Gondwana University, Gadchiroli

Syllabus

for

Master of Science (M. Sc.) Electronics

Sem III & IV

Based on NEP – 2020

(With effect from 2024-25)

Board of Studies in Electronics

Faculty: Science and Technology

Gondwana University, Gadchiroli

NEP 2020 P.G. PROGRAMME SESSION 2024-25

Faculty of Science and Technology

Program Name - M.Sc. Sem-III (ELECTRONICS)

Sr. No.	Course Category	Subject name	Total Credit	Teaching Scheme (Hrs)			Examination Scheme									Total Marks
							Theory					Practical				
				Theory	Practical	Total Hrs.	UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing	
1	Major	Electromagnetic Fields and Antennas	04	04	--	04	80	20	100	40	03	--	--	--	--	100
2		Digital Communication	04	04	--	04	80	20	100	40	03	--	--	--	--	100
3		Mobile and Satellite Communication	04	04	--	04	80	20	100	40	03	--	--	--	--	100
4		Practical Based on Major Subject 1,2,3	02	-	04	04	-	-	-	-	-	30	20	50	25	50
5	Major (Elective) Any one from elective basket	Optoelectronics and optical fiber communication IC Technology VLSI Design CMOS System Design	02	02	--	02	40	10	50	20	02	--	--	-	-	50
6		Practical based on Elective Subject	02	-	04	04	-	-	-	-	-	30	20	50	25	50
7		Research Project	04	--	08	08	--	--	--	--	--	60	40	100	50	100
Total			22	14	16	26	280	70	350	-	-	120	80	200	125	550

Gondwana University, Gadchiroli

NEP 2020 P.G. PROGRAMME SESSION 2024-25

Faculty of Science and Technology

Programme Name - M.Sc. Sem IV (Electronics)

Sr. No.	Course Category	Subject name	Total Credit	Teaching Scheme (Hrs)			Examination Scheme									Total Marks
							Theory					Practical				
				Theory	Practical	Total Hrs.	UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing	
1	Major	Mechatronics	04	04	--	04	80	20	100	40	03	--	--	--	--	100
2		Network Analysis and Synthesis	04	04	--	04	80	20	100	40	03	--	--	--	--	100
3		Practical-I based on Mechatronics	02	-	04	04	-	-	-	-	-	30	20	50	25	50
4		Practical-II based on Network Analysis and Synthesis	02	-	04	04	-	-	-	-	-	30	20	50	25	50
5	Major (Elective) Any one from Elective basket	Fabrication and Characterization Techniques for Electronics Devices Technology in Smart City Electronics Commerce	04	04	--	04	80	20	100	40	03	--	--	--	--	100
6		Research Project	06	--	12	12	--	--	--	--	--	90	60	150	75	150
Total			22	12	20	32	240	60	300	-	-	150	100	250	125	550

M. Sc. SEMESTER III

DSC 7 Major (Credits: 04)

Paper- I (PSCELT301)

Electromagnetic Fields and Antennas

Unit I: Electromagnetic waves

The equation of continuity for time varying fields, Maxwell's equations, EM waves in a homogeneous medium, wave equations for a conducting medium, conductors and dielectrics, Poynting's theorem, interpretation of E x H, complex Poynting vector.

Unit II: Antenna Basics

Basic radiation equation, radiation resistance, antenna patterns, half-power bandwidth, radiation intensity, directivity and gain, resolution, apertures, effective heights, Fii's transmission formula, field zones, linear, elliptical and circular polarization.

Unit III: Antenna types

The antenna family, short dipole antenna, antenna arrays, broad-side and end-fire arrays, linear arrays, folded dipole, Yagi-Uda array, helical beam antenna, horn antenna, rhombic antenna, parabolic reflectors.

Unit IV: Antennas for mobile communications and antenna measurements

Antennas for terrestrial mobile communications, base station antennas, switched beam and beam forming antennas, antennas on cellular handsets, micro-strip lines and antenna.

Antenna measurements: The reciprocity theorem, antenna ranges, compact antenna test ranges (CATR), instrumentation for measurement of radiation properties of antenna under test (AUT).

References:

1. Electromagnetic waves and Radiating Systems: E. C. Jordan and R. E. Balmain, PHI, New Delhi
2. Antennas: For All Applications: John D. Kraus and R. J. Marhefka, TMH, New Delhi
3. Antennas and Radiowave Propagation: R. E. Collin, MGH, International Edition

Practical

1. Study of the structure and operation of wired, aperture, planar and array antennas.
2. Proof of Inverse square law
3. Proof of Reciprocity theorem
4. Measurement of radiation pattern of all wired and aperture antennas
5. Measurement of radiation pattern of planar antennas
6. Measurement of radiation pattern of reflector antennas
7. Measurement of radiation pattern of array antennas
8. Analysis of co-polarization and cross polarization
9. Design and simulation of microstrip antenna using CST tool.
10. Measurement of antenna parameters using Network Analyzer.

DSC 8 Major (Credits: 04)

Paper- II (PSCELT302)

Digital Communication

Unit I: Signals and spectra

Classification of signals, energy and power signals, energy spectral density, power spectral density, unit impulse function, sifting property of the Dirac delta function, Fourier series, Parseval's theorem, Fourier transforms, properties of Fourier transforms, convolution properties, graphical convolution.

Unit II: Digital Communication system

Elements of digital communication system, the sampling theorem, aliasing error, PAM, PPM & PWM signals generation and detection, Pulse code modulation, uniform and non-uniform quantization, SNR, compounding characteristics, Inter-symbol interference, Nyquist criteria of zero ISI, eye pattern.

Unit III: Digital Modulation Techniques

Coherent binary modulation techniques, PSK, FSK, QPSK, MSK differential pulse code modulation, predictor, delta modulation, adaptive delta modulation, slope overload and granular noise, M-array signalling.

Unit IV: Information Coding

Measure of information, entropy, mutual information, Shannon's coding theorem, channel capacity, capacity of Gaussian channel, source coding, Huffman code, channel coding, block codes, syndrome decoding, convolutional coding, code tree, spread spectrum communication: PN sequences, direct sequence and frequency hopping spread spectrum systems.

Books:

1. Digital communications: Bernard Sklar (Pearson Education, Asia Publ)
2. Modern Digital and Analog Communications Systems: B. P. Lathi (Oxford Univ. Press)
3. Analog and Digital Communications: Hwei Hsu (Schaum Outline MGH)

References:

1. Digital communications: Symon Haykin (John Wiley & Sons)
2. Modern Digital communications Systems : Leon W. Couch (PHI, New Delhi)
3. Digital communications: J. G. Proakis (MGH)

Practical on Digital Communication

1. Study of PCM circuit and quantization
2. Study of PAM, PWM and PPM circuits and detection of these signals
3. Study of a Delta modulator
4. Study of a DBPSK communication system
5. Study of an adaptive Delta modulator
6. Study of a convolutional encoder
7. study of a PN sequence generator
8. Study of a spread spectrum direct sequence communication system

DSC 9 Major (Credits: 04)

Paper- III (PSCELT303)

Mobile and Satellite Communication

Unit I: Cellular Concepts and Equalization

Cellular telephone system, frequency reuse, channel assignment and land off strategies, elements of cellular radio system design, switching and traffic, data links and microwaves, system evaluation, interference and system capacity, Improving coverage capacity; Fundamentals of equalization, space polarization.

Unit II: Diversity, channel coding and GSM system for Mobile

Frequency and time diversity techniques, channel coding; service and features, GSM system architecture, GSM channel types, GSM frame structure, intelligent cell concept and applications; Features of handset, SMS, security; Interfacing of mobile with computer, application of mobile handset as modem, data storage device, multimedia device; Measurement of signal strength; Introduction to CDMA digital cellular standard

Unit III: Satellite Communication

Satellite orbits, frequencies, stabilization, orbital parameters, coverage area, work angle, Attitude and orbit control system, telemetry tracking and command power system; Satellite Link design: system noise temperature and G*/*T ratio, down link design, domestic satellite system; eclipse on satellite.

Unit IV: Multiple Access Techniques

FDMA and TDMA, TDMA synchronization and timing, code division multiple access. Applicability of CDMA to commercial system, Earth's path propagation effects; satellite services for communication – Weather forecasting, remote sensing, direct to home (DTH) TV.

Books:

1. Mobile Cellular Telecommunication: William C. Y. Lee, MGH Inc., 1995
2. Mobile communication: Jochen Schiller, Pearson Education, 2nd Edition, 2004
3. Satellite Communication: T. Pratt, Wiley Eastern Publication
4. Satellite Communication: D. C. Agrawal, Khanna Publications, New Delhi

Practical on Mobile and Satellite Communication

1. To Study Design Parameter of a Satellite
2. Design of a Digital Satellite Receiver
3. Analysis of a GPS Receiver
4. Analysis of Data services in INMARSAT communication system
5. To study Ionosphere to Launch and analyze NASA 4D Ionosphere
6. Analysis of Modulation Techniques for LEO Satellite Downlink Communications.
7. To analyze effects and impacts of rain attenuation on Satellite Communication
8. Evaluation of SNR in Satellite Links. To calculate the Carrier to noise ratio for uplink and downlink and also the overall carrier to noise ratio.
9. Analysis of Link Budget Equation.
10. To obtain a plot of the relationship between the Height of the satellite i.e. Orbital Altitude and the Satellite Antenna Diameter for the parameters achieved during Link budget Analysis
11. Analysis of Direct Sequence Spread Spectrum (DSSS) Technique.
12. Analysis of Frequency Hopping Spread Spectrum (FHSS) Technique.

DSE 7 Major Elective-I (Credits:02)

Paper- IV (PSCELT304)

Optoelectronics and optical fiber communication

Unit -I:

Lamps and illumination systems, LEDs – working principle and applications, LED lighting, Display devices, indicators, numeric, alphanumeric and special function displays, Liquid Crystal Display elements, Plasma Displays, Multimedia projectors, Semiconductor lasers, - Fabry-Perot lasers, Distributed Feedback, (DFB) lasers, Distributed Bragg Reflection (DBR) lasers.

Unit – II:

Photodetectors types and applications, PN and PIN Photodiodes, Avalanche Photodiodes (APD) Optocouplers, Opto interrupters, LASCR. used in safety interlocks, power isolators, rotary and linear encoders and remote control. Intrinsic and Extrinsic Fiber optic sensors.

Unit – III:

Optical Fiber Theory, Parameters of Optical Fibers, Types of Optical Fibers-Single Mode and Multi-Mode Fibers, Step Index & Graded Index Fibers. Modal Properties-Waveguide Parameter (V Number), Cut-off wavelength, Dispersion-Intermodal and Intramodal dispersion

Loss Mechanism in Optical Fibers-Adsorption and Scattering, Fresnel Reflection, Micro bending & Macro bending, Connector types and Splices, Misalignment and Mismatch losses.

Unit IV:

Fiber-Optic transmitters and receivers, Direct Modulators, External Modulators-Electro-Optic Modulators, Electro-Absorption Modulators, Noise in detection process, Noise Equivalent Power (NEP).

Text / Reference Books:

1. Optical Engineering Fundamentals B.H. Walker, PHI
2. Electro-Optical Instrumentation Sensing and Measuring with Lasers: SilvanoDonati, Pearson
4. Fiber optics and Optoelectronics: R.P. Khare, Oxford Press.
5.Optical Fiber Communication Principles and Systems A. Selvarajan, S.Kar and Srinivas, TMH
6. Optical Fiber Communications G. Keiser, TMH

Practical on Optoelectronics and optical fiber communication

1. Study of Light Emitting Diodes (LEDs)
2. Study of Light Depended Resistors (LDRs)
3. Study of Infrared Leds and Sensors
4. Study of Optocouplers
5. Study of Photodiodes and Phototransistors
6. Study of Optical Communication - Optical Fiber Training Set
7. Study of Optical Fiber Power Measurements
8. Study of Optical Fiber Attenuation Measurements
9. Study of Measurement of Bending Losses and Numerical Aperture

DSE 8 Major Elective-II (Credits: 02)

Paper- IV (PSCELT304)

IC Technology and VLSI Design

UNIT-I:

Material purification. Epitaxial growth: LPE, VPE, MBE. Clean room specifications and requirements, Vacuum technology, sputtering, oxidation, growth mechanism and kinetics (thin and ultrathin oxides), oxidation techniques, redistribution of dopants at the interface and oxidation induced defects.

UNIT–II:

Diffusion: Fick's law, diffusion mechanism, measurement techniques, diffusion in SiO2. Ion Implantation: systems and dose control, ion range, ion stopping, knock on ranges, metallization choices.

UNIT –III:

Etching: dry etching, pattern transfer, plasma etching, sputter etching, control of etch rate and selectivity, control of edge profile. Process simulation and process integration, Lithography: optical, electron beam, ion beam, X-ray lithography, lift off, dip pen. Pattern generation, Fabrication of few devices like MMIC, laser diode etc.

UNIT-IV:

Process control methods: Yield and reliability, causes of IC failure, VLSI process integration, NMOS IC technology, CMOS IC technology, Bipolar IC technology.

Books & References:

1. VLSI Design by K. Lal Kishore etal, I.K. International Publishing House
2. VLSI DESIGN –S.M. Sze
3. VLSI TECHNOLOGY- Gandhi

Practicals:

1. Design of an Inverter with given specifications*,
2. Design of DC Analysis
3. Design of AC Analysis
4. Design of Transient Analysis
5. Design a 4 bit R-2R based DAC
6. Design an op-amp with the given specification
7. HDL based design entry, Test bench creation and simulation of BCD counters, PRBS generators, Comparators (min 4-bit) / Bothe multiplier / Carry select adder.
8. Synthesis, Placement and Routing (P&R) and post P&R simulation of the
9. Invoke the PLL and demonstrate the use of the PLL module for clock generation in FPGAs.

DSE 9 Major Elective-III (Credits: 02)

Paper-IV (PSCELT304)

CMOS System Design

Unit - I:

CMOS IC design process, MOSFET capacitances, Amplifiers, common source amplifier, source follower, common gate amplifiers, push pull amplifier, noise and distortion in amplifiers, Differential amplifiers, source coupled pair, current source load, CMRR, noise, matching considerations, Basic CMOS Op-amp design, characterization of Op-amp, Op-amp compensation, Basic CMOS comparator, characterization.

Unit - II:

CMOS digital circuits, logic gates, static logic gates, dynamic logic gates, DC and switching characteristic.

Unit - III:

Mixed signal systems, Data converter fundamentals, converting analog to digital signals, sample and hold characteristics, ADC specifications, DAC specifications.

Unit - IV:

Power Analysis, sources of power dissipation, static and dynamic power dissipation, Power Optimization Techniques, Adaptive Power Supply.

Text/Reference Books

1. CMOS VLSI Design- Weste and Harris
2. CMOS Circuit Design, Layout, and Simulation -R. Jacob Baker, Harry W. Li & David E. Boyce
3. Digital Integrated Circuits- A Design Perspective, Rabaey, Chandrakasan, and Nikolic.
4. Design of Analog CMOS Integrated Circuits, B. Razavi, McGraw Hill

Practicals:

1. Study I-V characteristics of MOSFET.
2. Design of MOS capacitor.
3. Design basic logic gate.
4. Current mirror.
5. Design a basic differential amplifier.
6. Design a comparator.

M. Sc. SEMESTER IV

DSC 10 Major (Credit: 04)

Paper – I (PSCELT401)

Mechatronics

Unit I: Basic Elements of a mechatronic system

General introduction to mechatronic systems, traditional and mechatronics designs, control systems, open and closed-loop systems, sensors and transducers; performance parameters of transducers, static and dynamic characteristics, potentiometer sensor, LVDT, push-pull displacement sensor, eddy current proximity sensors, optical encoders.

Unit II: Basic System Models

A mathematical model of a system, elements in mechanical system, mass, moment of intertia, elements in electrical systems, resistors, capacitors, inductors, comparison of elements in these systems and their defining equations, dynamic responses of systems: examples of first and second order systems

Unit III: System transfer Functions

Conversion of differential equation into Laplace transform, transfer function of R-C series circuit, first order system with step input: illustrative examples, systems with negative feedback, location of poles on the s-plane, poles of stable and unstable systems, frequency response of a system of sinusoidal input, phasor equations, frequency response for a first-order system, Bode plots.

Unit IV: Closed-loop controllers

Lag, steady-state error, control modes, op-amps as signal conditioners, electronic proportional controller, system response, PD and PI control, PID controller, digital controllers, controller tuning, process reaction method, ultimate cycle method, Ziegler and Nichols criterion, adaptive control, self-tuning.

Reference:

1. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering: William Bolton, Pearson Education Publishers, New Delhi

Practical on Mechatronics

1. Introduction to Mechatronics
2. Stepper motor interface
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis basic hydraulic, pneumatic and electrical circuits using software.
8. Study of PLC and its applications.
9. Study of image processing

DSC 11 Major (Credit:04)

Paper – II (PSCELT402)

Network Analysis and Synthesis

Unit I: Network Analysis

Mesh analysis, mesh equations, super-mesh analysis, nodal analysis, nodal equations, source transformation technique, state variable analysis.

Unit II: Network Theorems and Applications

Star-delta transformations; Superposition, Thevenin's, Norton's and reciprocity theorems, duals and duality, Tellegen's and Millman's theorem.

Unit III: Laplace Transform and Properties

Laplace transformation, properties of Laplace transforms, partial fraction expansion, Heaviside's expansion theorem: illustrative examples.

Unit IV: Network Functions and synthesis Techniques

One-port and two-port networks, poles and zeors of network functions, time domain behaviour from the pole zero plot; stability of active networks, Hurwitz polynomials, positive real functions, Ruth-Hurwitz array and R-H criteria, Foster and Cauer methods of synthesis of RC and LC networks.

Books:

1. Network Analysis: M. E. Van Valkenberg, PHI, New Delhi

2.Circuits and Networks: Analysis and Synthesis: A. Sudhakar and S. P. Shyammohan, Tata McGraw Hill, New Delhi

Practical on Network Analysis & Synthesis

1. Verification of principle of superposition with dc and ac sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits
3. Verification of Tellegin's theorem for two networks of the same topology.
4. Determination of transient response of current in RL and RC circuits with step voltage input.
5. Determination of transient response of current in RLC circuit with step voltage input for under damp, critically damp and over damp cases
6. Determination of frequency response of current in RLC circuit with sinusoidal ac input
7. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.

DSE 10 Major Elective -I (Credit:03)

Paper – IV (PSCELT404)

Fabrication and Characterization Techniques for Electronics Devices

Objective:

- The main objective is to train the manpower/students in the field of semiconductor science and technology relevant to modern electronic industry/technology.

Course Outcomes:

- Understanding the fabrication and characterization technology for electronic (micro & nano) and opto-electronic devices based on Inorganic and Organic materials.
- Knowledge and skills necessary for device fabrication. This includes developing the ability to use clean room and vacuum techniques besides making them understand the basic concepts of electronic device fabrication at micro and nano-scale level.
- Trained manpower will be conversant with various processes and instruments to characterize the electronic materials and devices at different level for real time application.

Unit I:

Vacuum Science and thin film technology: Kinetic theory of gases, Production of Vacuum: Mechanical pumps, Diffusion pump, Getter and Ion Pumps. High Vacuum and Ultra High vacuum Systems: thermal and e-beam evaporation, sputtering, MBE etc. Atomic layer deposition, Electrodeposition, Spray pyrolysis, Spin coating.

Unit II:

Surface modification of materials: thermal treatment, thermomechanical treatment, ion beam irradiation. Etching: dry etching, plasma etching, sputter etching, control of etch rate and selectivity, control of edge profile. Lithography: optical, electron beam, ion beam, X-ray lithography, lift off, dip pen nanolithography. Pattern generation. Fabrication of few devices like MMIC, laser diode etc.

Unit III:

Spectroscopic Techniques: UV-visible-NIR Spectroscopy, Photoluminescence (PL), Raman Spectroscopy, X-ray photoelectron spectroscopy (XPS) and Transform Spectroscopy (FTIR). Electrical Characterization: current-voltage (I-V) and capacitance-voltage (C-V), Deep Level Transient Spectroscopy (DLTS).

Unit IV:

X-Ray Diffraction (XRD): The Bragg‘s condition, Laue method, Rotating crystal method, powder method, Determination of lattice type and crystal structure. Electron Microscope: Scanning electron microscope (SEM), Transmission electron microscopy (TEM), Field Emission SEM. Scanning probe microscopy: Atomic Force microscopy (AFM), Scanning tunneling microscopy (STM).

Suggested Reading:

1. Preparation of Thin Films, Joy George, Marcel Dekkar (1992)
2. Thin Film Phenomena, K. L. Chopra, Mc Graw Hill, (1970)
3. Physics of thin films by Ludmila Eckertova-Envas Press NY 1986 2nd Ed.
4. VLSI Fabrication Principles (Si and GaAs) by Sorab K. Gandhi , 2nd Ed. John Wiley 1994
5. Integrated Circuit Engineering-Design, Fabrication and Application by Arther B Glaser and Gerald E Subak-Sharpe, Addison Wesley Pub.Company, Reading, Massachusetts, BellTel Lab, Copyright 1977.
6. Semiconductor Material and Device Characterization, Dieter K. Schroder, John Wiley & Sons inc. (1998)
7. Modern Semiconductor Fabrication Technology by Peter Gise and Richard Blanchard, Prentice Hall, NJ

DSE 11 Major Elective- II (Credit: 03)

Paper – IV (PSCELT404)

Technologies in Smart City

Unit - I:

Introduction to technologies used smart cities: Internet of Things, Wireless sensing networks, Big data, Cloud computing, Artificial intelligence, Machine vision, etc.

Smart sensors: Construction and working of smart sensors, smart temperature sensors, humidity/moisture sensors, acoustic sensors, gas sensors, pressure sensors, acceleration sensors, level sensors.

Unit - II:

Cloud Computing: Introduction, cloud computing platforms, parallel programming in the cloud distributed storage systems, virtualization, cloud security, multicore operating systems.

Unit – III:

Big Data: Introduction, definition and taxonomy, value for the enterprise, setting up the demo environment first steps with the Hadoop ecosystem. The Hadoop ecosystem, introduction.

Unit - IV:

Networking and security in smart cities: Smart city metrics, dash boarding, mobility, shared services, standards and protocols, ownerships, cyber-security, safety and privacy.

Case Studies: Smart Buildings, Smart city service management.

Recommended Books

1. Picon, A. *Smart Cities: A Spatialised Intelligence*. John Wiley & Sons, 2015

2. Kyung, C., Lin, Y., Liu, Y. and Yasuura, H. *Smart Sensors and Systems*. Cham: Springer International Publishing 2015.

3. Schwab, K. *The Fourth Industrial Revolution*. Crown Publishing Group2017.

4. Townsend, A. M. *Smart cities: Big data, civic hackers, and the quest for a new utopia*. WW Norton & Company, 2013.

5. Alba E, Chicano F, Luque G. Smart Cities. Cham: Springer International Publishing; 201

DSE12 Major Elective- III (Credit: 03)

Paper – IV (PSCELT404)

Electronic Commerce

Unit – I:

Introduction to E– commerce: Meaning and concept – E– commerce v/s Traditional Commerce– E– Business & E– Commerce – History of E– Commerce – EDI – Importance, features & benefits of E– Commerce – Impacts, Challenges & Limitations of E– Commerce – Supply chain management & E – Commerce – E – Commerce infrastructure.

Unit – II:

Business models of E – Commerce: Business to Business – Business to customers– Customers to Customers – Business to Government – Business to Employee – E – Commerce strategy – Influencing factors of successful E– Commerce.

Unit – III:

Marketing strategies & E – Commerce: Website – components of website – Concept & Designing website for E– Commerce – Corporate Website – Portal – Search Engine – Internet Advertising – Emergence of the internet as a competitive advertising media– Models of internet advertising – Weakness in Internet advertising – Mobile Commerce.

Unit -IV:

Electronic Payment System: Introduction – Online payment systems – prepaid and postpaid payment systems – e– cash, e– cheque, Smart Card, Credit Card , Debit Card, Electronic purse – Security issues on electronic payment system – Solutions to security issues – Biometrics – Types of biometrics. Legal and ethical issues in E– Commerce: Security issues in E– Commerce– Regulatory framework of E– commerce.

Books recommended:

1. Turban, Efraim, and David King, "Electronic Commerce: A Managerial Perspective", 2010, Pearson Education Asia, Delhi.
2. Kalakota, Ravi, "Frontiers of Electronic Commerce", 2004, Addison – Wesley, Delhi.
3. Rayport, Jeffrey F. and Jaworksi, Bernard J, "Introduction to E–Commerce", 2003,
4. Tata McGraw Hill, New Delhi.
5. Smantha Shurety, "E–Business with Net Commerce", Addison – Wesley, Singapore.
6. Rich, Jason R: Starting an E–Commerce Business, 2007, IDG Books, Delhi.
7. Laudon, Kenneth C and Carol Guercio Traver: E–Commerce business. Technology, 2011, Pearson Education, Delhi.
8. Stamper David A, and Thomas L.Case: Business Data Communications, 2005, Pearson Education, New Delhi.
9. Willam Stallings: Business Data Communications, 2007, Pearson Education, New Delhi

Lab Course VIII (Credits: 06) (PSCELP408)

Research Project