CURRICULUM

FOR

ELECTRICAL & COMMUNICATION ENGINEERING

SEMESTER – VII (ELECTRICAL COMMUNICATION & ENGINEERING)

S.No	Paper Code	Paper Title	L	T	P	Credits
1	104701	Business Analytics	3	0	0	3
2	104702	Cost Management of Engineering Projects	3	0	0	3
3	100705	Graduate Employability Skills and Competitive Courses (GATE, IES, etc.)	3	0	0	0
4	1047xx	Program Elective - III	3	0	0	3
5	1047xx	Program Elective- II	3	0	0	3
6	104703	Wireless Communication	3	0	0	3
7	100709	Project-I	0	0	12	6
8	100702	Summer Entrepreneurship-III	0	0	16	8

PAPER CODE - 104 701

104701	Business Analytics	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business An- alytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Module 2

Trendiness and Regression Analysis: Modelling Relationships and Trends in
Data, simple Linear Regression. Important Resources, Business Analytics Personnel,
Data and models for Business analytics, problem solving, Visualizing and Exploring
Data, Business Analytics Technology.

Module 3

Organization Structures of Business analytics: Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predictive Modelling Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Module 4

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Causal Vari- ables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using
Analytic Solver Platform, New- Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Module 5

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent trends: In Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Suggested Books:

➔ Business analytics Principles, Concepts, and Applications by Marc J.Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
➔ Business Analytics by James Evans, persons Education

PAPER CODE - 104 703

104703	Wireless Communication	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Introduction to Wireless Communication Systems: Evolution of mobile radio communications; examples of wireless comm. systems; paging systems; Cordless telephone systems; overview of generations of cellular systems, comparison of various wireless systems.

Module 2

Introduction to Personal Communication Services (PCS): PCS architecture, Mobility management, Networks signalling. The Cellular Concept and Multiple Access Techniques: A basic cellular system, Frequency Reuse basic theory of hexagonal cell layout, spectrum efficiency, FDM/TDM, Cellular System, channel allocation schemes, Handover Analysis, cellular CDMA, Soft capacity, Erlang capacity comparison, multiple access techniques: FDMA, TDMA, CDMA.

Module 3

2G Networks: Second generation, digital, wireless systems: GSM, I S136 (D-AMPS), IS-95 CDMA. Global system for Mobile Communication (GSM) system overview: GSM Architecture, Mobility Management, Network signalling, mobile management, voice signal processing and coding. Spread Spectrum Systems- Cellular code Division Access Systems- Principle, Power Control, effects of multipath propagation on code division multiple access.

Module 4

2.5G Mobile Data Networks: Introduction to Mobile Data Networks, General Packet Radio Services (GPRS): GPRS architecture, GPRS Network nodes, EDGE, Wireless LANs, (IEEE 802.11), Mobile IP. Third Generation (3G) Mo- bile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G, Introduction to 4G.

Module 5

Introduction to Wireless Channels and Diversity: Fast Fading Wireless Channel Modelling, Rayleigh/Rician Fading Channels, BER Performance in Fading Channels, Introduction to Diversity modelling for Wireless Communications.

Suggested Books:

→ Theodore S. Rappaport, "Wireless Communications: Principles and Practice" 2nd Edition (2008), 2008
→ Andrew J Viterbi, "CDMA Principles of spread spectrum communications",Addition Wesley, 1995
→ J S Lee and L E Miller, "CDMA systems engineering handbook", Artech House,1998
→ Marvin K Simon, Jim K Omura, Robert A Scholtz, Bary Klevit, "Spread Spectrum Communications", 1995
→ Sergio Verdu, "Multiuser Detection", Cambridge University Press, 1998
→ Andrew S Tanenbaum, "Computer Network", Pearson/ PHI, 4th edition, 2009

PROGRAM ELECTIVE

PAPER CODE - 104 704

104704	Antennas and Wave Propagation	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Fundamental Concepts : Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Radiation: Potential function and electromagnetic fields, a small current element radiation, Power radiated by current element and radiation resistance, Radiation from quarter wave monopole and half wave dipole.

Antenna Arrays: Analysis of uniformly spaced arrays with uniform and nonuniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkun off polynomial method, Woodward-Lawson method. Aperture and

Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic re- flector and cassegrain antennas.

Broadband Antennas: Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Microstrip Antennas: Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Basic Concepts of Smart Antennas: Concept and benefits of smart antennas, fixed weight beamforming basics, Adaptive beamforming. Different modes of Radio Wave propagation used in current practice.

Guided waves and waveguides: Waves between parallel planes. TM and TE waves,
Their propagation and attenuation in parallel plane guides,
Rectangular waveguides – TE and TM waves in rectangular guides, Wave impedance, Circular waveguides, Introduction to resonators.

Name of Authors / Books /Publishers:

"Antennas", J.D. Kraus, McGraw Hill, 1988
"Antenna Theory - Analysis and Design", C.A. Balanis, John Wiley, 1982
"Antenna Engineering Handbook", McGraw hill, 1984
"Micro Strip Antennas", I.J. Bahl and P. Bhartia, Artech House, 1980
"Electromagnetic Waves", R.K. Shevgaonkar, Tata McGraw Hill, 2005
"Electromagnetic Waves and Radiating Systems", (Prentice-Hall Electrical Engineering
Series) by Edward C. Jordan, 2006
"Antennas and Radio Wave Propagation", R.E. Collin, McGraw Hill, 1985

PAPER CODE – 104 705

104705	Optical Fiber Communication	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Introduction: Optical Fiber :-Structures, Waveguiding and Fabrication Nature of light, Basic optical laws and Definition, Optical fiber modes and Con- figuration,
Mode theory for circular waveguides, Single mode fibers, Graded index fiber, Fiber materials, Fabrication and mechanical properties, Fiber

optic cables, Basic Optical Communication System, Advantage of Optical Communication System

Module 2

Attenuation in Optical Fibers: Introduction, Absorption, Scattering, Very Low Loss Materials, All Plastic and Polymer-Clad-Silica Fibers. Wave Prop- agation: Wave propagation in Step-Index and Graded Index Fiber, Overall Fiber Dispersion-Single
Mode Fibers, Multimode Fibers, DispersionShifted Fiber, Dispersion, Flattened Fiber, Polarization

Module 3

Source and Detectors: Design and LED's for Optical Communication, Semiconductor Lasers for Optical Fiber Communication System and their types,
Semiconductor Photodiode Detectors, Avalanche Photodiode Detectors and Photomultiplier Tubes. Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling. Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operationFundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers

Module 4

Optical Fiber Communication Systems: Data Communication Networks – Network
Topologies, Mac Protocols, Analog System. Advanced Multiplexing Strategies – Optical
TDM, Sub carrier Multiplexing, WDM Network. Archi- tectures: SONET/SDH. Optical Transport Network, Optical Access Network, Optical Premise Network. Applications-Military Applications, Civil, Consumer and Industrial Applications.

Suggested Books:

➔ "Optical Communication System", Gowar, IEEE Press – 2nd Edition
➔ "Fiber Optics and Opto Electronics", R.P.Khare, Oxford Publication
➔ "Optical Information Processing", F. T. S. Yu, Wiley, Newyork, 1983

➔ "Fiber optic Communication Systems", John Wiley and sons, New York, 1992
➔ "An Introduction to Fiber Optics", A. Ghatak, K. Thyagarajan, Cambridge University Press.
➔ "Optical Communication Components and Systems", J. H. Franz and V. K. Jain, Narosa Publish, 2013.
➔ "Optical Fiber Communications", John M. Senior, PEARSON, 3rd Edition,2010

PAPER CODE – 104 706

104706	Micro and Nano Electronics	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Evolution of Nanoelectronics: Moore's Law, Silicon Electronics, Limitations, Discussion of the International Technology Roadmap characteristics: Need for new concepts in electronics, Silicon MOS Transistor from Micro to Nano, Future Opportunities, Nanocomputing

Module 2

Tunnel Junctions and Applications of Tunneling: Tunneling Through a Potential Barrier, Potential Energy Profiles for Material Interfaces – Metal - Insulator, Metal
- Semiconductor, and Metal – Insulator- Metal Junctions , Applications of Tunneling,
Field Emission, Gate - Oxide Tunneling and Hot Electron Effects in MOSFETs, Double Barrier Tunneling and the Resonant Tunneling Diode.

Module 3

Ballistic and Spin Transport: Coulomb Blockade , Tunnel Junction Excited by a Current Source , Coulomb Blockade in a Quantum Dot Circuit , Single Electron
Transistor, Ballistic Transport , Electron Col- lisions and Length Scales, Ballistic Transport Model, Quantum Resistance and Conductance, Transport of Spin and
Spintronics Devices, Applications.

Module 4

Molecular Electronics: Introduction to molecular electronics - An atomistic view of electrical resistance, Schrodinger equation, Self - consis- tent field, Band Structure, Level broadening, Coherent

transport, Non-coherent transport in molecular electronics devices ,
Molecular Devices, Logic Switches, Interface Engineering Issues

Suggested Books:

- → George W. Hanson, "Fundamentals of Nanoelectronics'', Prentice Hall, 2007
- → Karl Goser et.al, "Nanoelectronics and Nanosystems: From Transistors toMolecular and Quantum devices", Springer, 2005
- → Mark. A. Reed and Takhee, "Molecular Electronics", American Scientific Publishers, 2003
- → Mitin V., V. Kochelap, and M. Stroscio, "Introduction to", Cambridge University Press, 2008
- → Michael C. Petty, "Molecular Electronics: From Principles to Practice", JohnWiley and Sons, Ltd, 2007.
- → Ramachandran K. I. et.al, "Computational Chemistry and Molecular Modeling", Springer,2008.
- → J. H. Franz and V. K. Jain, "Optical Communication Components and Systems", Narosa Publish, 2013
- → John M. Senior, "Optical Fiber Communications", PEARSON, 3rd Edition, 2010.

PAPER CODE – 104 707

104707	Embedded System	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Introduction to Embedded Systems: Definition of Embedded System.
Embedded
Systems Vs General Computing Systems. History of Embedded Systems.
Classification,
Major Application Areas. Purpose of Embedded Systems, Characteristics
and Quality Attributes of Embedded Systems. Typical Embedded System:
Core of the Embedded System:
General Purpose and Do- main Specific Processors, ASICs, PLDs,
Commercial
Off-The-Shelf Compo- nents (COTS), Memory: ROM. RAM. Memory according
to the type of
Inter- face. Memory Shadowing, Memory selection for Embedded Systems,
Sensors and Actuators. Communication Interface: On board and External
Communication Interfaces, Programming.

Module 2

Embedded Firmware: Reset Circuit. Brown-out Protection Circuit. Oscillator Unit. Real lime Clock. Watchdog Timer, Embedded firmware Design Approaches and

Development Languages. RTOS Based Embedded System De- sign: Operating System Basics, Types of Operating Systems, Tasks. Process and Threads. Multiprocessing and Multitasking, Task Scheduling.

Module 3

Task Communication: Shared Memory. Message Passing. Remote Procedure Call and Sockets. Task Synchronization: Task Communication/Synchronization Issues. Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Module 4

Introduction to ARM: ARM Architecture ARM Design Philosophy, Registers, Program Status Register. Instruction Pipeline Interrupts and Vector Table. Architecture Revision, ARM Processor Families.

Module 5

ARM Programming: Instruction Set: Data Processing Instructions. Addressing Modes. Branch. Load. Store Instructions, PSR Instructions. Conditional Instructions.

Thumb Instruction Set: Register Usage, Other Branch Instructions. Data Processing Instructions. Single-Register and Multi Register LoadStore Instructions. Stack. Software Interrupt Instructions.

Module 6

ARM Programming in C: Simple C Programs using Function Calls, Pointers,

Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction

Scheduling, Register Allocation. Conditional Execution and

Loops **Suggested Books:**

➔ Embedded System Design -Frank Vahid, Tony Givargis, John Wiley.
➔ C -Michael J. Pont, 2nd Ed, Pearson Education, 2008.
➔ ARM Systems Developer's Guides-Designing and Optimizing System Software Andrew N. Sloss. Dominic Symes. Chris Wright, 2008. Elsevier.

➔ Introduction to Embedded Systems -Shibu K.V, McGraw Hill

PAPER CODE - 104 708

104708	High Speed Electronics	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Transmission line theory: Basics, Crosstalk and non-ideal effects, Signal integrity, Impact of packages, Vias, Traces, Connectors, Non-ideal return cur- rent paths, High frequency power delivery, Methodologies for design of high speed buses, Radiated emissions and minimizing system noise, Noise Analysis, Sources, Noise Figure, Gain compression, Harmonic distortion, Inter modulation, Crossmodulation, Dynamic range

Module 2

Devices: Passive and active, Lumped passive devices (models), Active (models, low vs. high frequency).

Module 3

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers
(and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages.

Module 4

Mixers, Up conversion Down conversion, Conversion gain and spurious response, Oscillators Principles, PLL Transceiver architectures.

Module 5

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards, Board Assembly, Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Suggested Books:

➜ "High-Speed Digital System Design: A Handbook of Interconnect Theory and
Design Practices", Stephen H. Hall, Garrett W. Hall, James A. McCall, WileyIEEE Press,2000
➜ "The Design of CMOS Radio-Frequency Integrated Circuits", Thomas H. Lee, Cambridge University Press, 2004
➜ "RF Microelectronics", Behzad Razavi, Prentice-Hall, 1998
➜ "Microwave Transistor Amplifiers", Guillermo Gonzalez, 2nd Edition, Prentice Hall
➜ "RF and Microwave Wireless systems", Kai Chang, Wiley
➜ "Electronic Product design", R.G. Kaduskar and V.B.Baru, Wiley India, 2011

PAPER CODE - 104 709

104709	Digital System Design	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Introduction to Digital Design Concepts: Review of digital design fundamentals, minimization and design of combinational circuits, sequential machine fundamentals

Module 2

Clocked Sequential Finite State Machines: State diagram, analysis of synchronous circuits, derivation of state graphs and tables, reduction of state tables, state assignment, design of sequence detectors, serial data code conversion, design of synchronous sequential state machine, design and applications of counters and shift registers

Module 3

Multiinput System Controllers Design: System controller, controller design principles, timing and frequency considerations, DFD development, controller architecture design, asynchronous input handling, state assignment concepts, flip-flop level implementation using VEM's

Module 4

Sequential Design using LSI & MSI circuits: Using decoders, multiplexers in sequential circuits, sequential network design using ROMs, PLAs and PALs, Programmable gate Arrays (PGAs)

Module 5

Asynchronous Sequential Finite State Machines: Introduction, analysis of asynchronous networks, races and cycles, derivation of primitive flow tables, reduction of primitive flow tables, state assignments, hazards, asynchronous sequential network design

Module 6

VHDL: Why VHDL? Basic Language Elements, Data objects, classes and data types, operators, overloading, logical operators, VHDL representation of Digital design entity and architectural declarations, introduction to behavioral, dataflow and structural models

Suggested Books:

→ William I Fletcher "An Engineering Approach to Digital Design", PHI, 3rd Indian reprint, (1994)
→ Z Navabi "VHDL-Analysis and Modelling of Digital Systems", McGraw Hill, 2nd Edition (1997)
→ Kevin Skahill "VHDL for Programmable Logic", Pearson Education, 1st Indian Reprint (2004)
→ Jr. Charles H. Roth, "Fundamentals of Logic Design", Jaico Publishers, 4th Edition, (2002).
→ M Morris Mano "Digital Design", Pearson Education, 3rd Edition (2002)

PAPER CODE - 104 710

104710	VLSI Technology	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Introduction to MOS technology: Introduction to IC technology, MOS and related VLSI technology, Basic MOS transistors (Enhancement mode and depletion mode), NMOS process, CMOS process (P – Well, N – Well, Twin – tub processes), Bi CMOS process flow, aspects of CMOS and Bi CMOS devices.

Module 2

Brief introduction of VLSI: Architecture Definition, Functional Design, Logic Design, Circuit Design and Physical Design

Module 2

Crystal growth and doping: Starting materials, Czochralski technique, Gradient freeze technique, Considerations for proper crystal growth (role of point defects, thermal gradients, turbulences, pull and spin rate, crystal orientation, crystal hardening techniques), Doping (rapid stirring conditions, partial stirring conditions, radial doping variations), Zone processes (Zone refining, Zone leveling, neutron transmutation doping)

Module 3

Diffusion: Diffusion in a concentration gradient, Diffusion equation, Impurity behavior in Silicon, diffusion systems for Silicon, redistribution during oxide growth, diffusion during oxide growth, cooperative diffusion, evaluation techniques for diffused layers in Silicon.

Module 4

Epitaxy: Nucleation and growth, doping, dislocation, thermally induced strain, Molecular Beam epitaxy, Vapor phase epitaxy for Silicon, Liquid phase epitaxy.

Module 5

Ion-Implantation: Penetration range (nuclear and electronic stopping, Transverse effects), Implantation damage, annealing, Ion – Implantation systems, process consideration, high energy and high current implants.

Module 6

Native Films: Thermal Oxidation of silicon (kinetics of oxide growth, oxidation systems, oxidation induced stacking faults, properties of thermal oxides), Thermal nitridation of Silicon, Plasma.

Module 7

Deposited Films: Films deposition methods (vacuum evaporation, sputter deposition, Chemical vapor Deposition), Film characteristics (step coverage, grown habit, mechanical stress, electromigration)

Module 8

Etching and Cleaning: wet chemical etching in silicon based processes, Dry physical etching, Dry chemical etching, Reactive Ion etching, Etch induced damage, Cleaning (wet and dry).

Module 9

Lithography: Photo reactive materials, pattern generation and mask making, pattern transfer optical printing, advanced techniques (short wavelength, multilayer resist, phase shifting masks, Electron beam techniques, Xray printing), Mask defects, Pattern transfer defects.

Module 10

Process integration: Isolation, (P-N junction, Mesa, Oxide), self alignment, local oxidation, planarization, metallization, gettering, Process flow for CMOS

Suggested Books:

→ 'Basic VLSI Design by Pucknell and Eshraghian.
→ VLSI Fabrication Principles by Sorab Gandhi.
→ The science and engineering of Microelectronic Fabrication by Stephen Campbell.
→ VLSI Design by Sujata Pandey and Manoj Pandey.
→ CMOS VLSI design by Wolfe.

PAPER CODE - 104 711

104711	Information and Coding Theory	L:3	T:0	P:0	CREDIT:3

Detailed contents:

Module 1

Information Theory: Definition of Information, Entropy, Mutual Information, Properties of Mutual Information, Fundamental Inequality, I.T. Inequality,

Divergence, Properties of Divergence, Divergence Inequality, Relationship between entropy and mutual information, Chain Rules for entropy, relative entropy and mutual information.

Module 2

Channel Capacity: Uniform Dispersive Channel, Uniform Focusing Channel, Strongly Symmetric Channel, Binary Symmetric Channel, Binary Erasure Channel. Channel Capacity of all these channels, Channel Coding Theo- rem, Shannon-Hartley Theorem.

Module 3

Data Compression: Kraft inequality, Huffman codes, Shannon-Fano coding, Arithmetic Coding.

Module 4

Linear Block Codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities;
Perfect codes. Cyclic Codes, BCH codes; Reed- Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes.

Module 5

Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift-register synthesis technique and its relation to Berlekamp's algo- rithm. A fast Berlekamp - Massey algorithm.

Module 6

Convolution codes: Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm, Turbo Codes, Concatenated Code **Suggested Books:**

→ Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2001 → ArijitSaha, "Information Theory, Coding and Cryptography", Pearson Education, 2013
→ Thomas M. Cover, Joy A. Thomas, "Elements of Information Theory", Wiley India Pvt. Ltd, 2nd Edition, 2013
→ J.Mary Jones, "Information and Coding Theory", Springer, 2000

- → Ranjan Bose, "Information Theory, Coding and Cryptography", Tata Mc-Graw Hill, 2nd Edition, 2008

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