>12</b>

**Total Credits: 68**

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6011	Mathematical Foundations of Computer Science	4-0-0-4	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand different types of graphs</li> <li>To identify the problems of congruence relation</li> <li>To solve problems of linear congruence relation using different methods</li> <li>To illustrate different algorithms</li> <li>To apply linear programming in graph theory</li> <li>To describe different types of codes</li> </ol>			
<b>Expected Outcomes</b> After the course the students will be able <ol style="list-style-type: none"> <li>To know different types of graphs</li> <li>To identify the problems of congruence relation</li> <li>To solve problems of linear congruence relation using different methods</li> <li>To illustrate different algorithms</li> <li>To apply linear programming in graph theory</li> <li>To describe different types of codes</li> </ol>			
<b>TEXT BOOK</b> <ol style="list-style-type: none"> <li>John Clark and Derek Allan Holton, "A first look at Graph Theory", World Scientific, 1991.</li> <li>Wade Trape, Lawrence C. Washington, Introduction to cryptography with coding theory.</li> <li>D.A. Burton, Elementary Number theory, 6/e, Tata Mc. Graw Hill 2007</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>Balakrishnan R. and Ranganathan K, "A text book of Graph Theory" Spring Verlag, 2000.</li> <li>Harary F., "Graph Theory" Perseus Books, 1994.</li> <li>Rosen K.H, "Elementary Number Theory", 6th Ed, Addison-Wesley, 2010.</li> <li>Dudley U., "A guide to elementary number theory", The mathematical association of America, 2009.</li> <li>Andrews G. E. "Number Theory", Dover Publications, 1971.</li> </ol>			
<b>COURSE PLAN</b>			
Module	Contents	Hours	Sem Exam Marks
I	Graph, First theorem of Graph Theory, regular graph, sub graph, Paths, Cycles. Matrix representation, Trees, Bridges, Theorems, spanning trees, Directed graphs, In-degree and Out-degree	16	25%
<b>First Internal Exam</b>			
II	Shortest Path Model, Systematic Method, Dijkstra's Algorithm, Floyd's Algorithm, Minimum Spanning Tree Problem, Prim Algorithm, Kruskal's Algorithm, Maximal Flow Problem, Linear Programming modeling of Maximal Flow problem, Maximal Flow Problem Algorithm	16	25%
	Euclidean Algorithm, Fundamental Theorem of Arithmetic and Applications, Dirichlet Progressions, Irrational Numbers, Fermat	14	25%

III	Factorization, Linear Diophantine Equations, Congruence, Linear Congruence, Chinese Remainder Theorem, Wilson's and Fermat's Little Theorem, Euler's Theorem, Properties of the Euler Phi Function		
<b>Second Internal Exam</b>			
IV	The Binary Symmetric Channel, Error Correction, Error Detection, Linear Codes, Representation Through Generator and Parity-Check Matrices, Syndrome Decoding, Hamming Codes, Introduction to Finite Fields and Double-Error-Correcting Codes, Irreducible Polynomials, Primitivity, Singleton Bound, MDS Codes, Hamming Sphere-Packing Bound, Perfect Codes.	16	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6021	Advanced Database Management System	4-0-0-4	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To introduce the concept of Parallel And Distributed Databases with System Architectures</li> <li>2. To familiarize I/O Parallelism, Query and operation Parallelism, Three Tier Client Server Architecture.</li> <li>3. To illustrate Object And Object Relational Databases Operations – Complex Objects – Object Database Standards, Languages and Design: ODMG Model and Relational Systems.</li> <li>4. To explain and classify.Enhanced Data Models, Different types of databases and Genome Data Management.</li> <li>5. To analyze Mobile Databases, Effect of Mobility on Data Management and Mobile Transaction Models</li> </ol>			
<b>Expected Outcomes</b> <ol style="list-style-type: none"> <li>1. The student should be able to learn the concept of Parallel And Distributed Databases and System Architectures.</li> <li>2. The student should be able to get familiarized with I/O Parallelism ,Query and operation Parallelism ,Three Tier Client Server Architecture</li> <li>3. The student should be able to explain different types of databases and mobile transaction models</li> </ol>			
<b><u>TEXT BOOK</u></b> <ol style="list-style-type: none"> <li>1. R. Elmasri, S.B. Navathe: Fundamentals of Database Systems, 4th Edition, Pearson Addison-Wesley, 2004, ISBN 0-321-20448-4</li> <li>2. Vijay Kumar, “ Mobile Database Systems”, John Wiley &amp; Sons, 2006.</li> </ol> <b><u>REFERENCES</u></b> <ol style="list-style-type: none"> <li>1. Thomas Cannolly and Carolyn Begg, “ Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.</li> <li>2. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database SystemConcepts”, Fifth Edition, McGraw Hill, 2006.</li> <li>3. C.J.Date, A.Kannan and S.Swamynathan,”An Introductionto databaseSystems”, Eighth Edition, Pearson Education, 2006.</li> <li>4. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition 2004.</li> <li>5. S Ceri, G Pelagatti; ""Distributed Databases: Principles and Systems"; Tata McGraw-Hill Publishing Company Limited, ISBN 0-07-066215-0</li> <li>6. M Tamer Ozsu, P Valduriez; "Principles of Distributed Database Systems"; Pearson Education Pvt. Ltd., 2005, ISBN 81-7808-375-2.</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Mod ule	Contents	Hours	Sem Exam Marks
I	Parallel And Distributed Databases: Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures - Parallel Databases: I/O Parallelism –Query and operation Parallelism –Distributed Databases - Three Tier Client	16	25%

	Server Architecture- Case StudiesCase on Postgresql, mongoDB.		
<b>First Internal Exam</b>			
II	Object And Object Relational Databases: Concepts for Object Databases: Object Identity and structure – – Encapsulation of Operations – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems.JSON, NoSQL	16	25%
III	Enhanced Data Models: Temporal Databases – Spatial Databases – Multimedia Databases – Deductive Databases – XML Databases – Structured, semi structured & unstructured data, tree data model, DTD, XML schema, XML documents and databases. XML querying. Multimedia Databases- issues, applications,BSON	14	25%
<b>Second Internal Exam</b>			
IV	Mobile Databases: Mobile Databases: Location and handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models	16	25%
<b>End Semester Exam</b>			



Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6031	Computer Networks	4-0-0-4	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To build an understanding of the fundamental concepts of computer networking.</li> <li>2. To familiarize the student with the basic taxonomy and terminology of the computer networking area.</li> <li>3. To introduce the student to advanced networking concepts, preparing the student for entry in computer networking post graduate basics.</li> <li>4. To analyze the services and features of the various layers of data networks.</li> <li>5. To design, calculate, and apply subnet masks and addresses to fulfill networking requirements.</li> <li>6. To analyze the features and operations of various application layer protocols.</li> </ol>			
<b>Expected Outcomes</b> <ol style="list-style-type: none"> <li>1. Students will able to analyse and apply fundamental concepts of Network Engineering.</li> <li>2. Students will proficient in various computer networking and technologies used therein.</li> <li>3. Students will able to apply networking knowledge and tools in various computer installations.</li> </ol>			
<b>TEXTBOOK:</b> <ol style="list-style-type: none"> <li>1. Larry L. Peterson, Bruce S. Davie, Computer Networks - A Systems Approach, 5th Edition , Morgan Kaufmann,2011. ISBN: 978-0-12385-059-1</li> </ol> <b>REFERENCES:</b> <ol style="list-style-type: none"> <li>1. Data Communications and Networking , Behrouz A Forouzan , Tata McGraw-Hill Co Ltd , 5th Edition</li> <li>2. Dougus E. Comer , “Internetworking with TCP/IP Principles, Protocols” &amp; Architecture, Vol-1, 6th edition,Addison-Wesley, 2013. ISBN:978-0-13608-530-0</li> <li>3. William Stallings . “Data &amp; Computer Communications” ,10th edition, Prentice Hall,2013. ISBN: 978-0-13350-648-8</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Computer Networks Foundation - Applications – Requirements - Network Architecture: Layering and Protocols, Internet Architecture - Implementing Network Software: Application Programming Interface (Sockets), Examples – Performance - Ethernet and Multiple Access Networks (802.3): Physical Properties, Access Protocol – Switching and Bridging: Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches	14	25%

<b>First Internal Exam</b>			
II	Basic Internetworking (IP): Service Model, Global Addresses, Datagram Forwarding in IP, Subnetting and Classless Addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting, Virtual Networks and Tunnels – Routing: Distance Vector (RIP), Link State (OSPF), Metrics - Implementation and Performance - Interdomain Routing (BGP) - IP Version 6 (IPv6) – Multicast - Multiprotocol Label Switching (MPLS)	14	25%
III	End-to-End Protocols: Simple Demultiplexer (UDP) - Reliable Byte Stream (TCP) - Remote Procedure Call - Transport for Real-Time Applications (RTP) - Congestion Control and Resource Allocation: Issues in Resource Allocation - Queuing Disciplines - TCP Congestion Control – Congestion Avoidance Mechanisms - Quality of Service	14	25%
<b>Second Internal Exam</b>			
IV	Network Security: Pretty Good Privacy (PGP) Secure Shell (SSH) - Transport Layer Security (TLS, SSL, HTTPS) - Transport Layer Security - IP Security (IPsec) – Firewalls - Applications: Electronic Mail (SMTP,MIME, IMAP) – World Wide Web (HTTP) - Web Services - Name Service (DNS), Network Management (SNMP), Overlay Networks: Routing Overlays, Peer-to-Peer Networks, Content Distribution Networks.	14	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6041	Parallel and Distributed Computing	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To understand Parallel processing concepts and different levels of parallelism</li> <li>2. To exploit different memory hierarchies and the issues related to it.</li> <li>3. To apply parallelism in hardware level and use it for faster computing</li> <li>4. To explore thread level parallelism and programming based on it.</li> <li>5. To understand distributed systems and design algorithms for distributed computing.</li> <li>6. To understand resource security and protection methods.</li> </ol>			
<b>Expected Outcomes</b> After completion of the course the students would be able <ol style="list-style-type: none"> <li>1. To understand Parallel processing concepts and different levels of parallelism</li> <li>2. To exploit different memory hierarchies and the issues related to it.</li> <li>3. To apply parallelism in hardware level and use it for faster computing</li> <li>4. To explore thread level parallelism and programming based on it.</li> <li>5. To understand distributed systems and design algorithms for distributed computing.</li> <li>6. To understand resource security and protection methods.</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>1. David A Patterson and John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann, 2013.</li> <li>2. John L. Hennessy and David A Patterson, "Computer Architecture-A Quantitative Approach", Fourth Edition, Morgan Kaufmann.</li> <li>3. Nancy A. Lynch, , "Distributed Algorithms", Morgan Kaufmann Publishers Inc.</li> </ol>			
<b>REFERENCES</b> <ol style="list-style-type: none"> <li>1. David B. Kirk and Wen-mei W. Hwu, "Programming massively parallel processors: A hands-on approach", First Edition, Morgan Kaufmann, 2010.</li> <li>2. Mukesh Singhal, Niranjana G. Shivaratri "Advanced Concepts In Operating Systems: Distributed, Database, And Multiprocessor Operating Systems", Tata McGraw-Hill Edition, 2001.</li> <li>3. George Coulouris, Jean Dellimore and Tim KIndberg, "Distributed Systems Concepts and Design", Pearson Education, 5th Edition, 2011.</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Introduction to parallel processing - Overview of pipelining – pipelined data paths and control – Data hazards – Control	10	25%

	hazards – Exceptions - parallelism via Instruction –Reducing branch costs with prediction – exploiting ILP using static and dynamic scheduling		
<b>First Internal Exam</b>			
II	Exploiting memory hierarchy – basics of cache – measuring & improving cache performance - Cache coherence – Virtual Machines – virtual memory. Parallel processors – SISD, MIMD, SIMD, SPMD and Vector — Hardware multithreading – Shared memory processors	10	25%
III	Thread level parallelism – Centralized shared memory architectures – Distributed shared memory and directory based coherence – Synchronization – Models of memory Consistency – multi core processors and their performance. Computing GPUs- GPU System Architectures - Programming GPUs- Multithreaded Multiprocessor Architecture.	10	25%
<b>Second Internal Exam</b>			
IV	Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models. Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a synchronous Ring, Algorithms in a General Synchronous Networks, The Access Matrix Model – Implementation of Access Matrix Model – Safety in the Access Matrix Model	12	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6151	Theory of Computation	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To understand the basics of finite automata</li> <li>2. To know regular languages</li> <li>3. To familiarize turing machine &amp; computable functions</li> <li>4. To solve the problems using turing machine</li> <li>5. To analyze the computational complexity of Turing machine based problems</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able <ol style="list-style-type: none"> <li>1. To know the basics of finite automata</li> <li>2. To know regular languages</li> <li>3. To know Turing machine &amp; computable functions</li> <li>4. To solve the problems using Turing machine</li> <li>5. To analyze the computational complexity of Turing machine based problems</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>1. Thomas A Sudkamp, Languages and Machines, Pearson Education , Third Edition, 2012 ISBN 978-81-317-1475-1</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>1. J.E.Hopcroft,J.D.Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Education, 3rd Edition, 2011. ISBN 978-81-317-2047-9</li> <li>2. Harry R. Lewis, Christos H Papadimitriou, Elements of the Theory of Computation, PHI Learning Pvt. Ltd. Second Edition 2010, ISBN 978-81-203-2233-2</li> <li>3. John Martin, Introduction to Language and Theory of Computation, TMH, 2007, ISBN 978-0-07-066048-9</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Finite Automata: Finite state machines-state diagrams-DFA Minimization. Regular Languages, Properties, Pumping lemma. Context Free Languages: simplification- Normal Forms- CYK algorithm. Pumping Lemma for context free languages, Pushdown Automata.	12	25%
<b>First Internal Exam</b>			
II	Turing Machines: Language Acceptors- multitrack machines, Two-way Tape machines, multitape machines, nondeterministic	10	25%

	Turing Machines. Turing Computable Functions: Sequential operation of functions, Composition of functions, Uncomputable functions		
III	Chomsky Hierarchy, Decision problems and recursive languages, Problem reduction, Church-Turing Thesis, Universal machines. Undecidability: Halting problem, Rice's Theorem, Post Correspondence problem. Primitive Recursive Functions, Godel Numbering, Computable partial functions	10	25%
<b>Second Internal Exam</b>			
IV	Computational Complexity: Measurement of complexity, Time complexity of Turing Machine, Linear Speedup, Properties of Time Complexity of Languages. Classes P and NP, Polynomial Time Reduction, Satisfiability problem, Class relations, NP complete problems, 3 Satisfiability Problem, Reductions and sub-problems	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6251 *	Virtualization Techniques	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand the basics of virtualization</li> <li>To know the process of server consolidation</li> <li>To understand the process of network virtualization</li> <li>To familiarize the virtualization of storage devices.</li> </ol>			
<b>Expected Outcomes</b> <b>After the course the students should be able to</b> <ol style="list-style-type: none"> <li>To know the basics of virtualization</li> <li>To know the process of server consolidation</li> <li>To know the process of network virtualization</li> <li>To know the virtualization of storage devices.</li> </ol>			
<b>REFERENCES</b> <ol style="list-style-type: none"> <li>William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008.</li> <li>Chris Wolf , Erick M. Halter, Virtualization: From the Desktop to the Enterprise, APress 2005.</li> <li>Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.</li> <li>James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.</li> <li>David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	OVERVIEW OF VIRTUALIZATION : Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization-Virtualization Advantages – Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines – Hypervisor - Key Concepts	11	25%
<b>First Internal Exam</b>			

II	SERVER CONSOLIDATION : Hardware Virtualization – Virtual Hardware Overview - Server Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Server Virtualization – Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform	11	25%
III	NETWORK VIRTUALIZATION : Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFI's Virtual Firewall Contexts Network Device Virtualization - Data- Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation – Ipsec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF - Aware Routing Multi-Topology Routing.	10	25%
<b>Second Internal Exam</b>			
IV	VIRTUALIZING STORAGE : SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries. Overview of Hypervisors :Xen Virtual machine monitors- Xen API – VMware – VMware products – VMware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server	10	25%
<b>End Semester Exam</b>			



Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6351	Multimedia Networking	3-0-0-3	2015
<b>Course Objectives</b>  1. To understand the basics of multimedia networking 2. To understand the multimedia coding methods 3. To understand the multimedia applications in networks 4. To familiarize the quality of service in multimedia networking 5. To understand the wireless multimedia communication			
<b>Expected Outcomes</b> After the course the students should be able to 1. To explain the basics of multimedia networking 2. To know the multimedia coding methods 3. To know the multimedia applications in networks 4. To know the quality of service in multimedia networking 5. To know working of the wireless multimedia communication			
<b>References:</b>  1. Multimedia Communications: Protocols and Applications ,Franklin F Kuo, J.Joaquin Garcia , Wolf gang Effelsberg,Prentice Hall Publications. 2. Multimedia Communications : Applications, Networks, Protocols and Standards , Fred Halsall,Addison Wesley Publications. 3. AJAX, Rich Internet Applications, and Web Development for Programmers,Paul J Deitel and Harvey M Deitel,Deitel Developer Series,Pearson education. 4. Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002 5. Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education, 2004. 6. William Stallings, 'High Speed Networks: Performance and Quality of Service', 2 <sup>nd</sup> Edition, Pearson Education, 2002. 7. Kurose and Ross, 'Computer Networks : A top down Approach', Pearson Education, 2002 Nalin K Sharda, 'Multimedia Information Networking', Prentice Hall of India, 1999 8. Aura Ganz, Zvi Ganz and Kitti Wongthawaravat, 'Multimedia Wireless Networks: Technologies, Standards and QoS', Prentice Hall, 2003. 9. Ellen Kayata Wesel, 'Wireless Multimedia Communications: Networking Video,Voice and Data'			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Introduction to Multimedia Networking, Paradigm shift of Digital Media Delivery, Telematics: Infotainment in automobiles, Major components of Multimedia Networking. Digital Speech	10	25%

	Coding, Digital Speech Coding: LPC modeling and Vocoder, Regular Pulse Excitation with long-term prediction, Code-Excited Linear Prediction (CELP), Multiple-Pulse-Excitation Coding Digital Audio Coding: Human Psychoacoustics, Subband Signal Processing and Polyphase Filter implementation, MPEG-1 Audio Layers, Dolby AC3 Audio Codec, MPEG-2 Advanced Audio Coding (AAC), MPEG-4 AAC (HE-AAC).		
<b>First Internal Exam</b>			
II	Multimedia Applications in Networks. Introduction, Application Level Framing, Audio/Video Conferencing-Session Directories, Audio/Video Conferencing, Adaptive Applications, Receiver Heterogeneity, Real Time Application with Resource Reservation, Video Server, Applications requiring reliable multicast – White Board, Network Text Editor for Shared Text Editing, Multi Talk, Multicast file transfer, MultiMedia Applications on the World Wide Web – Multicast Web Page Sharing, Audio/Video Streams in the www, Interactive Multiplayer Games.	11	25%
III	Digital Multimedia Broadcasting, Moving from DVB-T to DVB-H, T-DMB Multimedia broadcasting for portable devices. Multimedia Quality Of Service of IP networks, Layered Internet Protocol (IP), IP Quality Of Service, QoS mechanisms, IP Multicast and Application-Level Multicast (ALM), Layered Multicast of Scalable Media. Quality Of Service issues in Streaming Architectures, QoS mechanisms for Multimedia Streaming, Windows Media streaming technology by Microsoft, Sure Stream Streaming Technology by Real Networks, Internet Protocol TV (IPTV).	11	25%
<b>Second Internal Exam</b>			
IV	Wireless Multimedia Communication: End to End QoS provisioning in Wireless Multimedia Networks – Adaptive Framework –MAC layer QoS enhancements in Wireless Networks – A Hybrid MAC protocol for Multimedia Traffic – Call Admission Control in Wireless Multimedia Networks – A Global QoS Management for Wireless Networks	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6451	Advanced Data Mining	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To introduce the concept of Data Mining and its purpose, types of learning, Data Warehouses, Multi dimensional data bases, Data Preprocessing and the different applications of data mining.</li> <li>2. To familiarize Association rules mining, Classification and Prediction, and its issues.</li> <li>3. To illustrate Cluster Analysis, categorization of Major Clustering Methods and Outlier Analysis.</li> <li>4. To explain and classify Mining Streams, Time Series and Sequence Data: Mining Data Streams, outline Mining Sequence Patterns in Biological Data, and Graph Mining.</li> <li>5. To analyze NoSQL databases and the big data platform, construct a survey of various NoSQL data bases, demonstrate Map reduce concepts and Hadoop architecture and examine Neo4j and its application in Social Network data Analysis.</li> </ol>			
<b>Expected Outcomes</b> <ol style="list-style-type: none"> <li>1. The student should be able to learn the concept of Data Mining and its purpose, various phases of data mining, supervised vs. unsupervised learning.</li> <li>2. The student should be able to summarize Data Warehouses, OLAP, Multi dimensional data bases, Data Preprocessing and the different applications of data mining.</li> <li>3. The student should be able to get familiarized with Association rules mining, Apriori algorithms, relevant examples and scope for improvement.</li> <li>4. The student should be able to interpret issues regarding Classification and Prediction, compare Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation and Support Vector Machines.</li> <li>5. The student should be able to illustrate Cluster Analysis, K-Means algorithm with example and suggestions for improvements.</li> <li>6. The student should be able to demonstrate a Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, and Outlier Analysis.</li> <li>7. The student should be able to explain Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, outline Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data and Graph Mining.</li> <li>8. The student should be able to analyze the NoSQL databases and the big data platform, construct a survey of various NoSQL data bases, demonstrate Map reduce concepts and Hadoop architecture and examine Neo4j and its application in Social Network data Analysis.</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>1. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques” , 3rd edition Morgan Kaufmann Publishers, ISBN:978-93-80931-91-3.</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>1. G.K Gupta , “Data mining”, 1<sup>st</sup> edition, PHI publications, ISBN:81-203-3053-6.</li> <li>2. Ian.H.Witten, E.Frank, M.A Hall , “Data mining-Practical machine learning tools and techniques”, 3<sup>rd</sup> edition, Elsevier Publications, ISBN: 978-93-80501-86-4.</li> <li>3. Richard Royger “Data mining “, 1<sup>st</sup> edition, Pearson Education, ISBN 81-297-1089-7.</li> <li>4. Rajan Chattamvelil , “Data mining methods” , 1<sup>st</sup> edition, Narosa publishers, ISBN: 978-81-7319-967-7.</li> </ol>			

5. Margaret H. Dunham and S.Sridhar, “Data Mining: Introductory and Advanced Topics “, 1 <sup>st</sup> edition, Pearson Education, ISBN: 978-81-77587-85-2. 6. K.P.Soman, Shyam Divakar, V. Ajay , “Insight into data mining-theory and practice” , 1 <sup>st</sup> edition, PHI publications-ISBN: 978-81-203-2897-6.			
<b><u>COURSE PLAN</u></b>			
<b>Module</b>	<b>Contents</b>	<b>Hours</b>	<b>Sem Exam Marks</b>
I	Data Mining-Purpose-Variou phases of data mining - supervised vs. unsupervised –learning- Data Warehouses: Modeling, Design, Implementation- OLAP-Multi dimensional data bases-Data Preprocessing: Cleaning, Integration, Reduction, Transformation, Discretization -Different applications of data mining	11	25%
<b>First Internal Exam</b>			
II	Association rules mining-Mining Frequent patterns, Associations and Correlations-Apriori algorithms- Examples -Possibilities for improvement- FP growth Algorithm-Classification and Prediction: Issues regarding Classification and Prediction, Classification by Decision Tree induction, Bayesian Classification, Rule-Based Classification, Neural Network Classification, Support Vector Machines	10	25%
III	Cluster Analysis-K-Means algorithm-Example and suggestions for improvements- A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, and Outlier Analysis and Detection.	11	25%
<b>Second Internal Exam</b>			
IV	Advanced Pattern Mining: Pattern Mining in multilevel, multidimensional space, Mining high dimensional data & colossal patterns, Mining compressed patterns. Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining. Introduction to MapReduce concepts and Hadoop architecture. Other methodologies of Data mining. Data mining & Society.	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6061	Research methodology	1-1-0-2	2015
<b>Course Objectives</b> 1. To understand the overview of research methodologies 2. To do statistical analysis on research data 3. To know the research ethics 4. To know how to write a research thesis and the analysis measures.			
<b>Expected Outcomes</b> After the course the students would be able to 1. To know the basics of research methodologies 2. To do statistical analysis on research data 3. To be aware of the research ethics 4. To know how to write a research thesis and the analysis measures			
<b>REFERENCE:</b> 1. Research Methodology By R Panneerselvam - Prentice Hall International 2004 - Eleventh printing, 2013. 2. Research Methodology By CR Kothari - New Age International publishers Second Revised Edition, Reprint 2013. 3. A beginners guide to uncertainty of measurement by Stephanie Bell, NPL Publishing 4. Research Methodology By Francis C. Dane, Brooks/Cole Publishing Company, California.			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Introduction - Meaning of Research, Objectives, Motivation, Types of Research. Research process- Problem definition- Objectives of Research- Research design- Data collection –Data Analysis –Interpretation of Results- Validation of Results. Formulation of a Research problem.	5	25%
<b>First Internal Exam</b>			
II	Basic Statistical measures - Measures of central tendency – Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, Measures of variation – Range, Mean Deviation, Quartile Deviation, Coefficient of Variation and Standard Deviation, Measures of skewness.	5	25%
III	Ethics of Research- Scientific Misconduct- Forms of Scientific Misconduct. Measurement of errors - Measurement uncertainty. Statistical test of hypothesis- T-test, Z Test, F-test, Chi-square test.	5	25%
<b>Second Internal Exam</b>			

IV	Guidelines for writing a PhD thesis - Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript. Impact factor-Validity, Merits, limitations. Other measurements of impact. h-index-advantages, criticism of h-index-modification of h-index, Intellectual property rights (IPR)- forms of IPR- patents-copyrights-Trademarks-Industrial design-geographical indication.	5	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6071	Seminar 1	0-0-0-2	2015
<b>Course Objective</b>  To assess the debating capability of the student to present a technical topic. In addition, to impart training to students to face audience and present their ideas and thus creating in them self-esteem and courage that are essential for engineers.			
<b>EVALUATION / ASSESSMENT</b> Individual students are required to choose a topic of their interest from Computer Network related topics preferably from outside the M.Tech syllabus and give a seminar on that topic about 30 minutes. A committee consisting of at least three faculty members shall assess the presentation of the seminar and award marks to the students. Each student shall submit two copies of a write up of his/her seminar topic. One copy shall be returned to the student after duly certifying it by the chairperson of the assessing committee and the other will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.			
<b>EXPECTED OUTCOME:</b> Students Shall Be Able To Apply Their theoretical Knowledge to develop a solution for real time problem.			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6081	Network Programming Lab	0-0-2-1	2015
<b>Course Objectives</b>  To impart practical knowledge on various protocols, client server model, RMI etc.			
<b>Expected Outcomes</b> Students Shall Be Able To Apply practical knowledge on various aspects of network programming.			
<b>REFERENCES:</b>  1. W.R. Stevens, “Unix Network Programming, Vol 1”, 2nd ed., Prentice-Hall Inc., 1998. 2. Douglas E.Comer, Hands on Networking with Internet Technologies, 2nd edition,Addison-Wesley,2004. ISBN: 978-0-13148-696-6 3. Douglas E.Comer , “Internetworking with TCP/IP, Vol. III: Client-Server Programming and Applications, Linux/Posix Sockets Version”, Addison-Wesley,2000. ISBN: 978-0-13032-071-1 4. Elliotte Rusty Harold “Java Network Programming” ,O'Reilly Media,			
<b>LIST OF EXERCISES / EXPERIMENTS</b>  1. Implementing IPC 2. TCP and UDP Socket programming 3. Programming with message passing interfaces (MPI) 4. Programming with Parallel Virtual Machines (PVM) 5. Client Server Programming with Java 6. UNIX socket Programming			



Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6012	Modern Operating Systems	4-0-0-4	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand the basics of operating system</li> <li>To understand the working of distributed operating system</li> <li>To understand the operations of database OS</li> <li>To understand the operations of multiprocessor OS</li> <li>To understand the working of real time OS</li> <li>To understand the operations of mobile OS</li> </ol>			
<b>Expected Outcomes</b> After this course the students would be able <ol style="list-style-type: none"> <li>To understand the basics of operating system</li> <li>To understand the working of distributed operating system</li> <li>To understand the operations of database OS</li> <li>To understand the operations of multiprocessor OS</li> <li>To understand the working of real time OS</li> <li>To understand the operations of mobile OS</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>Mukesh Singhal, Niranjana G. Shivaratri “Advanced Concepts In Operating Systems: Distributed, Database, And Multiprocessor Operating Systems”, Tata McGraw-Hill Edition, 2001.</li> <li>Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, 2006</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Concepts”, 8th Edition, John Wiley &amp; Sons, 2010. ISBN: 978-0-47012872-5</li> <li>Andrew S.Tanenbaum, “Modern Operating System”, Second Edition, Prentice Hall Inc., 2008.</li> <li>Neil Smyth, “iPhone iOS 6 Development Essentials – Xcode”, eBookFrenzy, 2012. ISBN:978-0-98602-730-7</li> <li>Marko Gargenta, “Learning Android”, O'Reilly Media, 2011 ISBN: 978-1-4493-905-0</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Operating System Basics: Overview – Synchronization Mechanisms – Synchronization Problems. Process Scheduling – Deadlocks: Detection – Prevention- Recovery – Models of Deadlocks.	10	25%
<b>First Internal Exam</b>			
II	Distributed Operating Systems: System Architectures- Design	10	25%

	issues – Communication models – Message Passing Model, Remote Procedure Call. Clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection		
III	Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives – Concurrency control algorithms. Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues –Process synchronization – Process Scheduling and Allocation- memory management.	10	25%
<b>Second Internal Exam</b>			
IV	Real Time & Mobile Operating Systems: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing. Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.	12	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6022	Cryptography and Network Security	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand OSI security architecture.</li> <li>To classify classic Encryption Techniques</li> <li>To implement different symmetric key and asymmetric key algorithms</li> <li>To construct protocols for various security aims with cryptographic tools</li> <li>To estimate and evaluate strength of cryptographic functions</li> <li>To Describe the principles of Message authentication Code ,hash functions and digital signature</li> <li>To Illustrate different types of Key distribution Methods</li> <li>To Design Different user authentication Protocols</li> </ol>			
<b>Expected Outcomes</b> The Students will be able to <ol style="list-style-type: none"> <li>Understand the basic concept of cryptography and network security</li> <li>Apply the knowledge of security for solving the problems in respective areas of specialization</li> </ol>			
<b><u>TEXT BOOKS:</u></b> <ol style="list-style-type: none"> <li>William Stallings, “Cryptography and Network Security Principles and Practice”, 5th Edition, Pearson,2013</li> </ol>			
<b><u>REFERENCES:</u></b> <ol style="list-style-type: none"> <li>Behrouz A Forouzan and Debdeep Mukhopadhyay, “ Cryptography and Network Security”, 2nd Edition, Mc Graw Hill,2007</li> <li>Atul Kahate, “Cryptography and Network Security”, 2nd Edition, Mc graw Hill,2007</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	<b>Attack on computers and computer security</b> – Computer Security Concepts ,OSI Security Architecture ,security Attacks, Security Services, Security mechanisms, A Model for Network Security, <b>Classical Encryption Techniques</b> - Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, <b>Symmetric key cryptography</b> – Stream Ciphers and Block ciphers, Feistel cipher, DES,DES Example,Strength of DES, AES Structure,AES transformation Functions, AES Key Exapnsion.	10	25%
<b>First Internal Exam</b>			
II	<b>Public key Cryptography</b> –Principles of Public key Crypto systems, RSA Algorithm, Security of RSA, Diffie Hellman Key Exchange Algorithm, Elgamal Crypto System, Elliptical Curve	11	25%

	Crypto System, <b>Data Integrity Algorithms</b> - Cryptographic Hash Functions-Applications, Simple hash Functions, Secure hash Algorithm, Message Authentication -Requirements, Functions, MAC, Digital Signature-Digital Signature Process, requirements, Elgamal Scheme, Schenorr Scheme, DSS Approach		
III	<b>Key management and Distribution:</b> Symmetric Key Distribution using Symmetric key Algorithm-key Distribution Scenario, session key life time, transparent key Control scheme, Decentralized key control, controlling key usage, Symmetric Key Distribution using asymmetric key Algorithm- Simple secret key distribution, distribution with confidentiality and authentication, Hybrid Scheme, Distribution of Public keys- Public Announcement, Publicly available directory, Public key Authority, Public key certificates, Public key Infra structure.	11	25%
<b>Second Internal Exam</b>			
IV	<b>User Authentication</b> -Remote user authentication Principles, Remote user Authentication using Symmetric encryption-Mutual Authentication, One way Authentication, Kerberos- Motivation, simple authentication Dialogue, More secure Authentication Dialogue, Version4 Authentication Dialogue, Kerberos Realms and Multiple Kerberis, Remote user Authentication using asymmetric encryption - Mutual authentication, one way authentication, Federated Identity Firewalls and Virtual private networks.	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6032	Wireless and Mobile Computing	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To build an understanding of the fundamental concepts Wireless communication and Networking.</li> <li>2. To explain and classify Mobile IP,</li> <li>3. To familiarize Cellular Wireless Networks, and Multiple Access Technology,</li> <li>4. To familiarize the student Wireless LAN-IEEE 802.11 Standard-Architecture, Services, Bluetooth, Zigbee etc</li> <li>5. To describe multiple access technologies</li> <li>6. To analyze WAP and advanced wireless networking practices</li> </ol>			
<b>Expected Outcomes</b> <ol style="list-style-type: none"> <li>1.The student should be able to learn the concept of Wireless communication.</li> <li>2.The student should be able to interpret issues regarding Handover, Security in mobile networks</li> <li>3.The student should be able to illustrate Wireless LAN-IEEE 802.11 Standard</li> <li>4.The student should be able to analyze advanced wireless networking practices</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>1. Vijay K Garg ,”Wireless communications and Networking” ,Morgan Kaufmann, 2007</li> <li>2. Theodore S Rappaport” Wireless Communications Principles and Practice”, Pearson Education, Second Edition.</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>1. KavehPahlavan, PrasanthKrishnamoorthy, “ Principles of Wireless Networks”, Pearson Education, 2003.ISBN:9780130930033</li> <li>2. Hansmann, LotharMerk, Martin Niclous, Stober, “ Principles of Mobile computing”, Springer, 2nd edition, Springer, 2006.ISBN:978-8-18128-073-2</li> <li>3. Jochen Schiller, “Mobile communications”, Pearson Education, Second Edition, 2008. ISBN:9788131724262</li> <li>4. William Stallings, “Wireless communications and Networks”, Pearson Education, 2009. ISBN:9788131720936</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Modern Wireless Communication Systems: 2G, 3G, 4G, WLL, LMDS, Cellular Concept—System Design Fundamentals, Frequency Reuse, Channel Assignment Strategies, Interference and System Capacity, Improving Coverage and Capacity in Cellular Systems, Mobility Management in Wireless Networks: Mobility Management Functions, Mobile Location Management, Mobile Registration, Handoff, Wireless Wide-Area Network (WWAN): Architecture, WWAN Subsystem Entities, Logical Channels, Channel and Frame Structure, Speech Processing,	11	25%

	Power Levels in Mobile Station, GSM Public Land Mobile Network Services		
<b>First Internal Exam</b>			
II	Multiple Access Techniques: Narrowband Channelized Systems, Spectral Efficiency, Comparisons of FDMA, TDMA, and DS-CDMA, Capacity of DS-CDMA System, Frequency Hopping Spread Spectrum with M-ary, Frequency Shift Keying, Orthogonal Frequency Division Multiplexing (OFDM), Multicarrier DS-CDMA (MC-DS-CDMA), Random Access Methods. Concept of Spread Spectrum, System Processing Gain, Requirements of Direct-Sequence Spread Spectrum, Frequency-Hopping Spread Spectrum Systems, Coherent Binary Phase-Shift Keying DSSS, Quadrature Phase-Shift Keying DSSS, Bit Scrambling, Requirements of Spreading Codes, Multipath Path Signal Propagation and Rake Receiver, TIA IS-95 CDMA System, Power Control in CDMA, Softer and Soft Handoff	11	25%
III	Wireless Local Area Networks: WLAN Equipment, WLAN Topologies, WLAN Technologies, IEEE 802.11 WLAN, Joining an Existing Basic Service Set, Security of IEEE 802.11 Systems, Power Management, IEEE 802.11b — High Rate DSSS, IEEE 802.11n, HIPERLAN, IEEE 802.16, WiMAX., Wireless Personal Area Networks: Bluetooth (IEEE 802.15.1), Bluetooth Protocol Stack, Bluetooth Link Types, Network Connection Establishment in Bluetooth, Wireless Sensor Network, Usage of Wireless Sensor Networks, Wireless Sensor Network Model, Sensor Network Protocol Stack, ZigBee Technology, IEEE 802.15.4 LR-WPAN Device Architecture, IEEE 802.15.3a — Ultra WideBand, Radio Frequency Identification	10	25%
<b>Second Internal Exam</b>			
IV	Mobile Network and Transport Layer, Concept of the Transmission Control Protocol/Internet Protocol Suite in Internet, Network Layer in the Internet, TCP Enhancements for Wireless Networks, TCP Enhancements for Wireless Networks, Mobile IP (MIP) and Session Initiation Protocol (SIP), Internet Reference Model, Wireless Application Protocol: WAP Programming Model, WAP Architecture, WAP Networking Environment, Security in Wireless Systems: Security and Privacy Needs of a Wireless System, Required Features for a Secured Wireless Communications System, Methods of Providing Privacy and Security in Wireless Systems, Wireless Security and Standards, IEEE 802.11 Security, Security in GSM, GPRS, and UMTS.	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6142	Internet Routing Design	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To understand the routing protocols</li> <li>2. To know the working of internet routing and the router architectures</li> <li>3. To analyze the network algorithms</li> <li>4. To familiarize the quality perspective in routing</li> <li>5. To know the traffic engineering</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able to <ol style="list-style-type: none"> <li>1. To know the routing protocols</li> <li>2. To explain the working of internet routing and the router architectures</li> <li>3. To analyze the network algorithms</li> <li>4. To know the quality perspective in routing</li> <li>5. To know the traffic engineering</li> </ol>			
<b>REFERENCES</b> <ol style="list-style-type: none"> <li>1. Network Routing: Algorithms, Protocols, and Architectures Deepankar Medhi and Karthikeyan Ramasamy (Morgan Kaufmann Series in Networking)</li> <li>2. Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices George Varghese (Morgan Kaufmann Series in Networking)</li> <li>3. TCP/IP Protocol Suite, (B.A. Forouzum) Tata McGraw Hill Edition, Third Edition</li> <li>4. TCP/IP Volume 1,2,3 (N. Richard Steveus Addison Wesley)</li> <li>5. Computer Networks (A.S. Taueubaum) Pearson Edition, 4th Edition</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	ROUTING PROTOCOLS: FRAMEWORK AND PRINCIPLES : Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing, Protocol, Link Cost.	10	25%
<b>First Internal Exam</b>			
II	INTERNET ROUTING AND ROUTER ARCHITECTURES : Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy- Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability. Router Architectures: Functions, Types, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures	10	25%
III	ANALYSIS OF NETWORK ALGORITHMS : Network Bottleneck, Network Algorithmics, Strawman solutions, Thinking Algorithmically, Refining the Algorithm, Cleaning up, Characteristics of Network Algorithms. IP Address Lookup	11	25%

	Algorithms : Impact, Address Aggregation, Longest Prefix Matching, Naïve Algorithms, Binary , Multibit and Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches IP Packet Filtering and Classification : Classification, Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for d Dimensions,		
<b>Second Internal Exam</b>			
IV	<p>QUALITY OF SERVICE ROUTING : QoS Attributes, Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing, Dynamic Call Routing in the PSTN, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching , Routing Protocols for QoS Routing.</p> <p>ROUTING AND TRAFFIC ENGINEERING : Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Problem Illustration: Layer 3 VPN, LSP Path Determination: Constrained Shortest Path Approach, LSP Path Determination: Network Flow Modeling Approach, Layer 2 VPN Traffic Engineering, Observations and General Modeling Framework, Routing/Traffic Engineering for Voice Over MPLS.</p>	11	25%
<b>End Semester Exam</b>			



Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6242	Big Data Analysis	3-0-0-3	2015
<b>Course Objectives</b> 1. To familiarize the basics of data mining and its applications 2. To know the application of data mining in big data & cloud 3. To know big data analysis methods 4. To understand the application of data mining in distributed systems			
<b>Expected Outcomes</b> After the course the students would be able 1. To know the basics of data mining and its applications 2. To know the application of data mining in big data & cloud 3. To know big data analysis methods 4. To know the application of data mining in distributed systems			
<b>REFERENCES:</b> 1. Jimmy Lin and Chris Dyer , “Data-Intensive Text Processing with MapReduce” , Morgan & Claypool Synthesis Lectures, 2010, ISBN 978-16-08453-42-9. 2. Anthony T Velte, Toby J Velte, R. Elsenpeter, “Cloud Computing a practical approach”, Tata McGraw-HILL, 2010, ISBN 978-00-70683-51-8. 3. Jiawei Han &MichelineKamber, “Data Mining – Concepts and Techniques” , Morgan Kaufmann Publishers, Elsevier, 2 <sup>nd</sup> Edition, 2006, ISBN:978-93-80931-91-3. 4. Ian.H.Witten, E.Frank,M.A Hall, “Data mining-Practical machine learning tools and techniques”, 3 <sup>rd</sup> edition, Elsevier Publications, ISBN: 978-93-80501-86-4. 5. Margaret H. Dunham ,S.Sridhar, “ Data Mining: Introductory and Advanced Topics” , 1 <sup>st</sup> edition, Pearson Education, ISBN: 978-81-77587-85-2.			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Data mining concepts, Applications of data mining, Stages of data mining-types of data mining applications-Data pre-processing-Principal component analysis- data normalization, data transformation- data reduction-Web mining-Types of web mining-Applications.	11	25%
<b>First Internal Exam</b>			
II	Advanced data mining concepts-Basics of big data and cloud computing, Cloud computing Fundamentals, public vs. private clouds, Types of cloud services-PaaS, SaaS, IaaS, Examples for each service. Role of virtualization in enabling the cloud, Cloud Applications: Technologies and the processes required when deploying web services, Application Development: Service creation environments to develop cloud based applications. Development environments for service development: Amazon, Azure, Google App-Social network analysis-Tools and applications-Examples	11	25%
III	Introduction to Big Data: Map-Reduce Basics: Functional	10	25%

	<p>Programming Roots, Mappers and Reducers, The Execution Framework, Partitioners and Combiners, The Distributed File System, Hadoop Cluster Architecture.</p> <p>MapReduce Algorithm Design: Local Aggregation, Combiners and In-Mapper Combining, Algorithmic Correctness with Local Aggregation, Pairs and Stripes, Computing Relative Frequencies, Secondary Sorting, Relational Joins</p>		
<b>Second Internal Exam</b>			
IV	<p>Big Data and Hadoop : Introduction to Hadoop Distributed File System, Map- Reduce Implementation with Hadoop, Hadoop Data Types BigData Management Tools: PIG: Pig's Data Model, HIVE: Hive Architecture, HIVEQL HBASE: MapReduce Integration, ZooKeeper, SQOOP.</p>	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6342	Ethical Hacking and Computer Forensics	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand the vulnerabilities associated with system and application software.</li> <li>To familiarize with the various methods used to hacking and protecting Computer and its Contents</li> <li>To introduce the student to the various cyber attack methods and prevention policies</li> <li>To familiarize the student with the basics of computer Forensic Technologies</li> <li>To understand digital evidence collection, and evidentiary reporting in forensic acquisition.</li> </ol>			
<b>Expected Outcomes</b> <ol style="list-style-type: none"> <li>Students will demonstrate the proficiency in understanding the flaws and vulnerability in operating systems and computer networking.</li> <li>Students will able to examine secure software construction practices.</li> <li>Students will demonstrate and ability to use computer forensic methods, to think laterally to investigate complex problems effectively utilize suitable tools.</li> <li>Students will able to incorporate approaches for risk management and best practices associated with various cyber crimes.</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security</li> <li>Secrets &amp; Solutions, Tata McGraw Hill Publishers, 2010.</li> <li>Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, 4<sup>th</sup> Ed. 2010.</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>Bensmith, and Brian Komer, Microsoft Windows Security Resource Kit, Prentice Hall of India, 2010</li> <li>RafayBaloch, "A Beginners Guide to Ethical Hacking". 3. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, "Gray Hat Hacking The <i>Ethical</i></li> <li><i>Hackers Handbook</i>", 3rd Edition, McGraw-Hill Osborne Media paperback(January 27, 2011)</li> <li>"Understanding Forensics in IT ", NIIT Ltd, Prentice-Hall Of India Pvt. Limited, 2005</li> <li>Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw -Hill, New Delhi, 2006.</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Casing the Establishment: What is foot printing, Internet Foot printing, Scanning, Enumeration, Enumerating Common Network services. Securing permission: Securing file and folder permission, Using the encrypting file system, Securing registry permissions. Securing service: Managing service permission, Default services in windows 2000 and windows XP. Unix: The	10	25%

	Quest for Root, Remote access, Local access, After hacking root.		
<b>First Internal Exam</b>			
II	Wireless Hacking: Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks, Firewalls: Firewalls landscape, Firewall Identification-Scanning Through firewalls, packet Filtering, Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of Dos Attackers, Types of DoS attacks, Generic Dos Attacks, UNIX and Windows DoS.	10	25%
III	Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.	11	25%
<b>Second Internal Exam</b>			
IV	Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies, Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.	11	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6152	Cyber Physical Systems	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand the design principles of cyber physical systems</li> <li>To know the applications of cyber physical systems</li> <li>To understand the energy concerns in cyber physical systems</li> <li>To apply the cyber systems in health care</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able <ol style="list-style-type: none"> <li>To know the design principles of cyber physical systems</li> <li>To know the applications of cyber physical systems</li> <li>To analyze the energy concerns in cyber physical systems</li> <li>To apply the cyber systems in health care</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>J. Lygeros, S. Sastry, and C. Tomlin, Hybrid Systems: Modeling, Analysis, and Control, pre-print monograph to be published by Springer Verlag, 2012. Used with permission.</li> <li>K. Astrom and R. Murray, Feedback Systems: An Introduction for Scientists and Engineers, Princeton University Press, 2012.</li> <li>E. Lee and S. Seshia, Introduction to Embedded Systems: A Cyber-Physical Systems Approach, <a href="http://LeeSeshia.org">http://LeeSeshia.org</a>, 2011.</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Cyber-Physical Systems Concepts , Cyber-Physical Systems: Design Challenges, Mobile Cyber-Physical Systems ,DESIGN PRINCIPLES : Cyber-Physical System Controls, Apprenticeship Learning for Cyber-Physical System, Intelligence Application of HDP- HMM in Recognition of Dynamic Hand Gestures	11	25%
<b>First Internal Exam</b>			
II	Cyber-Physical System Modeling on Cognitive Unmanned Aerial Vehicle Cyber-Physical System Security—Smart Grid Example Wireless Sensor and Actuator Networks for Cyber-Physical System Applications,Community Sensing, Wireless Embedded/Implanted Microsystems: Architecture and Security,The Application of Machine Learning in Monitoring Physical Activity with Shoe Sensors	11	25%
III	Energy Efficient Building, Cyber-Physical System for Smart Grid Applications Cyber-Physical System for Transportation	10	25%

	Applications, Video Communications in Unmanned Aerial Vehicle-Based Cyber-Physical Systems.		
<b>Second Internal Exam</b>			
IV	Cyber-Physical Medication Systems and Devices to Improve Health Care. Augmented Cognition for Intelligent Rehabilitation, Using Wiimote and Kinect for Cognitive Rehabilitation: Toward an Intelligent Sensor/Image Signal Processing, Functional Near-Infrared Spectroscopy for Autorehabilitation, Cyber-physical Systems: Toward Intelligent Signal Processing for Rehab Progress Indication	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6252	Wireless Sensor Networks	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To introduce the concept of Mobile ad hoc networking, its characteristics and applications in real world.</li> <li>2. To familiarize Sensor Network Deployment &amp; Configuration, Localization and Topology control.</li> <li>3. To distinguish the Wireless Communications, identify the Link quality characteristics.</li> <li>4. To explain Medium Access, random access MAC, S MAC, outline Energy efficient communication in adhoc networks and classify Power save protocols.</li> <li>5. To analyze Data Gathering, Tree construction algorithms with Lifetime optimization formulations</li> <li>6. To summarize Routing and Querying, categorize routing approaches as Proactive and reactive protocols, etc. Security aware routing, Maximum life time routing.</li> <li>7. To justify Collaborative Signal Processing, and address related problems.</li> <li>8. To characterize network traffic, QOS classification, Statistical analysis of non - real time traffic and real - time services.</li> <li>9. To examine security issues, attacks and countermeasures, security considerations in adhoc sensor networks.</li> </ol>			
<b>Expected Outcomes</b> <ol style="list-style-type: none"> <li>1. The student should be able to learn the concept of Mobile ad hoc networking, its imperatives, challenges, characteristics and applications in real world.</li> <li>2. The student should be able to be familiarized with the Sensor Network Deployment &amp; Configuration, Localization - Coverage and connectivity and Topology control techniques.</li> <li>3. The student should be able to distinguish Wireless Communications,- Link quality, shadowing and fading effects.</li> <li>4. The student should be able to explain Medium Access, scheduling sleep cycles, random access MAC, S MAC, outline Energy efficient communication in adhoc networks and classify Power save protocols.</li> <li>5. The student should be able to analyze Data Gathering, Tree construction algorithms and its analysis, asymptotic capacity, Lifetime optimization formulations.</li> <li>6. The student should be able to summarize Routing and Querying, Routing approaches categorized as Proactive and reactive protocols, Clustering and hierarchical routing, Multipath routing, Security aware routing, Maximum life time routing.</li> <li>7. The student should be able to justify Collaborative Signal Processing and Distributed Computation, the detection, estimation, classification problems</li> <li>8. The student should be able to characterize network traffic, QOS classification, Self similar processes, Statistical analysis of non - real time traffic and real - time services.</li> <li>9. The student should be able to examine the various Security issues-Attacks and countermeasures, Intrusion detection and Security considerations in adhoc sensor networks.</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>1. S Basagni&amp; M Conti “Mobile Adhoc Networking”, Wiley, 2004</li> <li>2. C.S Murthy, B.S Manoj, “Adhoc Wireless Networks”, Pearson 2004</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>1. Holger Karl &amp; Andreas Willig," Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.</li> <li>2. Feng Zhao &amp; Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.</li> <li>3. KazemSohraby, Daniel Minoii, &amp;TaiebZnati, "Wireless Sensor Networks- Technology, Protocols,</li> </ol>			

And Applications", John Wiley, 2007. 4. Anna Hac. "Wireless Sensor Network Designs", John Wiley, 2003. 5. T Janevski, "Traffic Analysis & Design of wireless IP Networks", Artech House, 2003.			
<b><u>COURSE PLAN</u></b>			
<b>Module</b>	<b>Contents</b>	<b>Hours</b>	<b>Sem Exam Marks</b>
I	Mobile ad hoc networking; imperatives, challenges and characteristics - Applications, Deployment & Configuration, Localization - Coverage and connectivity, Topology control, Connected dominating sets.	11	25%
<b>First Internal Exam</b>			
II	Wireless Communications,- Link quality, shadowing and fading effects, Medium Access, -Scheduling sleep cycles, random access MAC, S MAC Energy efficient communication in adhocnetworks. Power save protocols.	11	25%
III	Data Gathering - Tree construction algorithms and analysis - Routing and Querying, Routing approaches. Proactive and reactive protocols. Clustering and hierarchical routing. Multipath routing. Security aware routing. Maximum life time routing.	10	25%
<b>Second Internal Exam</b>			
IV	Collaborative Signal Processing and Distributed Computation:- Detection, Characterization of network traffic, QOS classification. Self similar processes. Statistical analysis of non - real time traffic and real - time services. Security issues-Attacks and countermeasures. Intrusion detection. Security considerations in adhoc sensornetworks.	10	25%
<b>End Semester Exam</b>			



Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6352	High Performance Embedded Computing	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand the basics of embedded systems and its architecture</li> <li>To analyze the performance of different processor architectures</li> <li>To understand the multiprocessor systems</li> <li>To understand the multiprocessor OS</li> </ol>			
<b>Expected Outcomes</b> <ol style="list-style-type: none"> <li>After the course the students would be able to</li> <li>To know the basics of embedded systems and its architecture</li> <li>To analyze the performance of different processor architectures</li> <li>To know the multiprocessor systems for computing</li> <li>To know the multiprocessor OS</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>Wayne Wolf “Computers as Components: Principles of Embedded Computer Systems Design” , Morgan Kaufmann; 1st edition (September 2000) ISBN-13: 978-1558605411</li> <li>Wayne Wolf "High-Performance Embedded Computing: Architectures, Applications, and Methodologies" Morgan Kaufmann(2006) ISBN-13: 978-0123694850</li> <li>Larry L Peterson “Computer Networks: A Systems Approach” Morgan Kaufmann (2007) ISBN-13: 978-0123705488</li> <li>Tammy Noergaard “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers” Newnes (February 24, 2005) ISBN-13: 978-0750677929</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Definition of embedded system - Constraints on embedded vs. standalone systems - Concept of real-time design - Time scales for real-time systems-Overview of computer architecture –ISA- Embedded Processor architecture- Memory and I/O bus architectures. The landscape of HPEC - Example applications - Design methodologies - Embedded Systems Design flows Models of computation -Parallelism and computation - Reliable system design - CE architectures	11	25%
<b>First Internal Exam</b>			
II	Evaluating processors - RISC and DSP processors - Parallel execution mechanisms - Super scalar, SMID and Vector processors- Variable performance CPU architectures - CPU Simulation - Automated CPU Design.Code generation and back-	10	25%

	end compilation - Memory oriented optimizations - Program performance analysis - Models of computation and languages		
III	Multiprocessor Architectures - Multiprocessor design techniques - Processing elements - Interconnection networks - Memory systems - Physically distributed systems and networks - multiprocessor design methodologies and algorithms	11	25%
<b>Second Internal Exam</b>			
IV	Multiprocessor software - RT multiprocessor operating systems - services and middleware for embedded multiprocessors - Hardware/Software co-design - performance analysis - Hardware/Software Co-Synthesis algorithms - Hardware/Software Co-Simulation	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6062	Mini Project	0-0-4-2	2015
<b>COURSE OBJECTIVES:</b> To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of a computer / information system and for enabling them to gain experience in organization and implementation of a small project, thus acquiring the necessary confidence to carry out main project in the final year.			
<b>EVALUATION / ASSESSMENT</b> In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex computer / information system with practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project. A committee consisting of minimum three faculty members specialized in computer science and engineering will perform assessment of the mini project. Students have to submit a report on the mini project and demonstrate the mini project before the evaluation committee.			
<b>EXPECTED OUTCOME:</b> Students Shall Be Able To Apply Their theoretical Knowledge to develop a solution for real time problem.			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC6072	Network Simulation Lab	0-0-2-1	2015
<b>Course Objectives</b> To impart practical knowledge on simulating different topologies, protocols, client server model, etc. in wired and wireless networks			
<b>Expected Outcomes</b> Students Shall Be Able To Apply practical knowledge on various aspects of network simulation.			
<b>REFERENCES:</b>  1. Hussein Al-Bahadili , “Simulation in Computer Network Design and Modeling: Use and Analysis”, Idea Group,U.S.,2012, ISBN:978-1-46660-191-8 2. Eitan Altman, Tania Jiménez, “ NS Simulator for Beginners”, Morgan & Claypool Publishers, 2012, ISBN: 978-1-60845-692-5. 3. Emad Aboelela , “Network Simulation Experiments Manual” ,Morgan Kaufmann, 2007. ISBN:978-0-08055-676-5 4. Users manual of various network simulators.			
<b><u>COURSE PLAN</u></b>  1. Familiarizing Network simulation tools like ns2, NCTUns, Opnet, Omnet, Glomosim, Boson NetSim etc. 2. Simulation to study link layer protocols 3. Simulation to study network layer protocols 4. Simulation to transport link layer protocols 5. Simulation to study application layer protocols 6. Simulation to study wireless and mobile communication protocols in varoius layers. 7. Simulation to study security and intrusion detection system systems in wired and wireless networks. 8. Simulation to study Network Management protocol- SNMP.			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7111	Soft Computing	3-0-0-3	2015
<b>Course Objectives</b> 1. To understand the basics of soft computing and artificial intelligence 2. To know how to apply neural networks in soft computing 3. To analyze the computational methods in soft computing 4. To extract knowledge from data using fuzzy logic			
<b>Expected Outcomes</b> After the course the students would be able 1. To know the basics of soft computing and artificial intelligence 2. To know how to apply neural networks in soft computing 3. To analyze the computational methods in soft computing 4. To extract knowledge from data using fuzzy logic			
<b><u>REFERENCES:</u></b> 1. Jyh-Shing Roger Jang., Chuen-Tsai Sun ,Eiji Mizutani, “Neuro-Fuzzy and Soft Computing, A Computational Approach to Learning and Machine Intelligence”, Prentice-Hall of India Pvt. Ltd., 2004. ISBN:978-0-13261-066-7 2. K.H. Lee, “First Course on Fuzzy Theory and Applications”, Springer, 2005 3. George J. Klir., Yuan Bo; Fuzzy Sets and Fuzzy Logic – Theory and Applications, Prentice-Hall of India Pvt. Ltd., 2001. 4. Simon Haykin, “Neural Networks- A Comprehensive Foundation”, Pearson Education, 2 <sup>nd</sup> ed., 2001. 5. D. E. Goldberg, “Genetic Algorithms in Search, Optimization & Machine Learning”, Pearson Education , 2001. 6. S. Rajasekaran, G.A.Vijaylakshmi. Pai, “Neural Networks, Fuzzy Logic, and Genetic Algorithms”, Prentice-Hall of India Pvt. Ltd., 2003.			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Introduction: Introduction to Soft Computing Concepts, Importance of tolerance in imprecision and uncertainty, Soft Computing Constituents and Conventional Artificial Intelligence, From Conventional AI to Computational Intelligence, Fuzzy Set Theory, Neural Networks and Evolutionary Computation Fuzzy Sets and Fuzzy Logic: Fuzzy sets versus Crisp sets, operations on fuzzy sets, Fuzzy Sets and Fuzzy Set Operations, Multi criteria Decision Making, Fuzzy Relations and Fuzzy Inference, Fuzzy Rule-based Systems	10	25%
<b>First Internal Exam</b>			

II	Artificial Neural Network: The neuron as a simple computing element, the Perceptron, Multilayer Neural Networks, Supervised Learning Neural Networks, Unsupervised Learning Neural Networks, Radial Basis Function Networks, Reinforcement Learning, Self-Organizing Maps, Adaptive Resonance Theory, Associative Memories, Applications.	11	25%
III	Evolutionary Computation: Genetic Algorithms and Genetic Programming, Evolutionary Programming, Evolutionary Strategies and Differential Evolution Coevolution, different operators of Genetic Algorithms, analysis of selection operations, convergence of Genetic Algorithms	10	25%
<b>Second Internal Exam</b>			
IV	Rough Sets: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications. Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.	11	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7211	Web Technologies	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To understand the basics of web page design</li> <li>2. To do scripting using JavaScript</li> <li>3. To know XML schema and transformation</li> <li>4. To design dynamic web pages using PHP and JSP</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able <ol style="list-style-type: none"> <li>1. To know the basics of web page design</li> <li>2. To do scripting using JavaScript</li> <li>3. To know XML schema and transformation</li> <li>4. To design dynamic web pages using PHP and JSP</li> </ol>			
<b><u>TEXT BOOK</u></b> <ol style="list-style-type: none"> <li>1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet and World Wide Web How To Program”, 5/E, Pearson Education, 2012.</li> </ol>			
<b><u>REFERENCES</u></b> <ol style="list-style-type: none"> <li>1. Robert W. Sebesta, “Programming the World Wide Web”, 8/E, Pearson Education, 2012.</li> <li>2. Chris Bates, “Web Programming – Building Intranet applications”, Wiley Publications, 3rd Edition, 2009.</li> <li>3. Jonathan Chaffer, Karl Swedberg, “Learning jQuery: Better interaction Design and Web Development with Simple JavaScript Techniques”, PACKT publishing, 2007.</li> <li>4. Marty Hall, “Core Servlets and Java Server Pages”, JAVA 2 Platform, Enterprise Edition services.</li> <li>5. David Karlins, ”Dreamweaver CS5.5 Mobile and Web Development with HTML5, CSS3, and JQuery”, Packt Publishing Ltd, 2011</li> <li>6. www.w3schools.com</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Introduction to Computers and the Internet, Introduction to HTML5 – Basic Tags , HTML5 Form input Types, Page-Structure Elements, CSS3: Borders-Backgrounds-TextEffects-Fonts-2D and 3DTransforms-Transitions-Animations, Media Queries	10	25%
<b>First Internal Exam</b>			
II	JavaScript: Introduction to Scripting - Control Statements - Repetition Statement – Functions – Objects - Document Object Model (DOM) - JavaScript Event Handling, jQuery: Selectors, Events, jQuery Effects: Hide/Show, Fade, Animate, stop, callback,	10	25%

	chaining.		
III	XML – Basics - XML Namespaces - Document Type Definitions – Schema - XML Vocabularies - Extensible Stylesheet Language and XSL Transformations - Parsers – DOM and SAX - XQuery and Xpath	10	25%
<b>Second Internal Exam</b>			
IV	HTTP Transactions - Multitier Application Architecture - Client-Side Scripting versus Server-Side Scripting - PHP - Converting Between Data Types – Arrays - String Processing with Regular Expressions - Form Processing and Business Logic – Database operations – Cookies, Java server pages(JSP) : Expressions and declarations – directives - JSP and java beans - include and forward directives - Database Access.	12	25%
<b>End Semester Exam</b>			



Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7311	Cloud Computing	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>1. To study basics structure of cloud system</li> <li>2. To understand the management of cloud services</li> <li>3. To know the concept of virtual data centre</li> <li>4. To design the storage network for cloud system</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able <ol style="list-style-type: none"> <li>1. To know the basic structure of cloud system</li> <li>2. To know the management of cloud services</li> <li>3. To know the concept of virtual data centre</li> <li>4. To design the storage network for cloud system</li> </ol>			
<b><u>TEXT BOOKS</u></b> <ol style="list-style-type: none"> <li>1. Nick Antonopoulos, Lee Gillame, “Cloud Computing principles, Systems and Application”, Springer,2010. ISBN: 978-1-84996-241-4</li> </ol>			
<b><u>REFERENCES</u></b> <ol style="list-style-type: none"> <li>1. GautamShroff, “Enterprise Cloud Computing: Technology, Architecture, Application”,Cambridge University Press,2010. ISBN-13: 978-1-10766-854-6</li> <li>2. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach”,McGrawhill,2009 ISBN: 978-0-07162-694-1</li> <li>3. Greg Schulz , “Cloud and Virtual Data Storage Networking” ,Auerbach Publications,2011,ISBN: 978-1-43985-173-9</li> <li>4. Volker Herminghaus, Albrecht Scriba, “ Storage Management in Data Centers”, Springer,2009. ISBN: 978-3-54085-022-9</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Cloud Computing Fundamental: Cloud Computing definition-private, public and hybrid cloud. Cloud types: IaaS, PaaS, SaaS. Benefits and challenges of cloud computing - public vs private clouds - role of virtualization in enabling the cloud - Business Agility: Benefits and challenges to Cloud architecture - Application availability – performance -security and disaster recovery. Cloud Applications: Technologies and the processes required when deploying web services-Deploying a web service from inside and outside a cloud architecture - advantages and disadvantages	10	25%

<b>First Internal Exam</b>			
II	Cloud Services Management: Reliability, availability and security of services deployed from the cloud - Performance and scalability of services - tools and technologies used to manage cloud services deployment. Application Development: Service creation environments to develop cloud based applications - Development environments for service development	11	25%
III	Virtual Data Centre: Environments-concept-planning and design-business continuity and disaster 11recovery principle- . Managing VDC and cloud environments and infrastructures. Information Storage Security & Design : Storage strategy and governance - security and regulations - Designing secure solutions - the considerations and implementations involved - Securing storage in virtualized and cloud environments - Monitoring and management - security auditing and SIEM.	10	25%
<b>Second Internal Exam</b>			
IV	Storage Network Design: Architecture of storage, analysis and planning - Storage network design considerations - NAS and FC SANs - hybrid storage networking technologies (iSCSI, FCIP, FcoE) - design for storage virtualization in cloud computing - host system design considerations. Cloud Optimized Storage: Global storage management locations – scalability - operational efficiency - Global storage distribution - terabytes to petabytes and greater -Policy based information management - metadata attitudes - file systems or object storage. Designing backup/recovery solutions to guarantee data availability in a virtualized environment Case study: Eucalyptus cloud	11	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7121	Software Defined Networking	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To know the basics of switching techniques</li> <li>To understand the evolution of networking</li> <li>To know open flow systems</li> <li>To understand SDN in data centres</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able <ol style="list-style-type: none"> <li>To know the basics of switching techniques</li> <li>To know the evolution of networking</li> <li>To know open flow systems</li> <li>To know SDN in data centres</li> </ol>			
<b>TEXT BOOKS</b> <ol style="list-style-type: none"> <li>T. Nadeau and K. Gray, SDN – Software Designed Network, OReilly, 2013.</li> </ol>			
<b>REFERENCES</b> <ol style="list-style-type: none"> <li>S. Azodolmolky, "Software Defined Networking with OpenFlow," PACKT Publishing, October 2013.</li> <li>H. Zhou, "The Internet of Things in the Cloud: A Middleware Perspective," CRC Press, 2012, ISBN:1439892997</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Basic Packet-Switching Terminology, The Modern Data Center, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Evolution of Switches and Control Planes, Cost, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs	10	25%
<b>First Internal Exam</b>			
II	The Evolution of Networking Technology, Forerunners of SDN , Software Defined Networking- OpenFlow, Sustaining SDN Interoperability, Network Virtualization, Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Methods	10	25%
III	OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.1 Additions, OpenFlow 1.2 Additions, OpenFlow 1.3 Additions, OpenFlow Limitations, Potential Drawbacks of Open	11	25%

	SDN, SDN via APIs, DN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization, Alternatives Overlap and Ranking		
<b>Second Internal Exam</b>			
IV	SDN in the Data Center, Data Center Demands, Tunneling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center, SDN in Other Environments, Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, Optical Networks	11	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7221	Web Security	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand security aspects in web applications</li> <li>To understand the SQL injection in Web sites</li> <li>To know Mod security in web applications</li> <li>To know hacking methods in web servers</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able <ol style="list-style-type: none"> <li>To know security aspects in web applications</li> <li>To know the SQL injection in Web sites</li> <li>To know Mod security in web applications</li> <li>To know hacking methods in web servers</li> </ol>			
<b>TEXT BOOK</b> <ol style="list-style-type: none"> <li>Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook, 2<sup>nd</sup> Edition, Wiley Publishing, Inc.</li> <li>Justin Clarke, SQL Injection Attacks and Defense, 2009, Syngress Publication Inc.</li> <li>Magnus Mischel, ModSecurity 2.5, Packt Publishing</li> <li>Stuart McClure Joel, ScambRay, George Kurtz, Hacking Exposed 7: Network Security Secrets &amp; Solutions, Seventh Edition, 2012, The McGraw-Hill Companies</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	<b>Web application security-</b> Key Problem factors – Core defence mechanisms- Handling user access- handling user input- Handling attackers – web spidering – Discovering hidden content Transmitting data via the client – Hidden form fields – HTTP cookies – URL parameters – Handling client-side data securely – Attacking authentication – design flaws in authentication mechanisms –securing authentication <b>Attacking access controls</b> – Common vulnerabilities – Securing access controls	10	25%
<b>First Internal Exam</b>			
II	<b>SQL Injection</b> - How it happens - Dynamic string building - Insecure Database Configuration - finding SQL injection – Exploiting SQL injection – Common techniques – identifying the database – UNION statements – Preventing SQL injection Platform level defenses - Using run time protection - web application Firewalls - Using ModSecurity - Intercepting filters- Web server filters - application filters – securing the database – Locking down the application data – Locking down the Database server	11	25%
III	<b>Mod Security</b> - Blocking common attacks – HTTP finger printing – Blocking proxied requests – Cross-site scripting – Cross-site	11	25%

	request forgeries – Shell command execution attempts – Null byte attacks – Source code revelation – Directory traversal attacks – Blog spam – Website defacement – Brute force attack – Directory indexing – Detecting the real IP address of an attacker		
<b>Second Internal Exam</b>			
IV	<b>Web server Hacking</b> - Source code disclosure – Canonicalization attacks – Denial of service – Web application hacking – Web crawling. Database Hacking – Database discovery – Database vulnerabilities	10	25%
<b>End Semester Exam</b>			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7321	Network Flow Algorithms	3-0-0-3	2015
<b>Course Objectives</b> <ol style="list-style-type: none"> <li>To understand the network flow problems</li> <li>To know shortest path algorithms</li> <li>To understand maximum flow and minimum cut</li> <li>To understand algorithms for minimum spanning trees</li> </ol>			
<b>Expected Outcomes</b> After the course the students would be able <ol style="list-style-type: none"> <li>To know the network flow problems</li> <li>To know shortest path algorithms</li> <li>To know maximum flow and minimum cut</li> <li>To know algorithms for minimum spanning trees</li> </ol>			
<b>TEXT BOOKS:</b> <ol style="list-style-type: none"> <li>Ravindra K. Ahuja, Thomas L. Magnanti, James B. Orlin, Network Flows – “Theory, Algorithms and Applications”, Prentice Hall</li> </ol>			
<b>REFERENCES:</b> <ol style="list-style-type: none"> <li>Ravindra K. Ahuja, Thomas L. Magnanti, James B. Orlin, Network Flows – “Theory, Algorithms and Applications”, Prentice Hall</li> <li>Mokhtar S. Bazaraa, John J. Jarvis, Hanif D. Sherali, “Linear Programming And Network Flows”, John Wiley &amp; Sons, 4th Edition,</li> <li>Gunther Ruhe, Kluwer, “Algorithmic Aspects Of Flows In Networks”, Academic Publishers Group</li> <li>Michael W. Lucas, “Network Flow Analysis”, , No Starch Press</li> <li>Alexander Engau, VdmVerlag Dr. Muller, “Semi-Simultaneous Flows In Multiple Networks”, Aktiengesellschaft &amp; Co. Kg</li> <li>Chen, Wai-kai, “Theory Of Nets: Flows In Network”’s, Wiley-Interscience (publisher)</li> <li>Ulrich Derigs, “Programming In Networks And Graphs: On The Combinatorial Background And Near-Equivalence Of Network Flow And Matching Algorithms”,</li> <li>Ford L. R. Jr. , Robert G. Bland, Fulkerson D. R, “Flows In Networks”, Princeton University Press.</li> <li>Alexander Hall, VdmVerlag Dr. Mueller E. K, “Scheduling And Flow-Related Problems In Networks”</li> <li>Pioro M, Routing, “Flow And Capacity Design In Communication And Computer Networks”, Elsevier India Private Limited.</li> </ol>			
<b><u>COURSE PLAN</u></b>			
Module	Contents	Hours	Sem Exam Marks
I	Network flow problems, Network representations, network transformations, Complexity Analysis, Developing Polynomial time algorithms, Search Algorithms, Flow Decomposition algorithms	10	25%
<b>First Internal Exam</b>			

II	Shortest Paths: Label Setting Algorithms – Dijkstra’s Algorithm, Dial’s implementation, Heap Implementation, Radix Heap Implementation. Shortest Paths : Label Correcting Algorithms – Generic Label Correcting algorithms, Special implementations of the modified label correcting algorithm, detecting negative cycles, All pairs shortest path problem	11	25%
III	Maximum Flows : Generic Augmenting path algorithm, Labeling algorithm and Max- Flow Min – cut theorem, Capacity Scaling Algorithm, Distance labels and layered networks, Generic pre flow push algorithm, FIFO pre flow push algorithm, Minimum Cost flows : Optimality conditions, Cycle canceling algorithm and the integrity property, Successive shortest path algorithm, Primal – dual algorithm, Out – of Kilter Algorithm, Capacity scaling algorithm, Cost scaling algorithm	11	25%
<b>Second Internal Exam</b>			
IV	Minimum Spanning Trees – Kruskal’s algorithm, Prim’s Algorithm, Sollin’s Algorithm, Convex Cost Flows – Pseudo Polynomial time algorithm, polynomial time algorithm. Generalized Flows – Augmented forest structures, determining potentials and flows for an augmented forest structure, generalized network simplex algorithm	10	25%
<b>End Semester Exam</b>			



Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7031	Seminar 2	0-0-2-2	2015
<b>Course Objective</b>  To assess the debating capability of the student to present a technical topic. In addition, to impart training to students to face audience and present their ideas and thus creating in them self-esteem and courage that are essential for engineers.			
<b>EVALUATION / ASSESSMENT</b> Individual students are required to choose a topic of their interest from Computer Network related topics preferably from outside the M.Tech syllabus and give a seminar on that topic about 30 minutes. A committee consisting of at least three faculty members shall assess the presentation of the seminar and award marks to the students. Each student shall submit two copies of a write up of his/her seminar topic. One copy shall be returned to the student after duly certifying it by the chairperson of the assessing committee and the other will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.			
<b>EXPECTED OUTCOME:</b> Students shall be able to apply their theoretical knowledge to develop a solution for real time problem.			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7041	Project (Phase 1)	0-0-8-6	2015
<b>COURSE OBJECTIVE:</b> To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.			
<b>EVALUATION / ASSESSMENT</b> The project work can be a design project/experimental project and/or computer simulation project on any of the topics in Information Security and its allied areas. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to continue their project outside the parent institute, subject to the conditions of M.Tech regulations. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members. The student is required to undertake the master research project Phase - I during the third semester and the same is continued in the 4th semester (Phase - II). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work, which is to be completed in the 4th semester. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.			
<b>EXPECTED OUTCOME:</b> Students Shall Be Able To Apply Their theoretical Knowledge to develop a solution for real time problem.			

Course No.	Course Name	L-T-P Credits	Year of Introduction
06NC7012	Project (Phase 2)	0-0-21-12	2015
<b>COURSE OBJECTIVE:</b> To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.			
<b>EVALUATION / ASSESSMENT</b> Master Research project phase - II is a continuation of project phase - I started in the third semester. There would be two reviews in the fourth semester, first in the middle of the semester and the second at the end of the semester. First review is to evaluate the progress of the work, presentation and discussion. Second review would be a pre-submission presentation before the evaluation committee to assess the quality and quantum of the work done. This would be a pre-qualifying exercise for the students for getting approval by the departmental committee for the submission of the thesis. At least one technical paper is to be prepared for possible publication in journal or conferences. The technical paper is to be submitted along with the thesis. The final evaluation of the project will be external evaluation.			
<b>EXPECTED OUTCOME:</b> Students Shall Be Able To Apply Their theoretical Knowledge to develop a solution for real time problem.			