

MS Program in Advanced Computing Technologies

Course Structure

	Code	Course Name	Credits*
BRIDGE	AST001	Computer Architecture & Operating System	
	AST002	Database Technology	
	AST003	Data Structures & Algorithms using C	
	NTC002	Computer Networks	
FOUNDATION	ACT501	Computer Architecture Evolution	2
	ACT502	Discrete Mathematics	2
	ACT503	Statistical Methods for Advanced Computing	1
	ACT504	System Programming – I	2
	ACT505	Database Application Design	2
	ACT506	Advanced C++ Programming	2
	ACT507	Java Programming- I	2
	ACT508	Seminar - I	1
CORE	ACT601	Chip-Multi Processor Architecture	2
	ACT602	Graph Theory and Algorithms	2
	ACT603	Design and Analysis of Algorithms	3
	ACT604	Design and Analysis of Parallel Algorithms	3
	ACT605	Theory of Compiler Design	2
	ACT606	System Programming – II	2
	ACT607	Concurrent and Parallel Programming	3
	ACT608	Java Programming – II	2
	ACT609	Seminar - II	1
ADVANCED	ACT701	Middleware and Messaging	2
	ACT702	High Performance Computing	2
	ACT703	Intelligent System	2
	ACT704	Multithreaded Parallelism: Languages and Compilers	2
	ACT705	Distributed and Cluster Computing	2
	ESD806	Graphics and Visualization	2
ELECTIVES	ACT801	Programming Environment for Multi-Core Architecture	2
	ACT802	Multi-Core Application Development	2
	ACT803	Embedded System Design around Chip-Multiprocessor Architecture	2
	ACT804	Game Programming	2
	ACT805	Grid Computing	2
	ACT806	Data Mining Application in Parallel Computing	2
	ACT807	Scientific and Technical Computing	2
	ACT808	Enterprise Computing	2
	ACT809	HPC Infrastructure: Design, Implementation and Management	2
	ACT810	Advances in Operating Systems Design	2
	ACT811	Advances in Compiler Construction	2
PROJECT	ACT901	Mini Project	2
	ACT902	Project	18

* 1 Credit Hr = 16 Class Hrs / 32 Lab Hrs in a semester

MS Program in Networking and Telecommunications

'A world linked by high-quality personalized video generating 15 exabytes (an exabyte equals a billion gigabytes) per month in Internet traffic by 2010, using technologies such as telepresence'

**- A world envisioned by John Chambers,
Chairman and CEO, Cisco Systems in ITU Telecom World 2006**

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 high Quality of Service (QoS) and security as demanded by corporates, institutions and individuals. Convergence is redefining the boundaries of data, voice and video services. Consumer market for broadband applications such as combined voice, data, multimedia, video, gaming, voice over Internet Protocol (VoIP) and entertainment signal transport is growing at the drastic rates. Service providers are actively moving towards IP-based Next-Generation Networks (NGNs), where transport over existing TDM infrastructure is being replaced with transport over IP infrastructure with very high QoS quality. IP Multimedia Subsystem (IMS) is emerging as the industry standard of choice for the NGNs. Such convergence of communication networks is posing interesting technological and business challenges, as the deployment of broadband networks grows aggressively. Service providers need to protect their existing investment while upgrading to IP systems. They are focusing on revenue enhancement opportunities by offering 'Triple Play' (data, voice and video) over broadband wired and wireless networks. Before 'Triple Play' gets stabilized in the market, the developments on 'Multiple Play' are already started. The forecast projects 80 million IPTV subscribers by the end of 2010 with global IPTV revenue of \$28 billion. The revenue building promise brings to manufacturers, vendors, and operators, along with the questions concerning the practicalities of delivering these services, how to design the networks and manage them? How to bill consumers for them? And how to regulate an environment where telecommunications, computing and broadcasting are all combined on one platform. As networks become more complex and use multiple converged technologies, it is now imperative for service providers to manage these networks efficiently. This MS Program in Networking and Telecom is devised to prepare the students to handle all such challenges in the fastest growing networking and telecom industry. The program provides comprehensive, theoretical, practical and real life knowledge of advanced networking and telecom technologies as demanded by the industry today and for the future.

Program

This autonomous, four semester, 24-month, 72 Credits, full-time Masters Program in Networking and Telecommunications is designed to propel students to accept design, development, testing, deployment and management of infrastructure, and application development for providing variety of services in the areas of:

- ▬ Internet Technologies
- ▬ Telecom Technologies
- ▬ Next Generation Networks
- ▬ Broadband Communication Technologies
- ▬ Network Planning, Design, and Optimization
- ▬ Network Management and Security
- ▬ Communication Software Development

Program Structure

- ▬ Successful completion requires 72 Credits.
- ▬ To bridge the gap between theory and practice, project work worth 18 Credits in

the last semester.

- ▬ The entire curriculum is distributed over six levels to aim at transcending the students' level of understanding for corporate readiness. The levels are respectively, Bridge, Foundation, Core, Advanced, Electives and Project.
- ▬ As an option to the advanced courses of this program, a student can take total 9 Credits courses from any other suitable MSP / MBAP program provided they are fit for such courses.
- ▬ Students have to carry out one mini project in specified semester to consolidate the technical knowledge in the selected specialization stream.
- ▬ Students are required to take three electives during the program.
- ▬ To be eligible for MSP in Advanced Networking and Telecommunications, a student has to take minimum subjects worth 63 Credits from this stream out of 72 Credits.

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 state-of-the art networking and telecom hardware and software tools in the laboratories.
- ▬ Practical exposure on Computer Associates (CA) Network Management tools.
- ▬ Expert lectures, seminars and case studies

by leading experts from industries

- ▾ An option to work on projects that require working with faculty members and students from other streams such as advanced software technologies, embedded systems, VLSI and ICT business management.

Eligibility

- ▾ Graduates with a Bachelor's degree in Engineering/Technology (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
- ▾ Programming background in C and C++ is desirable

Program Commencement

The program commences in July / October.

Evaluation and Certification

- ▾ Continuous evaluation and performance improvement program
- ▾ Course-wise Credits
- ▾ Balanced assessment based on internals, mid-term test, laboratory, final theory examinations and project
- ▾ Detailed transcripts along with certificate

Placement Assistance

- ▾ Career guidance at the institute
- ▾ Pre-placement facilitation/development and Campus Interview by leading Industries
- ▾ Active interface with Technology and user companies

Selection Process

The selection of an applicant for the course is based on the following:

- ▾ Application forms shall be scrutinized for academic profile in line with the eligibility criteria.
- ▾ Score received at the Graduation level.
- ▾ Scores received at the 'Accepted Qualifying Examinations' like GRE / GMAT / XAT / CAT / GATE and Performance in the Entrance Test
- ▾ Personal Interview

Basic Courses

COM 001: LIFE SKILLS DEVELOPMENT

This basic course prepares students for the rigors of the master's level program and professional careers that will follow. The course is divided into 9 sections that 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).

COM 002: 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 courses is offered under bridge courses to attain the requisite level of competency for further learning.
- ▾ Students will undergo entrance examination and interview as part of selection process. Depending on the performance, students will be advised to undergo the bridge courses.
- ▾ Duration of the bridge courses is three weeks prior to the beginning of the academic term.
- ▾ Performance in the bridge course count towards appropriate weightage in relevant foundation courses.

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 systems, I/O subsystem and device communication, introduction to Linux commands and shell scripts knowledge of a Linux text editor,

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.

ESD002: 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, transfer functions and frequency response, convolution, stability, Fourier series and Fourier transform, Filtering, applications to signal processing and communication systems.

NTC001: COMMUNICATION SYSTEMS

This course refreshes the knowledge related to the communication technologies. It covers fundamentals of communication systems, continuous and pulse analog modulation techniques, sampling process, digital encoding techniques such as PCM, DPCM, DM, ADM, Vocoders, LPC, CW digital communication techniques such as BPSK, QPSK, source coding, line coding, channel coding, Shanons-Hartley theorem, radio wave propagation.

NTC002: COMPUTER NETWORKS

This course shall emphasis on developing an understanding of the underlying principles of computer networking. Students will learn fundamental concepts of communication protocol stacks: OSI and TCP/IP, IP addressing schemes, subnetting, LAN, MAN, WAN fundamentals, circuit and packets switching, multiplexing, networking devices, network protocols, standards, Internet, Intranet, network security and allied technologies.

Foundation Courses

NTC501: PROGRAMMING METHODOLOGIES

(3 Credits, T=2 L=1)

This course focuses on fundamental concepts of programming languages extensively required in the field of networking and telecommunications. It covers programming basic building blocks like analysis and design of algorithm, top-down - bottom up programming approaches, effective programming

techniques considering factors like performance, security etc, and debugging techniques. Concepts of data structures, object oriented programming, unified modeling language, rapid application development frameworks, C and C++ programming is also taught in the course. Several programming assignments will be given so as to acquire the necessary programming skills.

NT502: NETWORK TECHNOLOGIES AND PROTOCOLS (4 Credits, T=3 L=1)

This course provides an understanding of local area networks as well as internetworking technologies and the associated protocols. It focuses on the studies and experimentation for various data link, network, transport, and application layer protocols. It includes study of Ethernet, gigabit Ethernet, token ring and FDDI networks, switching and bridging concepts, Trunking protocol (VTP), Dynamic Trunking protocol (DTP), VLANs, ATM LANs and LAN emulation. Internet, transport and application layer protocols/services such as IPv4, IPv6, ICMP, IGMP, TCP, UDP, ARP, RARP, NAT, DHCP, DNS, BOOTP, FTP, TFTP, Telnet. Concepts of advanced IP addressing, VLSM, CIDR are also taught with the necessary examples and case studies.

NTC503: ROUTING ALGORITHMS AND PROTOCOLS (3 Credits, T=2 L=1)

This course covers concepts, technologies, and protocols involved in routing of the IP packets over an Internet. It covers detailed study of static and dynamic routing algorithms, interior gateway protocols such as RIP, IGRP, EIGRP, OSPF, IS-IS, exterior gateway protocols such as EGP and BGP, route redistribution, route filtering and mapping, and access lists. It also deals with fundamental IP routing design such as scalable IP routing using OSPF, EIGRP, and BGP. Role-played by important local and global agencies such as APNIC, NIXI in Internet addressing and routing is also covered. Several laboratory assignments and case studies will be given for the complete understanding of these technologies and protocols.

AST509: INTRODUCTION TO DATABASE DESIGN (2 Credits, T=1 L=1)

This course focuses on the introduction to database technologies used in networking

and telecom environments, with emphasis on the various aspects of database design with respect to relational modeling, normalization and object oriented relational approach. The practical implementations are to be delivered in Oracle10g. The course also introduces the differences among various database architectures like host based, client Server and distributed.

NTC504 SERVER ADMINISTRATION AND MANAGEMENT (3 Credits, T=2 L=1)

This module covers the various aspects of server administration and management techniques. The topics covered under this course are installation, configuration, administration and management of Windows 2000 advanced server, active directory services, DHCP and DNS servers; Scripting language Tcl / Tk, managing log reports, Linux based web server using Apache, proxy server using Squid, mail server using sendmail / qmail, Introduction to RADIUS and TACACS servers for user management.

NTC505 SEMINAR - I (1 Credit)

Students are required to deliver seminars on topics relevant to the networking and telecommunication domain to campus wide audience.

Core Courses

NTC601: WIRELESS COMMUNICATIONS (3 Credits, T=2 L=1)

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 wireless channel impairments, cellular spectrum, cellular channels assignments, frequency reuse, fundamentals of cdmaOne and GSM cellular networks, concepts of mobility and handover in wireless cellular networks. Fundamentals and overview of PAN, Infrared, Bluetooth, Zigbee, 802.11 standards, and other 2.5G/3G wireless technologies are also discussed.

NTC602: OPTICAL NETWORKS (3 Credits, T=2 L=1)

This course provides an understanding of the role of optical fiber systems in networking and telecommunications.

Students will learn concepts of optical networks for LAN, MAN, and WAN applications. The course covers SONET/SDH networks, layers, frame formats, floating frames, Virtual Tributaries, multiplexing, Add/drop multiplexers, synchronization, BITS, PRS, OAMP, Alarms, DWDM technologies for MAN, Gigabit and metro Ethernet, optical amplifiers, cross-connects, wavelength assignment and routing algorithms, optical burst switching and packet switching, OOO, architectures of optical packet switching networks, MPLS for all optical routing and related state-of-the-art topics.

NTC603: NETWORK MANAGEMENT AND SECURITY (3 Credits, T=2 L=1)

This course covers concepts of network administration, management, network performance measurements and security issues involved in widely deployed networks. Network Management includes study of protocols such as SNMPv1/v2, RSVP, concepts of traffic shaping, congestion management, event correlation, and introduction to various network management tools. The topics covered on network security include security threats, attacks, security and firewall technologies, proxy services, cryptography, hashing, DES3, tunneling protocols, TCP/IP stack fingerprint techniques, layered security approach, introduction to IPSEC, public key encryption, and authentication technologies.

NTC604: NETWORK PROGRAMMING (3 Credits, T=2 L=1)

This course mainly focuses on communication protocols such as TCP/IP, XNS, UUCP, and then covers various aspects of socket programming for TCP and UDP, implementation of iterative and concurrent servers, overview of the concept of network communication like TFTP, remote command execution, rlogin and inter process communication. This course includes classroom teaching followed by Lab with an intention of getting strong theoretical foundation as well as hands on experience on creating and using sockets. After the completion of this course, students will be able to implement vital networking applications in conformity with their respective RFC specifications.

AST603 SOFTWARE ENGINEERING AND PROJECT MANAGEMENT (2 Credits, T=1 L=1)

This course provides a comprehensive analysis of software engineering techniques and shows how they can be applied in practical software projects, all with an object-oriented approach. This course extensively covers software process technology, system integration, requirements management, software project management, verification and validation, risk analysis, pattern-based reuse, dependable systems development, distributed system engineering, and legacy systems.

NTC605: SEMINAR -II (1Credit)

Students are required to deliver a seminar on advanced topics preferably research based and relevant to the state-of-the-art networking and telecommunication technologies to campus wide audience.

Advanced Courses**NTC701: MULTIMEDIA TECHNOLOGIES (3 Credits, T=2 L=1)**

This course provides the knowledge of advances in the multimedia communication technologies. It covers multimedia compression algorithms such as LZ, JPEG, MPEG, H.261, as well as integration techniques for triple play (voice, data, and video) multimedia applications and streaming techniques, voice and multimedia over IP technologies, and allied protocols such as SIP, H.323, MGCP/MEGACO, SAP, SDP, RTP/RTCP, RTSP, multimedia over wireless networks and study of voice gateways and media servers.

NTC702: BROADBAND TECHNOLOGIES (3 Credits, T=2 L=1)

This course focuses on principles and the necessity of broadband technologies and networks. The topics covered include wire-line broadband access such as digital subscriber lines, leased lines, cable modems, integrated services Digital Network (ISDN), Asynchronous Transfer Mode, B-ISDN, DOCSIS standards, passive optical networks, FTTH and FTTx technologies, various customer premises equipments, home network solutions, introduction to wireless broadband access technologies: LMDS, MMDS, WLL, optical

wireless and allied technologies

NTC703: PROTOCOL ARCHITECTURE AND APPLICATIONS (3 Credits, T=2 L=1)

This course focuses on the architectural aspects, design and applications of protocols commonly used in communication engineering. It covers various protocol development methods, protocol specifications, concept of finite state machines, protocol verification and validation process, protocol conformance testing, protocol performance testing etc. Various case studies and assignments to support the protocol design process as well as actual protocol implementation would be given for commonly used Layer-2, Layer-3 and a few application layer protocols used in communication engineering. This subject also covers introduction to system development life cycle, software testing, manual and automated software testing and associated tools.

NTC704: NEXT GENERATION NETWORKS (3 Credits, T=2 L=1)

This course covers signaling in wire-line networks, Intelligent Network (IN) standards, and issues related to the converging telecommunication networks. It starts with the discussion with Signaling System Number-7 (SS7) protocol and its components, signaling units, and associated protocols such as MTPs, ISUP, SCCP, TCAP, INAP, MAP; intelligent networks (IN), IN conceptual model, Capability Sets, creation of services, AIN, SS7 over IP, soft switching, other IN architectures such as TINA, Parley. It also emphasizes on Next Generation Networks (NGNs), under which the convergence issues for PSTN/ISDN and various networking and telecom technologies and multiple play services, proposed architectures, IP Multimedia Subsystems (IMS) and associated services are discussed.

Electives

The complete sets of elective courses are as given below. Each student has to select the three elective courses during the program.

NTC811: NETWORK ENGINEERING (3 Credits, T=2 L=1)

This course covers the entire process of analyzing, planning and designing of the new network as well as characterizing and upgrading of an existing network based on Ipv4 and IPv6. It also covers logical and physical network design concepts along with hierarchical and non-hierarchical design models, design issues for core, distribution and access layers, traffic engineering concepts, queuing models, redundancy, addressing schemes and network performance measurement, study of pre-installation requirements, traffic classification, QoS, traffic conditioning, load balancing etc. It also discusses about campus and enterprise network design, remote access design, MPLS switching, traffic monitoring and optimizing network performance, supported by relevant case studies.

NTC812: TELECOM SWITCHING AND TRAFFIC ENGINEERING (3 Credits, T=2 L=1)

This course shall emphasize on developing an understanding of the underlying principles of telecommunication transmission, evolution of telecommunication systems, switching systems and networks, Circuit switching, stored program control, traffic engineering, grade of service, blocking probability, modeling of switching systems, stochastic processes, loss system and delay system models. This course also provides a comprehensive coverage of telephone network aspects discussing subscriber loop systems, switching hierarchy, numbering and charging plan.

ESD503: DIGITAL SIGNAL PROCESSING (3 Credits, T=2 L=1)

This course covers the system characterization in time and frequency domains, discrete time Fourier transform (DTFT), DFT, FFT, Z-transform, 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 communication systems.

NTC821: ADVANCED NETWORK MANAGEMENT AND SECURITY (3 Credits, T=2 L=1)

This course focuses on advanced network management and security aspects. It includes SNMPv3, remote monitoring, ADSL Management, Telecommunications Management Network (TMN), theory related to widely used network and enterprise information infrastructure management systems such as Computer Associate's Unicenter. Security aspects such as public key infrastructure, digital certificates, internet security protocols, email security, wireless application protocol (WAP) security, various User Authentication Mechanisms like Kerberos, single sign on, introduction to ethical hacking and allied topics

NTC822: STORAGE AREA NETWORKS (3 Credits, T=2 L=1)

The course emphasizes on the study of various technologies for data storage and handling at server level. The topics covered are hard disks, optical, storage tapes technologies, RAIDs, local versus remote data storage, data backup strategies and technologies, requirement of a separate data storage networks, network attached storage (NAS), storage area network (SAN), SCSI and I-SCSI, Fiber Channel (FC) protocols FC over TCP/IP, Internet FC, Data storage security.

NTC823: MULTIPLE PLAY SERVICES (3 Credits, T=2 L=1)

This course focuses on various issues involved in the convergence of the communication networks for multi play applications such as voice, data, multimedia, video, internet services, which are going to be deployed on the same network and brought to consumers home by using the same delivery platform by removing the traditional boundaries of exist between fixed-line and wireless. The course covers issues, challenges for the next generation, high-QoS broadband IP networks convergence with traditional PSTN, DSL, ATM, CATV, PANS, WLAN, wireless technologies and other technologies.

NTC824: OSS AND BSS (3 Credits, T=2 L=1)

This course covers telecom network operations and management, traffic

management, network management, service provisioning/activation, and service level agreements (SLAs). It also focuses on management issues such as implementing service level management, telecommunications management network (TNM) for OSS and BSS, telecom operations map (TOM), extended telecom operations map (e-TOM), network inventory management, configuration management, fault management, web based telecommunications systems management, trouble ticketing, unified messaging service, operations and billing support systems, decision support systems, customer care and allied topics. Theory topics taught shall be supported with relevant case studies.

NTC825: TELECOM SOFTWARE DEVELOPMENT (3 CREDITS, T=2 L=1)

This course provides the understanding for developing telecom applications by using PERL, HTML and CGI. It focuses on development of software systems and applications for telecom and covers the fundamentals required for development of applications such as communication stack layers and associated protocols, networks management and security tools. This course includes assignments and case studies related to software development in telecom.

NTC826: EMBEDDED SOFTWARE DESIGN FOR NETWORKING AND TELECOM (3 Credits, T=2 L=1)

This course covers embedded system design issues, challenges and trends in embedded systems, assemblers, compilers, linkers, loaders, debuggers, profilers and 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.

Project**NTC901: MINI PROJECT (2 Credits)**

Students in a group of maximum two are expected to undertake a mini project that includes an extensive literature survey and/or design and development of system. An internal faculty guides the project. The

MS Program in Networking and Telecommunications

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

NTC 902: PROJECT (18 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 that will enhance their understanding in certain technology domains in real-life scenario. The research project includes researching on the given/chosen seminar topic that 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 that 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: 72

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

MS Program in Networking and Telecommunications

Course Structure

	Code	Course Name	Credits*
BRIDGE	AST 001	Computer Architecture and Operating Systems	
	ESD 002	Signals and Systems	
	NTC 001	Communication Systems	
	NTC 002	Computer Networks	
FOUNDATION	NTC 501	Programming Methodologies	3
	NTC 502	Network Technologies and Protocols	4
	NTC 503	Routing Algorithms and Protocols	3
	AST 509	Introduction to Database Design	2
	NTC 504	Server Administration and Management	3
	NTC 505	Seminar – I	1
CORE	NTC 601	Wireless Communications	3
	NTC 602	Optical Networks	3
	NTC 603	Network Management and Security	3
	NTC 604	Network Programming	3
	AST 603	Software Engineering and Project Management	2
	NTC 605	Seminar – II	1
ADVANCED	NTC 701	Multimedia Technologies	3
	NTC 702	Broadband Technologies	3
	NTC 703	Protocol Architecture and Applications	3
	NTC 704	Next Generation Networks	3
ELECTIVES	Elective – 1 (Select any ONE)		3
	NTC 811	Network Engineering	
	NTC 812	Telecom Switching and Traffic Engineering	
	ESD 503	Digital Signal Processing	
	Elective - 2 (Select any TWO)		3 each
	NTC 821	Advanced Network Management and Security	
	NTC 822	Storage Area Networks	
	NTC 823	Multiple Play Services	
	NTC 824	OSS and BSS	
	NTC 825	Telecom Software Development	
NTC 826	Embedded Software Design for Networking and Telecom		
PROJECT	NTC 901	Mini Project	2
	NTC 902	Project	18

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MS Program in Wireless Technologies

“There were more than 2 billion mobile phone users in 2005, and it is possible to foresee that 3 billion users will be reached by 2009.”

- Yoshio Utsumi,

Secretary General, International Telecom Union (ITU) in ITU Telecom World 2006

Wireless networks are rapidly becoming a part of our everyday life. The widespread availability of miniature wireless devices such as PDAs, cellular phones, pocket PCs, and sensors are one step towards making the vision of anywhere, anytime pervasive access and computing a reality. Cellular 2G/3G networks are true examples of such mobile communication systems. 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. The great success of the Internet and wireless communications has opened a new vista for future all-IP wireless applications, driven by increasing demand for packet data services in worldwide 2.5G and 3G networks. It has been envisioned that the future wireless systems will be operating based mainly on burst data services carrying multimedia contents, including voice, data, image and video. Such increasing demand for multimedia communication drives the development of consumer and enterprise markets as well as the evolution of wireless technologies. The support of multimedia is believed to be one of the pre-requisites to guarantee the success of the next generation wireless networks. But we are still a long way off from the goal of seamless wireless operation where any wireless device would be able to connect to any other wireline/wireless device at any time, in any place, and while satisfying the requirements of the user. Recently, mobile adhoc networks, sensor networks and mesh networks are emerging as three typical multi-hop networks. Technology under development for wireless networks is making important steps toward this goal. This MS Program in Wireless Technologies is designed to prepare the students to handle such challenges in the fastest growing wireless industry. The program provides comprehensive, theoretical, practical and real life knowledge of advanced wireless technologies as demanded by the industry today and for the future.

Program

This autonomous, four semester, 24-month, 72 Credits, full-time Masters Program in Wireless Technologies is designed to equip students with the knowledge for design, development and planning in the field of Wireless Technologies. The major focus of the program includes the areas:

- ▲Wireless Networking Technologies
- ▲Wireless Network Management and Security
- ▲Wireless Application Development
- ▲Wireless Network Planning, Design, and Optimization
- ▲Next Generation Wireless Networks

Program Structure

- ▲Successful completion requires 72 Credits.
- ▲To bridge the gap between theory and practice, project work worth 18 Credits in the last semester.
- ▲The entire curriculum is distributed over six levels to aim at transcending the students' level of understanding for

corporate readiness. The levels are respectively, Bridge, Foundation, Core, Advanced, Electives and Project.

- ▲As an option to the advanced courses of this program, a student can take total 9 Credits courses from any other suitable MSP / MBAP program provided they are fit for such courses.
- ▲Students have to carry out one mini project in specified semester to consolidate the technical knowledge in the selected specialization stream.
- ▲Students are required to take three electives during the program
- ▲To be eligible for MSP in Wireless Technologies, a student has to take minimum subjects worth 63 Credits from this stream out of 72 Credits.

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 state-of-the-art wireless, networking, and telecom hardware and software tools in the laboratories
- ▲Expert lectures, seminars and case studies by leading experts from industries
- ▲An option to work on projects that require working with faculty members and students from other streams such as advanced software technologies, embedded systems, VLSI and ICT business management

Eligibility

- ▲Graduates with a Bachelor's Degree in Engineering / Technology (with minimum 50 percent marks) of at least four years' duration in Electronics / Communication /