RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

EC- 6001 Cellular mobile communication

Course Contents

Unit-I

Introduction to cellular mobile system

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning of cellular system.

Elements of cellular radio system design

General description of problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I in an omni-directional antenna system, hand off mechanism, cell splitting, components of cellular systems.

Unit-II

Cell coverage for signal and traffic

General introduction, mobile point-to-point model, propagation over water or flat open area, foliage loss, propagation in near- in distance, long distance propagation, path loss from point-to-point prediction model, cell site antenna heights and signal coverage cells, mobile-to-mobile propagation.

Cell site antennas and mobile antennas

Equivalent circuits of antennas, gain and pattern relationship, sum and difference patterns, antennas at cell site, unique situations of cell site antennas, mobile antennas.

Unit-III

Cochannel interference reduction

Cochannel interference, real time cochannel interference measurement at mobile radio transceivers, design of antenna systems - omni directional and directional, lowering the antenna height, reduction of cochannel interference, umbrella- pattern effect, diversity receiver, designing a system to serve a predefined area that experiences cochannel interference.

Types of Noncochannel interference

Adjacent channel interference, near-end-far-end interference, effect on near-end mobile units, cross-talk, effects of coverage and interference by applying power decrease, antenna height decrease, beam tilting, effects of cell site components, interference between systems, UHF TV interference, long distance interference.

Unit-IV

Frequency management and Channel Assignment

Frequency management, frequency spectrum utilization, setup channels, channel assignment, fixed channel assignment, non-fixed channel assignment algorithms, additional spectrum, traffic and channel assignment, perception of call blocking from the subscribers

Handoffs and dropped calls

Value of implementing handoffs, initiation of handoff, delaying a handoff, forced handoff, queuing of handoff, power- difference handoff, mobile assisted handoff and soft handoff, cell-site handoff and intersystem handoff, dropped call rate formula.

Unit-V

Digital Cellular Systems

GSM- architecture, layer modeling, transmission, GSM channels and channel modes, multiple access scheme.

CDMA- terms of CDMA systems, output power limits and control, modulation characteristics, call processing, hand off procedures.

Miscellaneous mobile systems- TDD systems, cordless phone, PDC, PCN, PCS, non cellular systems.

References:

1. Lee: Cellular and Mobile Telecommunication- Analog & digital systems, TMH.
2. Rappaport: Wireless Communications- principles and practice, Pearson Education.
3. Lee: Mobile communications design fundamentals, Wiley India.
4. Faher Kamilo: Wireless Digital Communication, PHI Learning.
5. Raj Kamal: Mobile Computing, Oxford University Press.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

EC- 6002 Digital signal Processing

Unit – I

Discrete-Time Signals and Systems

Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, discrete time systems described by difference equation, solution of difference equation, implementation of discrete-time systems, stability and causality, frequency domain representation of discrete time signals and systems.

Unit - II

The z-Transform

The direct z-transform, properties of the z-transform, rational z-transforms, inversion of the z transform, analysis of linear time-invariant systems in the z- domain, block diagrams and signal flow graph representation of digital network, matrix representation.

Unit - III

Frequency Analysis of Discrete Time Signals

Discrete fourier series (DFS), properties of the DFS, discrete Fourier transform (DFT), properties of DFT, two dimensional DFT, circular convolution.

Unit - IV

Efficient Computation of the DFT

FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, decomposition for 'N' composite number.

Unit - V

Digital filters Design Techniques

Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques-rectangular and other windows, examples of FIR filters, design using windowing.

References:

1. Oppenheim and Schafer: Digital Signal Processing, PHI Learning.
2. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI Learning.
3. Proakis: Digital Signal Processing, Pearson Education.
4. Rabiner and Gold: Theory and Application of Digital Signal Processing, PHI Learning.
5. Ingle and Proakis: Digital Signal Processing- A MATLAB based Approach, Thompson, Cengage Learning.

List of Experiments:

1. Generation, analysis and plots of discrete-time signals.
2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.
4. Computation and plot of DTFT of sequences, verification of properties of DTFT.
5. Computation and plots of z-transforms, verification of properties of z-transforms.
6. Computation and plot of DFT of sequences, verification of properties of DFT.
7. Computation and plots of linear/circular convolution of two sequences.
8. Computation of radix-2 FFT- Decimation in time and Decimation in frequency.
9. Implementation of IIR and FIR filter structures (direct, cascade, parallel etc).
10. Implementation of **v**arious window design techniques (Rectangular, Bartlett, Hann, Hamming etc).

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

EC- 6003 Antennas and wave Propagation

Unit I
Radiation
Potential function and the Electromagnetic field, potential functions for Sinusoidal Oscillations, retarded potential, the Alternating current element (or oscillating Electric Dipole), Power radiated by a current element, Application to short antennas, Assumed current distribution, Radiation from a Quarter wave-monopole or Half wave dipole, sine and cosine integral, Electromagnetic field close to an antenna, Solution of the potential equations, Far-field Approximation.

Unit II
Antenna Fundamentals
Introduction, network theorems, directional properties of dipole antennas, travelling –wave antennas and effect of feed on standing-wave antennas, two –element array, horizontal patterns in broad-cast arrays, linear arrays, multiplication of patterns ,effect of earth on vertical patterns, Binomial array, antenna gain, effective area.

Unit III
Types of antennas
Babinet's principles and complementary antenna, horn antenna, parabolic reflector antenna, slot antenna, log periodic antenna, loop antenna, helical antenna, biconical antenna, folded dipole antenna, Yagi-Uda antenna, lens antenna, turnstile antenna. Long wire antenna: resonant and travelling wave antennas for different wave lengths, V-antenna, rhombic antenna, beverage antenna, microstrip antenna.

Unit IV
Antenna array synthesis
Introduction, retarded potentials, array structures, weighting functions, linear array analysis, different forms of linear arrays, Schelknoff unit circle, linear array synthesis, sum and difference patterns, Dolph-Chebychev synthesis of sum pattern, Taylor synthesis of sum patterns, Bayliss synthesis of difference patterns, planar arrays, arrays with rectangular boundary.

Unit V
Propagation of radio waves
Fundamentals of electromagnetic waves, effects of the environment, modes of propagation.
Ground wave propagation- Introduction, plane earth reflection, space wave and surface wave, transition between surface and space wave, tilt of wave front due to ground losses.
Space wave propagation- Introduction, field strength relation, effects of imperfect earth, curvature of earth and interference zone, shadowing effect of hills and buildings, absorption by atmospheric phenomena, variation of field strength with height, super refraction, scattering, tropospheric propagation, fading, path loss calculations.
Sky wave propagation- Introduction, structural details of the ionosphere, wave propagation mechanism, refraction and reflection of sky waves by ionosphere, ray path, critical frequency, MUF, LUF, OF, virtual height, skip distance, relation between MUF and skip distance.

References:

1. Jordan and Balmain: Electromagnetic Waves and Radiating System, PHI Learning.
2. Krauss: Antennas and wave propagation, TMH.
3. Balanis: Antenna Theory Analysis and Design, Wiley India Pvt. Ltd.
4. Harish and Sachidananda: Antennas and wave propagation, Oxford University Press.
5. Raju: Antennas and Wave Propagation, Pearson Education.
6. Kennedy: Electronic Communication Systems, TMH.

List of Experiments:

1. To Plot the Radiation Pattern of an Omni Directional Antenna.
2. To Plot the Radiation Pattern of a Directional Antenna.
3. To Plot the Radiation Pattern of a Parabolic Reflector Antenna.
4. To Plot the Radiation Pattern of a Log Periodic Antenna.
5. To Plot the Radiation Pattern of a Patch Antenna.
6. To Plot the Radiation Pattern of a Dipole/ Folded Dipole Antenna.
7. To Plot the Radiation Pattern of a Yagi (3-EL/4EL) Antenna.
8. To Plot the Radiation Pattern of a Monopole/ WHIP/ Collinear Antenna.
9. To Plot the Radiation Pattern of a Broad site Antenna.
10. To Plot the Radiation Pattern of a Square Loop Antenna.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

EC- 6004 VLSI circuits and systems

Unit I

Introduction

Introduction to CMOS VLSI circuit, VLSI design flow, Design strategies ,Hierarachy, regularity, modularity, locality, MOS Transistor as a Switches, CMOS Logic, Combinational circuit, latches and register, Introduction of CAD Tool , Design entry, synthesis, functional simulation.

Unit II

Specification of sequential systems

Characterizing equation & definition of synchronous sequential machines. Realization of state diagram and state table from verbal description, Mealy and Moore model machines state table and transition diagram. Minimization of the state table of completely and incompletely specified sequential machines.

Unit III

Asynchronous Sequential Machine

Introduction to asynchronous sequential machine, Fundamental mode and Pulse mode asynchronous sequential machine, Secondary state assignments in asynchronous sequential machine, races and hazards.

Unit IV

State Machine

Algorithmic state machine and fundamental concept of hardware/ firmware algorithms. Controllers and data system designing.

Unit V

Fault Detection in combinational circuit

Types of faults, Fault detection using Boolean Difference and path sensitization method.

Concept of PROM, PLA, PAL, CPLD and FPGA, PALASM software applications.

Refrences:

1. Neil Weste: Principle of CMOS VLSI Design, TMH.
2. Kohavi: Switching & Finite Automata Theory, TMH.
3. Lee: Digital Circuits and Logic Design, PHI Learning..
4. Roth Jr.: Fundamentals of Logic Design, Jaico Publishing House.
5. Parag K. Lala: Fault Tolerant and Fault Testable Hardware Design, BS Publication.

LIST OF EXPERIMENTS

1. Write a Verilog/VHDL Code to implement a 4X1 MUX.- (a)Using If-Else Statement (b)Using case statement (c)Using conditional assignment statement
2. Write a Verilog/VHDL code to implement a 2-bit wide 8X1 MUX-(a) Using If-Else Statement (b) Using case statement (C) Using conditional assignment statement
3. Write Verilog/VHDL code to implement 6-bit comparator
   Write a Verilog/VHDL Code to implement a 4Bit Synchronous counter.
4. Write Verilog/VHDL programs to implement an Up/Down counter
5. Write a Verilog/VHDL Code to implement D flip-flop, using positive level triggering.
6. Write a Verilog/VHDL Code to implement D flip-flop, using negative edge triggering.
7. Write a Verilog/VHDL Code to implement JK flip-flop, using negative edge triggering.
8. Write a Verilog/VHDL Code to implement, synthesize and simulate a 4 bit shift register.
9. Write a Verilog/VHDL Code to implement 1011 non-overlapping sequence detector.
10. Write a Verilog/VHDL Code to implement 1010 overlapping sequence detector.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

Elective-II EC- 6005 (1) Nano Electronics

Unit 1: Introduction Nanoscale technology: Consequences of the nanoscale for technology and society. Molecular building blocks for nanostructure systems, Nano-scale 1D to 3D structures, Band structure and density of states at low dimensional structure. Size dependent properties (Elelctrical, mechanical, optical, thermal etc).top down and bottom up technique, lithographic, nanolithographic and nonlithographictechniques:plused laser depositon,plasma arc discharge, e-beam sputtering, ball milling , solgel, electrodeposition, chemical vapour deposition.

Unit 2: Characterization technique Scanning probe microscopy: (Principle, construction and working;) Scanning tunnelling microscope, Atomic force microscope, scanning electron microscope, Transmission electron microscope, Carbon materials :Allotropes of carbon, Structure of Carbon Nanotubes, types of CNTs-, Electronic properties of CNTs, Band structure of Graphene ,Band structure of SWNT from grapbene ,electron transport properties of SWNTs ,

Unit -3:Introduction to magnetism and superconductivity Basic magnetic phenomena: paramagnetism, ferromagnetism, ferrimagnetism, anti-ferromagnetism;nano-magnetism; giant and colossal magnetoresistance; ferrofluids. Basic superconductivity phenomena; flux quantisation and Josephsoneffects.

Unit 4: Fundamental of nanoeletronics Charging of quantum dots, Coulomb blockade, Quantum mechanical treatment of quantum wells, wires and dots, Widening of bandgap in quantum dots, Strong and weak confinement, spin field effect transistor. single electron transistors, other SET and FET structure.

Unit 5: Silicon MOSFETs Silicon MOSFET: fundamental of MOSFET devices, scaling rules, silicon dioxide based gate dielectrics, metal gates , junction and contacts, advanced MOSFET concepts

References:

1.G. W. Hanson: Fundamentals of Nanoelectronics, Pearson Education.
2. K. K. Chattopadhyay and A. N. Banerjee: Introduction to Nanoscience and Nanotechnology, PHI Learning.
3. John H. Davis: Physics of low dimension semiconductor, Cambridge Press.
4.KTu, JW Mayer, LC Feldman, "Electronic Thin Film Science", Macmillan, New York, 1992.
5. Z Cui , "Mico-Nanofabrication", Higher Education press, Springer, 2005.
6.Brian Cantor, "Novel Nanocrystalline Alloys and Magnetic Nanomaterials," Institute of Physics Publications, 2005.
7. S.Chikazumi and S.H. Charap," Physics of Magnetism", Springer-verlag berlin Heideberg, 2005
8.CaoGuozhong, "Nanostructures and Nanomaterials - Synthesis, Properties and Applications", Imperial College Press, 2004.
9. SadamichiMaekawa, "Concepts in Spintronics", Oxford University Press, 2006

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

Elective-II EC- 6005 (2) RFID

UNIT I. : Introduction: Automatic Identification Systems, a Comparison of Different ID Systems,Components of an RFID System.**Differentiation Features of RFID Systems:** FundamentalDifferentiation Features, Transponder Construction Formats, Frequency, Range and Coupling,Information Processing in the Transponder, Selection Criteria for RFID Systems.

UNIT II : Fundamental Operating Principles: 1-Bit Transponder, Full and Half Duplex Procedure, Sequential Procedures.**Physical Principles of RFID Systems:** Magnetic Field, Electromagnetic Waves, Surface Waves.

UNIT III : Frequency Ranges and Radio Licensing Regulations: Frequency Ranges Used, European Licensing Regulations, National Licensing Regulations in Europe, National Licensing Regulations.
Standardisation: Animal Identification, Contactless Smart Cards, ISO 69873 — Data Carriers for Tools and Clamping Devices, ISO 10374 — Container Identification, VDI 4470 — Anti-theft Systems for Goods, Item Management.

UNIT IV : Coding and Modulation: Coding in the Baseband, Digital Modulation Procedures. **Data Integrity:** The Checksum Procedure, Multi-Access Procedures — Anticollision. **Data Security :**Mutual Symmetrical Authentication, Authentication Using Derived Keys, Encrypted Data Transfer.

UNIT V : Sensors & sensing technology and interfacing Techniques, Transponder with Memory Function, HF interface, Example circuit — load modulation with subcarrier, Example circuit — HF interface for ISO 14443 transponder, Address and security logic, Read-only transponder, Writable transponder, Transponder with cryptological function, Segmented memory, MIFARE_ application directory, MIFARE_ plus, Modern concepts for the dual interface card, Measuring Physical Variables, Transponder with sensor functions, Measurements using microwave transponders, Sensor effect in surface wave transponders.
Readers: Data Flow in an Application, Components of a Reader, Low Cost Configuration — Reader IC U2270B, Connection of Antennas for Inductive Systems, Reader Designs.
Applications: Contactless Smart Cards, Public Transport, Ticketing, Access Control, Transport Systems, Animal Identification, Electronic Immobilisation, Container Identification, Sporting Events, Industrial Automation, Medical Applications. Interfacing technology, Zigbee

Textbooks:
1. Klaus Finkenzeller"RFIDHandbook"Second Edition John Wiley & Sons Ltd.
2. STEPHEN B. MILES, SANJAY E. SARMA, JOHN R. WILLIAMS"RFID Technology and Applications" Cambridge
University Press 2008.
3. Yan Zhang and Paris Kistos "Security in RFID and sensor networks" CRC press 2009.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

Elective-II EC- 6005 (3) Statistical signal Processing

UNIT- I : REVIEW :
IIR and FIR filters design, Filtering problems, Advanced signal processing techniques and transforms, Multirate Signal processing – Down sampling/up sampling, Introduction to discrete Hilbert transform, wavelet transform, Haar transform.
State Estimation Filter- Concept of Estimation of linear and nonlinear signals, estimation Wiener Filter Non linear Estimation-Concept of sufficient statistics and statistical estimation of parameters .

UNIT- II : ADAPTIVE FILTERING :
Introduction to Adaptive filtering, Types of adaptive filters, Introduction to Statistical signal Detection, Four classes of application in interference (noise, echo) cancellation, Identification, Inverse modeling, prediction. Least mean square filter (LMS), Recursive least square filter (RLS), Simulation and design of LMS and RLS filters ,its Applications. Binary decisions with multiple observations, Vector observations, Waveform Observation, Detection of signals in additive Gaussian Noise, random noise and color noise.

UNIT- III : KALMAN FILTERS :
Introduction to Kalman Filters (KF) . Adaptive beam forming. Kalman filtering.state measurement and estimation for scalar random variables , prediction and estimation of Linear signals, design techniques, Extended Kalman filter (EKF), prediction and estimation of nonlinear signals, applications of KF,EKF in audio and speech signals detection.

UNIT- IV :
Filtering of Random Processes, Spectral factorization, Special types of Random Processes, The Levinson-Durbin Recursion, The Inverse Levinson-Durbin Recursion, The Cholesky Decomposition, Inverting a Toeplitz matrix.

UNIT – V :
Wiener filtering, The FIR Wiener filter, Linear prediction, Noise Cancellation, The IIR Wiener filter, Causal and noncausal IIR Wiener filter, Causal Wiener filtering, Causal linear Prediction, Wiener deconvolution.

References :
1. “Statistical Signal Processing Vol. 1 : Estimation Theory, vol. 2 :
Detection Theory “ by Steven. M. Kay, Prentice Hall Inc, 1995.
2. “Adaptive Filter theory” by S. Haykin, Pearson Education publication.
3. “Detection, Estimation and Modulation Theory Part 1” by Harry L. Van Trees, John
Wiley & Sons Inc, 1968.
4. “Statistical Digital Signal Processing and Modeling” by Monson H. Hayes, John Wiley and Sons, Inc.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

Elective-II EC- 6005 (4) IPR (Intellectual Property Rights)

Course Objective

Acquaint the students with the basic concepts of Intellectual Property Rights; and sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR.

UNIT I Introduction

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- *Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property.*

Major international documents relating to the protection of IP - *Berne Convention, Paris Convention, TRIPS*. The World Intellectual Property Organization (WIPO).

UNIT II Copyright

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, *Civil, Criminal, Administrative*, Registration Procedure.

UNIT III Patents

Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory licence, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

UNIT IV – Trade Marks, Designs & GI

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

UNIT V Contemporary Issues & Enforcement of IPR

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

Course Outcome:

1. Students will be able to understand Primary forms of IPR
2. Students will be able to asses and critique some basic theoretical justification for major forms of IP Protection
3. Students will be able to compare and contrast the different forms of IPR in terms of key differences and similarities.
4. Students will be able understand the registration procedures related to IPR.
5. Students will be exposed to contemporary issues and enforcement policies in IPR.

References:

1. P. Narayanan, Intellectual Property Law, Eastern Law House

2. . Neeraj Pandey and Khushdeep[Dharni, Intellectual Property Rights, PHI, 2014

3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.

4. Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.

5. Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.

6. Prabuddha Ganguli, " Intellectual Property Rights" Mcgraw Hill Education, 2016.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

EC- 6006 Workshop-II

Course Contents

Use and application of Electronic Instruments: CRO, Function generator, Conception Level Introduction: Specifying Parts, Packages and Pin Names, Libraries and Checking foot prints of the components, Partlist, Netlist, Making Netlist Files, Placing Parts, Routing Traces, Modifying Traces, Mounting Holes, Adding Text, PCB Layout, DRC, Pattern Transfer etc.

PCB FABRICATION PROCESS: Etching, cleaning, drying and drilling etc.

ASSEMBLING AND TESTING : Identifying the components and its location on the PCB, soldering of active and passive components, Testing the assembled circuit for correct functionality, Prototype designing etc.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Electronics & Communication Engineering, VI-Semester

EC-6007 Creativity and Entrepreneurship Development

Course Objective:

- Understand and use tools for generating entrepreneurial ideas and problem solving.
- Understand and use tools for the selection of ideas.
- Understand and gain the skills that are needed to implement ideas in today's society
- Understand Entrepreneurship's part in process that includes idea generation and implementation.
- Understand the concept of Entrepreneurship and its place in today's society

Course Outcomes:

- Recognize an opportunity for a user group and frame an appropriate design challenge that addresses the need for the user.
- Practice observation, interview and empathy skills to evolve a thorough understanding of the needs of the user.
- Share and integrate team leanings.
- Generate, develop and describe creative ideas that address the design challenge.

Syllabus:

1. The concept of Entrepreneurship, its history and its place in society.
2. The concept of Entrepreneurship and its relation to concept of innovation.
3. Creative processes for idea generation and problem solving.
4. Business plan.
5. Role of creativity, innovation and business research.
6. Entrepreneurship opportunities in contemporary business environment.

Reference Books :

1. Dollinger M.J. "Entrepreneurship strategies and resources," 3rd edition Pearson Education New Delhi.
2. Panda, Shiba charan "Entrepreneurship development", Anmol publication New Delhi.
3. Richard Blundel & Nigel locket, "Exploring Entrepreneurship : practices & perspectives Oxford.
4. Charles E. Banford & Garry D. Bruton, "Entrepreneurship – A small business Approach, Mcgrawhill Education.
5. P. Narayana Reddy, "Entrepreneurship" : Text and cases, Cengage learning
6. Rajeev Roy, "Entrepreneurship" Oxford.