1.4.2 Description of courses

M.Sc. (Communication Software and Network) Programme

Core Courses

EE6108 Computer Networks
AUs: 3
Prerequisites: NIL
Semester 1
Network protocols and services. Transport protocols and services. Local area networks. Wide area networks and internetworking. Broadband and Asynchronous Transfer Mode (ATM) networks.

EE6701 Software Requirements Analysis and Design
AUs: 3
Prerequisites: NIL
Semester 1
Overview of software engineering. Object-oriented modeling concepts. Object modeling. Dynamic modeling. Functional modeling. System design. Object design. Object-oriented methodology and tools.

EE6703 Multimedia Networking
AUs: 3
Prerequisites: NIL
Semester 1
Introduction to multimedia networks. Quality of service and traffic characteristics. Traffic scheduling. Multicasting mechanisms. Resource reservation. Multimedia communication protocols. Networked multimedia applications issues.

EE6711 Object-Oriented Software Development
AUs: 3
Prerequisites: NIL
Semester 1
Software development platform, language and environment. Object-Oriented implementation in C++. Object-Oriented implementation in JAVA. Distributed Object-Oriented programming. Comparative study of Object-Oriented programming languages. Software reuse.

Electives (select any four courses)

EE6104 Network Performance Analysis
AUs: 3
Prerequisites: NIL
Semester 1
Review of probability theory and graph theory. Queuing theory. Networks of queues. Flow and congestion control. Routing-flow allocation. Controlled and random access techniques in data networks. Performance analysis of circuit switching.

EE6125 Network Planning and Management
AUs: 3
Prerequisites: NIL
Semester 2
Network performance issues. Network simulation and optimisation. Network operations, control and maintenance. Network administration. Network management database and tools. Capacity planning. Network security and integrity.

EE6205 Real Time and Embedded Systems
AUs: 3
Prerequisites: NIL
Semester 1

Fundamentals of real time and embedded systems. Real time operating systems. Design methodologies. Development, debugging tools and programming languages. Reliability. Case studies and applications.

EE6403 Distributed Multimedia Systems
AUs: 3
Prerequisites: NIL
Semester 2
Media and Media Systems. Multimedia Storage. Media Processing and Application. Media Transmission and Delivery. Quality of Service on Distributed Multimedia Systems. Multimedia Applications.

EE6712 Distributed Computing
AUs: 3
Prerequisites: NIL
Semester 2
Introduction and overview of distributed computing. Object-Oriented client/server systems. Distributed data and transaction management. Distributed operating systems and distributed computing platforms. Processes and processors in distributed systems. Real-time consideration.

EE6713 Network Design and Simulation
AUs: 3
Prerequisites: NIL
Semester 2
Introduction to network design. Approaches to network design. Topological network design. Network reliability. Network design simulation. Data analysis.

EE6715 Network Traffic Engineering
AUs: 3
Prerequisites: NIL
Semester 2
Internet architectures, service models and network layer protocols. User services and source traffic models. Traffic measurement, estimation and forecasting. Performance analysis and simulation tools. Traffic control and resource management.

EE6731 Network Programming
AUs: 3
Prerequisites: NIL
Semester 2
Windows system-level programming. UNIX system-level programming. Kernel programming. Data communication protocol project.

M.Sc. (Communications Engineering) Programme

Core Courses

EE6101 Digital Communication Systems
AUs: 3
Prerequisites: NIL
Semester 1
Communication signals and baseband transmission. Digital modulation/demodulation. Error correction coding. Spread-spectrum techniques.

EE6105 RF Engineering Techniques
AUs: 3
Prerequisites: NIL
Semester 1
Transmission line circuit design and S-parameters. Measurements of S-parameters. Overview of RF passive circuits, active devices and equivalent circuit models. Introduction to circuit and field analysis techniques. RF sub-systems engineering. RF transceiver architecture.

EE6108 Computer Networks
AUs: 3
Prerequisites: NIL
Semester 1
Network protocols and services. Transport protocols and services. Local area networks. Wide area networks and internetworking. Broadband and Asynchronous Transfer Mode (ATM) networks.

EE6124 Satellite, Fixed and Mobile Radio Systems
AUs: 3
Prerequisites: NIL
Semester 2
Radio propagation. Path analysis. Terrestrial line-of-sight radio systems. Mobile radio systems. Satellite communication systems.

Electives (select any four or five courses)

EE6104 Network Performance Analysis
AUs: 3
Prerequisites: NIL
Semester 1
Review of probability theory and graph theory. Queuing theory. Networks of queues. Flow and congestion control. Routing-flow allocation. Controlled and random access techniques in data networks. Performance analysis of circuit switching.

EE6107 RF Circuit Design
AUs: 3
Prerequisites: NIL
Semester 2
Amplifier circuits. Oscillator circuits. Detector and mixer circuits. Frequency multiplier and control circuits. Microwave frequency synthesisers. Design exercises using commercial RF CAD tools

EE6109 MIC and Printed Antenna Design
AUs: 3
Prerequisites: NIL
Semester 1
Microstrip transmission lines. Analysis of passive reciprocal microwave devices. Microwave filter synthesis and design. Basic antenna parameters. Microstrip patch antennas. Microstrip antenna arrays. Design exercises of microwave integrated circuits and microstrip antennas

EE6122 Optical Fibre Communications
AUs: 3
Prerequisites: NIL
Semester 2
Optical fibre fundamentals. System components. Optical fibre transmission systems. WDM systems and subsystems. Optical networks. Measurement techniques.

EE6125 Network Planning and Management
AUs: 3
Prerequisites: NIL
Semester 2
Network performance issues. Network simulation and optimisation. Network operations, control and maintenance. Network administration. Network management database and tools. Capacity planning. Network security and integrity.

EE6126 Wireless Multiple Access Communications
AUs: 3
Prerequisites: NIL
Semester 2
Wireless channel models. Wireless digital modulation techniques. FDMA/TDMA techniques. CDMA techniques. Fading and ISI mitigation techniques.

EE6303 Electromagnetic Compatibility and Interference
AUs: 3
Prerequisites: NIL
Semester 2
EMC/EMI Overview. EMI Properties of Passive Components. Crosstalk and Cabling. Grounding. Shielding. Conducted EMI and Filtering. Non-linear Phenomena. Digital Circuit Noise and Radiation. Electrostatic Discharge. EMI Emission Measurements and Test Methods. Susceptibility Testing

EE6401 Advanced Digital Signal Processing
AUs: 3
Prerequisites: NIL
Semester 1 and 2
Discrete signal analysis and digital filters. Power spectrum estimation. Linear prediction and optimal linear filters. Multi-rate digital signal processing. DSP Architectures and applications.

EE6425 Speech Analysis and Processing
AUs: 3
Prerequisites: NIL
Semester 1
Fundamentals of Speech. Speech Enhancement. Dynamic Time Warping. Hidden Markov Models (HMM). Speech Recognition and Speaker Verification Systems. Scalar and Vector Quantisation. Linear Predictive Coding. Transform Coding.

EE6427 Video Signal Processing
AUs: 3
Prerequisites: NIL
Semester 2
Video Basics. Video Signals Sampling and Rate Conversion. Video Signal Filtering and Enhancement. Video Coding Principles and Standards. Emerging Video Communications Systems.

EE6703 Multimedia Networking
AUs: 3
Prerequisites: NIL
Semester 1
Introduction to multimedia networks. Quality of service and traffic characteristics. Traffic scheduling. Multicasting mechanisms. Resource reservation. Multimedia communication protocols. Networked multimedia applications issues.

EE6713 Network Design and Simulation
AUs: 3
Prerequisites: NIL
Semester 2
Introduction to network design. Approaches to network design. Topological network design. Network reliability. Network design simulation. Data analysis.

M.Sc. (Computer Control and Automation)

Core Courses

EE6203 Computer Control Systems
AUs: 3
Prerequisites: NIL
Semester 1
Discrete-time system modeling and analysis. Cascade compensation. State-space design methods. Optimal control. Design and implementation of digital controllers.

EE6204 Systems Analysis
AUs: 3
Prerequisites: NIL
Semester 2

Linear, dynamic and integer programming. Random processes. Queuing models. Optimization techniques. Markov decision process.

EE6205 Real Time and Embedded Systems
AUs: 3
Prerequisites: NIL
Semester 1
Fundamentals of real time and embedded systems. Real time operating systems. Design methodologies. Development, debugging tools and programming languages. Reliability. Case studies and applications.

EE6401 Advanced Digital Signal Processing
AUs: 3
Prerequisites: NIL
Semester 1 and 2
Discrete signal analysis and digital filters. Power spectrum estimation. Linear prediction and optimal linear filters. Multi-rate digital signal processing. DSP Architectures and applications.

Electives (Select four or five courses)

EE6221 Robotics and Intelligent Sensors
AUs: 3
Prerequisites: NIL
Semester 2
Overview of robotics. Motion planning and control. Mobile robots. Controller hardware/software systems. Sensor systems and integration 1 and 2

EE6222 Machine Vision
AUs: 3
Prerequisites: NIL
Semester 1
Fundamentals of Computer Vision. Feature Extraction Techniques. Object Recognition and Interpretation. Three Dimensional Computer Vision. Three-Dimensional Recognition Techniques.

EE6223 Computer Control Networks
AUs: 3
Prerequisites: NIL
Semester 1
Data Networks in Control and Automation. Local Area Network Concepts and Fieldbus. Application Layer of Fieldbus and MAP. Internetworking and Protocols. Real-time Operating Systems and Distributed Control. Network Performance and Planning. Multimedia in Advanced Control and Instrumentation.

EE6224 Neural and Fuzzy Systems
AUs: 3
Prerequisites: NIL
Semester 1
Neural Dynamics and Models. Synaptic Dynamics. Single and Multi-layered Perceptrons. Radial-Basis Function Networks. Fuzzy Logic Theory. Fuzzy Systems and Applications.

EE6225 Process Control
AUs: 3
Prerequisites: NIL
Semester 2
Basic control algorithms. Advanced control strategies. Multivariable control. Plant parameter estimation. Process modelling and simulation. Case studies in process control.

EE6402 Real-Time DSP Design and Applications
AUs: 3
Prerequisites: NIL
Semester 1

Architectures for General-purpose Digital Signal Processor. Peripherals for DSP Applications. Development Tools for DSP Application. Digital FIR/IIR Filter Implementation. Fast Fourier Transform Implementation.

EE6503 Modern Electrical Drives
AUs: 3
Prerequisites: NIL
Semester 2
Introduction. DC Motor Drives. Induction Motor Drives. Synchronous Motor Drives. Servo-Motor Drives.

M.Sc. (Electronics)

Core Courses

EE6306 Digital IC Design
AUs: 3
Prerequisites: NIL
Semester 1
Review of Integrated Circuit Fundamentals. Layout and Design Issues. CMOS Digital Circuits. BiCMOS Digital Circuits. Sub-System Design in Digital Circuits. Design Methodologies.

EE6601 Advanced Wafer Processing
AUs: 3
Prerequisites: NIL
Semester 2
Thin film deposition. Chemical and mechanical polishing. Lithography and resist technology. Etching process and technology. Cleaning technology. Process integration. Metrology and analytical techniques.

EE6602 Quality and Reliability Engineering
AUs: 3
Prerequisites: NIL
Semester 2
Quality management and planning. Statistical process control. Design of experiments. Reliability planning & statistical framework. Burn-in, failure mode and effect analysis (FMEA), and accelerated testing.

EE6604 Advanced Topics in Semiconductor Devices
AUs: 3
Prerequisites: NIL
Semester 1
Bipolar transistor operating principles. Bipolar device modelling. State-of-the-art bipolar structures. MOS device operation. MOSFET modelling. MOS device scaling effects. Semiconductor memories. Semiconductor heterojunctions. Future trends and challenges.

Electives (Select four or five courses)

EE6203 Computer Control Systems
AUs: 3
Prerequisites: NIL
Semester 1
Discrete-time system modeling and analysis. Cascade compensation. State-space design methods. Optimal control. Design and implementation of digital controllers.

EE6303 Electromagnetic Compatibility and Interference
AUs: 3
Prerequisites: NIL
Semester 2

EMC/EMI Overview. EMI Properties of Passive Components. Crosstalk and Cabling. Grounding. Shielding. Conducted EMI and Filtering. Non-linear Phenomena. Digital Circuit Noise and Radiation. Electrostatic Discharge. EMI Emission Measurements and Test Methods. Susceptibility Testing.

EE6307 Analog IC Design
AUs: 3
Prerequisites: NIL
Semester 2
Review of Fundamentals. Analog Building Blocks. Switched Capacitor Circuits. Current Mode Circuits. Continuous-Time Filters. Data Converters.

EE6328 Signal Integrity in High-Speed Digital Systems
AUs: 3
Prerequisites: NIL
Semester 2
High Speed Properties of Logic Gates. Modeling and Analysis of Interconnections. Transmission Lines and Terminations. Power Distribution Networks and Ground Planes. Clock Distribution. Case Study.

EE6401 Advanced Digital Signal Processing
AUs: 3
Prerequisites: NIL
Semester 1 and 2
Discrete signal analysis and digital filters. Power spectrum estimation. Linear prediction and optimal linear filters. Multi-rate digital signal processing. DSP Architectures and applications.

EE6506 Power Semiconductor & Passive Devices
AUs: 3
Prerequisites: NIL
Semester 1
Overview of Power Electronics and Semiconductor Physics. Power Diodes and Thyristors. Power Transistors. Control and Protection of Devices. Passive Components and Magnetics.

EE6608 Advanced Semiconductor Physics
AUs: 3
Prerequisites: NIL
Semester 2
Crystal structure. Energy bands of semiconductors. Doping and carrier concentrations. Electrical transport phenomena. High field effects. Optical and thermal properties. Quantum size effects.

EE6610 IC Packaging
AUs: 3
Prerequisites: NIL
Semester 1
IC Packaging Overview. Electrical Packaging Design for Advanced Packages. Thermal Management for Advanced Packaging. Single Chip and Multichip Packaging. IC Assembly, Sealing and Encapsulation. Microsystems Packaging and Applications. IC Packaging Reliability and Failure Analysis.

EE6617 Nanoelectronics
AUs: 3
Prerequisites: NIL
Semester 2
Introduction to Nanotechnology. Synthesis of Nanomaterials. Lithography. Analysis and Manipulation Methods. Carbon Nanotubes and its applications. Quantum Computing.

EE6801 Modern Optics
AUs: 3
Prerequisites: NIL
Semester 1

Fundamental Optics. Scalar Diffraction. Wavefront Modulation. Holography and Interferometry. Fourier Optics and Optical Systems Analysis.

EE6802 Laser Technology and Applications
AUs: 3
Prerequisites: NIL
Semester 2
Laser Fundamentals. Laser Beams and Resonators. Laser Oscillation. Laser Transient Effects. Laser Techniques. Nonlinear Optics. Design of Laser Systems. Semiconductor Lasers. Laser Applications.

EE6808 Display Technologies
AUs: 3
Prerequisites: NIL
Semester 1
Electronic Information Displays. Passive Matrix Liquid Crystal Displays. Active Matrix Liquid Crystal Displays. Plasma Display Panels. Organic Light-Emitting Devices. Field Emission Displays. Electroluminescent Displays and Electrochromic Displays. Emerging Display Technologies.

ES6102 Advanced Digital System Design (Course is offered by School of Computer Engineering)

M6401 Product Design & Development (Course is offered by School of Mechanical & Aerospace Engineering)

M.Sc. (Power Engineering) Programme

Core Courses

EE6501 Power Electronic Converters
AUs: 3
Prerequisites: NIL
Semester 1
Introduction. AC-to-DC Converters. DC-to-DC Converters. DC-to-AC Converters.

EE6509 Renewable Electrical Energy Systems
AUs: 3
Prerequisites: NIL
Semester 2
Introduction to Electric Power Industry. Distributed Generation. Micro-Hydro Power Systems. Wind Power Systems. Solar and Photovoltaic Power Systems.

EE6510 Power System Operation and Planning
AUs: 3
Prerequisites: NIL
Semester 2
Forecasting and Scheduling. Network Application Functions. Probability and Reliability. Generation and Transmission Planning.

EE6512 High Voltage Engineering and System Protection
AUs: 3
Prerequisites: NIL
Semester 1
Computational Methods for Electric Field. Insulation Engineering. System faults. Protection of Plants and Lines. System Aspects of Protection.

Electives (Select any 4 or 5 courses)

EE6203 Computer Control Systems
AUs: 3
Prerequisites: NIL

Semester 1
Discrete-time system modeling and analysis. Cascade compensation. State-space design methods. Optimal control. Design and implementation of digital controllers.

EE6204 Systems Analysis
AUs: 3
Prerequisites: NIL
Semester 2
Linear, dynamic and integer programming. Random processes. Queuing models. Optimization techniques. Markov decision process.

EE6225 Process Control
AUs: 3
Prerequisites: NIL
Semester 2
Basic control algorithms. Advanced control strategies. Multivariable control. Plant parameter estimation. Process modelling and simulation. Case studies in process control.

EE6303 Electromagnetic Compatibility & Interference
AUs: 3
Prerequisites: NIL
Semester 2
EMC/EMI Overview. EMI Properties of Passive Components. Crosstalk and Cabling. Grounding. Shielding. Conducted EMI and Filtering. Non-linear Phenomena. Digital Circuit Noise and Radiation. Electrostatic Discharge. EMI Emission Measurements and Test Methods. Susceptibility Testing.

EE6401 Advanced Digital Signal Processing
AUs: 3
Prerequisites: NIL
Semester 1 and 2
Discrete signal analysis and digital filters. Power spectrum estimation. Linear prediction and optimal linear filters. Multi-rate digital signal processing. DSP Architectures and applications.

EE6503 Modern Electrical Drives
AUs: 3
Prerequisites: NIL
Semester 2
Introduction. DC Motor Drives. Induction Motor Drives. Synchronous Motor Drives. Servo-Motor Drives.

EE6506 Power Semiconductor & Passive Devices
AUs: 3
Prerequisites: NIL
Semester 1
Overview of Power Electronics and Semiconductor Physics. Power Diodes and Thyristors. Power Transistors. Control and Protection of Devices. Passive Components and Magnetics.

EE6508 Power Quality
AUs: 3
Prerequisites: NIL
Semester 2
Concept of Power Quality. Voltage Fluctuations and Variations. Transient Overvoltages. Harmonic Distortions.

EE6511 Power System Modelling and Control
AUs: 3
Prerequisites: NIL
Semester 1
Steady-state Power System Networks. Network Components. Stability Analysis. Power System Control.

M.Sc. (Signal Processing)

Core Courses

EE6401 Advanced Digital Signal Processing
AUs: 3
Prerequisites: NIL
Semester 1 and 2
Discrete signal analysis and digital filters. Power spectrum estimation. Linear prediction and optimal linear filters. Multi-rate digital signal processing. DSP Architectures and applications.

EE6402 Real-Time DSP Design and Applications
AUs: 3
Prerequisites: NIL
Semester 1
Architectures for General-purpose Digital Signal Processor. Peripherals for DSP Applications. Development Tools for DSP Application. Digital FIR/IIR Filter Implementation. Fast Fourier Transform Implementation.

EE6403 Distributed Multimedia Systems
AUs: 3
Prerequisites: NIL
Semester 2
Media and Media Systems. Multimedia Storage. Media Processing and Application. Media Transmission and Delivery. Quality of Service on Distributed Multimedia Systems. Multimedia Applications.

EE6404 VLSI Digital Signal Processors
AUs: 3
Prerequisites: NIL
Semester 2
Digital Signal Processors. Classification of Architectures. Data and Instruction Memories. VLSI Special Instruction-set Single Chip (SISC) Processors. Data Path Logic Design. Rapid Prototyping. Code Generation for Embedded Processors. Digital Signal Multiprocessors. Formal Methods for Scheduling, Assignment and Allocation.

Electives (Select 4 or 5 courses)

EE6101 Digital Communication Systems
AUs: 3
Prerequisites: NIL
Semester 1
Communication signals and baseband transmission. Digital modulation/demodulation. Error correction coding. Spread-spectrum techniques.

EE6108 Computer Networks
AUs: 3
Prerequisites: NIL
Semester 1
Network protocols and services. Transport protocols and services. Local area networks. Wide area networks and internetworking. Broadband and Asynchronous Transfer Mode (ATM) networks.

EE6222 Machine Vision
AUs: 3
Prerequisites: NIL
Semester 1
Fundamentals of Computer Vision. Feature Extraction Techniques. Object Recognition and Interpretation. Three Dimensional Computer Vision. Three-Dimensional Recognition Techniques.

EE6224 Neural and Fuzzy Systems
AUs: 3

Prerequisites: NIL
Semester 1
Neural Dynamics and Models. Synaptic Dynamics. Single and Multi-layered Perceptrons. Radial-Basis Function Networks. Fuzzy Logic Theory. Fuzzy Systems and Applications.

EE6421 Statistical Signal Processing
AUs: 3
Prerequisites: NIL
Semester 1
Review of Random Processes. Fundamentals of Detection Theory. Signal Detection in Noise. Signal Estimation Theory. Properties of Estimators. Application of Signal Detection and Estimation.

EE6422 Adaptive Signal Processing
AUs: 3
Prerequisites: NIL
Semester 2
Fundamentals of Adaptive Signal Processing. Gradient-Based Adaptive FIR and IIR Filters. Method of Least Squares Estimation. Recursive Least Squares. Lattice Filters. Nonlinear Adaptive Filtering. Applications.

EE6423 Array Signal Processing
AUs: 3
Prerequisites: NIL
Semester 2
Sensor-Array Fundamentals. Array Beamforming. Basic Direction Finding & Geolocation. Advanced Direction Finding & Geolocation. Target Tracking. Array Geometry Optimisation & Calibration. Smart Antennas & Software Radio in Wireless Communications.

EE6424 Digital Audio Signal Processing
AUs: 3
Prerequisites: NIL
Semester 1
Psychology of Hearing. Audio Test and Measurement. Principles of Digital Audio. Audio Processing and Synthesis. Microphones and Loudspeakers. Digital Audio Compression. Digital Audio Broadcasting.

EE6425 Speech Analysis and Processing
AUs: 3
Prerequisites: NIL
Semester 1
Fundamentals of Speech. Speech Enhancement. Dynamic Time Warping. Hidden Markov Models (HMM). Speech Recognition and Speaker Verification Systems. Scalar and Vector Quantisation. Linear Predictive Coding. Transform Coding.

EE6426 Image Processing and Pattern Recognition
AUs: 3
Prerequisites: NIL
Semester 1
Image Fundamentals. Image Enhancement. Image Restoration. Feature Selection and Extraction. Classification Methods. Connectionist Approach.

EE6427 Video Signal Processing
AUs: 3
Prerequisites: NIL
Semester 2
Video Basics. Video Signals Sampling and Rate Conversion. Video Signal Filtering and Enhancement. Video Coding Principles and Standards. Emerging Video Communications Systems.

The following courses will be offered to research students:

EE7201 Computational Methods in Engineering

AUs: 3
Prerequisites: NIL
Semester 1
Matrices. Method of Least Squares. Optimization. Case Study I - Matrix Factorization in Kalman Filtering. Statistical Methods. Monte-Carlo Methods. Numerical Solution to Differential Equations. Case Study II – Parameter Estimation and Monte-Carlo Simulation in Optics Sensing.

EE7204 Linear Systems
AUs: 3
Prerequisites: NIL
Semester 1
Input/Output System Models. State Space Representation. Norms of Signals and Systems. Decomposition of Linear Time-Invariant Systems. Linear Feedback Design. Convex Optimization for Linear System Analysis and Design.

EE7205 Research Methods
AUs: 3
Prerequisites: NIL
Semester 2
Research Preparation and Planning. Research Sources and Review. Quantitative Methods for Data Analysis. Experimental research methods. Academic Writing & Presentation.

EE7206 System Modeling and Identification
AUs: 3
Prerequisites: NIL
Semester 2
Introduction. Models for Systems and Signals. Nonparametric Time and Frequency Analysis. Parameter Estimation Methods. On-line System Identification Methods. Model Validation, Simulation and Case Studies.

EE7401 Probability and Random Processes
AUs: 3
Prerequisites: NIL
Semester 2
Probability concepts. Random variables. Multiple random variables. Sum of random variables and multidimensional distributions. Random Sequences. Probability density function estimation. Random variable simulation. Random processes. Correlation functions. Spectral density. Random processes in linear systems. Optimum linear systems. Nonlinear systems.

EE7601 Optical Methods in Research
AUs: 3
Prerequisites: NIL
Semester 2
This course covers the essential principles and techniques in optical microscopy, metrology and spectroscopy.

EE7602 Design, Fabrication and Analysis of Electronic Devices
AUs: 3
Prerequisites: NIL
Semester 1
Electronic devices overview. Electronic device fabrication. Device Design. Simulation and layout. Electronic interfaces. Packaging and Characterization electronic devices and applications.

***These courses may not be offered in every semester*:**

EE9309 Special Topics in Integrated Circuits and Systems
AUs: 3
Prerequisites: NIL
The course is designed for graduate research students who want to know more about the new developments in the field of integrated circuits and systems.

EE9901 Special Topics – Complex Adaptive System
AUs: 3
Prerequisites: NIL
Introduction to complex adaptive systems. Definition and construction of adaptive agents for agent-based models. Innovation through the use of building blocks. Using networks to describe the interactions in agent-based models. Agent-based models for studying the origin and acquisition of language.

EE9902 Special Topics – Quantum Physics in Modern Technology
AUs: 3
Prerequisites: NIL
A Brief Review of Quantum Physics, Electron Spin and Spintronics, Fermi Gas of Electrons, Bose Gas and Bose-Einstein Condensation, Pairing Up Electrons: Superconductivity, Josephson Junctions and Superconducting Quantum Interference Device (SQUID), Quantum Hall Effect, Laser Cooling.

EE9903 Special Topics in Defect Chemistry of Metal Oxides
AUs: 3
Prerequisites: NIL
A Brief Review of Defect Chemistry in Metal Oxides, A Few Useful Crystal Structures, Lattice Defects and the Law of Mass Action, Intrinsic and Extrinsic Ionic Disorder, Defect Complexes and Associates, Ionic Transport, Intrinsic and Extrinsic Electronic Disorder, Intrinsic and Extrinsic Nonstoichiometry, Order vs Disorder and Some Typical Oxides.

Joint Nanyang Technological University - Technische Universität München Master of Science (IC Design)

Core Courses

NM 6001 Digital IC Design (NTU)
AUs: 3
Prerequisites: NIL
Semester 1
Review of Integrated Circuit Fundamentals. Layout and Design Issues. CMOS Digital Circuits. BiCMOS Digital Circuits. Sub-System Design in Digital Circuits. Design Methodologies.

NM 6002 Analog IC Design (NTU)
AUs: 3
Prerequisites: NIL
Semester 1
Review of Fundamentals. Analog Building Blocks. Switched Capacitor Circuits. Current Mode Circuits. Continuous-Time Filters. Data Converters.

NM 6003 System-on-Chip Solutions and Architecture (TUM)
AUs: 3
Prerequisites: NIL
Semester 1
Basics of CMOS integrated circuits from a system's perspective. From MOSFET transistor to realization of combinational / sequential logic. Finite state machines (FSM), SRAM, DRAM, FLASH, FPGA, CPU core building blocks. Packaging and i/o technology. IC design methodologies. Standard cell, custom, platform SoC, System modeling. Projection of IC technology scaling and implementation alternatives. Integrated system solutions in inter-networking and communications. SONET/SDH transport framers and digital cross connects. Ethernet LAN/ATM SAN switches. Control point processors and communication controllers. Network processors.

NM 6004 Design Methodology and Automation (TUM)
AUs: 3
Prerequisites: NIL
Semester 1
Computer-aided design of analog and digital integrated circuits. VLSI design flow. System level, algorithmic level, register transfer level, logic level, circuit level. VLSI design methods, high-level

synthesis, logic synthesis, layout synthesis. Analog and digital simulation, test design, formal verification. Techniques from discrete mathematics and computer science.

NM 6005 Digital Signal Processing (NTU)
AUs: 3
Prerequisites: NIL
Semester 1
Introduction. Discrete Fourier transform (DFT) and fast Fourier transform (FFT). Z transform. Digital filters. Linear prediction and optimum linear filters. Power spectrum estimation.

NM 6006 Mixed Signal Circuit Design (TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Fundamentals of discrete time signal processing. MOSFET as a switch. Sample & hold circuits, switched capacitor circuits. Data converter fundamentals. Nyquist rate D/A and A/D converters. Over sampling, noise shaping, A/D and D/A converters using sigma-delts modulators. Switched capacitor filters.

NM 6007 Laboratory 1: Analog IC Design
AUs: 3
Prerequisites: NIL
Semester 2
Training students to use standard software tools to design basic analog circuit blocks.

NM 6008 Laboratory 2: Digital IC Design
AUs: 3
Prerequisites: NIL
Semester 1
Training students to use standard software tools to design basic digital circuit blocks and sub-systems.

Electives (Select 4 courses)

NM 6009 RF IC Design (NTU)
AUs: 3
Prerequisites: NIL
Semester 2
System Design Considerations. CMOS RF Components and Devices. Low-noise amplifier (LNA); Mixers; Voltage-controlled oscillators (VCOs). RF power amplifiers. Phase-Locked Loops and Frequency Synthesizers.

NM 6010 IC Packaging (NTU)
AUs: 3
Prerequisites: NIL
Semester 2
Plastic packaging materials. Manufacturing process for plastic encapsulated microelectronics. State-of –the–art packaging techniques. Failure mechanisms. Qualification process and accelerated testing. Effects of packaging on electrical performance. Future trends and challenges.

NM 6011 IC Marketing/ Business/ Management (NTU)
AUs: 3
Prerequisites: NIL
Semester 2
Trends in the IC industry: Technology and manufacturing trends, Demand, applications and product trends. Market Characteristics: The customers, Business cycles, Demand lead and supply lag (the bull-whip effect), IC industry, supply and value chain, stakeholders, Geographical distribution of excellence centers, Technology centers, design centers, fabrication centers, The dis-integration of the value chain, outsourcing trends. Managing the marketing function: The sources of product ideas, The role of standards, formats, and intellectual property. Strategic partnership, distributorship, Demand forecast, matching supply with demand.

NM 6012 Advanced MOSFET and Novel Devices (TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Historical development of mainstream MOSFETs until today: economical, technological and physical fundamentals. Properties of long channel and short channel MOSFETs. Hot carrier effects, scaling rules, basic of charge carrier transport (quantum-mechanical, hydro-dynamics, ballistics). Proposed new MOSFET structures (vertical MOSFETs, double-gate, fully-depleted MOSFETs). Hot-electron transistors, tunneling transistors, low-dimensional devices, single-electron transistor, single – electron memories, quantum-electronics.

NM 6013 Nano-Electronics (TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Low dimensional structures: quantum wells, quantum wires and quantum dots. Electronic, optical, transport properties of nanostructures. Quantum semiconductor devices. Fabrication and characterization techniques of nanotechnology. Applications of nanostructures, nanodevices and nanosystems. The bottom-up approach to nanotechnology: introduction to molecular electronics and optoelectronics. Organic materials for electronics: self-assembled monolayers; conducting polymers; carbon nanotubes. Circuit implementations and architectures for nanostructures: quantum cellular automata and cellular non linear networks. Introduction to quantum computing.

NM 6014 Design for Testability of VLSI (NTU/TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Fault Models and Testability concepts. Test Generation and Fault Simulation Algorithms. Introduction to Testable Design. Test Response Compression. Shift-register polynomial division. Pseudo-random sequence generators. Special purpose shift-register circuits. Random pattern BIST. Built-in boundary scan structure. Limitations and other concerns of random pattern test. Test techniques for automatic test equipment.

NM 6015 Embedded Systems (TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Introduction to HW/SW codesign. Design flow from function graphs to FPGA netlists and executable object code for microprocessor. Modeling and specification of mixed hardware/software solutions for embedded systems. Graph partitioning and binding to execution units. Scheduling. Estimation of design quality. Target architectures and prototyping platforms for HW/SW systems. Basic introduction into VHDL and SystemC.

Broadening courses

Information on the course description is available on the German Institute of Science & Technology (GIST) website: http://www.gist.edu.sg/modules_int_circuit.aspx

Enrichment

- NM 6020 Business and Technical English (GIST)

Cross Discipline Modules

- International Patent Law (GIST) (10 hours)
- Selected topics in Business and Administration (GIST) (10 hours)
- Selected topics in Management Methods (GIST) (10 hours)
- Cultural, Social and Economical Aspects of Globalisation (GIST) (10 hours)
- Aspects of European and Asian Culture and History (GIST) (10 hours)

Joint Nanyang Technological University - Technische Universität München Master of Science (Microelectronics)

Core Courses

NM 6601 Microfabrication Technology (NTU)
AUs: 3
Prerequisites: NIL
Semester 1
Gate oxide growth processes. Characterization of gate oxide. Metal Deposition techniques. Ni-silicide technology. Plug processes. Cu technology. Dielectric film deposition. Polysilicon film deposition. Advanced lithography techniques. Optical proximity correction. Phase shift mask. Resist technology and modelling. Anti-reflective coatings. Deep-UV lithograph. Gate stack etch. Etch chemistry for low dielectric constant materials. Etch process for aluminum metal stacks. Shallow trench isolation. Single and Dual damascene processes. Advanced silicidation. Local interconnects. Electron microscopy and spectroscopy. Fluorescence spectroscopy. High resolution microscopy. Physics of low-k dielectrics. Low-k dielectric materials. Deposition of low-k dielectric films. Fundamentals of CMP. Metal CMP. Oxide CMP. Slurry composition and chemistry. Fundamentals of cleaning chemistry. Effects of contaminations. Wet cleaning technology. Dry cleaning technology.

NM 6602 Quality and Reliability Engineering (NTU)
AUs: 3
Prerequisites: NIL
Semester 2
Modern conceptual framework for quality. Total quality management. Quality Planning. ISO 9000 series quality management system. Quality awards. Origins and characteristics of variability. Concept and the process of statistical process control. Control charts for variables. Control charts for attributes. Construction and interpretation of control charts. Six-sigma process. Process capability assessment. Process capability indices. Experimentation in quality design and improvement. Noise in experiments. Design and interpretation of 2k factorial experiments. Blocking and randomisation. Confounding. Analysis of two-level factorial designs. Two-level fractional factorial designs. Basic Probability and Statistics for Reliability. Statistical aspect of reliability, Exponential distribution, Weibull distribution. Reliability estimation – Graphical method. Confidence Interval. Application of multiple censored data analysis. Statistical modeling of accelerated stress testing. Potential pitfall of accelerated life testing from reliability statistics perspective. Concept of Burn-in. Burn-in Planning. Effectiveness analysis for Burn-in.

NM 6603 Modern Semiconductor Devices (NTU)
AUs: 3
Prerequisites: NIL
Semester 2
Review of Basic Concepts. Transistor Action. Minority Carrier Profiles. Non-ideal Effects. High Current Effects. Transient Behavior. Breakdown in Bipolar Transistors. Small Signal Equivalent Circuits. Cut-off Frequency. Ebers-Moll Model and Gummel-Poon Model. Advanced Bipolar Structures – Polysilicon and Double Polysilicon Structures. V-Groove Bipolar Transistor. Base Etched Self-Aligned Transistor. Polysilicon Base Transistor. Review of CMOS Structure. Principle of MOSFET Operation. MOSFET Threshold voltage. Charge Control Model, Velocity Saturation Effects, Source and Drain Resistance. Short and Narrow Channel Effects, Reverse Short Channel Effect, Hot Electron Effect, Subthreshold Conduction. Read Only Memories. Static Random Access Memories. Dynamic Random Access Memories. Novel Non-volatile Memories. Fundamental Limits to Device Scaling. Reliability Issues. SiGe Electronic Devices.

NM 6604 Laboratory 1: Semiconductor Process and Device Simulation (NTU)
AUs: 3
Prerequisites: NIL
Semester 1
Process models: diffusion, oxidation, implantation. Process variables/targets: doping profiles, junction depths, oxide thickness. Process simulation: Simulate a given sub-micron CMOS process recipe and study profiles and layer structures. Physical models. Numerical algorithms and solutions. Device performance parameters. Short-channel effects. DC simulations. Device simulation: Simulate the DC characteristics of the “fabricated” device and analyze device operation

with respect to potential, field, and carrier distributions as well as terminal I–V characteristics. Wafer-split experiment. Device-target vs. process-variable relations. Transistor performance optimization/trade-offs through process variation. Technology development and optimization. Design of Experiment (DOE): Implement a computer experiment to study the scaling characteristics (varying gate length) of the given sub-micron technology. Study the influence of process variations on device performance parameters.

NM 6605 Laboratory 2: Design and Modelling of Nanodevices (NTU-TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Quantum blockade, quantum Ohm law, quantum conductance, quantum capacitance, quantum confinement, coherent transport, and transmission. Nanowire, transistors, influence of interface properties, low current to high current regime, scattering to ballistic regimes, noise spectrum. Quantum well. Energy subbands and wave functions. k.p methods. Band structure calculation by using single band and 6-band k.p methods. Density of state, doping concentration, and Fermi energy level calculations by using single band and 6-band k.p methods. Intersubband(intraband) transition. Squared transition element calculation. Absorption spectrum. Cut-off wavelength of photodetector. Influence of Ge composition and well width on peak wavelength of photodetectors. Transition energy. Emission wavelength. Doping concentration. Fermi level. Organic devices (Organic thin film transistors, OLED, organic solar cells). Molecular diodes and switches. Carbon Nanotubes.

NM 6606 Integrated Circuit Manufacturing (TUM)
AUs: 3
Prerequisites: NIL
Semester 1
Overview on history and semiconductor markets; basic statistics for probability calculations in manufacturing; discussion of classical and modern production models such as inventory models or Just-in-time; brief overview on CMOS-Technology and processes of chip fabrication; discussion of special features in a wafer fab like fabrication in lots, automatisation, work flow; detailed investigations in factory dynamics: describing the physical behaviour of a wafer fabrication line by equations, 4-partner model, queuing theory, the laws and performance parameters (such as capacity, cycle time, utilization) for evaluation of fab productivity, dreams and nightmares of managers; overall equipment and factory efficiency (OEE, OFE); quality management with design of manufacturability, machine capability investigations, design of experiments, statistical process control; verification of the courses findings by a student experiment called "Penny-Fab".

NM 6607 Optomechatronic Measurement Systems (TUM)
AUs: 3
Prerequisites: NIL
Semester 1
This course aims at providing basic knowledge on optical measurement systems designed for on-line device characterization in wafer fabs. Main aspects include: The interaction of microelectronics, micromechanics and microotics; properties of light; laser-based measurement systems; basic principles of optical interferometry; wafer surface analysis; shape and deformation measurement; stress sensors; optical waveguides; application-oriented measurement devices such as thin film interferometers, spectroscopic ellipsometers, and speckle interferometers.

NM 6608 Physical Electronics (TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Introduction to the basic physical mechanisms and material properties governing the operational behaviour of electronic and mechatronic microdevices and systems. 1. Overview and motivation: Basic energy-domain coupling effects in solid-state microstructured electronic and micromechatronical devices and their application fields: microelectronics, power electronics, microsensors, microactuators, and microsystems. 2. Characteristic properties of semiconductor materials: Intrinsic and extrinsic electric conductivity, mobility, carrier generation and recombination, thermal conductivity, thermoelectricity, galvanomagnetism. 3. Solid-state devices under near-equilibrium operating conditions: Band theory, electronic density of states, thermodynamic

equilibrium, entropy maximum principle semiconductor carrier statistics, equilibrium properties in non-uniform, doped material systems, excess carrier phenomena, drift diffusion model and its extensions.

Electives (Select 4 courses)

NM 6610 Integrated Circuit Packaging (NTU)
AUs: 3
Prerequisites: NIL
Semester 1
Die Passivation. Leadframe. Die-attach and Wirebond Materials. Tape Automated Bonds. Mounding Compounds. Characterization of Molding Compound Properties. Other Encapsulants. Leadframe Fabrication. Die Attachment. Tape Automated Bonding. Encapsulation Process Technology. Deflashing. Lead Finish. Lead Trimming and Forming. Marking and Inspection. Ball grid array, Flip-chip technology, and Surface mount technology. Classification of Failure Mechanisms. Analysis of Failures. Failure Accelerators. Models for Failure Mechanisms. Ranking of Potential Failures. Comparison of Plastic and Ceramic Package Failure Modes. Classification of Failure Mechanisms. Analysis of Failures. Failure Accelerators. Models for Failure Mechanisms. Ranking of Potential Failures. Comparison of Plastic and Ceramic Package Failure Modes. Heat dissipation issues, mechanical stress issues, passivation issues and hermeticity issues. Trends in Circuit Technology. Trends in Materials, Design, and Fabrication. Trends and Challenges in Circuit Card Assemblies. Issues Related to MEMS Packaging.

NM 6611 Failure Mechanisms and Device Characterization (NTU)
AUs: 3
Prerequisites: NIL
Semester 2
Classification of failure mechanisms. Brief description of various failure mechanisms. Fail distribution, fail kinetics and modeling. Intrinsic physical defects. Extrinsic physical defects. Cosmetic defects. Underlying physics of the failure mechanisms: latch-up, second breakdown and soft error, crystal defects induced. Acceleration factors for the failure mechanisms. Corresponding failure modes for the failure mechanisms. Underlying physics of the failure mechanisms: defect related breakdown, time-dependent-dielectric breakdown, ESD and EOS, ionic contamination. Acceleration factors for the failure mechanisms. Corresponding failure modes for the failure mechanisms. Underlying physics of the failure mechanisms: electromigration, contact electromigration, via electromigration and corrosions. Acceleration factors for the failure mechanisms. Corresponding failure modes for the failure mechanisms. Underlying physics of the failure mechanisms: hot carrier effect and surface roughness effect. Acceleration factors for the failure mechanisms. Corresponding failure modes for the failure mechanisms. Identification of predominant mechanism, using temperature to accelerate integrated circuit failure mechanisms, combining several failure mechanisms with different activation energies, acceleration models including voltage, failure mechanisms driven reliability testing, failure mechanism consistency under test and field conditions, calculating the acceleration factor, projecting fails to the field.

NM 6612 Silicon Photonics (NTU)
AUs: 3
Prerequisites: NIL
Semester 2
Basic electrical and optical characteristics of silicon semiconductor materials, material fabrication and processing technique. The difficult to generate light from Silicon. Basic ideas and operating principle of Si based quantum wells and quantum cascade using lattice matched Si/Si_xGe_{1-x} materials. Design consideration of quantum cascade lasers and infrared detectors using Si/Ge material. The merits and difficulties of the realization of Si based quantum cascade devices. Porous silicon, state-of-the-art silicon nanocrystals fabrication techniques. Electrical transport mechanism in silicon nanocrystals, silicon nanocrystal capacitors, memory. Light emission mechanism in Si nanocrystal. Insulator on Silicon (IOS) fabrication technique. Application of IOS. High-speed optical modulator using IOS platform. Raman Amplification Silicon lasers using IOS. The reasons for realized silicon optoelectronic integrated circuits (Si-OEIC). Design and realization of Si-OEIC. Trends and challenges in the future development of using silicon technique in manufacturing of consumer optoelectronics products.

NM 6613 ULSI Technology (NTU)
AUs: 3
Prerequisites: NIL
Semester 1
MOS Structure. MOSFETS. NMOS Process. CMOS Process. P-Well CMOS. N-Well CMOS. Twin-Well CMOS. Basic Bipolar Transistors. Advanced Bipolar Transistor Structures. Introduction of BiCMOS. Geometry Effect on Circuit Speed. Experimental Short-Channel Characteristics. Short-Channel Effect on Drain Current. Geometry Effects on Threshold Voltage. Hot Carrier Effect and Drain Engineering. Scaling Laws of MOS Devices. Velocity Saturation. CMOS Latchup: Basic Switching Operation, Causes of Latchup, Latchup Characterization, and Latchup Prevention. MOS Isolation. CMOS Isolation. New Isolation Techniques for CMOS. ielectrics for Advanced VLSI CMOS: high-k gate dielectrics; low-k dielectrics.

NM 6614 RF Silicon Electronics (TUM)
AUs: 3
Prerequisites: NIL
Semester 1
Fundamentals of semiconductor physics, band structure and transport, lattice vibrations, low dimensional semiconductor physics, silicon as the base material the p-n junction, diodes, the p-n diode, pin diodes, metal-semiconductor barriers, the Schottky diode, the Si bipolar transistor, the SiGe heterostructure bipolar transistor, equivalent circuits, high frequency properties, nonlinear behaviour and noise properties of the Si bipolar transistor and the SiGe HBT, Si field effect transistors, SiGe-hetero FETs, high frequency properties nonlinear behaviour and noise properties of Si field effect transistors and SiGe-hetero FETs, tunnelling phenomena, silicon transit time devices, the resonant phase transistor, rf silicon monolithic integrated circuits, silicon integrated millimeterwave circuits (SIMMWICs), transmission line and interconnect structures in monolithic integrated circuits. Monolithic integration of planar circuit elements, rf circuits: amplifiers, oscillators, mixers, high-speed digital circuits, computer modelling and optimisation of devices, passive structures and circuits, measurement and parameter extraction.

NM 6615 Simulation and Optimization of Analog Circuits (TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Analog simulation: circuit topology, modified nodal analysis (MNA); AC (small-signal) simulation; DC (operating point) simulation, Newton-Raphson, linearized circuit models; TR (transient) simulation, numerical integration, discretized circuit models; large-signal models; Analog optimization: structural analysis, sizing rules, sensitivity analysis, nominal design; worst-case analysis classical, realistic, general; yield analysis, Monte-Carlo, geometric; design centering; probability calculus, expectation values, expectation estimators; optimality conditions constrained/unconstrained; univariate optimization, line search; multivariate optimization, gradient-free, Newton, quasi-Newton, Levenberg-Marquardt, least-squares, conjugate-gradient; constrained optimization, Quadratic Programming; Sequential Quadratic Programming; Linear Programming, Simplex Algorithm, Ellipsoid Algorithm; statistical optimization, Kjellstroem Algorithm.

NM 6616 Nanoelectronics (TUM)
AUs: 3
Prerequisites: NIL
Semester 2
Low dimensional structures: quantum wells, quantum wires and quantum dots. Electronic, optical, transport properties of nanostructures. Quantum semiconductor devices. Fabrication and characterization techniques of nanotechnology. Applications of nanostructures, nanodevices and nanosystems. The bottom-up approach to nanotechnology:introduction to molecular electronics and optoelectronics. Organic materials for electronics: self-assembled monolayers; conducting polymers; carbon nanotubes. Circuit implementations and architectures for nanostructures: quantum cellular automata and cellular non linear networks. Introduction to quantum computing.

NM 6617 Advanced MOSFETs and Novel Devices (TUM)
AUs: 3
Prerequisites: NIL
Semester 2

Historical development of mainstream MOSFETs until today; economical, technological and physical fundamentals; properties of long channel and short channel MOSFETs, hot carrier effects; scaling rules; basics of charge carrier transport (quantum mechanical, hydro dynamics, ballistics); proposed new MOSFET structures (vertical MOSFETs, double gate, fully depleted MOSFETs); hot electron transistors; tunneling transistors; low dimensional devices; single electron transistor, single electron memories, quantum electronics.

Broadening Courses

Information on the course description is available on the German Institute of Science & Technology (GIST) website: http://www.gist.edu.sg/modules_microelectronics.aspx

Enrichment

- NM 6062 Business and Technical English (GIST) (80 hours)

Cross Discipline Modules

- International Patent Law (GIST) (10 hours)
- Selected topics in Business and Administration (GIST) (10 hours)
- Selected topics in Management methods (GIST) (10 hours)
- Cultural, social and economical aspects of globalization (GIST) (10 hours)
- Aspects of European and Asian Culture and History (GIST) (10 hours)

Graduate Diploma in Information-Communication Technology

EE5701 Data Communications and Network Protocols
AUs: 3
Prerequisites: NIL
Semester 2
Data communication fundamentals. Communication networks. Local area networks. Network and transport protocols. Internetworking.

EE5702 Foundations of Software Engineering
AUs: 3
Prerequisites: NIL
Semester 2
Introduction. Requirement analysis and design. Software management and planning. Introduction to object-oriented approach. Software quality assurance. Software maintenance and reuse.

EE5703 Object-Oriented Programming
AUs: 3
Prerequisites: NIL
Semester 2
Object-Oriented programming in C++. MFC programming. Windows NT programming.

EE5704 Multimedia Communications
AUs: 3
Prerequisites: NIL
Semester 1
Introduction to multimedia networks. Quality of service and traffic characteristics. Traffic scheduling. Multicasting mechanisms. Resource reservation. Multimedia communication protocols. Networked multimedia applications issues.

EE5705 Internet Business Technology
AUs: 3
Prerequisites: NIL
Semester 1
Introduction to electronic commerce. World Wide Web technology. Date warehouses and data mining technology. Information security technology. Electronic payment system. Standards for electronic commerce. Applications of electronic commerce.

EE5706 Web Technology
AUs: 3
Prerequisites: NIL
Semester 1
Introduction to web technologies. Web design in Java and JavaScript. Structuring Web data in XML.