EC – 1861 Data Communication & Computer Network

Course Title	Course Code	Credits - 4		
		L	T	P
Data Communication & Computer Network	EC 1861	3	-	2

COURSE OBJECTIVE

To build an understanding of the fundamental concepts of data communication.
To familiarize the student with the basic taxonomy, model and terminology of computer networking.
To develop an appreciation of the Internet architecture and protocols, as well as a sound understanding of the protocol mechanisms employed at the IP and Transport layers of the Internet.
Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

PRE-REQUISITES

Basics of communication engineering.

COURSE CONTENTS

Unit I: Introduction: Data Communication, Networks - Physical structures; different topologies, Categories of Networks: LAN, MAN, WAN, Interconnection of networks, The Internet, Transmission Modes, Protocols and Standards, Standards Organizations, The OSI model, different layers in OSI model. TCP/IP protocol suite with different layers, Addressing - physical, logical, port and specific addresses, Digital Data Transmission- Synchronous and asynchronous transmission.

Unit II: Physical Layer: Line Coding, Line Coding Scheme, Multiplexing - Frequency Division, Wavelength Division, Synchronous Time Division, Statistical Time Division Multiplexing. Switching-Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks. Structure of Circuit and Packet switches, Dial-up Modems, Digital Subscriber Line - ADSL, HDSL, SDSL, VDSL, Cable TV for Data Transfer- Bandwidth, Sharing, data Transmission Schemes.

Unit III: Data Link Layer: Introduction - Types of Errors, Redundancy, Detection Vs Correction, Forward Error Correction Vs Retransmission, Modular Arithmetic. Block Coding - Error Detection, Error Correction, Hamming Code, Linear Block Codes, Cyclic Codes - Cyclic Redundancy Check, Hardware Implementation, simple,, Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ.

Unit IV: Medium Access: Random Access- ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). Controlled Access-Reservation, Polling, Token Passing. Channelization- Frequency-Division Multiple Access (FDMA), Time- Division Multiple Access (TDMA), Code-Division Multiple Access (CDMA

Unit V: Network Security and Connecting Networks: Encryption/Decryption, Digital Signature, Data Encryption Standard (DES), PGP, Access Authorization. Connecting Devices- Hubs, Repeaters, Bridges, Routers and Gateway. Connecting Remote LANs. Virtual LANs - Membership, Configuration, Communication between Switches, IPv4- Address Space, Notation, Classful & Classless Addressing, IPv6 - Structure and Address Space, Advantages, Packet Format. The Integrated Services Digital Network (ISDN)- Narrow band ISDN, Broadband ISDN Service. Digital hierarchies (SONET/SDH).

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COURSE OUTCOMES:

On successful completion of this course student should be able to:

CO 1: Understand and explain computer network technology, data com systems and its components, Ethernet, wireless network IEEE 802.11 and Bluetooth standard. Enumerate the layers of OSI Mode, TCO/IP model and explain function of each layers. – (BL1, BL2, BL3)

CO 2: Identify and analyze the different types of network, network topologies and protocols.—(BL3, BL4)

CO 3: Design different networks and Provide solutions for network security.-(BL3, BL6)

TEXT BOOKS & REFERENCES:

- B. A. Forouzan and Sophia Chung Fegan: Data Communications and Networking, 4th Ed, TMH.
- W. Tomasi: Introduction to Data Communications and Networking, Pearson Education.
- S. Tanenbaum: Computer Networks, Pearson Education.
- W. Stalling: Data and Computer Communication, Pearson Education.
- P. C. Gupta: Data Communications and Computer Networks, PHI.
- Elahi and M. Elahi: Data Network and Internet-Communications Technology, Cengage Learning.
- Duck: Data Communication and Networking, Pearson Education.
- The TCP/IP Guide, by Charles M. Kozierok, Free online Resource, http://www.tcpipguide.com/free/index.htm

LABORATORY EXPERIMENTS

1. Introduction about discrete events simulation and its tools -CO1
2. Installation of NS3 in linux -CO1
3. Program in NS3 to connect two nodes-CO3
4. Program in NS3 for connecting three nodes considering one node as a central node.-CO3
5. Program in NS3 to implement star topology -CO3
6. Program in NS3 to implement a bus topology. -CO3
7. Program in NS3 for connecting multiple routers and nodes and building a hybrid topology.-CO3
8. Installation and configuration of NetSim -CO1
9. Program in NS3 to implement FTP using TCP bulk transfer.-CO3
10. Program in NS3 for connecting multiple routers and nodes and building a hybrid topology and then calculating network performance -CO2
11. To analyze network traces using wire shark software.-CO2

END

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EC – 1862(A) Optical Communication

Course Title	Course Code	Credits - 4		
		L	T	P
Optical Communication	EC 1862(A)	3	-	2

COURSE OBJECTIVE

The objective of course is to familiarize students with various optical fiber modes, configurations and various signal losses occur in optical fiber and to study about various optical sources and optical receivers and their use in the optical communication system.

PRE-REQUISITES

- Introduction to communication system
- Electromagnetic Theory

COURSE CONTENTS

Unit I: Introduction: Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Element of an Optical Fiber Transmission link, Optical fiber wave guides-Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes,Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fibre materials. Multi Mode Fibers, Linearly Polarized Modes,V-number, Mode coupling, Step Index fibers, Graded Index fibers.

Unit II: Signal Degradation: Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -RI profile and cut-off wavelength.

Unit III: Optical Sources and Coupling Direct and indirect Band gap materials-LED structures, Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effect, Laser operation – Semi conductor laser diode – Spatial Emission pattern of Laser – operation – Semi conductor laser diode – Spatial Emission pattern of Laser, Power Launching and coupling.

Unit IV: Optical Recievers Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers. Optical fiber Connectors- Connector types, Single mode fiber connectors, Connector return loss.Fibre -to- Fibre joints, Fibre splicing. Fiber Splicing- Splicing techniques, Splicing single mode fibers. Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints, Optical amplifiers, EDFA.

Unit V: Digital Transmission System Point-to-Point links System considerations -Link Power budget -Rise - time budget -Noise Effects on System Performance, Operational principle of WDM, Basic on concepts of SONET/SDH Network, Eye pattern.

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COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** Develop basic understanding of concepts of optical communication, understand and measure signal degradation.: Apply the knowledge for measuring and comparing the performance of different optical systems. (BL1, BL2, BL3) **CO2:** Analyze different optical signals, optical communication systems and networks. (BL3, BL4) **CO3:** Design optical systems like sources, couplers, various types of receivers and splices based on required specifications of application.(BL3,BL5)
TEXT BOOKS & REFERENCES:	• J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994. • J. Gower, "Optical Communication System", Prentice Hall of India, 2001. • Fiber Optic Communications – D.K. Mynbaev, S. C. Gupta and Lowell L. Scheiner, Pearson Education, 2005. • Text Book on Optical Fibre Communication and its Applications – S. C. Gupta, PHI, 2005. • Fiber Optic Communication Systems – Govind P. Agarwal, John Wiley, 3rd Ediition, 2004. • Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004. • Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000
LABORATORY EXPERIMENTS	1. Optical Power Measurements.-CO2 2. The HeNe Laser Intensity Profile: Experimental Verification-CO2 3. Light Polarization and Focal Length measurement of of Thin Lenses.-CO2 4. Determination of the Acceptance Angle and Numerical Aperture of Optical Fibers-C02 5. Light Coupling to Multimode Graded Index Fiberr.-CO2 6. Fiber Misalignment Loss Measurement.-CO2 7. OTDR Measurement of Fiber Length, Attenuation and Splice Loss..-CO2 8. Setting up fiber optic analog and digital link.-CO3 9. Intensity modulation system using analog and digital input signal.-CO2 10. Frequency modulation and pulse modulation system.-CO2 11. Measurement of optical power and propagation losses using Optical power meter--CO2 END

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EC – 1862(B) FPGA Architecture & Applications

Course Title	Course Code	Credits - 4		
		L	T	P
FPGA Architecture & Applications	EC 1862(B)	3	-	2

COURSE OBJECTIVE

The objective of this course is to provide knowledge on digital hardware realization, and prototyping on FPGA.

PRE-REQUISITES

- Digital circuits and systems
- Understanding of XILINX IDE
- Fundamentals of VHDL Language.
- Understanding of FSMs

COURSE CONTENTS

Unit I: Revision of basic Digital systems: Combinational Circuits. Sequential Circuits Timing. Electrical Characteristics. Power Dissipation. Digital system Design. Top down Approach to Design, Case study. Data Path, Control Path. Controller behavior and Design. Case study Mealy & Moore Machines. Timing of sequential circuits. Pipelining, Resource sharing. FSM issues (Starring state, Power on Reset, State diagram optimization, State Assignment, Asynchronous Inputs, Output Races, fault Tolerance).

Unit II: Programmable Logic Devices: Introduction. Evolution: PROM, PLA, PAL. Architecture of PAL's. Applications. Programming PLD's. Design Flow. Programmable Interconnections. Complex PLD's (MAX - 7000, APEX). Architecture, Resources, Applications, Tools and Demonstration of the tool.

Unit III: FPGA: Introduction. Logic Block Architecture. Routing Architecture. Programmable Interconnections. Design Flow. Xilinx Virtex-II (Architecture). Altera Stratix, Actel 54SX Architecture. Boundary Scan Programming FPGA's. Constraint Editor, Static Timing Analysis. Applications. Tools. Case Study. Xilinx Virtex II Pro, Embedded System on Programmable Chip. Hardware-software co-simulation, Bus function models, BFM Simulation. Debugging FPGA Design.

Unit IV: VHDL for Synthesis: Introduction. Behavioral, Data flow, Structural Models. Simulation Cycles. Process. Concurrent Statements. Sequential Statements. Loops. Delay Models. Sequential Circuits, FSM Coding. Library, Packages. Functions, Procedures. Operator Inferencing. Test bench.

Unit V: Current state of the field: Applications: SoC, IP Design, SoPC. Design methodology, System Modeling, Hardware-Software Co-design. Device Technology. Application Domains.

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COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** Understand and describe the architecture, functioning of Programmable Devices.—(BL1, BL2) **CO2:** Analyze FPGA Board, and different algorithms-(BL3, BL4). **CO3:** Develop and implement algorithms on SOC devicesfor various applications-(BL3, BL6)
TEXT BOOKS & REFERENCES:	1. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall. 2. Kevin Skahil, VHDL for programmable logic, Addison Wesley. 3. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill. 4. PLD, FPGA data sheets.

END

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EC – 1862(C) Probability & Stochastic Process

Course Title	Course Code	Credits - 4		
		L	T	P
Probability & Stochastic process	EC 1862(C)	3	-	2

COURSE OBJECTIVE	To expose the students to the basics of probability theory and random processes essential for their subsequent study of analog and digital communication.
PRE-REQUISITES	• Signal & Systems
COURSE CONTENTS	**Unit I**: Definitions, scope and history; limitation of classical and relative-frequency-based definitions. Sets, fields, sample space and events; axiomatic definition of probability. Combinatorics: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications. Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties **Unit II**: Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables. Function of random variable, pdf of the function of a random variable; Function of two random variables; Sum of two independent random variables. Expectation: mean, variance and moments of a random variable. Joint moments, conditional expectation; covariance and correlation; independent, uncorrelated and orthogonal random variables. Random vector: mean vector, covariance matrix and properties. **Unit III**: Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution. Vector-space representation of random variables, linear independence, inner product, Schwarz Inequality. Elements of estimation theory: linear minimum mean-square error and orthogonality principle in estimation. Central Limit Theorem. **Unit IV**: Random process: realizations, sample paths, discrete and continuous time processes, examples. Probabilistic structure of a random process; mean, autocorrelation and auto covariance functions. Stationary: strict-sense stationary (SSS) and wide-sense stationary (WSS) processes. Autocorrelation function of a real WSS process and its properties, cross-correlation function. Ergodicity and its importance. **Unit V**: Spectral representation of a real WSS process: power spectral density, properties of power spectral density; cross-power spectral density and properties; auto-correlation function and power spectral density of a WSS random sequence. Linear time-invariant system with a WSS process as an input: stationary of the output, auto-correlation and power-spectral density of the output; examples with white-noise as input; linear shift-invariant discrete-time system with a WSS sequence as input.

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COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO 1:** Illustrate and simulate formulate fundamental probability distribution and density functions, as well as functions of random variables. Explain the concepts of expectation, conditional expectation, stationary, wide-sense stationary processes and describe the properties (BL1, BL2, BL3) **CO 2:** Analyze continuous and discrete time random processes and applied the theory of stochastic processes to analyze linear systems (BL3, BL4) **CO 3:** Develop solutions to basic problems in filtering, prediction and smoothing. (BL3, BL6)
TEXT BOOKS & REFERENCES:	• Papoulis, A., 'Probability, Random Variables and Stochastic Processes', McGraw Hill (3PrdP edition), 1991. • Cooper, G.R., McGillem, C.D., Probabilistic Methods of Signal and System Analysis, Oxford University Press. • Peebles, P.Z., Probability, Random Variables and Random Signal Principles, 4e, McGraw Hill. • H. Stark & J.W. Woods: Probability, Random Processes and Estimations Theory for Engineers, (2/e), Prentice Hall. END

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EC – 1863(A) Microwave Theory and Techniques

Course Title	Course Code	Credits - 4		
		L	T	P
Microwave Theory and Techniques	EC 1863(A)	3	-	2

COURSE OBJECTIVE	This course will introduce students to the concepts of Microwave theory and design. He will be able to understand the working of Microwave systems. Generation, detection and measurement of microwaves.
PRE-REQUISITES	• Instrumentation and measurement • Electromagnetic Field Theory • Antenna theory
COURSE CONTENTS	**Unit-I**: Microwave Transmission System: Introduction, Microwave spectrum, Uniform guide structures, rectangular wave guides, Circular Wave guides, Solution in terms of various modes, Properties of propagating and evanescent modes, Dominant modes, Normalized model voltages and currents, Power flow and energy storage in modes frequency range of operation for single mode working, effect of higher order modes, Strip line and micro strip lines general properties, Comparison of coaxial, Micro strip and rectangular wave guides in terms of band width, power handling capacity, economical consideration etc. **Unit-II**: Microwave Networks and Component: Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, Non reciprocal, Examples of two, three and four port networks, wave guide components like attenuator, Phase shifters and couplers, Flanges, Bends, Irises, Posts, Loads, Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Multi-hole directional coupler, Directional couplers, Microwave resonators- rectangular. Excitation of wave guide and resonators by couplers. Principles of operation of non reciprocal devices, properties of ferrites and Isolators **Unit-III**: Microwave Solid State Devices and Application: PIN diodes, Properties and applications, Microwave detector diodes, detection characteristics, Varactor diodes, parametric amplifier fundamentals, Manley-Rowe power relation, Frequency converters and harmonic generators using varactor diodes, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT diodes. **Unit-IV**: Microwave Vacuum Tube Devices: Interaction of electron beam with electromagnetic field, power transfer condition. Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in reflex klystrons, mode frequency characteristics. Effect of repeller voltage variation on power and frequency of output. Principle of working of magnetrons. Electro dynamics in planar and cylindrical magnetrons, Cutoff magnetic field, Resonant cavities in magnetron, Π-mode operation Mode separation techniques, Rising sun cavity and strapping. Principle of working of TWT amplifier. Slow wave structures, Approximate gain relationship in forward wave TWT.

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Unit-V: Microwave Measurements: Square law detection, Broadband and tuned detectors. Wave-guide probes, Probe and detector mounts, Slotted line arrangement and VSWR meter, Measurement of wave-guide impedance at load port by slotted line, Microwave bench components and source modulation. Measurement of scattering matrix parameters, High, Medium and low-level power measurement techniques, Characteristics of bolometers, bolometer mounts, Power measurement bridges, Microwave frequency measurement techniques, calibrated resonators (transmission and absorption type). Network Analyzer and its use in measurements.

COURSE OUTCOMES:

Students will be able to -

CO 1: Understand the basic concept and principle of microwave transmission system, and spectrum, different parameters, microwave network and components, solid-state vacuum tubes devices and measurement devices. –(BL1,BL2)

CO 2: Analyze different microwave network. Able to measure different physical quantities using micro devices.—(BL3, BL4)

CO 3: Design different waveguides, couplers and isolators.—(BL3, BL6)

TEXT BOOKS & REFERENCES:

- Liao: Microwave Devices and Circuits, Pearson Education.
- Kulkarni, "Microwave Engineering", Dhanpat Rai New Delhi
- Rao: Microwave Engineering, PHI Learning.
- Collins: Foundations of Microwave Engineering, Wiley India.
- Srivastava and Gupta: Microwave Devices and Circuits, PHI Learning.
- Reich: Microwave Principles, East West Press.
- Pozar: Microwave Engineering, Wiley India
- Roy and Mitra: Microwave Semiconductor Devices, PHI learning.

LABORATORY EXPERIMENTS

1. To determine the frequency and wavelength in rectangular waveguide working on TE10 mode.-CO2
2. To determine the SWR and reflection coefficient.CO2
3. Study of VI characteristics of Gunn diode.CO1
4. Study of following characteristics of Gunn diode:
   (a) Output Power and frequency as a function of bias voltage.CO1
   (b) Square wave modulation through Pin diodeCO1
5. Study of attenuator.CO1
6. Study of phase shifter.CO1
7. Measurement of dielectric constant (liquid and solid):
   (a) Low loss solid dielectrics.-CO2
   (b) Liquid dielectrics or solutions.CO2
8. Study of voice Communication by using microwave test bench.-CO1
9. Study of PC to PC communication by using microwave test bench.CO1
10. Study of resonant cavity.CO1

END

Sandeep Poddar

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EC – 1863(B) Computer Architecture

Course Title	Course Code	Credits - 4		
		L	T	P
Computer Architecture	EC – 1863(B)	3	-	2

COURSE OBJECTIVE	**The objective of this course is to make student understand** the basic structure and operation of digital computer, hardware-software interface, concept of pipe-lining and different ways of communicating with I/O devices and standard I/O interfaces.
PRE-REQUISITES	Logic Design
COURSE CONTENTS	**UNIT I: OVERVIEW & INSTRUCTIONS:** Eight ideas, Components of a computer system, Technology, Performance, Power wall, Uniprocessors to multiprocessors; Instructions, operations and operands, representing instructions, Logical operations, control operations, Addressing and addressing modes. **UNIT II: ARITHMETIC OPERATIONS:** ALU, Addition and subtraction, Multiplication, Division, Floating Point operations, Subword parallelism. **UNIT III: PROCESSOR AND CONTROL UNIT:** Basic MIPS implementation, Building datapath, Control Implementation scheme, Pipelining, Pipelineddatapath and control, Handling Data hazards & Control hazards, Exceptions. **UNIT IV: PARALLELISM:** Instruction, level, parallelism, Parallel processing challenges, Flynn's classification, Hardware multithreading, Multicore processors **UNIT V: MEMORY AND I/O SYSTEMS:** Memory hierarchy, Memory technologies, Cache basics, Measuring and improving cache performance, Virtual memory, TLBs, Input/output system, programmed I/O, DMA and interrupts, I/O processors.
COURSE OUTCOMES:	**After completion of the course, the student is able to** **CO1:** Gain basic understanding of operations and instruction set. Understand the working of processors and possible data hazards. Understand the concept of parallelism and how it helps to improve the operation of system. (BL1, BL2) **CO2:** Perform the arithmetic operations on a computer and analyze the result. Differentiate between different memories on the basis of performance and operating processes. (BL3, BL4) **CO3:** Design and implement different sequential and combinational circuits using different computer architectures. (BL3, BL6)

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TEXT BOOKS& REFERENCES:

- David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman / Elsevier, Fifth edition, 2014.
- V. CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VI th edition, Mc Graw-Hill Inc, 2012.
- William Stallings "Computer Organization and Architecture", Seventh Edition, Pearson Education, 2006.
- Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
- Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
- John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.

LABORATORY EXPERIMENTS

1. Write a program to add two 8 bit number (A + B = RESULT with a carry and without a carry). CO2
2. Write a program to subtract one 8 bit number from another (A - B = RESULT with a borrow and without a borrow). CO2
3. Write a program to find out AND, OR, NOT, XOR, NAND, NOR, XNOR of two 8 bit number.CO2
4. Write a program to find out addition of two 16 bit numbers. CO2
5. Write a program to find out subtraction of two 16 bit numbers. CO2
6. Implement the logic gates (AND, OR, XOR, NOT, NAND, NOR, XNOR) in VHDL using Data Flow Architecture. CO3
7. Design and implement the Half Adder circuit in VHDL using Data Flow and Behavioral Architecture.CO3
8. Design and implement Full Adder circuit in VHDL using Data Flow and Behavioral Architecture. CO3
9. Design and implement a 2:1 MUX. using Behavioral Architecture.CO3
10. Design and implement a 4:1 MUX. using Behavioral Architecture.CO3
11. Design and implement 8 bit multiplication/Division circuit using Data Flow Architecture. CO3
12. Design and implement a 4:1 MUX using two 2:1 MUX using structural architecture. CO3
13. Design and implement a full adder using two half adder using Structural Architecture CO3
14. Design and implement T, D and SR Flip Flop in VHDL using Behavioral architecture.CO3
15. Design and implement a shift registers(4 bits) using Data Flow architecture.CO3
16. Design and implement different counters (4 bits) using Data Flow architecture using Structural architecture CO3
17. Design and implement an ALU (8 bit) using Data Flow architecture using Structural architecture CO3

END

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EC – 1863(C) Speech and Audio Processing

Course Title	Course Code	Credits - 4		
		L	T	P
Speech and Audio Processing	EC 1863(C)	3	-	2

COURSE OBJECTIVE	To introduce speech production and related parameters of speech. To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech. To understand different speech modeling procedures such as Markov and their implementation issues.
PRE-REQUISITES	Matlab Programming Digital signal processing
COURSE CONTENTS	**UNIT I**: BASIC CONCEPTS: Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods. **UNIT II**: SPEECH ANALYSIS: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. **UNIT III**: SPEECH MODELING: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence– Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues. **UNIT IV**: SPEECH RECOGNITION: Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models– n-grams, context dependent sub-word units; Applications and present status. **UNIT V**: SPEECH SYNTHESIS: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** Acquire knowledge, understand and able to demonstrate fundamentals of speech, their features, analysis/synthesis, recognition processes and modeling techniques. (BL1,BL2,BL3) **CO2:** Extract and compare different speech parameters and analyze. (BL3,BL4) **CO3:** Design a speech recognition system. (BL3,BL6) **CO4:** Evaluate performance of different speech synthesis techniques. (BL3,BL5)

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TEXT BOOKS& REFERENCES:	• SLawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003 • Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002. • Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.

END

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EC – 1864(A) Cellular Mobile Communication

Course Title	Course Code	Credits - 3		
Cellular Mobile Communication	EC 1864(A)	L	T	P
		3	-	-

COURSE OBJECTIVE	By the end of the course, the student will be able to analyze and design wireless and mobile cellular systems. By the end of the course, the student will have the ability to work in advanced research wireless and mobile cellular programs.
PRE-REQUISITES	Analog & Digital Communication Antenna and Wave Propagation

COURSE CONTENTS

Unit I: Introduction to cellular mobile system: Introduction to cellular mobile system, History of wireless 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, Hand off mechanisms, Cell splitting, Consideration of the components of cellular systems.

Unit II Co-channel Interference Models and Reduction: Co-channel Interference, real time co-channel interference measurement at mobile radio transceivers, Design of antenna system - Omni directional and directional, Lowering the antenna height, Reduction of co-channel interference, Umbrella- Pattern effect, Diversity receiver, Designing a system to serve a predefined area that experiences Co-Channel Interference. Types of Non co-channel interference- adjacent channel Interference, Near-End-Far-End interference, Effects on Near-End mobile units, Cross-Talk, Effects on 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 III: Cell coverage for signal and traffic: General introduction, obtaining the mobile point-to-point model, Propagation over water or flat open area, foliage loss, propagation in near in distance, long distance propagation, 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, mobile antennas.

Unit IV: Frequency management and Channel Assignment: Frequency management, Frequency spectrum utilization, Setup channels, Fixed channels assignment, Non-fixed channel assignment algorithms, Traffic and channel assignment. Handoffs and Dropped Calls: Types of Handoff, 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.

Unit V: Case study of Digital Cellular System: GSM, Architecture, Layer Modeling, Transmission, GSM channels and Channel Modes. Architectures of GPRS, EDGE, UMTS, IMT 2000.

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(Dr. J V Ogale)
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COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO 1:** Understand and describe concept and basic fundamental of cellular mobile system, network, performance, parameters, frequency, management channel assignment, different architecture and protocols. **CO 2:** Analyse mobile system for attenuation and interference and do complex inventor for channel assignment and frequency management. **CO 3:** Analyse cell coverage for signal and traffic **CO 4:** Design cell spilt mobile outage and handoff procedure.
TEXT BOOKS& REFERENCES:	• Lee: Cellular and Mobile Communication, 2nd edition, McGraw Hill. • D. P. Agrawal and Q. An Zeng: Wireless and Mobile Systems, Cengage Learning, 2006. • FaherKamilo: Wireless Digital Communication, Prentice Hall of India, New Delhi, 2006. • G. J. Mullet: Introduction to Wireless Telecommunication Systems and Networks, Cengage Learning. • Raj Kamal: Mobile Computing, Oxford University Press.

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EC – 1864(B) Nano Electronics & MEMS

Course Title	Course Code	Credits - 3		
		L	T	P
Nano Electronics & MEMS	EC 1864(B)	3	-	-

COURSE OBJECTIVE	The objective of this course is to familiarize the student with advances in field of Nano Technology.
PRE-REQUISITES	Electronics Devices
COURSE CONTENTS	**Unit 1**: Introduction Nano scale technology: Consequences of the nano scale 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 (Electrical, mechanical, optical, thermal etc.).top down and bottom up technique, lithographic, nanolithography and non-lithographic techniques: pulsed laser deposition, plasma arc discharge, e-beam sputtering, ball milling, sol-gel, electro deposition, chemical vapor deposition. **Unit 2**: Characterization technique Scanning probe microscopy: (Principle, construction and working) Scanning tunneling microscope, Atomic force microscope, scanning electron microscope, Transmission electron microscope, Carbon materials :Allotropes of carbon, Structure of Carbon Nano tubes, types of CNTs-, Electronic properties of CNTs, Band structure of Graphene, Band structure of SWNT from grapbene, electron transport properties of SWNTs, **Unit 3:** Fundamental of Nano electronics Tunnel junction and applications of tunneling, Tunneling Through a Potential Barrier, Metal—Insulator, Metal-Semiconductor, and Metal-Insulator-Metal Junctions, Coulomb Blockade, Tunnel Junctions, Tunnel Junction Excited by a Current Source. Field Emission, Gate—Oxide Tunneling and Hot Electron Effects in Nano MOSFETs, Theory of Scanning Tunneling Microscope, Double Barrier Tunneling and the Resonant Tunneling Diode. **Unit 4:** The Single-Electron Transistor Single- Electron Transistor Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Coulomb Blockade in a Nano-capacitor, Molecular SETs and Molecular Electronics. **Unit-V:** MEMS and NEMS Introduction to MEMS and NEMS, working principles, as micro sensors (acoustic wave sensor, biomedical and biosensor, chemical sensor, optical sensor, capacitive sensor, pressure sensor and thermal sensor), micro actuation (thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Piezo-resistivity, Piezo-electricity and thermoelectricity, MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition etc.

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COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** understand the potential of Nano Technology and the design approaches and conduction mechanism at nano level, **CO2:** analyze the Nano level circuits and physics behind Quantum wells, its structure and working **CO3:** Simulate the standard designs and implement their own designs using EDA Tools for various applications.
TEXT BOOKS& REFERENCES:	• Hayt, Kemmerley and Durbin, "Engineering Circuit Analysis", TMH. • M.E. Van Valkenburg, "Network analysis", PHI. • Artice M Davis "Linear Circuit Analysis", PWS Pub. Co. • Van Valkenberg M.E., B.K. Kinarawala "Linear circuits", PHI. • David K. Cheng "Analysis of Linear Systems", Narosa Publishing House. • Bruce Carlson, "Circuits", Thomson Learning.
LABORATORY EXPERIMENTS	1. G. W. Hanson: Fundamentals of Nano electronics, 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. Stephen D. Sentaria, Microsystem Design, Kluwer Academic Press 6. Marc Madou, Fundamentals of microfabrication & Nanofabrication. 7. T. Fukada&W.Mens, Micro Mechanical system Principle & Technology, Elsevier, 1998. 8. Julian W. Gardnes, Vijay K. Varda, Micro sensors MEMS & Smart Devices, 2001. 9. Z Cui, "Mico-Nanofabrication", Higher Education press, Springer, 2005. 10. Brian Cantor, "Novel Nanocrystalline Alloys and Magnetic Nanomaterials," Institute of Physics Publications, 2005. 11. S. Chikazumi and S.H. Charap," Physics of Magnetism", Springer-verlag berlin Heideberg, 2005 12. CaoGuozhong, "Nanostructures and Nanomaterials - Synthesis, Properties and Applications", Imperial College Press, 2004. 13. Sadamichi Maekawa, "Concepts in Spintronics", Oxford University Press, 2006

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EC – 1864(C) Adaptive Signal Processing

Course Title	Course Code	Credits - 3		
		L	T	P
Adaptive Signal Processing	EC 1864(C)	3	-	-

COURSE OBJECTIVE	The objective of this course is to enable to understand the concepts of Adaptive signal processing and then Design and Develop Adaptive Filtering Systems
PRE-REQUISITES	• Engineering Mathematics • Signals & Systems • Digital Signal Processing
COURSE CONTENTS	**Unit I:** Discrete Time Stochastic Process: Probability and Random Variable, Discrete Time Random Process, Power Spectral Density, autocorrelation and covariance structures of Discrete time random Process, Eigen analysis of autocorrelation matrices **Unit II:** Adaptive Systems: Definitions and Characteristics, Adaptive Linear Combiner, input signal and weight vector, performance function gradient, and minimum mean square error. Introduction to filtering: smoothing and prediction, linear optimum filtering orthogonality, Wiener-Hopf equation, performance surface. **Unit III**: Searching performance surface, stability and rate of convergence, learning curve, gradient search, Newton's Method, method of steepest descent, comparison, gradient estimation, performance penalty, variance, excess MSE and time constants, mis-adjustments. **Unit IV**: LMS Algorithm: convergence of weight vector, LMS/Newton Algorithm, The sign LMS and normalized LMS algorithm, Block LMS, Review of circular convolution, overlap and save method, circular correlation, Frequency Transform based implementations of Block LMS. **Unit V:** Applications: Adaptive modeling and system identification, adaptive modeling for multi path communication channel, adaptive equalization of telephone channels, active noise control, echo cancellation, and beam forming.
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** understand, analyze and compare adaptive systems in terms of different performance parameters and their characteristic equations **CO2:** implement the concepts and types of LMS algorithm, and other methods **CO3:** design and develop their own adaptive algorithms and improve the performance of existing systems
TEXT BOOKS& REFERENCES:	• "Adaptive Filter Theory", S. Haykin, Pearson Education 2003. • "Adaptive Signal Processing" B. Widrow, and S. D. Sterns, Pearson Education 2005. • "Statistical and Adaptive Signal Processing" Manolakis, Ingle, and Kogon, McGraw Hill International Edition.

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Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B. Tech –For batch admitted in July 2018
Electronics And Communication Engineering

EC – 1865(A) Embedded System Design

Course Title	Course Code	Credits - 3		
Embedded System Design	EC 1865(A)	L	T	P
		3	-	-

COURSE OBJECTIVE	To give the knowledge of Microcontroller & Advance Processor architecture, its programming & application for embedded systems design.
PRE-REQUISITES	• Digital Electronics. • Microprocessors & Interfacing

COURSE CONTENTS

Unit–1:Introduction to Embedded Systems: Definition of System &Embedded System, Embedded Systems Vs General Computing Systems, Architecture of Embedded Systems: Hardware & software, Design and Development Process, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit -2: Microcontroller for Embedded System: Introduction 8051microcontroller its internal Architecture, pin configuration, Instruction set, stack, Modes of addressing, ALP etc.

Unit -3: Processor for Embedded System: ARM Processor, ARM design philosophy, ARM Processor fundamental, ARM Instruction set, Thumb instruction set exception and Interrupt handling etc.

Unit 4: Device and communication buses & distributed Network: I/O Types and Examples, Serial, Parallel and wireless communication devices, Timer and Counter devices. Serial bus communication Protocols, Parallel Bus device Protocols, Wireless and mobile System Protocols.

Unit 5: Embedded System Designing & Application: 8051 interfacing with LED, Switches, LCD, Motor, keypad ADC, DAC, Sensor and Sevens segment etc, & it's Programming using 'C'/ALP. ARM application.

COURSE OUTCOMES:

On successful completion of this course student should be able to:

CO 1: understand what is microprocessor, microcontroller, communication protocols, ARM and embedded system and its importance in real life engineering and industrial applications

CO 2: consolidate theoretical concepts of embedded system and microcontroller architecture

CO 3: Learn practice and implement program using concepts of microcontroller

CO 4: learn peripherals interfacing and programming to solve prototype problems

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TEXT BOOKS& REFERENCES:	• Embedded Systems-Architecture, Programming and Designby Rajkamal, 2007, TMH. • The 8051 microcontroller and embedded systems Using Assembly and C 2nd Edition- By M. Ali Mazidi, Pearson Education India, 2007 • ARM Systems Developer's Guides-Designing & Optimizing System Software–Andrew N.Sloss, Dominic Symes, Chris Wright, 2008, Elsevier • Introductionto Embedded Systems-Shibu K.V, McGraw Hill. • Embedded System Design-FrankVahid,Tony Givargis, John Wiley. • Embedded Systems–Lyla, Pearson, 2013

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