



INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY

P-14 Pune Infotech Park, Hinjawadi, Pune 411 027, India. Tel : 91-20-2933441 Fax : 91-20-2934191 Email : info@isquareit.com

Master of Science Programme in Advanced Information Technology (MSP-AIT)

with specialisation in

Networking and Telecommunications

An autonomous full-time Masters Programme of PIT

Internet and telecom infrastructure has become the major drive for the emerging, knowledge-based economy. The modern information infrastructure covering Global Information Infrastructure (GII), National Information Infrastructure (NII) Wide Area Networks (WANs), Metropolitan Area Networks (MANs) and Local Area Networks (LANs), must provide multiservices over these networks with Quality of Service (QoS) and security as demanded by corporates, institutions and individuals. The convergence is redefining the traditional boundaries of voice, video and data services. The entire field is in a great flux and there are technological, economic and regulation challenges. This course provides a comprehensive, theoretical, practical and real-life knowledge of advanced networking and telecommunications as demanded by the industry today and tomorrow.

THE PROGRAMME

This four trimester full-time Master of Science programme is designed, developed and delivered by experts from the networking and telecommunication industries under the inspiring guidance of an internationally acclaimed panel of visionary leaders and innovators in the field of Information Technology. It is designed to cater to market needs by providing practical knowledge of state-of-the-art Internetworking and Telecommunication Technologies, Advanced Network Security, Network Management and Administration.

DISTINCTIVE FEATURES

- Theory and laboratory sessions to gain experience of practical situations in LAN/WAN/MAN/ carrier class networks and convergence technologies
- Exposure to various tools to understand and practice network programming, network management and network security
- Expert lectures, seminars and case studies by leading experts from industries
- Foundations for taking Internationally Recognised Certifications (IRC) examinations

ELIGIBILITY

- Graduates with a Bachelor's Degree of minimum three years' duration in Electrical/Electronics/Communication/Information Technology/Computer Science or equivalent
- Students appearing in their final year of graduation may also apply.
- Basic knowledge of Data Communication and Networking
- Sound background in computing
- See insert on "Selection and Admission Procedure" for more details

COURSE COMMENCEMENT

The course commences in June / September / January

EVALUATION AND CERTIFICATION

- Periodic evaluation and performance improvement programme
- Module-wise credits

- Balanced assessment based on internals, examination and project
- Detailed transcripts along with certificate

PLACEMENT ASSISTANCE

- Career guidance at the institute
- Pre-placement facilitation/development
- Active liaison with companies in Infotech Park
- Campus interviews by leading industries in India

CURRICULUM

COMMON FOUNDATION PROGRAMME

● Self-Management and Leadership

This module helps the students to understand one's self and to develop leadership qualities. The student will be taught Yoga of well being, meditation techniques, the Art of Living, self management and leadership, team building, sports, gym and creative arts.

● Foreign Language

This module is designed for students aspiring to learn a foreign language for business communication to avail of global career opportunities.

English language course will be a pre-requisite for foreign students who do not have adequate proficiency in English.

● ICT Business Management

The course provides students with basic management skills for performing in Information & Communication Technology and a high emphasis on computer usage and office productivity and project management.

The topics include applying principles of effective communications, time management, interpersonal skills project management, product management, innovation management and finance management.

TRIMESTER I

COMMON CORE PROGRAMME

● Computer Architecture

This module focuses on the study of the hardware structure of computer systems and subsystems. Topics include: processor architecture, parallelism and pipelining, cache and memory organisation, I/O controllers and interconnection structures.

● Theory of Operating Systems

This module covers operating system design concepts with examples from the Linux and Windows operating systems. The topics covered (tentatively) include operating system structures, process and thread management, process synchronisation and communication, memory management, virtual memory, file system, I/O subsystem and device management, communication, protection and security.

● Database Technologies

This module focuses on the theory of database engineering. The module includes topics like file processing, some introductory data structures, the differences between file processing and database processing, fundamental concepts of the relational model, normalisation of data, database integrity issues, database design, SQL and an overview of the functions of a database management system.

● Data Communication and Networking

In this module, the emphasis will be on developing an understanding of the underlying principles of data communications and networking. The student will learn the concepts and terminology of data communications and networking. It covers topics on communication models, network protocols, standards, LANs, WANs, the internet, intranet and networking applications.

TRIMESTER II

ADVANCED TECHNOLOGY PROGRAMME I

● Switching and Routing Technologies

This module introduces the general concepts of switching and routing involved in the communication networks. It covers circuit switching, packet switching, frame relay, internetworking, congestion control in data networks, mechanisms of static and dynamic routing and associated algorithms.

● LAN Protocols and Bridging

This module introduces various LAN protocols and technologies involved by the usage of bridges and switches for LAN applications. The topics covered include LAN protocols, bridging and switching for LAN, VLANs and LAN emulation.

● Internet Protocols

This module focuses on internet protocols and various other services and protocols associated with it. The topics covered include TCP/IP protocol and associated services/protocols such as subnetting, CIDR, ARP, NAT, DNS, BOOTP, DHCP, ICMP, Telnet, FTP, TFTP. It also covers IP routing protocols such as OSPF, BGP, EIGRP, RIP, etc.

● Network Management and Security

This module focuses on the concepts of administration, management and security issues involved in widely deployed

networks. The topics to be covered include network design, network management, network traffic and security management, protocols like SNMP and RSVP. It also includes study of installation, configuration, administration and management of Windows.

● Network Programming

This module prepares the students with network programming concepts and developing applications under Windows/Linux environment using sockets. The topics include networking, TCP/IP protocol suite, sockets programming, the internet and its protocols, WAP and web programming, security and other network programming APIs.

TRIMESTER III

ADVANCED TECHNOLOGY PROGRAMME II

● Optical Networking

This module focuses on fiber optic technologies and networks. The topics covered include fiber optic communication technologies, Dense Wavelength Division Multiplexing (DWDM), SONET/SDH and integrated optics.

● Wireless Networking

This module focuses on wireless technologies and wireless networks. The topics covered include principle of wireless systems, design and networking, issues involved in LAN and WAN applications for fixed and mobile wireless systems and wireless network security.

● Broadband Technologies

This module focuses on state-of-the-art broadband technologies and broadband networks. The topics to be covered include Asynchronous Transfer Mode (ATM), Integrated Services Digital Network (ISDN), Virtual Private Networks (VAN), leased lines, dial-up networking and Digital Subscriber Lines (DSL).

● Voice/Data Integration Technologies

This module provides an overview of technologies and applications of integrated voice/data networking. It covers study of advanced voice communication techniques such as voice over IP, voice over ATM, voice and data compression techniques and Media Gateway Control Protocol.

● Applications of Networking and Telecom

This module focuses on use of various protocols and technologies studied so far in practical applications. It covers transmission and telco services, building and managing internet data centers, case studies for internet service providers, enterprise network design and other challenging applications.

TRIMESTER IV

RESEARCH PROGRAMME

The research programme leading to masters level competency includes researching on the given/chosen seminar topic, which will generally be a state-of-the-art in the field and then delivering the seminar to peer and faculty along with its documentation in the prescribed IEEE format. Following the seminar the student has to undertake research project under the guidance of tenure/visiting faculty/industry experts. The research project has to be submitted in the form of a dissertation, which will be examined by the experts nominated by the institution. The research project is the culmination of students learning in the institute and is expected to be of high standards as demanded from the institute from time to time.

The Institute reserves the rights to change / revise the course contents as per the prevailing market conditions and technological advances.



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Master of Science Programme in Advanced Information Technology (MSP-AIT)

with specialisation in

Advanced Networking and Telecommunications

An autonomous full-time Master's Programme (18 months)

Internet and telecom infrastructure have emerged as drivers for a knowledge-based economy. The modern information infrastructure covering Global Information Infrastructure (GII), National Information Infrastructure (NII), Wide Area Networks (WANs), Metropolitan Area Networks (MANs) and Local Area Networks (LANs), must provide multiservices over these networks with Quality of Service (QoS) and security as demanded by corporates, institutions and individuals. Convergence is redefining the traditional boundaries of voice, video and data services. The entire field is in great flux and there are technological, economic and regulation challenges. This course provides a comprehensive, theoretical, practical and real-life knowledge of advanced networking and telecommunications as demanded by the industry today, and for the future.

THE PROGRAMME

This four trimester full-time Master of Science Programme is designed, developed and delivered by experts from the networking and telecommunication industries under the inspiring guidance of an internationally acclaimed panel of visionary leaders and innovators in the field of Information Technology. It is designed to cater to market needs by providing practical knowledge of state-of-the-art Internetworking and Telecommunication Technologies, Advanced Network Security, Network Management and Administration.

DISTINCTIVE FEATURES

- Theory and laboratory sessions to gain experience of practical situations in LAN/WAN/MAN/ carrier class networks and convergence technologies
- Exposure to various tools to understand and practice network programming, network management and network security
- Expert lectures, seminars and case studies by leading experts from industries

ELIGIBILITY

- Graduates with a Bachelor's Degree (with minimum 50% marks) of atleast four years' duration in Electrical/Electronics/Communication/Information Technology/Computer Science or equivalent
- Basic knowledge of Data Communication and Networking
- Sound computing background in C and C++ languages
- See insert on "Selection and Admission Procedure" for more details

COURSE COMMENCEMENT

The course commences in June / September / January

EVALUATION AND CERTIFICATION

- Periodic evaluation and performance improvement programme
- Module-wise credits
- Balanced assessment based on internals, examination and project
- Detailed transcripts along with certificate

PLACEMENT ASSISTANCE

- Career guidance at the institute
- Pre-placement facilitation/development
- Active liaison with companies in Infotech Park
- Campus interviews by leading industries in India

CURRICULUM

TRIMESTER I (4 months)

COMMON FOUNDATION PROGRAMME

- **CC 100: Self-Management and Leadership (2 CREDITS)**

This module helps each student to understand oneself and to

develop leadership qualities. The student will be taught yoga of well-being, meditation techniques, self management and leadership, team building, sports, gym and creative arts.

- **CC 101: Foreign Language (Level 1)**

This module is designed for students aspiring to learn a foreign language for business communication to avail of global career opportunities. An English language course will be a pre-requisite for foreign students who do not have proficiency in English.

- **CC 102: ICT Business Management (1 CREDIT)**

This module provides students with basic management skills for performing in Information & Communication Technology with a high emphasis on computer usage and office productivity and project management.

The topics include applying principles of effective communications, time management, interpersonal skills project management, product management, innovation management and finance management.

COMMON CORE PROGRAMME

- **AST 501: Theory of Operating Systems (3 CREDITS)**

This module covers operating system design concepts with examples from the Linux and Windows operating systems. The topics (tentatively) include operating system structures, process and thread management, process synchronisation and communication, memory management, virtual memory, file system, I/O subsystem and device management, communication, protection and security.

- **AST 502: Database Technologies (3 CREDITS)**

This module focuses on the theory of database engineering. The module includes topics like file processing, introductory data structures, the differences between file processing and database processing, fundamental concepts of the relational model, normalisation of data, database integrity issues, database design, SQL and an overview of the functions of a database management system.

- **AST 503 : Computer Architecture (3 CREDITS)**

This module focuses on the study of the hardware structure of computer systems and subsystems. Topics include : processor architecture, parallelism and pipelining, cache and memory organisation, I/O controllers and interconnection structures.

- **NT 503: Data Communication and Networking (3 CREDITS)**

In this module, the emphasis will be on developing an understanding of the underlying principles of data communications and networking. The student will learn fundamental concepts of data communications and networking. Topics include communication models, network protocols, standards, LANs, WANs, the internet, intranet and networking applications.

● **NT 504: Project (3 CREDITS)**

A project has to be submitted in the form of a dissertation, which will be examined by experts nominated by the institute

TRIMESTER II (4 months)

ADVANCED TECHNOLOGY PROGRAMME I

● **CC 101: Foreign Language (Level 2)**

This module is designed for students aspiring to learn a foreign language for business communication to avail of global career opportunities. An English language course will be a pre-requisite for foreign students who do not have proficiency in English.

● **NT 601: Digital Communication (3 CREDITS)**

Waveform characterization and modeling of speech/image sources; quantization of signals; uniform, non-uniform adaptive quantization; pulse code modulation (PCM) systems; differential PCM (DPCM); linear prediction theory; delta modulation and sigma-delta modulation systems; sub-band coding with emphasis on speech and audio coding; data compression methods like Huffman coding, Ziv-Lempel coding and arithmetic coding.

● **NT 602: Switching and Routing Technologies (3 CREDITS)**

This module introduces the general concepts of switching and routing involved in the communication networks. It covers circuit switching, packet switching, frame relay, internetworking, congestion control in data networks, mechanisms of static and dynamic routing and associated algorithms.

● **NT 603: Internet Protocols (3 CREDITS)**

This module focuses on internet protocols and various other services and protocols associated with it. The topics covered include TCP/IP protocol and associated services/protocols such as subnetting, CIDR, ARP, NAT, DNS, BOOTP, DHCP, ICMP, Telnet, FTP, TFTP. It also covers IP routing protocols such as OSPF, BGP, EIGRP, RIP, etc.

● **NT 607: LAN Protocols and Bridging (3 CREDITS)**

This module introduces various LAN protocols and technologies involved by the usage of bridges and switches for LAN applications. The topics include LAN protocols, bridging and switching for LAN, VLANs and LAN emulation.

● **NT 608: Server Administration and Management (3 CREDITS)**

This module prepares the students with network programming concepts and developing applications under Windows/Linux environment using sockets. The topics include networking, TCP/IP protocol suite, sockets programming, the internet and its protocols, WAP and web programming, security and other network programming APIs.

● **NT 609: Network Programming (3 CREDITS)**

This module prepares the students with network programming concepts and developing applications under Windows/Linux environment using sockets. The topics include networking, TCP/IP protocol suite, sockets programming, the internet and its protocols, WAP and web programming, security and other network programming APIs.

● **NT 704: Advanced Operating System Concepts (3 CREDITS)**

The topics include advanced operating system structures, process and thread management, process synchronization and communication, memory management, virtual memory, file system, I/O subsystem and device management, communication, protection and advanced security.

TRIMESTER III (4 months)

ADVANCED TECHNOLOGY PROGRAMME II

● **CC 101: Foreign Language (Level 3)**

This module is designed for students aspiring to learn a foreign language for business communication to avail of global career opportunities. An English language course will be a pre-requisite for foreign students who do not have proficiency in English.

● **NT 800: RESEARCH PROGRAMME (20 CREDITS)**

The research programme leading to master's level competency

includes researching on the given/chosen seminar topic, which will generally be state-of-the-art in the field and then delivering the seminar to peers and faculty along with its documentation in the prescribed IEEE format. Following the seminar the student has to undertake a research project under the guidance of tenure track/visiting faculty and industry experts. The research project has to be submitted in the form of a dissertation, which will be examined by experts nominated by the institute. The research project is the culmination of the student's learning in the institute and is expected to be of high standards as demanded by the industry from time to time.

TRIMESTER IV (6 months)

● **NT 600: Broadband Technologies (3 CREDITS)**

This module focuses on state-of-the-art broadband technologies and broadband networks. The topics to be covered include Asynchronous Transfer Mode (ATM), Integrated Services Digital Network (ISDN), Virtual Private Networks (VPN), leased lines, dial-up networking and Digital Subscriber Lines (DSL).

● **NT 604: Network Management and Security (3 CREDITS)**

This module focuses on the concepts of administration, management and security issues involved in widely deployed networks. The topics to be covered include network design, network management, network traffic and security management, protocols like SNMP and RSVP. It also includes study of installation, configuration, administration and management of Windows.

● **NT 605: Wireless Networking (3 CREDITS)**

This module focuses on wireless technologies and wireless networks. The topics covered include principle of wireless systems, design and networking, issues involved in LAN and WAN applications for fixed and mobile wireless systems and wireless network security.

● **NT 606: Optical Networking (3 CREDITS)**

This module focuses on fibre optic technologies and networks. The topics covered include fibre optic communication technologies, Dense Wavelength Division Multiplexing (DWDM), SONET/SDH and integrated optics.

● **NT 611: Applications of Networking and Telecom (3 CREDITS)**

This module focuses on use of various protocols and technologies studied so far in practical applications. It covers transmission and telco services, building and managing internet data centres, case studies for internet service providers, enterprise network design and other challenging applications.

● **NT 700: Multimedia Technologies (3 CREDITS)**

The objective of this course is to introduce current techniques in multimedia communications especially as applied to wireless networks. The course will introduce the basic issues in multimedia communications and networking. Topics covered include: Multimedia information representation – text, images, audio, video; Introduction to Information Theory – information of a source, average information of a discrete memoryless source, source coding for memoryless sources; Multimedia compression – text, image, audio, video; Standards for multimedia communications; Transmissions and protocols; Circuit switched networks; the Internet; broadband ATM networks; Packet video in the Network environment; Transport protocols – TCP/IP; TCP; UDP; RTP and RTCP; Wireless networks – models, characteristics; Error resilience for wireless networks.

● **NT 701: Next Generation Networks (3 CREDITS)**

VoIP, VoATM, VoDSL, WLANs, Next generation OSSs, Media and Access Gateways, Voice, video and data services, Next generation mobile networks, Multiservice switching and Transmission networks, fibre access, Fixed wireless access, satellite access, Optical Networks, Access and devices, Softswitch technology, Neural networks for optimization and signal processing

TOTAL COURSE CREDITS : 79

NOTE : Foreign language is an independent certificate programme, compulsory for all the students.



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Master of Science Program in Advanced Information Technology (MSP-AIT)

with specialization in

Networking and Telecommunications (Incorporating Wireless Technologies)

An autonomous full-time residential Master's Program (18 months)

*"The next big killer application on the internet is going to be education.
Education over the internet is going to be so big it is going to make
e-mail usage look like a rounding error"* – John Chambers

Modern information infrastructure that covers Global Information Infrastructure (GII), National Information Infrastructure (NII), Wide Area Networks (WANs), Metropolitan Area Networks (MANs) and Local Area Networks (LANs) must provide multiple services with Quality of Service (QoS) and security as demanded by corporates, institutions and individuals. Convergence is redefining the boundaries of data, voice and video services. Wireless network systems designed to GSM and IS-95 standards have been deployed worldwide in the past decade for providing value-added applications and services on these systems. The evolution of 2G technologies to 3G and 4G poses interesting technological and business challenges, as the deployment of broadband networks grows aggressively. As multiple technologies such as Bluetooth, WiFi, WiMax are deployed, service providers are focusing on revenue enhancement opportunities by offering 'Triple Play' (data, voice and video) and other applications over broadband wired and wireless networks. As networks become more complex and use multiple technologies, it is now imperative for service providers to manage these networks efficiently. Issues related to Network Management and Operations Support Systems (OSS) will be dealt with in detail in this program. The program also covers Extended Telecom Operations Map (eTOM) and provides comprehensive, theoretical, practical and real life knowledge of advanced networking and telecom and wireless technologies as demanded by the industry today and for the future.

THE PROGRAM

This four trimester, 18 months program of 60 credits is designed to equip students to accept design, development, testing of wireless systems, deployment & management of infrastructure, application development for providing variety of services in the areas of,

- Intelligent Networks
- 3G/4G Wireless Networks
- Broadband Technologies
- Telecom Business Management

PROGRAM STRUCTURE

- Completion of the program requires 60 credits
- Course work and laboratory assignments
- Industry or research project

PROGRAM PEDAGOGY

All courses are designed to address the key areas like theoretical foundation, practical relevance and the real life problem solving approach. To achieve that courses will be delivered using collaborative learning process through class room lectures, laboratory sessions, assignments, student seminars, lectures by industry experts, case studies, relevant industry visits and research / industry projects.

DISTINCTIVE FEATURES

- Theory and laboratory sessions to gain experience of practical situations in carrier class networks and convergence technologies.
- Working with the latest networking and telecom hardware and software tools in the laboratories.
- An option to work on projects which require working with faculty members and students from other streams such as advanced software technologies, embedded systems, VLSI and ICT business management.
- Expert lectures, seminars and case studies by leading experts from industries

ELIGIBILITY

- Graduates with a Bachelor's degree (with minimum 50 percent marks) of at least four years' duration in Electrical/Electronics/

Communication/Information Technology/Computer Science or equivalent

- Basic knowledge of Data Communication and Networking
- Sound computing background in C and C++ languages
- See insert on 'Selection and Admission Procedure' for more details

PROGRAM COMMENCEMENT

The program commences in June / September / January

EVALUATION AND CERTIFICATION

- Periodic evaluation and performance improvement program
- Course-wise credits
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PLACEMENT ASSISTANCE

- Career guidance at the institute
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- Active interface with technology and user companies

CURRICULUM

BASIC COURSES

• COM001: LIFE SKILLS DEVELOPMENT

This basic course prepares students for the rigors of the Masters' level program and professional careers that will follow. The course is divided into 9 sections, which will be conducted throughout the program.

The course stresses on: communication and presentation, leadership development, working in teams, time management, negotiation skills, stress management through yoga, multicultural and diversity management and offsite experiential learning. The ultimate objective of this course is to develop individuals with high Intelligence, Emotional and Spiritual Quotients (IQ, EQ and SQ).

COM002: FOREIGN LANGUAGE (LEVEL 1)

In order to equip students to take up global careers, a choice of foreign languages as a major subject is offered. Medium of instruction is English.

BRIDGE COURSES

- Keeping in view the diverse background of students, variety of bridge courses are offered to attain the requisite level of competency for further learning.
- Students will undergo entrance examination and interview as a part of selection process. Depending on the performance, students will be advised to undergo bridge courses.
- Duration of the bridge courses is 4 weeks prior to the beginning of the academic term.
- **AST001: COMPUTER ARCHITECTURE AND OPERATING SYSTEMS**

This course covers operating system design concepts with examples from Linux and Windows operating system. It also focuses on the study of the hardware structure of computer systems and sub-systems. The topics in operating system include: operating system structures, process and thread management, memory management, virtual memory, file system, I/O subsystem and device communication. Protection and Security management. The topics in computer architecture include: processor architecture, parallelism and pipelining, cache and memory organization, I/O controllers and interconnection structures.

- **AST002: DATABASE TECHNOLOGIES**

This course focuses on the theory of database engineering. The course includes topics like file processing, introductory data structures, the differences between file processing and database processing, fundamental concepts of the relational model, normalization of data, database integrity issues, database design, SQL and an overview of the functions of a database management systems.

- **NTW001: DATA COMMUNICATIONS AND NETWORKING**

This course will emphasis on developing an understanding of the underlying principles of data communications and networking. The student will learn fundamental concepts of data communications and networking. Topics include communication models, network protocols, standards, LANs, WANs, the internet, intranet and networking applications.

- **NTW002: SIGNALS AND SYSTEMS**

This course deals with the representation of signals and systems, system properties, mathematical models of continuous-time and discrete-time signals and systems, time-domain and frequency domain concepts, sampling, laplace and z-transforms, transfer functions and frequency response, convolution, stability, Fourier series and Fourier transform, AM/FM modulation, Filtering, applications to signal processing and communication systems.

FOUNDATION COURSES

- **NTW501: NETWORK TECHNOLOGIES AND PROTOCOLS (4 Credits)**

This course provides an understanding of Local Area Network (LAN) as well as Internet technologies and in-depth knowledge of Ethernet, Token ring, FDDI networks, LAN switching and bridging, ATM LANs, VLANs, Gigabit Ethernet and case studies, LAN Emulation, Wireless LANs, Quality of Service (QoS) concepts, Introduction to Internet protocols, Advanced IP addressing such as VLSM, CIDR and subnetting, IPv4 and IPv6, Mobile IP, Access lists, ATM and Frame relay networks, associated protocols and services such as FTP, TFTP, ARP, RARP, NAT, DHCP, DNS, BOOTP, Introduction to VPN

- **NTW502: ROUTING ALGORITHMS AND PROTOCOLS (3 Credits)**

This course covers concepts, technologies, and protocols involved in routing of the packets over an Internet. It covers topics such as static and dynamic routing algorithms, multi-protocol routers and their associated interior and exterior protocols used in practical applications, Route redistribution, route filtering and mapping, and access lists. Important protocols covered are RIP, IGRP, EIGRP, OSPF, BGP, ICMP, IGMP, etc.

- **NTW503: PERFORMANCE EVALUATION OF TELECOM NETWORKS (3 Credits)**

This course focuses on fundamentals of performance evaluation techniques: measurement, simulation and analytical modeling. The main focus will be analytical modeling - probability models, Markov models, queuing models, stochastic processes, Quality of Service (QoS) parameters, queuing delays in MIMO Networks. Traffic analysis and modeling will also be covered along with relevant case studies.

- **NTW504: WIRELESS COMMUNICATIONS (3 Credits)**

This course begins with discussion on antennas and propagation, spread spectrum theory, cellular mobile telephone architecture, characterization of wireless channel, including path loss for different environments, multi-path fading. It also covers modulation techniques and wireless channel impairments, frequency assignments, frequency reuse, concept of cell splitting and handover with respect to cellular systems. System architecture, call management and system functioning in GSM and CDMA.

- **NTW505: NETWORKING AND TELECOM LAB (2 Credits)**

This laboratory consists of experiments on configuration of various switches, routers, VLAN configuration, various LAN and IP protocols such as static routing protocols, RIP, IGRP, OSPF. Several simulators are available for configuration of VPN, wireless communications and analytical modeling of telecommunication networks.

CORE COURSES

- **NTW601: OPTICAL NETWORKS (3 Credits)**

This course provides an understanding of the role of optical fiber systems in networking and telecommunications. The students will learn concepts of optical networks for LAN, MAN, WAN, and access network applications. The course covers SONET/SDH Networks, DWDM Technologies along with FDDI for MAN, Gigabit and metro Ethernet, fiber channel for SAN applications, wavelength assignment and routing algorithms, Passive Optical Networks (PONs), Fiber to the home (FTTH), Fiber to the Curb (FTTC), optical burst switching and packet switching, MPLS for future all optical routing and related state of the art topics.

- **NTW602: MULTIMEDIA TECHNOLOGIES (2 Credits)**

This course covers compression algorithms as well as integration techniques offering Triple play (data, voice and video) multimedia systems and configurations, storage technologies, multimedia applications, multimedia communication technologies (such as frame relay, ISDN, FDDI, SONET, ATM, B-ISDN), advanced voice communication techniques such as voice over IP, voice over ATM, Media Gateway Control (MGCP) Protocol, H.323, SIP and future of multimedia services.

- **NTW603: NETWORK MANAGEMENT AND SECURITY (3 Credits)**

This course covers concepts of network administration, management and security issues involved in widely deployed networks, network performance measurements. It also includes study of protocols such as SNMP, RSVP, UDP, traffic shaping, congestion management tools. Security threats, types of attacks, security and firewall technologies, proxy services, Hashing, DES, DES3, Introduction to VPN, tunneling protocol, introduction to IPSEC, public key encryption, cryptography, authentication technologies such as RADIUS, AAA.

- **NTW604: NETWORK PROGRAMMING (2 Credits)**

This course prepares students with network programming concepts and developing applications under Windows/Linux environment using sockets. The topics include networking, TCP/IP protocol suite, sockets programming, the internet and its protocols, WAP and web programming, security and other network programming APIs.

ELECTIVE-1 Select any ONE from the following list as per the stream of specialization

Each student has to select a specialization stream as per his (or her) carrier path. Elective courses are offered as per specialization streams.

NETWORKING AND TELECOM STREAM

● NTW801: NETWORK ENGINEERING (2 Credits)

This course covers network planning, dimensioning and network design issues for core as well as access part of the network. Study of pre-installation requirements, traffic classification, traffic attributes, traffic conditioning, load balancing, QoS requirements, RF planning etc. It also discusses about hierarchical designs, design models for LANs and WANs, remote access design, tag switching, MPLS based designs, power budget, traffic monitoring and optimizing network performance and relevant case studies.

WIRELESS COMMUNICATIONS STREAM

● NTW802: WIRELESS LAN TECHNOLOGIES (2 Credits)

This course provides in-depth knowledge of various wireless LAN technologies such as Bluetooth, WiFi, WiMax and relevant standards such as IEEE 802.11 will be covered. Various frame types and formats, addressing mechanisms, spread spectrum techniques will be discussed. Concept of mobile IP, mobility, Quality of Service (QoS) as well as LAN performance measurement will also be covered.

● NTW605: NETWORKING AND TELECOM LAB (2 Credits)

This laboratory consists of experiments on various network and congestion management tools and security aspects of networks. CDMA and GSM simulators as well as hardware devices such as routers, bridges, wireless access points, wireless devices are available for configuring and testing various aspects of network engineering, wireless LAN technologies and optical networking.

● NTW901: MINI PROJECT (2 Credits)

Students are expected to undertake a project that includes an extensive literature survey and/or design and development of system. An internal faculty guides the project. The project has to be submitted in the form of a report, which will be examined by experts nominated by the institute.

ADVANCED COURSES

● NTW701: OPERATION SUPPORT SYSTEMS (2 Credits)

This course covers OSS and BSS features and their integration aspects. It includes analysis, mediation and provisioning for fraud management, inventory management and trouble ticketing. It covers unified messaging service, billing systems, decision support systems, customer care etc. using middle ware such as TIBCO and CORBA.

● NTW702: PROTOCOL ARCHITECTURE AND APPLICATIONS (3 Credits)

This course covers topics on protocol structure, error control, flow control, specification and modeling. Also covers concepts of protocol validation, validation models, correctness requirements, protocol design rules, finite state machines, conformance testing, synthesis and validation. Introduction to key protocols such as SS7 protocol suite, VoIP protocols such as MEGACO, MGCP, SIP, LAPD, LAPB, MPLS and their applications.

● NTW703: BROADBAND TECHNOLOGIES (3 Credits)

This course focuses on the principle and need of broadband, state-of-the-art broadband standards, technologies and networks. The topics covered include wire-line broadband access such as digital subscriber lines (DSL), leased lines, Integrated Services Digital Network (ISDN), Asynchronous Transfer Mode (ATM), B-ISDN, DOCSIS standards, various Customer Premises Equipment (CPE), Home Network Solution (HNS), wireless broadband access technologies: LMDS, MMDS, satellite and core supporting networks.

ELECTIVE-2 Select any ONE from the following list as per the stream of specialization

NETWORKING AND TELECOM STREAM

● NTW803: INTELLIGENT NETWORKS (2 Credits)

This course covers trunk signaling in wire-line networks, signaling in wireless networks such as call set-up, roaming, feature control, applications signaling, details study of SS7 link types, SS7 protocol suite and functions, SS7 translation, SS7 network planning & engineering, operational issues, intelligent networks (AIN, INAP), SS7 in wireless networks (CAMEL, WIN), applications and CNAIP,

SS7 in IP and broadband networks, soft switching, future of intelligent networks.

● NTW804: SERVER ADMINISTRATION AND MANAGEMENT (2 Credits)

This module focuses on the aspects of various Server Administration and Management techniques. The topics to be covered include Installation, Configuration, Administration and Management of Windows 2000, Exchange 2000, and Linux.

WIRELESS COMMUNICATIONS STREAM

● NTW805: DIGITAL SIGNAL PROCESSING (2 Credits)

This course introduces the basics of discrete time signals and systems, and covers the system characterization in time and frequency domains, discrete time Fourier transform (DTFT), DFT, FFT, Z-transform, A/D, D/A converter, digital signal processing of continuous time signals, digital filter design (FIR and IIR), digital spectral analyses of signals, and application of non-uniformly sampled signals. This module also includes software implementation of DSP algorithms as applied to wireless communication systems in the form of mini project.

● NTW806: 3G/4G WIRELESS NETWORKS (2 Credits)

This course begins with the discussion of supporting voice, video, and high-speed data applications on the wireless networks. Study of 2.5G technologies such as GPRS and CDMA-1X RTT and evolution of 2.5G technologies to 3G such as WCDMA, CDMA2000, & UMTS, and 4G technologies and relevant standards are studied for planning, deployment, and security.

ELECTIVE-3 Select any ONE from the following list as per the stream of specialization

NETWORKING AND TELECOM STREAM

● AST701: INFORMATION SECURITY MANAGEMENT (2 Credits)

Introduction: Types of security violations, basic security concepts; security threats - intruders, viruses, worms, ethical hacking, spoofing, sniffing; physical and environment security; network security- Firewall, Intrusion Detection System (IDS), scanner, Virtual Private Networks (VPN); network security management; Authentication Authorization and Accounting (AAA) - access control principles and objectives, network authentication, application authentication, hardware based, software based; Internet security and protocol: risk management and business continuity planning; security policy, standards, and organization; data cryptography - introduction, various symmetric and asymmetric encryption algorithms; software security - Secure Software Architecture.

● NTW807: TELECOM BUSINESS MANAGEMENT (2 Credits)

This course covers network rollout, capital expenditure, operational expenditure considerations, return on investments, payback period, brand management: services, advertisements, spectrum management and auction, project management, time management, man power management, cost management and validation, OSS/BSS aspects and architecture, order management, billing, inventory, customer care and also integration of applications using middle ware like TIBCO, We Methods, Vitria, and CORBA.

● NTW808: SPECIAL TOPICS IN NETWORKING AND TELECOM (2 credits)

Suitable topics will be offered time to time by concerned faculty in the upcoming areas in Networking and Telecommunications.

WIRELESS COMMUNICATIONS STREAM

● NTW809: EMBEDDED SYSTEM DESIGN FOR WIRELESS (2 Credits)

This course covers embedded system design issues, challenges and trends in embedded systems, assemblers, compilers, linkers, loaders, debuggers, profilers & test coverage tools, utilities like make, ranlib, objcopy and objdump, configuring and building GNU cross-tool chain, and building RTOS/EOS image for target hardware. It also includes porting RTOS and embedded operating systems, writing time and space sensitive programs, and writing device drivers. Suitable mini-project will be given as applied to wireless communication systems.

- **NTW810: CDMA/ UMTS NETWORK PLANNING AND OPTIMIZATION (2 Credits)**

This course covers issues such as RF network planning activities for CDMA/UMTS networks, CDMA air interface standard such as IS-95 or CDMA-2000 and UMTS link budgeting, propagation models, traffic modeling, soft hand-off control, hard hand-off planning, spectrum planning, site selection criterion, case study example, available network planning tools, performance matrices, analysis and troubleshooting of common network problems, testing and tuning of CDMA-2000/ UMTS network, IS-707A packet data services, simple and mobile IP, mobility management, wireless internet optimization. Relevant case studies will be given to support the concepts taught.

- **NTW811: SPECIAL TOPICS IN WIRELESS COMMUNICATIONS (2 Credits)**

Suitable topics will be offered time to time by concerned faculty in the upcoming areas in wireless communication.

- **NTW704: NETWORKING AND TELECOM LAB (2 Credits)**

This laboratory consists of experiments on server administration, digital signal processing, ISDN, broadband technologies, Ad Hoc wireless networks. Simulators/ trainers as well as hardware devices such as wireless routers, wireless access points, wireless bridges are available for configuration and testing of wireless networks.

PROJECT

- **NTW902: PROJECT (15 Credits)**

Students can take up an industry-sponsored project or a research based in-house project leading to Master's level competency.

For industry-sponsored projects, the Career Management Center facilitates interaction between students and the industry. Students are encouraged to work on projects which will enhance their understanding in certain technology domains in real-life scenario.

The research project includes researching on the given/chosen seminar topic which will generally be state-of-the-art in the field and then deliver the seminar to peers and faculty along with its documentation in the prescribed IEEE format. Following the seminar the student has to undertake a research project under the guidance of tenure track/visiting faculty/and industry experts. The research project has to be submitted in the form of a dissertation, which will be examined by experts nominated by the institute. The research project is the culmination of the student's learning in the institute and is expected to be of high standards as demanded by the industry from time to time.

TOTAL COURSE CREDITS: 60

NOTE : Foreign language is an independent certificate program, compulsory for all students

