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| **KERALA TECHNOLOGICAL UNIVERSITY**  http://ktu.edu.in/images/logo_final.png  **SCHEME AND SYLLABUS**  **FOR**  **M. Tech. DEGREE PROGRAMME**  **IN**  **INFORMATION TECHNOLOGY**  **WITH SPECIALIZATION**  **NETWORK ENGINEERING**  **CLUSTER 05 (ERNAKULAM II)**  **KERALA TECHNOLOGICAL UNIVERSITY CET Campus, Thiruvananthapuram Kerala, India -695016**  **(2015 ADMISSION ONWARDS)** |

**KERALA TECHNOLOGICAL UNIVERSITY**

**SCHEME AND SYLLABUS FOR M. Tech. DEGREE PROGRAMME**

**Branch: INFORMATION TECHNOLOGY**

**Specialization: NETWORK ENGINEERING**

**SCHEME**

**SEMESTER – I**

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| ***Exam Slot*** | ***Course No*** | ***Subjects*** | **L-T-P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Duration**  **(hrs)** |
| A | 05IT 6001 | Mathematical Foundations For Network Engineering | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05IT 6003 | Advanced Data Structures and Algorithms | 3-1-0 | 40 | 60 | 3 | 4 |
| C | 05IT 6005 | Design and Analysis of Networks | 3-1-0 | 40 | 60 | 3 | 4 |
| D | 05IT 6007 | Computer Network Management | 2-1-0 | 40 | 60 | 3 | 3 |
| E | 05IT 601x | Elective 1 | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05IT 6077 | Research methodology | 1-1-0 | 100 | 0 | 0 | 2 |
|  | 05IT 6091 | Network Programming Lab | 0-0-2 | 100 | 0 | 0 | 1 |

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| Elective – I | |
| Course No | Subjects |
| 05IT 6011 | Internet and Web Technology |
| 05IT 6013 | High Performance Networks |
| 05IT 6015 | Multimedia and Rich Internet Applications |

**SEMESTER – II**

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| *Exam Slot* | *Course No* | *Subjects* | *L-T-P* | *Internal Marks* | *End Semester Exam* | | *Credits* |
| Marks | Duration (hrs) |
| A | 05IT 6002 | Advanced Distributed Systems | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05IT 6004 | Adhoc and Sensor Networks | 2-1-0 | 40 | 60 | 3 | 3 |
| C | 05IT 6006 | Network Flow Algorithms | 3-1-1 | 40 | 60 | 3 | 3 |
| D | 05IT 602x | Elective 2 | 2-1-0 | 40 | 60 | 3 | 3 |
| E | 05IT 603x | Elective 3 | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05IT 6066 | Seminar- I | 0-0-2 | 100 | 0 | 0 | 2 |
|  | 05IT 6088 | Mini Project | 0-0-4 | 100 | 0 | 0 | 2 |
|  | 05IT 6092 | Network Simulation Lab | 0-0-2 | 100 | 0 | 0 | 1 |

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| **Elective – II** | |
| Course No | Subjects |
| 05IT 6022 | Protocol Engineering |
| 05IT 6024 | High-Performance Scientific Computing |
| 05IT 6026 | Performance Evaluation of Computer Networks |

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| **Elective – III** | |
| Course No | Subjects |
| 05IT 6032 | Networking in Embedded Systems |
| 05IT 6034 | Internet Routing Design |
| 05IT 6036 | Complex Networks |

**SEMESTER – III**

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| ***Exam Slot*** | ***Course No*** | ***Subjects*** | ***L-T-P*** | ***Internal Marks*** | ***End Semester Exam*** | | ***Credits*** |
| **Marks** | **Duration(hrs)** |
| A | 05IT 704x | Elective 4 | 2-1-0 | 40 | 60 | 3 | 3 |
| B | 05IT 705x | Elective 5 | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05IT 7067 | Seminar II | 0-0-2 | 100 | 0 | 0 | 2 |
|  | 05IT 7087 | Project (Phase 1) | 0-0-8 | 50 | 0 | 0 | 6 |

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| **Elective – IV** | |
| **Course No** | **Subjects** |
| 05IT 7041 | Social Network Analysis |
| 05IT 7043 | Agent Based Intelligent Systems |
| 05IT 7045 | Information Retrieval, Data Mining & Data Warehousing |
| **Elective – V** | |
| **Course No** | **Subjects** |
| 05IT 7051 | Network Forensics |
| 05IT 7053 | Distributed Algorithms |
| 05IT 7055 | Ontology & Semantic Web |

**SEMESTER IV**

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| **Exam**  **Slot** | **Course No** | **Subjects** | **L-T-P** | **Internal**  **Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Duration(hrs)** |
|  | 05IT 7088 | Project Phase II | 0-0-21 | 70 | 30 | \_ | 12 |

12 Total: 68

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6001** | | **Mathematical Foundations For Network Engineering** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand Coding theory and networking techniques * To be familiar with the basic concepts of Graph theory and number theory   **COURSE OUTCOMES:**   * Students understand Coding theory and networking techniques * Students have knowledge on Graph theory and number theory | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Graph, First theorem of Graph Theory, regular graph, subgraph, Paths, Cycles. Matrix representation, Trees, Bridges, Theorems, spanning trees, Directed graphs, Indegree and Outdegree | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Introduction to Number Theory**  Euclidean Algorithm, Fundamental Theorem of Arithmetic and Applications, Dirichlet Progressions, Irrational Numbers, Fermat 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. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Coding Theory**  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. | | | | 10 |
| **IV** | **Network Techniques**  Shortest Path Model, Systematic Method, Dijikstra’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 | | | | 8 |

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| **END SEMESTER EXAM (ALL Modules)** |
| **REFERENCES:**  1. John Clark and DerekAllan Holton, “A first look at Graph Theory”, World Scientific, 1991.  2. Balakrishnan R. and Ranganathan K, “A text book of Graph Theory” Spring Verlag, 2000.  3. Harary F., “Graph Theory” Perseus Books, 1994.  4. Rosen K.H, “Elementary Number Theory”, 6th Ed, Addison-Wesley, 2010.  5. Dudley U., “A guide to elementary number theory”, The mathematical association of America, 2009.  6. Andrews G. E. “Number Theory”, Dover Publications, 1971.  7. Bose R., “Information Theory Coding and Cryptography” , Tata Mc Graw Hill, 2007.  8. Roth R.M, “Introduction to Coding Theory”, CUP, 2006.  9. MacWilliams F.J, Sloane N.J.A., “The Theory of Error Correcting Codes”, North Holland, 1977.  10. Paneerselvam R., Operations Research, Prentice Hall of India Private Limited, New Delhi 2004.  11. Ravindra K. Ahuja, Thomas L. Magnanti, James B.Orlin, “Network Flows – Theory,Algorithms and Applications”, 1st Edition, Prentice Hall, 1993. |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6003** | | **Advanced Data Structures and Algorithms** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * Familiarize with advanced data structures based trees and heaps. * Learn to choose the appropriate data structure and algorithm design method for a specified application. * Study approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice. * Learn different advanced algorithms in dynamic programming, flow network * and computational geometry   **COURSE OUTCOMES:**  After completion of the course completion, the students will be able   * To compare different implementations of data structures and to recognize the advantages and disadvantages of the different implementations. * To design, write, and analyze the performance of programs that handle structured data and perform more complex tasks, typical of larger software projects. * To determine which algorithm or data structure to use in different scenarios. * To demonstrate analytical comprehension of concepts such as abstract data , algorithms and efficiency analysis | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Trees -Threaded Binary Trees, Selection Trees, Forests and binary search trees, Counting Binary Trees, Red-Black Trees, Splay Trees, Suffix Trees, Digital Search Trees, Tries- Binary Tries-patricia, Multiway Tries. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Priority Queues **-** Single and Double Ended Priority Queues, Leftist Trees, Binomial Heaps, Fibonacci Heaps, Pairing Heaps, Symmetric Min-Max Heaps, Interval Heaps | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Analysis of Algorithms-review of algorithmic strategies, asymptotic analysis, solving recurrence relations through Substitution Method, Recursion Tree, and Master Method  Dynamic Programming-Rod cutting-top down and bottom up approach, matrix chain multiplication-recursive solution, longest common subsequence problem | | | | 10 |
| **IV** | Maximum Flow**-**Flow Networks, Ford-Fulkerson method-analysis of Ford-Fulkerson, Edmonds-Karp algorithm, Maximum bipartite matching  Computational Geometry**-** Line segment properties, finding the convex hull**,** finding the closest pair of points.  Implementations using Python have to be conducted and evaluated for data structures and algorithms. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**   1. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Fundamentals of Data Structures in C, Second Edition, University Press, 2008 2. Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Data Structures using C and C++, Second Edition, PHI Learning Private Limited, 2010 3. Thomas Cormen, Charles, Ronald Rives, Introduction to algorithm,3rd edition, PHI Learning 4. Ellis Horowitz and Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, 2nd Edition, Hyderabad . 5. Sara Baase & Allen Van Gelder , Computer Algorithms – Introduction to Design and   Analysis, Pearson Education.   1. Anany Levitin, Introduction to The Design & Analysis of Algorithms, Pearson   Education, 2nd Edition, New Delhi, 2008.   1. Berman and Paul, Algorithms, Cenage Learning India Edition, New Delhi, 2008. 2. S.K.Basu , Design Methods And Analysis Of Algorithms ,PHI Learning Private Limited, New Delhi,2008. 3. Jon Kleinberg and Eva Tardos, Algorithm Design, Pearson Education, NewDelhi, 2006. 4. Hari Mohan Pandey, Design Analysis And Algorithms, University Science Press, 2008. 5. R. Panneerselvam, Design and Analysis of Algorithms, PHI Learning Private Limited, New Delhi, 2009. 6. Udit Agarwal, Algorithms Design And Analysis, Dhanapat Rai & Co, New Delhi, 2009. 7. Aho, Hopcroft and ullman, The Design And Analysis of Computer Algorithms, Pearson Education, New Delhi, 2007. 8. S.E.Goodman and S. T. Hedetmiemi, Introduction To The Design And Analysis Of Algorithms, McGraw-Hill International Editions, Singapore 2000. 9. Richard Neapolitan, Kumarss N, Foundations of Algorithms, DC Hearth &company.   Sanjay Dasgupta, Christos Papadimitriou, Umesh Vazirani, Algorithms, Tata McGraw-Hill Edition. | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6005** | | **Design and Analysis of Networks** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To Become familiar with the concepts of  computer networks * What is a computer network and what are the fundamental protocols. To analyze network architectures in stochastic and deterministic way. Principles of IP4 * To explore more on different network routing protocols. * To understand the knowledge of congestion control in computer network.   **COURSE OUTCOMES:**  On completion, student will be able to:   * Explain network routing protocols and architectures. * Implement key Internet applications and their protocols, and will apply to develop their own protocols. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Internet Protocol : IPv4 - IP Datagram Formats - Data and Fragmentation - Address Masks, Prefixes, and Subnetworks - Network Address Translation (NAT) - IP Switching and Routing - Local Delivery and Loopbacks - Address Resolution Protocol - Route Control and Recording – ICMP - Discovering Routers - Path MTU Discovery – Multicast - IP Version Six | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Routing and Forwarding – CIDR - Building and Using a Routing Table - Router IDs, Numbered Links, and Unnumbered Links - Distributing Routing Information - Distance Vectors - Link State Routing - Path Vectors and Policies - Computing Paths– Routing Information Protocol – OSPF - OSPF – Intermediate System to Intermediate System - Border Gateway Protocol - Multicast Routing - Inter-Gateway Routing Protocol - Inter-Domain Routing Protocol | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | End-to-End Protocols : Ports and Addresses - User Datagram Protocol - UDP Message Format - Transmission Control Protocol - Segment Format - Connection Establishment and Termination - Flow Control - Triggering Transmission - Silly Window Syndrome - Nagle’s Algorithm - Adaptive Retransmission - Karn/Partridge Algorithm - Remote Procedure Call – BLAST – CHAN – SELECT – SunRPC- Stream Control Transmission Protocol - Real-time Transport Protocol | | | | 10 |
| **IV** | Congestion Control : Packet-Switched Network - Connectionless Flows - Issues in Resource Allocation - Fair Resource Allocation - Queuing Disciplines – FIFO - Fair Queuing - TCP Congestion Control - Additive Increase/Multiplicative Decrease - Slow Start - Fast Retransmit and Fast Recovery - Congestion-Avoidance Mechanisms – DECbit - Random Early Detection - Source-Based Congestion Avoidance – Tahoe, Reno, and Vegas- QoS Application Requirements - Real-Time Audio - Taxonomy of Real-Time Applications - Approaches to QoS Support | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **Text Books:**  1. The Internet and Its Protocols - A Comparative Approach by ADRIAN FARREL, Elsevier  2. Computer Networks – A Systems Approach by Larry L. Peterson and Bruce S. Davie, The Morgan Kaufmann Series in Networking  **REFERENCES:**  1. Data networks by D.Berteskas and R Gallagar, Printice Hall  2. Design and Analysis of Communication Networks by V Ahuja, McGraw Hill  3. Kerchenbaum A., “Telecommunication Network Design Algorithms”, Tata McGraw Hill  4. James D.McCabe, Network analysis, Architecture and Design, 2nd Edition, Elsevier, 2003.  5. Bertsekas & Gallager, Data Networks, second edition, Pearson Education, 2003.  6. Introduction to Probability Models by Sheldon Ross (8th edition) Academic Press, New York, 2003.  7. Paul J.Fortier, Howard E.Michel, Computer Systems Performance Evaluation and Prediction, Elsevier, 2003.  8. Thomas G. Robertazzi, “Computer Networks and Systems Queuing Theory and Performance Evaluation” 3rd Edition Springer, 2000.  9. An Engineering approach to computer networking by S.Keshav, Pearson education  10. Network Algorithms by George Varghese, Morgan Kaufmann | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6007** | | **Computer Network Management** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  The objective of this course is to   * To understand the need for interoperable network management * To learn to the concepts and architecture behind standards based network management * To understand the concepts and terminology associated with SNMP. * To understand network management as a typical distributed application * To study the current trends in network management technologies   **COURSE OUTCOMES:**  Upon completion of this course, the students will be able to   * Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. * Apply network management standards to manage practical networks. * Formulate possible approaches for managing OS I network model. * Use on SNMP for managing the network * Use RMON for monitoring the behavior of the network * Explore the possibilities of improving the speed of the network and managing them * Identify the various components of network and formulate the scheme for the managing them | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Basic Foundations: Review of TCP/IP protocol stack , Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | SNMPv1 Network Management: The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model  RMON: Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Broadband Network Management: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles. | | | | 10 |
| **IV** | Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**   1. Mani Subrahmanian, “Network Management, Principles and Practice”, Pearson Education. 2. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008. 3. Morris, “Network management”, Pearson Education. 4. Mark Burges, Wiley Dreamtech, “Principles of Network System Administration”. 5. John Wiley, “Distributed Network Management”. 6. Mani Subrahmanian, “Network Management, Principles and Practice”, Pearson Education. 7. Morris, “Network management”, Pearson Education. 8. Mark Burges, Wiley Dreamtech, “Principles of Network System Administration”. 9. John Wiley, “Distributed Network Management”. 10. Paul J.Fortier, Howard E.Michel, Computer Systems Performance Evaluation and Prediction, Elsevier, 2003. 11. Thomas G. Robertazzi, “Computer Networks and Systems Queuing Theory and Performance Evaluation” 3rd Edition Springer, 2000. 12. An Engineering approach to computer networking by S.Keshav, Pearson education 13. Network Algorithms by George Varghese, Morgan Kaufmann | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6011** | | **Internet and Web Technology** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the main ideas and concepts on web services. * Studying and working on a related topic of internet applications such as information hiding and system security. * To understand the concepts of UDDI, SOAP, WSDL, MVC.   **COURSE OUTCOMES:**   * Students can develop simple web services. * Students can develop applications related topic of internet applications such as information hiding and system security. * Students knows the concepts of UDDI, SOAP, WSDL, MVC. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Web Technology - Web 2.0 technologies, Web services, Web Services Architecture, Web Services Communication Models, Implementing Web Services, Evolution and differences with Distributed computing, XML - Name Spaces - Structuring With Schemas and DTD - Transformation.  **SOAP**- Anatomy of a SOAP Message, SOAP Encoding, SOAP Message Exchange Model, SOAP Communication, SOAP Messaging, SOAP Bindings for Transport Protocols, SOAP Security, Building SOAP Web Services, Developing SOAP Web Services Using Java | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **WSDL**- Anatomy of a WSDL Definition Document, WSDL Bindings, WSDL Tools  **UDDI**- UDDI Registries, Programming with UDDI, Implementations of UDD, Registering as a Systinet, UDDI Registry User, Publishing Information to a UDDI Registry, Searching Information in a UDDI Registry, Deleting Information from a UDDI Registry | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Web services: REST Basics, SOAP versus REST  Introduction to Ajax, Ajax Design Basics, Introduction to Mashups, user interface services. Platform for Web Services Development, MVC Design Pattern, Web services - EJB, .NET, J2EE Architecture, J2EE Components & Containers, Specification, Application servers, Struts, Introduction to JSON-BSON. | | | | 10 |
| **IV** | Web Transactions, Coordination, Orchestration, and Choreography – tools BPEL, WSCDL Overview of Web service standards -BPEL4WS. WS-Security and the Web services security specifications, WS Reliable Messaging, WS-Policy, WS-Attachments.  Web Service Case Study - Web Service Search Engine, Web Service Discovery, WebService Composition. Web Service – SOAP vs Web Service – REST. Overview of node.js | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. B.V.Kumar, S.V.Subrahmanya, Web Services – An Introduction, Tata McGraw-Hill  2. Steve Graham et.al., Building Web Services With Java: Making Sense Of Xml, Soap, Wsdl, And Uddi, Pearson  3. Michael Havey, Essential Business Process Modeling, O'Reilly Media, Inc.  4. K. Qian, Java Web development illuminated, Jones & Bartlett Learning  5. R. Krishnamoorthy & S. Prabhu, “Internet and Java Programming”, New Age International Publishers, 2004.  6. Frank. P. Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.  7. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.  8. McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers, 2005.  9. Deitel, and Nieto, “Internet and World Wide Web – How to program”, Pearson Education Publishers, 2000.  10. Elliotte Rusty Harold, “Java Network Programming”, O’Reilly Publishers, 2002.  11. Ramesh Nagappan , Robert Skoczylas and Rima Patel Sriganesh, " Developing Java Web Services", Wiley Publishing Inc., 2004.  12. Guillermo Rauch, Smashing Node.Js: JavaScript Everywhere, John Wiley & Sons | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6013** | | **High Performance Networks** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the fundamental principles to develop a comprehensive understanding of network architectures, control, performance, and wireless networks that explains current and emerging networking technologies. * Describe and interpret the basics of high speed networking technologies. * Apply the concept learnt in this course to optimize and troubleshoot high-speed network. * Demonstrate the knowledge of network planning and optimization. * Design and configure network that have outcome characteristics needed to support a specified set of applications.   **COURSE OUTCOMES:**  Students can able to:   * To understand the fundamental principles to develop a comprehensive understanding of network architectures, control, performance, and wireless networks that explains current and emerging networking technologies. * Describe and interpret the basics of high speed networking technologies. * Apply the concept learnt in this course to optimize and troubleshoot high-speed network. * Demonstrate the knowledge of network planning and optimization. * Design and configure network that have outcome characteristics needed to support a specified set of applications | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Network Performance analysis: Objectives and requirements for Quality of Service (QoS) in high performance networks. Architecture of high performance networks (HPN), design issues, protocols for HPN, VHF backbone networks, virtual interface architectures, virtual interface for networking, High-speed switching and routing - internet and PSTN IP switching techniques, SRP protocols, SRP authentication, and key exchange, comparison of TCP/IP, FTP, TELNET, queuing systems, network modeling as a graph | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Gigabit Ethernet: Architecture, standards, interface, applications, network design  Frame relay: Frame relay protocols and services, frame relay congestion Control.  ATM: Architecture, protocol, switching, traffic and congestion control, flow control ATM service categories, ATM in LAN environment, classical IP over ATM.  ADSL and DSL Technologies: Background and technological capabilities, Standards and associations, Architecture.  Fiber Optics Communication: GPON (Gigabit capable Passive Optical Network), SONET/SDH and comparison with other available standards. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Introduction to MPLS and QOS, Network Components of MPLS, working RSVP protocol, MPLS network Components, MPLS basic working, Applications, IETF approach, RSVP protocol, Integrated & differential Services Framework.  Storage and networking concepts – SCSI bus architecture – Networking in front of the server – Networking behind the server – Network -attached Storage – Fibre channel internals – Layers – Data encoding – Framing protocol – class of service – flow control – Name and addressing conventions. | | | | 10 |
| **IV** | SAN topologies – Point-to Point – Arbitrated Loop – Loop Addressing-Loop Initialization-Port Login-Loop port state machine – Design considerations for Arbitrated Loop –Fabrics – Fabric login – Simple Name Server – State Change Notification – Private Loop Support – Fabric Zoning – Building Extended SANs.  Fibre Channel Products – Gigabit Interface Converters (GBICs) – host Bus Adapters – Fibre channel RAID – Fibre channel JBODs – Arbitrated Loop Hubs – hub Architecture – Unmanaged Hubs – Managed Hubs – Switching Hubs – Fabric Switches – Fibre Channel-to-SCSI Bridges – SAN software Products – Problem isolation in SANs – Isolation Techniques – Fibre channel Analyzers. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Storage Networks Explained – Uif Troppens, Raiver Erkens and Wolfgang Muller, John Wiley & Sons, 2003.  2. Alex Goldman, “Storage Area Networks Fundamentals”, Cisco Press 2002  3. Storage Area Network Essentials: a Complete Guide to understanding andimplementing SANs- Richard Barker and Paul Massiglia, John Wiley India  4. William Stallings: ISDN And BISDN  5. William Stallings: High Speed Networks  6. M Shwartz: Telecommunication Network Protocol Modeling And Analysis: Addison Wesley  7. Gallangar: Data Networks: Prentice Hall  8. Fred Halsall: Data Communication Computer Networks, And Open Systems: Addison Wesley  9. Kershanbaum : Telecommunication Network Design Algorithms: MGH  10. Jochetl Schiller: Mobile Communication: Addison Wesley.  11. Tanenbaum: Computer Networks: PHI  13. Johnson: Fast Ethernet  14. Tom Clark, “Designing Storage Area Networks”, Addison-Wesley Professional, 1stedition, 1999  15. Storage Networks: The Complete Reference – Robert Sparding, Tata Mcgraw Hills, 2003.  11. Ramesh Nagappan , Robert Skoczylas and Rima Patel Sriganesh, " Developing Java Web Services", Wiley Publishing Inc., 2004.  12. Guillermo Rauch, Smashing Node.Js: JavaScript Everywhere, John Wiley & Sons | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6015** | | **Multimedia and Rich Internet Applications** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the Multimedia Communication Models * To study the Multimedia Transport in Wireless Networks * To solve the Security issues in multimedia networks * To explore real-time multimedia network applications. * To explore different network layer based application.   **COURSE OUTCOMES:**  Students will be able to:   * Deploy the right multimedia communication models. * Apply QoS to multimedia network applications with efficient routing techniques. * Solve the security threats in the multimedia networks. * Develop the real-time multimedia network applications. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **Introduction to Multimedia :** Internet and Multimedia communications, Multimedia Networks, Multimedia Applications, Multimedia Information representation- Digitization Principles, Text, Images, Audio and Video, Compression Methods-Basic Coding Methods – Run Length coding, Huffman coding, Arithmetic coding, Discrete Cosine Transform, Differential PCM, Motion Compensated Prediction, Video Compression – JPEG, H.261, MPEG-1 Video, MPEG 2 and 3 Video, H.263, Wavelet and Fractal Image Compression, Audio Compression. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **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. | | | | 9 |

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| **INTERNAL TEST 2(Module 2)** | | |
| **III** | **Synchronization:** notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, and process management techniques.  **Multimedia Communication across Networks:** Layered video coding, error resilient video coding techniques, multimedia transport across IP networks and relevant protocols such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia in broadcast networks. | 10 |
| **IV** | **Rich Internet Applications(RIAs) with Adobe Flash and Flex :** Adobe Flash- Introduction, Flash Movie Development, Learning Flash with Hands-on Examples, Publish your flash movie, Creating special effects with Flash, Creating a website splash screen, action script, web sources. Adobe Flex 2- Introduction, Flex Platform Overview, Creating a Simple User Interface, Accessing XML data from your application, Interacting with Server Side Applications, Customizing your User Interface, Creating Charts and Graphs, Connection Independent RIAs on the desktop -Adobe Integrated Runtime (AIR), Flex 3 Beta. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**   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. Professional Adobe Flex 2, Rich Tretola , Simon barber and Renaun Erickson, Wrox,Wiley India Edition. 5. Multimedia Information Networking, Nalin K Sharda,PHI Learning. 6. Multimedia Computing, Communications & Applications, Ralf Steinmetz and Klara Nahrstedt,Pearson Education. 7. Multimedia Communication Systems: techniques, standards and networks, K.R.Rao,Bojkovic and Milovanovic.,PHI Learning. 8. Programming Flex 3,C.Kazoun and J.Lott,SPD. 9. Adobe Flex 3:Training from the Source,Tapper&others,Pearson Education. 10. Principles of Multimedia,R.Parekh,TMH. | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6077** | | **Research methodology** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  • Aware of the research process.  • Familiarize the tools and skills to investigate a research.  • Preparation of an effective report.  **COURSE OUTCOMES:**  • Able to do research in a systematic way.  • Effective use of appropriate tools for samples and data collection.  • Write research proposals and reports. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction-Tools for Planning Research, Finding resources, internet research skills, Evaluating and citing resources, publishing research- literature review – problem definition  Reproducible research-focus on the concepts and tools behind reporting modern data analyses in a reproducible manner.  (Students are expected set up a GitHub account and/or take part in collaborative projects such as Mozilla Science Lab,Linux Foundation , Wikis or technical blogging) | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Sampling fundamentals -Types of sampling: probability and non-probability sampling. Sampling theory, sampling distribution and sample size determination. Tools and techniques of data collection: Questionnaire and schedule for field surveys, interview, observation, simulation, experimental and case study methods. Collection, recording, editing, coding and scaling of data. Scale classification and types. Measurement of validity, reliability and practicality. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Descriptive and inferential statistics - Data analysis and interpretation –testing of hypothesis, testing of population mean, variance and proportion –Z test – t test – F test - chi square test.– standard error of the estimate. Testing goodness of fit. Brief introduction to non-parametric tests, factor analysis, discriminant analysis and path analysis (description only). | | | | 10 |
| **IV** | Meaning of interpretation and inference: importance and care for interpreting results.  Presentation of reports: structure and style. Parts of a research report. Guidelines for writing research papers and reports –. Ethics in research. Use of computers and internet in research.  Familiarization with Online tools for computer science researchers  **Case Study:** Familiarize Latex software for report preparation. Students have to take up a case study on particular samples and conclude with some hypothesis. A report of the same has to be submitted by the student at the end of this course. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. C. R. Kothari, Research Methodology, Methods and techniques (New Age International  Publishers, New Delhi, 2004).  2. R. Panneerseklvam, Research Methodology (Prentice Hall of India, New Delhi, 2011).  3. Ranjit Kumar, Research Methodology, A step by step approach (Pearson Publishers,  New Delhi, 2005.  4. Management Research Methodology : K. N. Krishnaswami, Appa Iyer and M  Mathirajan, Pearson Education, Delhi, 2010  5. Hand Book of Research Methodology : M N Borse, Sree Nivas Publications, Jaipur,  2004  6. Business Research Methods: William G Zikmund, South – Western Ltd, 2003  7. Research Methods in Social Science: P K Majumdar, Viva Books Pvt Ltd, New Delhi,  2005  8. Analyzing Quantitative Data: Norman Blaikie, SAGE Publications , London, 2003  **WEB REFERENCES:**  Module 1  http://help.library.ubc.ca/evaluating-and-citing-sources/evaluating-information-sources/  http://www.vtstutorials.ac.uk/detective/  http://connectedresearchers.com/online-tools-for-researchers/  https://www.ucl.ac.uk/isd/services/research-it/research-software/infrastructure/github/signup  https://www.mozillascience.org/training  https://www.ucl.ac.uk/isd/services/research-it  http://researchkit.org/  https://www.cs.ubc.ca/our-department/facilities/reading-room/research-publications/research-tools  Module 4  <http://www.i-studentglobal.com/study-programmes/science-engineering-computing-technology/50-essential-online-tools-for-every-computer-science-student> | | | | | |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6091** | | **Network Programming Lab** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand interprocess and inter-system communication * To understand socket programming in its entirety * To understand usage of TCP/UDP / Raw sockets * To understand how to build network applications   **COURSE OUTCOMES:**  •To write socket API based programs  •To design and implement client-server applications using TCP and UDP sockets  • To analyze network programs  At least 12 Programs must be covered in the Lab that must include but not restricted to the following areas.  Tools/Language used: Socket programming using C, Wireshark, GNS   * Familiarization of Graphical Network Simulator (GNS) * Familiarization of Wireshark * Detailed Study of protocols in TCP/IP model using Wireshark * Detailed Study of Subnetting and Supernetting * Experiments using GNS and Wireshark * Familiarization of following Linux/Unix network commands   + Ping   + traceroute   + arp   + route   + netstat   + About /etc folder   + IP Setting /Subnet Masking   + Setting up Hostname/Setting local name resolution * Installation and Configuration in Linux/Unix Environment   + Web Server   + File Server   + Remote Logins/Administration   + Database Server   + DNS   + NFS   + E-mail Server   + Firewall   + DHCP   + Proxy Server   + Samba   + LDAP * Socket Programming Experiments on   + TCP Echo Server, TCP Echo Client   + UDP Echo server, UDP Echo Client   + File Server   + Broadcast, Multicast   + Simple Network Time Protocol   + TCP Iterative Server   + TCP Concurrent Server * Familiarization on elementary commands to configure Router * Implementation of different routing protocols | | | | | |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**   1. Richard Stevens, Bill Fenner, “UNIX network programming Volume-1 –The Sockets Networking API”. 2. W. Richard Stevens, “Advanced Programming in the Unix Environment”, Addison Wesley. 3. Vahalia, Uresh., UNIX Internals – “A new Frontier” , PHI | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6002** | | **Advanced Distributed Systems** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To learn how to use Cloud Services. To gain knowledge Virtualization * To gain knowledge Task Scheduling algorithms. Apply Map-Reduce concept to applications. * To build Private Cloud. * To gain knowledge in cloud resource virtualization and scheduling.   **COURSE OUTCOMES:**  The student will be able to:   * Demonstrate simple Cloud Applications * Apply resource allocation, scheduling algorithms. Implement Map-Reduce concept. * Create virtual machines from available physical resources. Setup a private cloud. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Overlay Networks: Introduction - Routing Overlays - Structured Overlays - Unstructured Overlays. Peer to Peer Systems: P2P Network Architectures - Structured P2P Systems - Unstructured (Mesh) P2P Systems - Hybrid P2P Systems - Video Streaming Network Architecture. Topology Control - Structured Topology Control - Unstructured Topology Control. Trust - EigenTrust - PeerTrust – FuzzyTrust. Case Study: Gnutella | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Cluster Computing: Architecture – Classifications. High Speed Networks - Fast Ethernet - High Performance Parallel Interface - Asynchronous Transfer Mode– Infiny Band– Myrinet. Network RAM – Distributed Shared Memory. Case Study: Beowulf Cluster  Grid Computing: Services-Grid Standards – OGSA, WSRF, Grid Monitoring Architecture (GMA), Grid Security- PKI-X509 Certificates, Grid Scheduling and Resource Management, Grid Data Management, Grid Portals, Grid Middleware Case Study: Globus Toolkit | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Cloud Computing Fundamentals : Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models - Cloud Security - Cloud Infrastructure Mechanisms - Specialized Cloud Mechanisms - Cloud Management Mechanisms - Cloud Security Mechanisms. Cloud Computing Architectures - Fundamental Cloud Architectures - Advanced Cloud Architectures - Specialized Cloud Architectures. | | | | 10 |
| **IV** | Cloud Computing Technologies : Data in the cloud: Relational databases – Amazon RDS- Google Cloud SQL, No SQL databases - Amazon DynamoDB-Mongo DB. Cloud file systems: GFS and HDFS, BigTable, HBase.  Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce, Features and comparisons among GFS,HDFS etc, Map-Reduce model case study: Google. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**   1. Overlay Networks: Toward Information Networking, Sasu Tarkoma, CRC Press 2. Peer-to-Peer Computing: Applications, Architecture, Protocols, and Challenges, Yu-Kwong Ricky Kwok, CRC Press 3. High Performance Cluster Computing: Architectures and Systems, Volume 1, Ra jkumar Buyya, Prentice Hall 4. Cloud Computing: Concepts, Technology & Architecture, Thomas Erl; Zaigham Mahmood; Ricardo Puttini, Prentice Hall 5. George Coulouris, Jean Dellimore Tim Kindberg ,”Distributed Systems – Concepts and designing” Fifth Edition, Pearson Education Asia 6. Kai Hwang ,Jack Dongarra, Geoffrey Fox , Distributed and Cloud Computing, 1st Edition, Morgan Kaufmann 7. Ian Foster, Carl Kesselman, The Grid 2: Blueprint for a New Computing Infrastructure, Elsevier Series, 2004. 8. Vladimir Silva, Grid Computing for Developers, Charles River Media, January 2006. 9. Rajkumar Buyya, High Performance Cluster Computing: Architectures and Systems, Pearson 10. Andrei Gurtov, Dmitry Korzun , Structured Peer-to-peer Systems, Springer 11. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition) 12. Enterprise Cloud Computing by Gautam Shroff,Cambridge 13. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India 14. Google Apps by Scott Granneman,Pearson 15. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill, 16. Cloud Computing Bible by Barrie Sosinsky, Wiley India 17. Stefano Ferretti et.al. “QoS aware Clouds”, QoS , 2010 IEEE 3rd International Conference on Cloud Computing 18. Andrew S. Tenenbaum, “Distributed Operating Systems”, Pearson Education Asia 19. Pradeep. K.Sinha , “Distributed Operating Systems- Concepts and designing” , PHI 20. MapReduce Design Patterns, O'Reilly 21. Computer Networks – A Systems Approach, Larry L. Peterson and Bruce S. Davie, The Morgan Kaufmann Series in Networking | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6004** | | **Adhoc and Sensor Networks** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To gain knowledge on routing and protocols in Ad Hoc and sensor networks. * To get skilled in wireless networks technology platforms and standards. * To learn real time traffic support in wireless networks with working principles of wireless LAN. * To get familiar in standards of wireless LAN and learn hybrid networks   **COURSE OUTCOMES:**   * Understand the principles of Ad Hoc wireless and sensor networks. * Implement protocols with location based QoS. * Design and simulate sensor networks and assess performance. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **Ad Hoc Wireless Networks and MAC:** Introduction – Issues in ad Hoc wireless networks- MAC protocols – Issues, classifications of MAC protocols, Contention based protocols - Contention based protocols with reservation mechanism- Multi channel CSMA and power control MAC protocol | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Routing Protocols and TCP over Ad Hoc:** Issues in designing a routing protocol – Classifications of routing protocols – Hierarchical and power aware.multicast routing –Classifications- Tree based- Mesh based Ad Hoc transport layer issues- TCP over Ad Hoc – Feedback based - TCP with explicit link- TCP-Bus - Ad Hoc TCP and split TCP- Ad Hoc transport protocol. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Quality of Service in Ad Hoc Wireless Networks:** Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS solutions– MAC layer solutions – QoS routing protocols – Ticket based and predictive location based QoS routing protocols- On-Demand link state multipath QoS routing protocol- QoS frameworks- Energy management Ad Hoc – Battery and power management schemes - Transmission power management schemes. | | | | 10 |
| **IV** | **Wireless Sensor Networks:** Introduction – Sensor network architecture- Data dissemination – Gathering- MAC protocols for sensor networks –Self organizing- Hybrid TDMA/FDMA and CSMA based MAC - Location discovery and quality of sensor networks-Evolving standards - Energy efficient design.  **Hybrid Wireless Networks:** Introduction- Next generation hybrid wireless architectures-Routing in hybrid wireless networks- Power control schemes and load balancing in hybrid wireless networks- Recent advances in wireless networks –Ultra wide band radio communication-Wireless fidelity systems-Optical wireless networks. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**  1. C. Siva Ram Murthy and B. S. Manoj, *Ad Hoc Wireless Networks – Architectures and Protocols*, NewDelhi: Pearson Education, 2004.  2. Feng Zhao and Leonidas Guibas, *Wireless Sensor Networks*. Noida: Morgan Kaufman Publishers, 2004.  3. C. K. Toh, *Ad Hoc Mobile Wireless Networks.* New Delhi: Pearson Education, 2002.  4. Thomas Krag and Sebastin Buettrich, *Wireless Mesh Networking*. Mumbai: O’Reilly Publishers,2007 | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6006** | | **Network Flow Algorithms** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the Network flow problem and how to solve it * To understand Shortest path algorithms * To understand maximum flows and minimum flows * To understand minimum spanning tree algorithms   **COURSE OUTCOMES:**  Upon Completion of the course, the students will have the knowledge about   * Network flow problem and how to solve it * Shortest path algorithms * Maximum flows and minimum flows * Minimum spanning tree algorithms | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Network flow problems, Network representations, network transformations, Complexity Analysis, Developing Polynomial time algorithms, Search Algorithms, Flow Decomposition algorithms | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **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 | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **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 | | | | 10 |
| **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 | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**   1. Ravindra K. Ahuja, Thomas L. Magnanti, James B.Orlin, Network Flows – “Theory, Algorithms and Applications”, Prentice Hall 2. Mokhtar S. Bazaraa, John J. Jarvis, Hanif D. Sherali, “Linear Programming And Network Flows”, John Wiley & Sons, 4th Edition, 3. Gunther Ruhe, Kluwer, “Algorithmic Aspects Of Flows In Networks”, Academic Publishers Group 4. Michael W. Lucas, “Network Flow Analysis”, , No Starch Press 5. Alexander Engau, Vdm Verlag Dr. Muller, “Semi-Simultaneous Flows In Multiple Networks”, Aktiengesellschaft & Co. Kg 6. Wai-kai Che, John Wiley, “Theory Of Nets: Flows In Network”s, 7. Ulrich Derigs, “Programming In Networks And Graphs: On The Combinatorial Background And Near-Equivalence Of Network Flow And Matching Algorithms”, 8. Ford L. R. Jr. , Robert G. Bland, Fulkerson D. R, “Flows In Networks”, Princeton University Press. 9. Alexander Hall, Vdm Verlag Dr. Mueller E. K, “Scheduling And Flow-Related Problems In Networks” | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6022** | | **Protocol Engineering** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  • To understand the existing network architecture models and analyze the their performance  •To understand the high speed network protocols and design issues.  •To learn network security technologies and protocols  •To study various protocols in wireless LAN, MAN.  **COURSE OUTCOMES:**  • Ability to study, analyze and design seven layers of protocols of wired and wireless networks | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction: Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases Error Control, Flow Control: Type of Transmission Errors, Linear Block Code, Cyclic RedundancyChecks, Introduction to Flow Control, Window Protocols, Sequence Numbers, Negative Acknowledgments, Congestion Avoidance Network Reference Model: Layered Architecture, Network Services and Interfaces, Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Protocol Specification: Components of specification, Service specification, Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification. Protocol Specification Language (SDL): Salient Features. Communication System Description using SDL, Structure of SDL. Data types and communication paths, Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification, SDL based platform for network, OSPF, BGP Multi Protocol Label Switching SDL components. | | | | 9 |

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| **INTERNAL TEST 2(Module 2)** | | |
| **III** | Protocol Verification / Validation: Protocol Verification using FSM, ABP Verification, Protocol Design Errors, Deadlocks, Unspecified Reception, Non-executable Interactions, State Ambiguities, Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, Process Algebra based Validation, SDL Based Protocol Verification: ABP Verification, Liveness Properties, SDL Based Protocol Validation: ABP Validation. | 10 |
| **IV** | Protocol Conformance and Performance Testing: Conformance Testing Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance testing with Tree and Tabular Combined Notation (TTCN), Conformance Testing of RIP, Testing Multimedia Systems, quality of service test architecture (QOS), Performance Test methods. Protocol Synthesis and Implementation: Synthesis methods, Requirements of Protocol, Implementation, Objects Based Approach To Protocol Implementation, Protocol Compilers, Code generation from SDL. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES**   1. Pallapa Venkataram and Sunilkumar S. Manvi: Communication Protocol Engineering, PHI, 2004. 2. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004. 3. G. J. Holtzmann, “Design and validation of Computer protocols”, Prentice hall, 1991 (available on web) 4. K. Tarnay, “Protocol specification and testing”, Plenum press, 1991. | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6024** | | **High-Performance Scientific Computing** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * IPV4 and IPV6 protocols routing * Frame relay and ATM congestion control management * Network security and Integrated and Differentiated Services * Network management and its protocols   **COURSE OUTCOMES:**   * Students have knowledge about routing * Students have knowledge about frame relay and ATM congestion control management * Students have knowledge about network security and Integrated and Differentiated Services * Students have knowledge about Network management and its protocols | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Network Performance analysis: Objectives and requirements for Quality of Service (QoS) in high performance networks. Architecture of high performance networks (HPN), design issues, protocols for HPN, VHF backbone networks, virtual interface architectures, virtual interface for networking, High-speed switching and routing - internet and PSTN IP switching techniques, SRP protocols, SRP authentication, and key exchange, comparison of TCP/IP, FTP, TELNET, queuing systems, network modeling as a graph | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Gigabit Ethernet: Architecture, standards, interface, applications, network design.  Frame relay: Frame relay protocols and services, frame relay congestion Control.  ATM: Architecture, protocol, switching, traffic and congestion control, flow control ATM service categories, ATM in LAN environment, classical IP over ATM.  ADSL and DSL Technologies: Background and technological capabilities, Standards and associations, Architecture.  Fiber Optics Communication: GPON (Gigabit capable Passive Optical Network), SONET/SDH and comparison with other available standards. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Introduction to MPLS and QOS, Network Components of MPLS, working RSVP protocol, MPLS network Components, MPLS basic working, Applications, IETF approach, RSVP protocol, Integrated & differential Services Framework.  Storage and networking concepts – SCSI bus architecture – Networking in front of the server – Networking behind the server – Network -attached Storage – Fibre channel internals – Layers – Data encoding – Framing protocol – class of service – flow control – Name and addressing conventions. | | | | 10 |
| **IV** | SAN topologies – Point-to Point – Arbitrated Loop – Loop Addressing-Loop Initialization-Port Login-Loop port state machine – Design considerations for Arbitrated Loop –Fabrics – Fabric login – Simple Name Server – State Change Notification – Private Loop Support – Fabric Zoning – Building Extended SANs.  Fibre Channel Products – Gigabit Interface Converters (GBICs) – host Bus Adapters – Fibre channel RAID – Fibre channel JBODs – Arbitrated Loop Hubs – hub Architecture – Unmanaged Hubs – Managed Hubs – Switching Hubs – Fabric Switches – Fibre Channel-to-SCSI Bridges – SAN software Products – Problem isolation in SANs – Isolation Techniques – Fibre channel Analyzers. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**  1. Storage Networks Explained – Uif Troppens, Raiver Erkens and Wolfgang Muller, John Wiley & Sons, 2003.  2. Alex Goldman, “Storage Area Networks Fundamentals”, Cisco Press 2002 3. Storage Area Network Essentials: a Complete Guide to understanding andimplementing SANs- Richard Barker and Paul Massiglia, John Wiley India  4. William Stallings: ISDN And BISDN  5. William Stallings: High Speed Networks  6. M Shwartz: Telecommunication Network Protocol Modeling And Analysis: Addison Wesley  7. Gallangar: Data Networks: Prentice Hall  8. Fred Halsall: Data Communication Computer Networks, And Open Systems: Addison Wesley  9. Kershanbaum : Telecommunication Network Design Algorithms: MGH  10. Jochetl Schiller: Mobile Communication: Addison Wesley.  11. Tanenbaum: Computer Networks: PHI  13. Johnson: Fast Ethernet  14. Tom Clark, “Designing Storage Area Networks”, Addison-Wesley Professional, 1stedition, 1999  15. Storage Networks: The Complete Reference – Robert Sparding, Tata Mcgraw Hills, 2003. | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6026** | | **Performance Evaluation of Computer Networks** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the concept of computer system performance evaluation. * To know the implementation of M/M/1 queuing models * To learn continuous parameter Markov chains and state dependent queuing models   **COURSE OUTCOMES:**   * Understand the mathematical and statistical models of computers and networks. * Model communication networks and I/O computer systems * Use Queuing theory to measure performances of systems * Perform statistical analysis and interpretation of simulation results. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Performance Characteristics – Requirement Analysis: Concepts – User, Device, Network Requirements – Process – Developing RMA, Delay, Capacity Requirements – Flow analysis – Identifying and Developing Flows Models – Flow Prioritization – Specification. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Random variables – Stochastic process – Link Delay components – Queuing Models – Little’s Theorem – Birth & Death Process – Queuing Disciplines. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Markovian FIFO Queuing Systems – M/M/1 – M/M/a – M/M/∞ - M/G/1 – M/M/m/m and other Markov – Non – Markovian and self – similar models – Network of Queues – Burke’s Theorem – Jackson’s Theorem. | | | | 10 |
| **IV** | Multi- User Uplinks/Downlinks – Capacity Regions – Opportunistic Scheduling for Stability and Max Throughput – Multi-hop routing – Mobile Networks – Throughput Optimality and Backpressure | | | | 8 |

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| **END SEMESTER EXAM (ALL Modules)** |
| **Text books**  1. James D.McCabe, Network analysis, Architecture and Design, 2nd Edition, Elsevier,2003.  2. Bertsekas & Gallager, Data Networks, second edition, Pearson Education, 2003.  3. Introduction to Probability Models by Sheldon Ross (8th edition) Academic Press, NewYork, 2003.  **REFERENCES**  1. D. Bertsekas, A. Nedic and A. Ozdaglar, Convex Analysis and Optimization, Athena Scientific, Cambridge, Massachusetts, 2003.  2. Nader f. Mir Computer and Communication Networks, Pearson Education, 2007.  3.Paul J.Fortier, Howard E.Michel, Computer Systems Performance Evaluation and Prediction, Elsevier, 2003.  4. Thomas G. Robertazzi, “Computer Networks and Systems Queuing Theory and Performance Evaluation” 3rd Edition Springer, 2000. |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6032** | | **Networking in Embedded Systems** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the concepts of Serial/Parallel Communication in Embedded networking * To understand USB bus * To understand the elements of embedded networks * To understand Wireless sensor networks   **COURSE OUTCOMES:**  Upon Completion of the course, the students will have the knowledge about   * Concepts of Serial/Parallel Communication in Embedded networking * USB bus * Elements of embedded networks * Wireless sensor networks | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2 C) – PC Parallel port programming -ISA/PCI Bus protocols - Firewire | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers. Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure. | | | | 10 |
| **IV** | Wireless sensor networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCE BOOKS**  1. Frank Vahid, Givargis ‘Embedded Systems Design: A Unified Hardware/Software Introduction’, Wiley Publications  2. Jan Axelson, ‘Parallel Port Complete’ , Penram publications  3. Dogan Ibrahim, ‘Advanced PIC microcontroller projects in C’, Elsevier 2008  4. Jan Axelson ‘Embedded Ethernet and Internet Complete’, Penram publications  5. Bhaskar Krishnamachari, ‘Networking wireless sensors’, Cambridge press 2005 | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6034** | | **Internet Routing Design** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the concepts of routing protocols * To understand architecture of router * To understand the different models of network algorithms * To understand QoS of routing   **COURSE OUTCOMES:**  Upon Completion of the course, the students will have the knowledge about   * Routing protocols * Architecture of router * Different models of network algorithms * Quality of Service of routing | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **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. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **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 | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | 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 |
| **IV** | 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.  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. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**  1. Network Routing: Algorithms, Protocols, and Architectures Deepankar Medhi and Karthikeyan Ramasamy (Morgan Kaufmann Series in Networking)  2. Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices George Varghese (Morgan Kaufmann Series in Networking)  3. TCP/IP Protocol Suite, (B.A. Forouzum) Tata McGraw Hill Edition, Third Edition  4. TCP/IP Volume 1,2,3 (N. Richard Steveus Addison Wesley)  5. Computer Networks (A.S. Taueubaum) Pearson Edition, 4th Edition  6. Bhaskar Krishnamachari, ‘Networking wireless sensors’, Cambridge press 2005 | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 6036** | | **Complex Networks** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  •To understand the concepts of Social networks  •To under graph theory required for analyzing the network  •To understand the different models of networks  •To understand different types of searches in networks  **COURSE OUTCOMES:**  Upon Completion of the course, the students will have the knowledge about  • Social networks  • Graph theory required for analyzing the network  • Different models of networks  • Different types of searches in networks | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Types of network: Social networks, Information networks, Technological networks, Biological networks.  Properties of network: Small world effect, transitivity and clustering, degree distribution, scale free networks, maximum degree; network resilience; mixing patterns; degree correlations; community structures; network navigation. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Random Graphs: Poisson random graphs, generalized random graphs, the configuration model, power-law degree distribution, directed graph, bipartite graph, degree correlations. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Models of network growth: Price's model, Barabasi and Albert's model, other growth models, vertex copying models.  Processes taking place on networks: Percolation theory and network resilience, Epidemiological processes. | | | | 10 |
| **IV** | Applications: Search on networks, exhaustive network search, guided network search, network navigation; network visualization | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**  1. S. N. Dorogovtsev and J. F. F. Mendes, Evolution of Networks, Oxford University Press.  2. Narsingh Deo, Graph Theory, Prentice Hall of India. | | | | | |

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| OURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05IT 6066** | **Seminar - I** | 3-1-0-4 | 2015 |
| COURSE OBJECTIVES:  Each student should present a seminar on any topic related to the core / elective courses offered in the second semester of the M. Tech. Programme. The selected topic should be based on the papers published in reputed international journals preferably IEEE/ACM. The selected paper should be approved by the Programme Co-ordinator / Faculty member before presentation. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report. | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05IT 6088** | **mini project** | 3-1-0-4 | 2015 |
| The mini project is designed to develop practical ability and knowledge in tools/techniques to solve problems related to the industry, academic institutions and computer science research. Students can take up any application level/system level project pertaining to a relevant domain, preferably based on papers from IEEE/ACM journals. Projects can be chosen either from the list provided by the faculty or in the field of interest of the student. The topic should be approved by the Programme Co-ordinator / Faculty member before carrying out the work. For external projects, students should obtain prior permission after submitting the details of the guide and synopsis of the work. The project guide should have a minimum qualification of ME/M.Tech in Computer Science or related fields. At the end of each phase, presentation and demonstration of the project should be conducted, which will be evaluated by a panel of examiners. A detailed project report duly approved by the guide in the prescribed format should be submitted for end semester assessment. Marks will be awarded based on the report and their performance during presentations and demonstrations. Publishing the work in Conference Proceedings/Journals with National/International status with the consent of the guide will carry an additional weightage in the evaluation process. | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05IT 6092** | **network simulation lab** | 3-1-0-4 | 2015 |
| **Course Objectives**   * To know programming in NS2 * To understand how to simulate TCP and UDP protocols in UDP * To understand how to simulate Adhoc wireless sensor networks in NS2   **Course Outcomes:**  Upon Completion of the course, the students will be able to   * Write programs to simulate TCP and UDP protocols in NS2 * Simulate wireless sensor networks in NS2   **Experiment list:** Familiarizing Network Simulator – 2 (NS2) with suitable examplesSimulate a wired network consisting of TCP and UDP Traffic using NS2 and then calculate their respective throughput using AWK script.Performance evaluation of different routing protocols in wired network environment using NS2Performance evaluation of different queues and effect of queues and buffers in wired network environment using NS2Compare the behavior of different variants of TCP (Tahoe, Reno, Vegas….) in wired network using NS2. Comparison can be done on the congestion window behavior by plotting graph.Simulation of wireless Ad hoc networks using NS2Simulate a wireless network consisting of TCP and UDP Traffic using NS2 and then calculate their respective throughput using AWK script.Performance evaluation of different ad-hoc wireless routing protocols (DSDV, DSR, AODV …) using NS2Create different Wired-cum-Wireless networks and MobileIP Simulations using NS2. . | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 7041** | | **SOCIAL NETWORK ANALYSIS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the concepts of Social networks and Web Social Networks * To appreciate the modeling and visualizing techniques associated with Social Networks * To understand the different techniques used to mine communities from Web Social Networks * To appreciate concepts of evolution and prediction in Social Networks * To understand the application of text mining techniques for Content and Opinion mining   **COURSE OUTCOMES:**  Upon Completion of the course, the students will be able to   * Build a social network data set from existing social networking sites * Identify the different components of a web social network that can be used for analyzing and mining * Identify the different data structures and graph algorithms that can be used for web social network mining * Implement a community detection algorithm * Process Social Network data using MapReduce paradigm * Design an application that uses various aspects of Social Network Mining to improve its functionality and to harvest information available on the web to build recommender systems * Analyze social media data using appropriate data/web mining techniques | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **INTRODUCTION**  Introduction to Web -Limitations of current Web –Development of Semantic Web –Emergence of the Social Web –Statistical Properties of Social Networks -Network analysis -Development of Social Network Analysis -Key concepts and measures in network analysis -Discussion networks -Blogs and online communities -Web-based networks. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **MODELING AND VISUALIZATION**: Visualizing Online Social Networks -A Taxonomy of Visualizations -Graph Representation -Centrality-Clustering -Node-Edge Diagrams -Visualizing Social Networks with Matrix- Based Representations-Node -Link Diagrams -Hybrid Representations -Modelling and aggregating social network data-RandomWalks and their Applications –Use of Hadoop and MapReduce -Ontological representation of social individuals and relationships. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | MINING COMMUNITIES : Aggregating and reasoning with social network data, Advanced Representations -Extracting evolution of Web Community from a Series of Web Archive -Detecting Communities in Social Networks -Evaluating Communities –Core Methods for Community Detection & Mining -Applications of Community Mining Algorithms -Node Classification in Social Networks. | | | | 10 |
| **IV** | **EVOLUTION** :Evolution in Social Networks –Framework -Tracing Smoothly Evolving Communities -Models and Algorithms for Social Influence Analysis -Influence Related Statistics -Social Similarity and Influence -Influence Maximization in Viral Marketing -Algorithms and Systems for Expert Location in Social Networks -Expert Location without Graph Constraints -with Score Propagation –Expert Team Formation -Link Prediction in Social Networks -Feature based Link Prediction -Bayesian Probabilistic Models -Probabilistic Relational Models  **TEXT AND OPINION MINING:** Text Mining in Social Networks -Opinion extraction –Sentiment classification and clustering -Temporal sentiment analysis -Irony detection in opinion mining-Wish analysis -Product review mining –Review Classification –Tracking sentiments towards topics over time. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Charu C. Aggarwal ,“Social Network Data Analytics”, Springer; 2011  2. Peter Mika, “Social Networks and the Semantic Web” , Springer, 1St edition 2007.  3. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 1st edition, 2010.  4. Guandong Xu , Y anchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, Springer, 1 St edition, 2011.  5. Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010.  6. Ajith Abraham, Aboul E lla Hassanien, Václav Snášel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2009.  7. Toby Segaran, “Programming Collective Intelligence”, O’Reilly, 2012 | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 7043** | | **Agent Based Intelligent Systems** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the concepts of Social networks and Web Social Networks * To appreciate the modeling and visualizing techniques associated with Social Networks * To understand the different techniques used to mine communities from Web Social Networks * To appreciate concepts of evolution and prediction in Social Networks * To understand the application of text mining techniques for Content and Opinion mining   **COURSE OUTCOMES:**  Upon Completion of the course, the students will be able to   * Build a social network data set from existing social networking sites * Identify the different components of a web social network that can be used for analyzing and mining * Identify the different data structures and graph algorithms that can be used for web social network mining * Implement a community detection algorithm * Process Social Network data using MapReduce paradigm * Design an application that uses various aspects of Social Network Mining to improve its functionality and to harvest information available on the web to build recommender systems * Analyze social media data using appropriate data/web mining techniques | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Artificial Intelligence – intelligent agents – Environment – Structure of agents – Agent types – Problem solving agents – Uninformed Search strategies – Informed Search and Exploration – Adversarial Search. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Knowledge and reasoning – Knowledge Based Agents – First order logic – Reasoning – Backward chaining – Resolution – Knowledge representation – Handling uncertain knowledge – Reasoning under uncertainty – Statistical reasoning. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Planning – Components of planning systems – Planning with state space search – Partial order planning – Planning Graphs – Hierarchical planning – Multi agent planning. | | | | 10 |
| **IV** | Learning – forms of learning – Inductive learning – Learning decision trees – Explanation based learning – Statistical learning – Instantance based learning – Neural networks – Reinforcement learning.  Agent oriented programming language – KQML as an agent communication language – Java implementation of intelligent agents JADE – Languages supporting mobility – Telescript. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**  1. Software Agents: Jeffrey M.Broadshaw, AAAI Press (1997)  2. Multi agent System – A modern approach to distributed artificial intelligence: Gerhard Weiss, MIT Press (2000)  3. Artificial intelligence. A modern approach by Stuart Russell & Peter Norvig.  4. Artificial Intelligence by Elaine Rich & Kevin knight. | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 7045** | | **Information Retrieval, Data Mining & Data Warehousing** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  On completion of this course you should have gained a good understanding of the foundation concepts of information retrieval techniques and be able to apply these concepts into practice.  Specifically, students should be able to:   * To use different information retrieval techniques in various application areas * To apply IR principles to locate relevant information large collections of data * To analyze performance of retrieval systems when dealing with unmanaged data sources * To implement retrieval systems for web search tasks. * Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors. * Building basic terminology. * Learn how to gather and analyze large sets of data to gain useful business understanding. * Learn how to produce a quantitative analysis report/memo with the necessary information to make decisions. * Describing and demonstrating basic data mining   **COURSE OUTCOMES:**  Specifically, students should be able to:   * To use different information retrieval techniques in various application areas * To apply IR principles to locate relevant information large collections of data * To analyze performance of retrieval systems when dealing with unmanaged data sources * To implement retrieval systems for web search tasks. * Understand data mining principles and techniques | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Study some basic concepts of information retrieval and data mining, such as the concept of relevance, association rules, and knowledge discovery. **Basic IR Models:**Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity. Various indexing techniques for textual information items, such as inverted indices, tokenization, stemming and stop words**. Query Operations and Languages**: Relevance feedback, pseudo relevance feedback and Query expansion; Evaluation of Retrieval Performance: Measurements: Average precision, NDCG, etc. Cranfield paradigm and TREC conferences. **Text Representation:** Word statistics; Zipf's law; Porter stemmer; morphology; index term selection; using thesauri. Metadata and markup languages (SGML, HTML, XML). **Web Search:** Search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, Google PageRank); | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Text Categorization:** Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. **Language-Model Based Retrieval**: Using naive Bayes text classification for ad hoc retrieval. Improved smoothing for document retrieval. **Text Clustering:** Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Evolution of Decision Support Systems- Data warehousing Components –Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP ,OLTP, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations. Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Data Warehousing and Business Intelligence Trends | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating - Mining frequent patterns- association rule mining. Frequent item set mining methods – Apriori, FP growth, Correlation Analysis | | | | 10 |
| **IV** | Decision Tree Induction - Bayesian Classification – Rule Based Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – , Partitioning methods- k-means- Hierarchical Methods - distance- based agglomerative and divisible clustering, Density-Based Methods – expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis: Statistical approaches-Proximity based approaches-Clustering and Classification based approaches, Practical retrieval and data mining applications. Currently available tools. Advanced Techniques**:** Web Mining, Spatial Mining, Text Mining | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **Text books**  1. Ricardo Baexa-Yates & Berthier Ribeiro-Neto Modern Information Retrieval, Addison Wesley Longman,1999  2. Introduction to Information Retrieval by Christopher D. Manning, Prabhakar Raghavan and Hinrich Schtze Cambridge University Press in 2008 http://nlp.stanford.edu/IR-book/  3. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, third edition 2011, ISBN: 1558604898.  4. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, TataMc Graw Hill Edition, Tenth Reprint 2007.  5. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.  6. MargaretH. Dunham, S.Sridhar, “Data Mining: Introductory and Advanced Topics”, Pearson Education.  7. Mining the Web, Discovering Knowledge from Hypertext Data, Elsevier, Soumen Chakrabarti, Morgan Kaufmann publishers.  **REFERENCES**  1. Mehmed kantardzic, “Data mining concepts,models,methods, and algorithms”, Wiley Interscience, 2003.  2. Ian Witten, Eibe Frank, “Data Mining; Practical Machine Learning Tools and Techniques”, third edition, Morgan Kaufmann, 2011.  3. George M Marakas, “Modern Data Warehousing, Mining and Visualization”, Prentice Hall, 2003  4. Sergey Brin and Lawrence page, The anatomy of large scale hyper textual (Web) search engine, Computer Networks and ISDN systems, Vol 30,No 1-7  5. J Kleinberg, et. Al, The Web as a graph: Measurements, models and methods, | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 7051** | | **Network Forensics** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the fundamentals of Cryptography * To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity. To understand the various key distribution and management schemes. * To understand how to deploy encryption techniques to secure data in transit across data networks * To design security applications in the field of Information technology.   **COURSE OUTCOMES:**  Students will be able to:   * Analyze the vulnerabilities in any computing system and hence be able to design a security solution. * Identify the security issues in the network and resolve it. * Evaluate security mechanisms using rigorous approaches, including theoretical. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction to Network Forensics : Concepts in Digital Evidence, Challenges relating to Network Evidence, Network Forensics Investigative Methodology, Technical Fundamentals, Sources of Network-Based Evidence, On the Wire, In the Air, Switches , Routers, DHCP Servers, Name Servers, Authentication Servers, Network Intrusion Detection /Prevention Systems, Firewalls, Web Proxies, Application Servers, Central Log Servers. Evidence Acquisition: Physical Interception-Cables, Radio Frequency, Hubs, Switches, Traffic Acquisition Software, libpcap and WinPcap The Berkeley Packet Filter (BPF) Language, tcpdump , Wireshark, tshark, dumpcap, Active Acquisition- Common Interfaces, Inspection Without Access, Strategy. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Traffic Analysis : Protocol Analysis, Protocol Analysis Tools, Protocol Analysis Techniques, Packet Analysis, Packet Analysis Tools, Packet Analysis Techniques, Flow Analysis, Flow Analysis Tools, Flow Analysis Techniques, Higher-Layer Traffic Analysis, Common Higher-Layer Protocols, Higher-Layer Analysis Tools, Higher-Layer Analysis Techniques Statistical Flow Analysis, Process Overview, Sensors, Sensor Types, Sensor Software, Sensor Placement, Flow Record Export Protocols, NetFlow, IPFIX, sFlow, Collection and Aggregation, Wireless Traffic Capture and Analysis, Spectrum Analysis, Wireless Passive Evidence Acquisition, Common Attacks – Sniffing, Rogue Wireless Access Points, Evil Twin, WEP Cracking, Locating Wireless Devices. | | | | 9 |

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| **INTERNAL TEST 2(Module 2)** | | |
| **III** | Network Devices, Intrusion Detection and Analysis : Typical NIDS/NIPS Functionality, Sniffing , Higher-Layer Protocol Awareness, Alerting on Suspicious Bits Modes of Detection, Signature-Based Analysis, Protocol Awareness, Behavioral Analysis, Types of NIDS/NIPSs , NIDS/NIPS Evidence Acquisition , Comprehensive Packet Logging , Event Log Aggregation, Correlation, and Analysis, Sources of Logs - Operating System Logs , Application Logs Physical Device Logs, Network Equipment Logs, Network Log Architecture, Three Types of Logging Architectures, Remote Logging: Common Pitfalls and Strategies. Switches - Content-Addressable Memory Table, ARP, Switch Evidence, Routers-Types of Routers, Router Evidence, Firewalls -Types of Firewalls , Firewall Evidence. | 10 |
| **IV** | Advanced Topics: Network Tunneling, Tunneling for Functionality, Inter-Switch Link (ISL), Generic Routing Encapsulation (GRE), Tunneling for Confidentiality, Internet Protocol Security (IPsec), Transport Layer Security (TLS) and Secure Socket Layer (SSL), Covert Tunneling, Covert Tunneling Strategies, TCP Sequence Numbers, DNS Tunnels , ICMP Tunnels. Malware Forensics, Trends in Malware Evolution, Network Behavior of Malware, Propagation, Command-and-Control Communications, Payload Behavior. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **Text Book**  1. Sherri Davidoff, Jonathan Ham, “Network Forensics: Tracking Hackers through Cyberspace”, Pearson Education, 2012.  **References**  1. Katzendbisser, Petitcolas,"Information Hiding Techniques for Steganography and Digital Watermarking", Artech House. 42  2. Peter Wayner, "Disappearing Cryptography: Information Hiding, Steganography and Watermarking 2/e", Elsevier  3. Bolle, Connell et. al., "Guide to Biometrics", Springer  4. John Vecca, “Computer Forensics: Crime scene Investigation”, Firewall Media  5. Christopher L.T. Brown, “Computer Evidence: Collection and Preservation”, Firewall Media | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 7053** | | **Distributed Algorithms** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To learn Synchronous distributed systems and algorithms used in in it * To learn Asynchronous distributed systems and algorithms used in in it   **COURSE OUTCOMES:**   * To learn Synchronous distributed systems and algorithms used in in it * To learn Asynchronous distributed systems and algorithms used in in it | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction to model of synchronous distributed computing system, Leader election in a General Network - Simple Flooding Algorithm, Basic Breadth-First Search Algorithm., Bellman-Ford algorithm. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Algorithms in Synchronous Networks, Minimum Spanning Tree, Leader Election in a Synchronous Ring , LCR algorithm, HS algorithm, Time Slice Algorithm, Variable Speeds Algorithm, Lower Bound for Comparison-Based AlgorithmsMaximal Independent Set, LubyMIS algorithm. Distributed Consensus with Link Failures and Process Failures – Basics | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Introduction to model of asynchronous distributed computing system, Send/Receive systems, Broadcast systems, Multicast systems, Basic algorithms, Peterson Leader-Election Algorithm, Local Synchronizer, Safe Synchronizer. | | | | 10 |
| **IV** | Asynchronous System Model. Shared Memory Systems, Environment Model, Shared Variable Types, Mutual Exclusion - Asynchronous Shared Memory Model, Dijkstra's Mutual Exclusion Algorithm. Resource Allocation - Nonexistence of Symmetric Dining Philosophers Algorithms, Right-Left Dining Philosophers Algorithm, mutual exclusion and consensus, relationship between shared memory and network models, asynchronous networks with failures | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES**   1. Nancy A. Lynch, Morgan,” Distributed Algorithms”, Kaufmann Publishers, Inc 2. Wolfgang Reisig, W. Reisig, “Elements Of Distributed Algorithms: Modeling And Analysis With Petri Nets”, Springer-verlag 3. Tel Gerard , “Introduction To Distributed Algorithms”, 2nd Edition, Cambridge University Press 4. Sukumar Ghosh, ”Distributed Systems: An Algorithmic Approach (Hardcover)”, Chapman & Hall/crc 5. Valmir C. Barbosa,”An Introduction To Distributed Algorithms”, Mit Press 6. Randy Chow, Theodore Johnson, “Distributed Opearating Systems and Algorithm Analysis, , Pearson Education 7. Santoro N., Nicola Santoro, “Design And Analysis Of Distributed Algorithms”, Wiley-interscience 8. Fionnuala O'donnell, Vdm Verlag Dr. Muller, “A Simulated Framework For The Teaching Of Distributed Algorithms”, Aktiengesellschaft & Co. Kg 9. Ajay D. Kshemkalyani, Mukesh Singhal, “Distributed Computing - Principles, Algorithms, And Systems”, Cambridge University Press | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05IT 7055** | | **Ontology & Semantic Web** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To learn Web Intelligence * To learn Knowledge Representation for the Semantic Web * To learn Ontology Engineering * To learn Semantic Web Applications, Services and Technology * To learn Social Network Analysis and semantic web   **COURSE OUTCOMES:**  Students can able to   * Understand Web Intelligence * Students have Knowledge Representation for the Semantic Web * Students knows Ontology Engineering * Students knows Semantic Web Applications, Services and Technology * analysis Social Network and semantic web | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **INTRODUCTION :** Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background -Sample - Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need –Foundation – Layers – Architecture. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES** : Web Documents in XML – RDF - Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics - Traditional Ontology Languages – LOOM- OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL - DAML + OIL- OWL | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **ONTOLOGY LEARNING FOR SEMANTIC WEB** : Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms -Evaluation | | | | 10 |
| **IV** | ONTOLOGY MANAGEMENT AND TOOLS : Overview – need for management – development process – target ontology – ontology mapping – skills management system – ontological class – constraints – issues. Evolution– Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools. | | | | 8 |

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| **END SEMESTER EXAM (ALL Modules)** |
| **References**  1. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez “Ontological Engineering: with examples from the areas of Knowledge Management, e- Commerce and the Semantic Web” Springer, 2004  2. Grigoris Antoniou, Frank van Harmelen, “A Semantic Web Primer (Cooperative Information Systems)”, The MIT Press, 2004  3. Alexander Maedche, “Ontology Learning for the Semantic Web”, Springer; 1 edition, 2002  4. John Davies, Dieter Fensel, Frank Van Harmelen, “Towards the Semantic Web: Ontology – Driven Knowledge Management”, John Wiley & Sons Ltd., 2003.  5. John Davies (Editor), Rudi Studer (Co-Editor), Paul Warren (Co-Editor) “Semantic Web Technologies: Trends and Research in Ontology-based Systems”Wiley Publications, Jul 2006  6. Dieter Fensel (Editor), Wolfgang Wahlster, Henry Lieberman, James Hendler, “Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential”, The MIT Press, 2002  7. Mining the Web, Discovering Knowledge from Hypertext Data, Elsevier, Soumen Chakrabarti, Morgan Kaufmann publishers |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05IT 7067** | **Seminar II** | 3-1-0-4 | 2015 |
| Each student should present a seminar on any topic related to the core / elective courses offered in the first semester of the M. Tech. Programme. The selected topic should be based on the papers published in reputed international journals preferably IEEE/ACM. The selected paper should be approved by the Programme Co-ordinator / Faculty member before presentation. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report. | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05IT 7087** | **PROJECT PHASE I** | 3-1-0-4 | 2015 |
| In Master’s thesis Phase-I, the students are expected to select an emerging research area in Computer Science or related fields, after conducting a detailed literature survey, they should compare and analyze research work done and review recent developments in the area and prepare an initial design of the work to be carried out as Master’s Thesis. It is expected that the students should refer National and International Journals and conference proceedings while selecting a topic for their thesis. He/She should select a recent topic from a reputed International Journal, preferably IEEE/ACM. Emphasis should be given for introduction to the topic, literature survey, and scope of the proposed work along with some preliminary work carried out on the thesis topic.  Students should submit a copy of Phase-I thesis report covering the content discussed above and highlighting the features of work to be carried out in Phase-II of the thesis.  The candidate should present the current status of the thesis work and the assessment will be made on the basis of the work and the presentation, by a panel of examiners. This panel can be a committee headed by the head of the department with two other faculty members in the area of the project, of which one shall be the project supervisor .If the project is done outside the college, the external supervisor associated with the student will also be a member of the committee. The examiners should give their suggestions in writing to the students so that it should be incorporated in the Phase–II of the thesis. | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05IT 7088** | **PROJECT PHASE II** | 3-1-0-4 | 2015 |

In the fourth semester, the student has to continue the thesis work and after successfully finishing the work, he / she have to submit a detailed thesis report. The work carried out should lead to a publication in a National / International Conference or Journal. The papers received acceptance before the M.Tech evaluation will carry specific weightage.

Final evaluation of the project will be taken up only on completion of the project. This shall be done by a committee constituted for the purpose by the principal of the college. The concerned head of the department shall be the chairman of this committee. It shall have two senior faculty members from the same department, project supervisor and external supervisor, if any, of the student and an external expert either from an academic /R&D organization or from industry as members.