MANIPAL UNIVERSITY
JAIPUR

Department of Electronics and Communication Engineering

School of Electrical, Electronics and Communication (SEEC) Engineering

Manipal University Jaipur

B.Tech. (ECE)

Course Handout- (2019-20)

HoD

Director, SEEC

Director, DOA

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HoD, ECE **Director, SEEC** **Director, DOA**

HoD Director, SEEC Director, DOA

MANIPAL UNIVERSITY JAIPUR

School of Electrical, Electronics & Communication Engineering (SEEC)

Department of Electronics & Communication Engineering

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

[PO.1]. **Engineering knowledge:** Demonstrate and apply knowledge of Mathematics, Science, and Engineering to classical and recent problems of electronic design & communication system.

[PO.2]. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

[PO.3]. **Design/development of solutions**: Design a component, system, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

[PO.4]. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. An ability to understand the concepts of basic Electronics & Communication Engineering and to apply them to various areas like Signal processing, VLSI, Embedded systems, Communication Systems, Digital & Analog Devices, etc.

[PSO.2]. An ability to solve complex Electronics and Communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

[PSO.3]. Wisdom of social and environmental awareness along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

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Department of Electronics and Communication Engineering

Course Hand-out

Basic Electronics | EC1001 | 3 Credits | 3 0 0 3

Session: July 2019 – June 2020 | Faculty: Vishal Das | B.Tech. First Year

Course Outcomes: At the end of the course, students will be able to:

[EC1001.1]. Apply principles of physics to describe and analyse the working of semiconductor devices and integrated circuits and hence develop employability skills

[EC1001.2]. Analyse different biasing configurations of Bipolar Junction Transistor

[EC1001.3]. Analyse Inverting or Non-Inverting amplifier structures comprising of Operational Amplifier and to promote development of skills towards core employability

[EC1001.4]. Demonstrate inter-conversion on different number systems

[EC1001.5]. Demonstrate minimization of Boolean expressions

[EC1001.6]. Identify different elements of communication

A. SYLLABUS

PN Junction: Formation of depletion region, Effect of forward and reverse bias on depletion region, I-V characteristics and equivalent circuits of ideal and practical diode, Diode equation. Application of Diode: Series and parallel combination of diodes circuits, Half Wave and Full Wave rectifiers, capacitor filter, clipper, clamper circuits, Zener Diode; I-V Characteristics, Zener Regulators. BJT: Construction, schematic diagram and characteristic of CE, CB Configuration, CC configuration w.r.t. CE, Relation between α and β, transistor biasing, Q-point, load line, fixed bias, self-bias. Operational Amplifier: Ideal characteristics of an Op. Amp., Inverting and Non-inverting, amplifiers, Linear Circuit applications as voltage follower, integrator, differentiator, summing amplifier, subtractor. Digital Electronics: Number systems, Boolean algebra, De Morgan's Theorem, logic gates; Truth tables, SOP, POS form, K-map for minimization of Boolean expressions, Implementation of Boolean expressions with logic gates, Introduction to combinational & sequential circuits. Communication Systems: Elements of communication systems, Analog modulation scheme.

B. TEXT BOOKS

1. R. L. Boylestad, L. Nashelsky, Electronic Devices and Circuit Theory, (10e), Pearson, 2009.
2. S. Salivahanan, S. Arivazhagan, Digital circuits and Design, (5e), Oxford University Press, 2018.
3. G. Kennedy, B. Davis, S R M Prasanna, Electronic Communication systems, (6e), Mcgraw Hill, 2017.
4. V. K. Mehta, Rohit Mehta, Principles of Electronics, (10e), S. Chand Publication, 2006.
5. B. L. Thereja, Basic Electronics: Solid state, (5e), S. Chand Publication, 2005.

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School of Electrical, Electronics & Communication Engineering (SEEC)

Department of Electronics & Communication Engineering
Course Hand-out

Computer Organization and Architecture | EC 1304 | 4 Credits

Session: July 19 – Dec. 19 | Faculty: Ms. Deepika Bansal | B.Tech ECE III Semester

Course Outcomes: At the end of the course, students will be able to

[EC1304.1]. Apply the knowledge of digital logic circuits to computer organization and architecture.
[EC1304.2]. Analyse functional units of the processor such as the registers, arithmetic logical unit, addressing modes and instructions sets.
[EC1304.3]. Perform binary addition, subtraction, multiplication and division of integers and floating-point numbers.
[EC1304.4]. Analyse the organization of the control unit, memory unit and the I/O unit.
[EC1304.5]. Relate instruction level parallelism and interconnection networks with multiprocessors systems to make them employable in industry.

A. SYLLABUS

Basic structure and operation of Computers: Introduction to the basic operational concepts of digital computer. Von-Neumann and Harvard Architecture; Overview of typical computer architecture: Accumulator based, General Register based and Stack based. **Instruction Set:** Instruction formats, types and addressing modes. Reverse Polish notation. Opcode Encoding techniques, Stack Addressing, RISC and CISC architecture.

Data Path and Control Unit Design: Basic concepts, Data path: Fast adders, subtractors, Types of Bus structures. Control Unit design methods-Hardwired and micro programmed.

Computer Arithmetic: Multiplication of signed and unsigned integers, Booths multiplication Algorithm, Division, Floating Point Arithmetic Operation.

Memory Organization: Memory hierarchies: types of ROMs, Main memory: SRAM and DRAM, Memory Address Map; Cache memory: mapping functions – associative, direct and set-associative.

Input/Output Organization: Introduction to Input/output Organization: Types of I/O: Isolated I/O, memory mapped I/O, programmed I/O, Interrupt driven I/O; Introduction to Direct Memory Access (DMA) & DMA Controller, DMA transfer methods; Introduction to Arbiters and Bus Arbitration methods;

Introduction to Multicore and Multi-processor Systems: Parallel Processing, Pipelining Structure of General-purpose Multiprocessor, Interconnection networks, Memory organization in Multiprocessors, Cache Coherence, Multicore organization: hardware and software performance issues.

B. TEXT BOOKS

- M. Morris Mano, *Computer System Architecture*, Pearson, 8th Ed, 2011.
- W. Stallings, *Computer Organization and Architecture: Designing for Performance*, Prentice Hall, 7th Ed, 2006.
- V.C. Hamacher, Z. Vranesic & S. Zaky, *Computer Organization, McGraw Hill International Edition*, Computer Science series, 5th Ed, 2002.
- J.L. Hennessy and D. A. Patterson, *Computer Architecture: A Quantative Approach*, Morgan Kauffman Publication, 5th Ed., 2007.

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Course Hand-out

Analog Electronic Circuits | EC 1306 | 4 Credits | 3 1 0 4

Session: July 19 – Dec. 19 | Faculty: Mr. Mohit Kumar Sharma | Class: Core Subject

Course Outcomes: At the end of the course, students will be able to

[1306.1]. Develop and analyse various diode and transistor applications;
[1306.2]. Apply biasing scheme for transistor circuits;
[1306.3]. Prepare BJT and FET amplifier circuits;
[1306.4]. Analyse High and Low frequency models of Transistors; and
[1306.5]. Understanding of devices would enhance the technical as well as employability skills.

A. SYLLABUS

Junction Diode Analysis: Built in voltage, Transition and diffusion capacitances; **Introduction to BJT:** hybrid model, Hybrid – TT model, analysis of CE, CB, and CC configurations of BJT amplifiers, Miller's theorem; **Multistage amplifiers**: Distortion in amplifiers, Frequency response of an amplifier, bandwidth of cascaded amplifiers, frequency response of an RC coupled, direct coupled and transformer coupled stages; **Power amplifiers**: Classification of large signal amplifiers, Analysis and design with respect to efficiency, linearity and harmonic distortions of classes of Amplifier; **FET**: Structure of JFET and MOSFET, Characteristics, FET biasing, small signal, Analysis of CS, CD and CG amplifiers at low and high frequencies; **Feedback amplifiers**: Concept of feedback, types of feedback – their advantages and disadvantages, effect of feedback on frequency response & impedances; **Oscillators:** Barkhausen criterion for sustained oscillation, Nyquist criterion for stability of amplifier, Types of Oscillators: Hartley and Colpitt oscillator; Wein bridge oscillator; RC phase shift oscillator; crystal oscillator; **Introduction to Power Electronic Devices.**

B. TEXT BOOKS

[1] J. Millman & C. C. Halkias, "Integrated Electronics", Tata McGraw Hill, New Delhi, 2011

[2] R. L. Boylestad & L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall, 2009

C. REFERENCE BOOKS

[1] B.P. Singh and Rekha Singh, "Electronic Devices an Integrated Circuits", Pearson India, 2012

[2] S. Salivahanan and N Suresh Kumar, "Electronics Device and circuits", McGraw Hill Publication, 2010

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Course Hand-out

Digital System Design & HDL | EC 1308 | 4 Credits | 3 1 0 4

Session: July19 – December 19 | Faculty: Mr. Chusen Duari| Class: Core Subject

Course Outcomes: At the end of the course, students will be able to

[1308.1]. To design & analyze combinational circuits and implementation of minimization techniques.
[1308.2]. Able to understand and design different arithmetic circuits
[1308.3]. Design of synchronous and asynchronous sequential circuits using State Diagrams & Tables.
[1308.4]. To design and implement sequential logic function using FSM & ASM.
[1308.5]. Implementation & Verification of digital logic circuits & systems using Verilog HDL for enhancing the employability skills in VLSI Domain

A. SYLLABUS

Combinational Logic Design: Combinational circuit analysis, Techniques for minimization of Boolean functions such as Karnaugh map, VEM and Quine-Mc Cluskey methods; **Design of arithmetic circuits**: code convertors, BCD codes and arithmetic, Gray code, self-complimenting codes, multiplexers, demultiplexers, encoders, decoders & comparators, Parity generators and checker; **Introduction to Sequential Logic**: Need for sequential circuits, Binary cell, Latches and flip-flops. RS, JK, Master-Slave JK, D & T flip flops; **Synchronous Sequential Circuit Design**: Introduction to Synchronous Sequential circuits, Design of Synchronous Counters, Shift register, Finite State Machines, Moore and Mealy Machines. Timing issues in synchronous circuits; **Asynchronous Sequential Circuits**: Introduction to Asynchronous Sequential circuits, Asynchronous Counters, Pulse mode and Fundamental-mode Circuits, Cycles, Races and Hazards in asynchronous circuits; **Logic Families**: Basic ECL, Transistor-Transistor Logic and CMOS logic; **Introduction to Verilog programming:** Behavioural, Data flow, and structural modeling. Basic constructs, designing combinational and sequential circuits using Verilog.

B. TEXT BOOKS

1. S. Brown and Z. Vranesic, "Fundamentals of Digital logic with Verilog Design", McGraw Hill, 2013.
2. M. Mano and M. Ciletti, "Digital Design: With an introduction to Verilog HDL", Pearson, 2013
3. Z. Navabi, "Verilog Digital System Design" McGraw Hill, 2008.

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Course Hand-out

Analog Integrated Circuits and Systems | EC 1401 | 4 Credits | 3 1 0 4

Session: Jan–June.2020 | Faculty: Prof. Manish Tiwari/ Mr. Chusen Duari/Mr. Ashish Vijay| Class: Core Subject

Course Outcomes: At the end of the course, students will be able to:

[EC1401.1] Foster and analyse the characteristics of all individual blocks of an op-amp for skill development

[EC1401.2] Develop the skills to design various electronic circuits using op-amp applicable in linear domain.

[EC1401.3] Demonstrate the non-linear operation of op-amp and solve various problems in non-linear domain and designing of problems as well.

[EC1401.4] Analyse and calculate the impact of development projects and their characteristics impacts on environment and hence develop employability skill.

A. SYLLABUS

Operational Amplifier: Introduction: Basic block diagram of Op Amp.

Differential Amplifier: Types of differential amplifier, analysis using block diagram, characteristics of differential amplifier, analysis of emitter coupled differential amplifier using small signal hybrid model and MOS, methods of improving common mode rejection ratio using constant current source and current mirror circuits using MOS, current repeaters and active load; Circuit operation and analysis of level shifter and output stage of an operational amplifier; transfer characteristics of op. amp, measurement of operational amplifier parameters; CMOS Amplifier.

Linear applications of operational amplifier: Characteristics of ideal operational amplifier, open loop and closed loop operation of operational amplifier, voltage follower, integrator, differentiator, voltage to current converter, current to voltage converter, difference amplifier, instrumentation amplifier and bridge amplifier;

Active filters: Design and analysis of first and higher order low pass, high pass, band pass (wide and narrow band) and band elimination (wide and narrow band) and all pass active filters;

Non-linear applications of operational amplifier: Precision half wave and full wave rectifiers, peak detector, sample and hold circuit, log and antilog amplifiers, analog multipliers and dividers, comparators, window detector, Schmitt trigger, square wave, triangular wave generators and pulse generator;

Timer IC: Introduction, pin details of 555 I.C., functional diagram of 555 IC, astablemultivibrator, positive and negative edge triggered monostablemultivibrator, linear ramp generator and FSK generator.

Data converters: Principles of digital to analog converter (DAC) and analog to digital converters (ADC), binary weighted, R-2R digital to analog converters, flash type, successive approximation type, counter-type and servo tracking type and dual slope analog to digital converters, specifications of ADC and DAC.

Phase-locked loops: Functional diagram of voltage controlled oscillator - 566 I.C. and its analysis, Operating principle of PLL, study of IC 565, circuit analysis of phase detector, Definition and derivation for free running frequency, lock range and capture range, Applications of PLL as frequency multiplier, frequency divider, AM and FM demodulation and FSK demodulation

B. TEXT BOOKS

T1. K.R. Botkar "Integrated Circuits" Khanna Publishers Delhi.

T2. B. Razavi, "Design of Analog CMOS Integrated Circuits", Tata Mc-Graw Hill.

T3. A.HOLBERG; "CMOS analog Circuit Design", OXFORD Unv. Press. 3rd Edition, 2013

C. REFERENCE BOOKS

R1. S. William D. "Operational Amplifiers with Linear Integrated Circuits" Prentice Hall (2004)

R2. M. Jacob "Microelectronics", McGraw Hill (1979).

R3. F. Sergio "Design with Op amps & Analog Integrated Circuits" McGraw Hill (1997).

R4. D. L. Terrell, Butterworth - Heinemann "Op Amps Design, Application, and Troubleshooting" (1996).

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Course Hand-out

Microprocessor and Microcontroller | EC 1402 | 4 Credits | 3 1 0 4

Session: Jan–June.2020 | Faculty Dr. Abhishek Shrivastav, Mr. Rohit Mathur| Class: Core Subject

Course Outcomes: At the end of the course, students will be able to

[EC1402.1]. Classify problems related to the device architectural design and improvised the skill set

[EC1402.2]. Estimate and analyze problems based on the mathematical reasoning, leading to employability

[EC1402.3]. Develop Logical and Conditional programming skills to promote entrepreneurship

[EC1402.4]. Outline the conceptual details of the devices through programming problems

A. SYLLABUS

8086 Microprocessor: Introduction to 16-bit microprocessors, History of microprocessors. **8086 Architecture:** Bus Interface Unit and Execution Unit, Instruction pipeline, Data and Address Bus Configuration, Memory Segmentation, Memory Address generation, I/O Port addressing. **8086 Signals:** Functions of all signals, Minimum and Maximum Mode signals; Bus Cycles, Bus driver 8288. **8086 Instruction Set:** Types of Instructions and Addressing Modes, Programming; **8051 Microcontroller:** Architectural features, Programming model, I/O Ports, Addressing Modes, Instruction set of 8051, Programming; **ARM Processor fundamentals:** Introduction, RISC design philosophy, ARM design philosophy. Registers; Current Program Status Register; Pipeline and stages; Exceptions, Interrupts and Vector Table; Core Extensions: Coprocessors. **Instruction Set:** Arithmetic and Logic; Memory Load and Store; Block Load and Store; Branch and Branch with Link; Machine Control. **Thumb Instruction Set:** Thumb Register Usage; ARM-Thumb Interworking; Other Branching Instructions; Data processing; Single-Register Load-Store Instructions; Multiple-Register Load-Store Instructions; Stack instructions; Software Interrupt Instruction.

B. TEXT BOOKS

T1. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010

T2. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 – Microcontroller and Embedded systems",7th Edition, Pearson Education , 2004.

T3. S. Ferber, "ARM System-On-Chip Architecture", Addison-Wesley Professional imprint in Pearson, 2001.

C. REFERENCE BOOKS

R1. K. Ray & K. M. Bhurchandi, "Advanced microprocessor and peripherals", TMH 2006.

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Course Hand-out

Signals and Systems | EC 1405 | 4 Credits | 3 1 0 4

Session: Jan–Dec.2020 | Faculty: Mr. Mohit Sharma, Dr. Amit Kumar Singh| Class: Core Subject

Course Outcomes: At the end of the course, students will be able to

[EC1405.1] Acquire knowledge about continuous & discrete-time signals, implement time domain properties on various signals to perform basic operations on signals, able to identify different characteristics of systems and improving skill set

[EC1405.2] Inculcate vision to identify signals and demonstrate its usage to solve problems using Fourier transform and Fourier series for better employability

[EC1405.3] Foster ability to demonstrate problem solving using Laplace transform

[EC1405.4] Demonstrate ability to solve problems in discrete time domain using Z transform and promote entrepreneurship

A. SYLLABUS

Introduction to signals and systems: Definitions, Overview of specific systems, Classification of signals, Basic operations on signals, Elementary signals and functions, Systems viewed as interconnections of operations, properties of systems; **Time domain representations for Linear time-invariant systems**: Introduction, Convolution, Impulse response representation for LTI systems, properties of the impulse response representation for LTI systems, Differential and difference equation representations for LTI systems, Block diagram representations; **Fourier representation for signals**: The discrete-time Fourier series, continuous-time periodic signals: The Fourier series, Discrete-time non-periodic signals; **Applications of Fourier representations**: Introduction, Frequency response of LTI systems, Fourier transform representations for periodic signals Properties of Fourier transform, convolution and modulation with mixed signal classes; energy, power, parseval's theorem, spectra of signals, cross correlation and auto correlation, power and energy spectral density; **Applications of Laplace transform**: Continuous Time System Analysis using Laplace transform, Region of convergence and Stability, Analysis of continuous time signals and systems; **Z-Transform**: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems, pole-zero analysis, stability, the unilateral Z-Transform; **Sampling of Continuous-Time Signals**: Introduction, periodic sampling, Frequency domain Representation of sampling, Reconstruction of Band-limited Signal from its Samples.

B. TEXT BOOKS

T1. S. Haykin & B. V. Veen, *Signals and Systems*, John Wiley &Sons, New Delhi, 2005.

T2. A.V. Oppenheim, A. S. Willsky & A. Nawab, *Signals and Systems*, PHI. /Pearson Education, New Delhi, 2002.

C. REFERENCE BOOKS

R1. A. Anand Kumar, *Signals and Systems*, Prentice Hall, India.

R2. H. Hsu, R. Ranjan, *Signals and Systems*, Schaums's outline, Tata McGraw – Hill, New Delhi, 2006.

R3. B. P. Lathi, *Linear systems and Signals*, Oxford University Press, 2005.

R4. Simon Haykin , Barry Van Veen Signals and Systems, Wiley

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Course Hand-out

Embedded and Real Time Operating Systems | EC 1506 | 4 Credits | 3 1 0 4

Session: July-Dec 2019 | Faculty: Ms. Pallavi Yarde, Dr. Renu Kumawat | Class: Core Course

Course Objectives: At the end of the course, students will be able to

[EC 1506.1]. Review the basic concepts of Embedded Systems, Communication Protocols and Real Time Operating System.

[EC 1506.2]. Describe the architectures, structural and software requirements of Embedded Systems and their roles in real life applications.

[EC 1506.3]. Design Embedded System's firmware using Embedded C programming and apply these programming skills for solving various microcontroller-based problems and interfacing different peripheral devices.

[EC 1506.4]. Interpret and illustrate the requirements, specifications and roles of communication protocols used in embedded systems.

[EC 1506.5]. Identify and apply the knowledge of real-time operating systems for real life embedded systems and hence develop the employability skills.

[EC 1506.6]. Investigate the effects and various issues related to real time operating systems like scheduling, deadlock avoidance, inter-process communications, etc. in embedded system design.

A. Syllabus

Embedded Systems: Introduction, Classification, Elements of Embedded Systems, Hardware units, devices, Software, Embedded SOC (System on Chip), Design Process, Process of Embedded system development. **Case studies:** Automatic Chocolate Vending Machine (ACVM), Digital Camera. **Interrupts, Devices and Device Drivers:** Interrupts, Interrupt Handling Mechanism, Interrupt Controllers, Interrupt Latency, Timers, Counters, Device Drivers. **Buses and Communication Interfaces:** RS232, SPI, I2C and Programming. **Operating System:** Process Management: Processes, Threads, Process Synchronization, Process Scheduling; Deadlock. Inter-process Communication and synchronization of processes, threads and tasks: Multiple processes in application, multiple threads in application, distinction between function, ISRs and tasks by their characteristics, Semaphores, Synchronization with semaphores and Mutex, Shared data, Signal function, Message function, Mailbox, Pipe. **Real Time Operating Systems (RTOS):** Introduction, Classification, Services, Process Management, Timer function, Memory Management, Task Scheduling modules, Interrupt latency, **Case studies:** Embedded System in Automobile, Smart Card.

B. Text Books

T1. Rajkamal, "Embedded Systems: Architecture, Programming and Design", second edition, McGraw Hill publication, 2008

T2. Frank Vahid, Tony Givargis, "Embedded System Design: A unified Hardware/Software approach", John Wiley and Sons, 1999

T3. Abraham Silberschaltz, Peter Baer Galvin, Greg Gagne ,"Operating System Concepts" , 9th edition, 2013.

C. Reference Books

T4. Shibu, Embedded Systems, McGraw Hill education, 2014.

T5. M.A. Mazidi, The 8051 Microcontroller and Embedded Systems, using Assembly and C, Pearson, 2nd Ed, 2006

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Course Hand-out

Analog and Digital Communication | EC 1508 | 4 Credits | 3 1 0 4

Session: July-Dec. 2019 | Faculty: Mr. S. DasMahapatra, Ms. Madhuri Sahal | Class: Core Course

Course Outcomes: At the end of the course, students will be able to

[EC1508.1] Formulate basic elements of communication system and utilize the process for skill development

[EC1508.2] Analyse and compare different analog modulation and demodulation schemes to improve skill set and for better employability

[EC1508.3] Evaluate different digital baseband communication methods in time and frequency domain thus developing the analytic skill applicable to digital communication system.

[EC1508.4] Demonstrate different digital passband communication schemes and equip with design skills to apply in communication system and to foster the needs of entrepreneurship.

A. SYLLABUS

Overview & Background review: Spectral analysis: Review of Fourier Transform. Introduction to Noise: Thermal Noise, Shot Noise, Signal to Noise ratio, S/N of a tandem connection.

Analog Communication: Amplitude modulation: Generation & Detection; Time and Frequency domain analysis of: single tone AM, Multi tone AM, DSBSC, SSB, VSB. FDM. Angle modulation: Introduction to phase Modulation (PM) and frequency modulation (FM), Generation & Detection; Time and frequency domain analysis of FM, Modulation index for sinusoidal FM, Average power for sinusoidal FM, Single tone FM.

Analog to Digital Conversion: Introduction to digital signal detection: Model of Digital Communication System, Gram-schmitt orthogonalization procedure (signal space analysis), geometric interpretation of signals, response of bank of correlators to the noisy input, detection of known signals in noise. Pulse modulation systems: Pulse amplitude modulation (PAM), band width requirements and reconstruction methods, time division multiplexing (TDM), pulse duration modulation (PDM).

Base band digital data transmission: Base band digital communication systems, multilevel coding using PAM, pulse shaping and band width consideration, inter symbol interference (ISI), Nyquist condition for zero ISI, band-limited Nyquist pulses, the eye diagram. Introduction to PCM, DPCM systems. Digital modulation techniques: Band pass (modulated) digital data systems, binary digital modulation, ASK, PSK, DPSK, and FSK. M-ary data communication systems, quadrature amplitude modulation (QAM).

B. TEXT BOOKS

T1 S. Haykin, Communication Systems, Willey Education, 4th edition, 2001.

C. REFERENCE BOOKS

R1. Taub & D.L. Schilling, Principles of Communication systems, 3rd Ed. McGraw-Hill Co 2008.
R2. B. P. Lathi & Z. Ding, Modern Digital and Analog Communication Systems, Oxford, 2010.
R3. D. Roddy & J. Coolen, Electronic Communications, Fourth Edition, PHI 2001.
R4. Kennedy, Electronic Communication Systems, Third Edition, TMH 1994.
R5.H.P. Hsu, Analog and Digital Communications, Schaum's outline series TMH 2006.

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Course Hand-out

Linear and Digital Control Systems | EC 1509 | 4 Credits | 3 1 0 4

Session: July-Dec. 2019 | Faculty: Dr. Amit Kumar Singh, Dr. Lokesh Garg | Class: Core Course

Course Outcomes: At the end of the course, students will be able to:

[EC1509.1] Perform system's time and frequency-domain analysis with response to test inputs and find out the parameter which characterised the system performance.

[EC1509.2] Understand feedback concept, apply Laplace transform, model mechanical systems and use reduction techniques to obtain transfer functions.

[EC1509.3] Determine the (absolute) stability of a closed-loop control system, analyse and design control systems by applying suitable techniques, communicate design results in written reports and hence improve employability skills.

[EC1509.4] Apply different techniques to analyse system performance.

A. SYLLABUS

Block Diagrams and Signal flow graph: Transfer function, Block Diagram, Simplification of systems, Signal flow graphs, Gain formula, State diagram, Transfer function of discrete data systems (PTF), Zero order hold;

System modeling: Modeling of electrical and Mechanical Systems (translational & Rotational), System equations, its electrical equivalent (analogous) networks;

Time domain analysis: Stability, Routh-Hurwitz criterion, time response for Continuous data systems, type and order of systems, Steady state error for linear Systems, Unit step response for second order systems, Root locus properties and construction;

Frequency domain analysis: Introduction, second order prototype system, Bode diagram, Gain and Phase margins, Nyquist stability criterion;

Compensators and controllers: Proportional, Integral, PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators;

State space representation: Stability Analysis, State transition matrix, Eigen values, Controllability and observability;

Digital control systems: Stability and its tests, time response, Mapping between s-and Z- plane, Steady state error;

Process controls: Process and process control, model identification, feedback and feed forward controls and control strategies, actuators;

Controllers: Z-transform based control algorithms, PID controllers – direct digital controllers.

B. TEXT BOOKS

T1:Nagrath & Gopal, *Control system engineering*, PHI, 2009.

T2.A. K. Jairath, *Control Systems with essential theory*, 6th edition, CBS, 2015

T3.K. Ogata, *Modern control engineering*, 2nd Edition, PHI, 2010.

C. REFERENCE BOOKS

R1.S. I. Ashon, "*Microprocessors with Applications in Process Control*, TMH, 1986.

R2. B. C. Kuo, *Automatic Control Systems*, 7th Edition, PHI, 2009.

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Department of Electronics & Communication Engineering
Course Hand-out

Antennas | EC 1605 | 4 Credits | 3 1 0 4

Session: Jan. - June 2020 | Faculty: Prof. V.N. Tiwari, Dr. Dinesh Yadav | Class: Core Course

Course Outcomes: At the end of the course, students will be able to

[EC1605.1] Analyze the radiation phenomena and need of antenna theory for wireless applications to promote sustainable employment in RF field.

[EC1605.2] Analyse radiation characteristics and designing techniques of different antenna structures and hence develop entrepreneurship skills.

[EC1605.3] Understand the propagation of electromagnetic waves in different propagation modes

[EC1605.4] Recognize the effect involved in free space propagation to have better skill set

A. SYLLABUS

Introduction: Radiation Mechanism, current distribution, Antenna parameters; Vector potentials: Electric and magnetic vector potentials, solutions for wave equations, far-field radiation, Duality theorem, Reciprocity theorem; Linear wire Antennas: Infinitesimal, small and finite dipole Antennas, Region separation, Half wave length dipole; Loop Antennas: Small circular loop Antenna, circular loop with constant current, Ferrite loop; Antenna Arrays and other types of antennas: Two element array, N-element array – uniform, broadside, ordinary end-fire, Non-uniform Amplitude Arrays, planar and circular arrays; Qualitative study of Folded dipole, long wire, V, Rhombic, Helical, Yagi Uda, log-periodic, Aperture antennas, and horn Antennas, Babinet's principle, Huygens's principle, Rectangular and Circular Microstrip Patch antenna, Quality Factor, Bandwidth, Efficiency; Antenna Measurements: Radiation Pattern measurement, Distance requirement for uniform phase, uniform field amplitude requirement, Introduction to phase measurement; Gain Measurement: Comparison method, Near field method, Introduction to current distribution measurement, Measurement of antenna efficiency, measurement of Noise figure and noise temperature of an antenna polarization measurement; Propagation of EM waves: Ground wave Propagation, Space Wave Propagation, Troposphere and ionosphere propagation and its effect on Radio Waves.

B. TEXT BOOKS

T1. *C. A. Balanis, "Antenna Theory" 3e, John Wiley & Sons, New Delhi, 2010*
T2. *K. D. Prasad "Antenna and Wave Propagation", 3E, Satya Prakashan, New Delhi, 2009*

C. REFERENCE BOOKS

R1. *J. Kraus "Antenna and wave Propagation", 4e, Tata McGraw – Hill, New Delhi, 2010*
R2. *F. E. Termen "Radio Engineering" Tata McGraw – Hill, New Delhi, 1995*

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Course Hand-out

MOS VLSI Design | EC 1606 | 4 Credits | 3 1 0 4

Session: Jan. - June 2020 | Faculty: Dr. Shilpi Birla, Dr. Lokesh Garg, Ms. Neha Singh | Class: Core Course

Course Outcomes: At the end of the course, students will be able to

[EC1606.1] Illustrate MOS fabrication and its working for skilled employability

[EC1606.2] Analyze CMOS circuits in behavioral, structural and geometrical domain to have better skill set

[EC1606.3] Design and discuss CMOS circuits for delays and noise margin

[EC1606.4] Design and analyze different combinational logic circuits and systems using CMOS and other logic families to promote entrepreneurship

[EC1606.5] Implement sequential circuits using CMOS and other logic families

A. SYLLABUS

Introduction: VLSI technology trends, performance measures and Moore's law; MOS devices and circuits: MOS transistors, Study of depletion and enhancement mode operations, Threshold Voltage. Second order effects in MOSFETs; **Fabrication of ICs:** Lithographic process of MOS and CMOS fabrication. N-well, P-well and twin tub processes, Latch-up in CMOS, SOI process, VLSI Yield and economics; **MOS Circuit design & layouts:** Pass transistors and transmission gates, Implementation of Boolean functions and combinational circuits using switch logic & gate logic, Pseudo NMOS inverter, Dynamic and clocked CMOS inverters, Clocking strategies; **Basic circuit concepts and performance estimation:** Sheet resistance, Standard unit of capacitance, Estimation of delay in NMOS and CMOS inverters **Sub system design:** Design strategies, Design issues and structured approach. Design examples such as Adders, ALUs and Shifters, Design of sequential circuits; current trends: BiCMOS and GaAs devices and circuits, Low power VLSI circuit techniques, analog and mixed signal design.

B. TEXT BOOKS

T1. S. M. Kang & Y. Leblebici, CMOS digital Integrated circuits design and analysis, Tata McGraw Hill, 3rd edition, 1996.

C. REFERENCE BOOKS

R1. J. M Rabaey, *Digital Integrated Circuits*, Prentice Hall India, 2nd Edition, 2003.

R2. W. N. & K. Eshraghian, *Principles of CMOS VLSI Design*, Addison Wesley Publication, 2nd Edition, 1993.

R3. A. Mukherjee, *Introduction to NMOS & CMOS VLSI systems Design*, Prentice Hall, 1986.

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Course Hand-out

Digital Signal Processing | EC 1607 | 4 Credits | 3 1 0 4

Session: Jan. - June 2020 | Faculty: Ms. Madhuri Sahal, Dr. Neetu Marwah, Mr. C.P. Gupta | Class: Core Course

Course Outcome: At the end of the course, students will be able to

[EC1607.1] Characterize and analyse the signals and systems in time domain, frequency domain, z-domain and illustrate and interpret the Discrete Fourier Transform, FFT and acquire the skills to apply them to diverse engineering problems for employability.

[EC1607.2] Demonstrate and implement discrete time systems such as structures for FIR systems and IIR systems for improvised skill set.

[EC1607.3] Acquire the skills to design IIR filters and FIR filters using various techniques & illustrate and interpret the sampling and signal reconstruction, and multi-rate processing.

[EC1607.4] Acquire the skills to evaluate system response of LTI system & power spectral density estimation.

A. Syllabus

Review of signals and systems: Time and frequency analysis of signals and systems. Transform Analysis of LTI Systems: The frequency Response of LTI systems, Inverse system, All- Pass system, Minimum Phase system, Linear systems with Generalized Linear Phase. Frequency domain sampling and reconstruction of discrete time signals: Discrete-Time Processing of continuous- Time Signals, Continuous- Time Processing of Discrete-Time Signals, Changing the Sampling Rate Using Discrete-Time Processing. Discrete Fourier transform: Introduction, properties of the DFT, use of DFT in linear filtering, filtering of long data sequences, DFT as linear transformation; Computation of DFT, Decimation-in- Time and Decimation–in–frequency Algorithms. Implementation of discrete time systems: Structures for FIR systems – Direct form, cascade form, Frequency sampling and lattice structures. Structures for IIR systems – Direct form, cascade and parallel form. Design of IIR filters and digital FIR filters: Classical design by impulse invariance, bilinear transformation and matched Z transform, characteristics and design of commonly used filters – butter worth. Power spectrum estimation: Estimation of power spectra from Finite duration of observation of signals. Non-parametric methods of PSD estimation: Periodogram, Bartlett, Welch, Blackman and Tukey methods (qualitative analysis).

B. Text Books

T1. A.V. Oppenheim & R.W. Schafer, Discrete-Time Signal Processing, Pearson education 2003.
T2. S. Salivahanan, C. Gnanpriya, Digital Signal Processing, 2e, Tata McGraw-Hill Education, 2011.

C. Reference Books

R1 .J.G. Proakis, D.G. Manolakis, D. Mimitris, Introduction to Digital Signal Processing, Prentice Hall, India 2003.
R2. Sanjit K. Mitra, Digital Signal Processing A Computer Based Approach, 4e, Mc Graw Hill Education, 2013
R3. I. feachar & Jervis, Digital Signal Processing: A Practical approach, Pearson education, Asia, 2003.
R4. L.R. Rabiner & D.J. Gold, Theory and applications of digital signal processing Prentice Hall, India 1988.
R5. Anand Kumar, Signals and Systems, Prentice Hall, India.
R6. Tarun Kumar Rawat, Signals and Systems, Oxford University Press, 2010.

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Course Hand-out

VLSI/ULSI Process Technology | EC 1656 | 3 Credits | 3 0 0 3

Session: Jan. - June 2020 | Faculty: Dr. Kulwant Singh | Class: Program Elective

Course Objectives: At the end of the course, students will be able to

EC 1656.1	Illustrate the manufacturing methods and their underlying scientific principles in the context of technologies used in VLSI fabrication.
EC 1656.2	Foster knowledge of VLSI Fabrication principles in real time problems and enable to develop employability skills.
EC 1656.3	Design and discuss fabrication processes such as crystal growth, epitaxy, oxidation, lithography, etching, diffusion and metallization for improvised skill set
EC 1656.4	Contrast characteristics of various semiconductor materials used for fabrication.
EC 1656.5	Explain different crystals and their characteristic parameters

A. Syllabus

Material properties: Physical properties, Crystal structure, Miller indices, Packing Density, Defects, Dislocation: Crystal growth & Silicon Oxidation: Silicon Crystal Growth - Czochralski and Float Zone Technique, Distribution of dopants, Segregation/Distribution coefficient; Silicon oxidation: Thermal Oxidation process-Kinetics of oxide Growth; Photolithography: Photo resists, Lift Off technique, Optical Lithography, masks, photo resists, Pattern transfer, Resolution enhancement techniques, Next generation lithography- electron beam lithography; Diffusion & Ion implantation: Basic diffusion process, Fick's law, Pre-deposition and drive-in diffusion, Diffusion profile for various dopants, Lateral Diffusion; Range of Implanted Ions, straggle, ion stopping, ion Channelling, Annealing, Rapid Thermal Annealing; Etching: Wet chemical etching of Silicon, Silicon dioxide, Silicon Nitride and Aluminum. Dry etching, Plasma fundamentals and etch mechanism; Epitaxy: Epitaxial growth technique, Molecular beam epitaxy; Metallization: evaporation and sputtering, Realizing resistor; Single and double damascene process.

B. Text Books

T 1 S. M. Sze, VLSI Technology, Second Edition, McGraw Hill, 1988.
T 2 S.K. Gandhi, VLSI Fabrication Principles, Second Edition, John Wiley & Sons, 1983.

C. Reference Books

R1 S. A. Campbell, The Science & Engineering of Microelectronic Fabrication, Second Edition, Oxford University Press, 2005.
R2 G.S. May & S. M. Sze, Fundamentals of Semiconductor Fabrication, Wiley, 2004.

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Course Hand-out

Data Structure using C++ | EC 1658 | 3 Credits | 3 0 0 0

Session: Jan. - June 2020 | Faculty: Dr. Himanshu Chaudhary | Class: Program Elective

COURSE OUTCOMES: At the end of the course, students will be able to

|EC1658.1|. Develop concepts of object-oriented programming using C++ for employability

|EC1658.2|. Design operations on arrays, lists, stacks and queue data structures to gather required skill set

|EC1658.3|. Elaborate the notions of trees, binary search trees, Red Black tree, Heap.

|EC1658.4|. Design appropriate sorting algorithms skills such as merge sort, heap sort and quick sort etc. based on the problem given.

|EC1658.5|. Develop C++ program for developing employability skills using data structure applications.

A. SYLLABUS

Introduction to C++: Review of C++, Pointers and Arrays, Classes, Recursion, An overview of C++ programming language basic terms and operations. **Linked List:** Representing the linked list in memory, traversing a linked list, searching a linked list, Memory allocation: Garbage collection, Insertion and deletion from a linked list, Header linked list, two way linked list. **Stack, Queues and Recursion:** Array/ Linked representation of stack, Arithmetic expression; Polish notation, application of stack, Recursion implementation with stack, Queues, linked representation of queues, Deques, Priority queues. **Trees:** Tree Definitions, Decision Trees, Transition Diagrams, Ordered Trees, Traversal Algorithms, binary search trees: Counting Binary Trees, Full Binary Trees, Identity, Equality, and Isomorphism, Complete Binary Trees, Binary Tree Traversal Algorithms, Expression Trees, Implementations of The Traversal Algorithms, Multiway Search Trees, B-trees, Binary Search Trees, Performance of Binary Search Trees, AVL Trees. **Heaps and Priority Queues:** Heaps, the Natural Mapping, Insertion into a Heap, Removal from a Heap, Path length: Huffman's algorithm. **Sorting and Searching:** Various sorting algorithms like Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Merge Sort, Quick Sort, Heap Sort, Speed Limit for Comparison Sorts, Radix Sort, and Bucket Sort, Searching and data modification, Hashing. **Graphs:** Simple Graphs, Graph Terminology, Paths and Cycles, Isomorphic Graphs, The Adjacency Matrix for a Graph, The Incidence Matrix for a Graph, The Adjacency List for a Graph, Digraphs, Paths in a Digraph, Weighted Digraphs and Graphs, Euler Paths and Hamiltonian Cycles, Dijkstra's Algorithm, Graph Traversal Algorithms. **Analysis of algorithm**: Synergy between data structures and algorithm, Factors to be considered in the choice of data structures and algorithms.

B. TEXT BOOKS

T1. J. R. Hubbard, *Data Structures and Algorithms*, Schaum's Outlines. McGraw-Hill, New York, USA, 2000.

T2. Michael T. Goodrich, Roberto Tamassia, David M. Mount, *Data Structures and Algorithms in C++*, 2. illustrated Edition, John Wiley & Sons, 2010.

C. REFERENCE BOOKS

R1 R. Lewis, L. Deneberg, Data Structures and their Algorithms, Addison-Wesley UK, 1991.

R2 Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, University Paperback, Perason, 2014.

R3 Clifford A. Shaffer, Data Structures & Algorithm Analysis in C++, Third Edition, Dover Publication US, 2011.

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Course Hand-out

Network Protocols and Security | EC 1659 | 3 Credits | 3 0 0 0

Session: Jan. - June 2020 | Faculty: Ms. Pallavi Yarde | Class: Program Elective

Course Objectives: At the end of the course, students will be able to

[EC1659.1]. Have a good understanding of the Computer Networks, OSI reference model and TCP/IP Model.

[EC1659.2]. Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

[EC1659.3]. Finally observe the gaps and finding the solutions to the gaps.

[EC1659.4]. Describes the different layer protocols and design their structure to identify and understanding the importance.

[EC1659.5]. To be familiar with information security awareness and a clear understanding of its importance fundamental security issues that works with networking ethics that improve employability skills.

[EC1659.6]. To master fundamentals of secret and public cryptography, protocols for security services and also to be exposed to the importance of integrating people, processes and technology this may create employability.

A. Syllabus

Computer Networks: Introduction to Internet; Protocol, Network Edge: End System, Clients and Servers; Connection-oriented and Connectionless Services; Network Core: Circuit Switching, Packet Switching; Packet switched networks: Datagram and virtual-circuit networks, types of delay; TCP/IP model and Protocols: Layers and service models. Application Layer: Principles of Network Applications; The Web and HTTP (Hyper Text Transfer Protocol): Overview, Non-persistent and Persistent connections, HTTP message format, User-Server. Interaction: Cookies, HTTP content, Web caching. FTP (File Transfer Protocol): Introduction; FTP Commands and replies. Electronics Mail in Internet: SMTP (Simple Mail Transfer Protocol), Comparison with HTTP, **Mail Access Protocols**: POP3, IMAP. Domain Name Service (DNS): Services provided, Working, DNS Caching, DNS records and messages. **Transport Layer Protocols**: Connectionless Transport: UDP (User Datagram Protocol): Segment Structure, Checksum; Connection-oriented Transport: TCP (Transmission Control Protocol): Connection, Segment Structure, RTT (Round Trip Time) estimation, and Connection management, Delay modeling. **Network Layer**: Intra-Autonomous System (Intra-AS) Routing in the Internet: RIP (Routing Information Protocol), OSPF (Open Shortest Path First). Network Security: Introduction, **Cryptography**: .principles, Cryptography model, Brute-force attack, **Integrity**: Digital Signatures, Message Digests, Hash Function Algorithm; Key Distribution and Certification; **Access Control:** Firewall: Packet Filtering, Application Gateway. **Vulnerability, Threats, Attacks and Countermeasures:** Virus, Worms, Trojan Horses, Mapping, Packet Sniffing, Spoofing, Denial-of-Service and Distributed Denial-of-Service Attacks, Hijacking; Hacking: types of Hackers.

B. Text Books

T1. James F. Kurose and K. W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education Publication, Third Edition, 2005.

T2. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall publication, Fourth Edition, 2011

C. Reference Books

R1. William Stallings, "Computer Networking with Internet Protocols and Technology", Pearson Education Publication, 2009

R2. Atul Kahate, "Cryptography and Network Security", McGraw Hill Education (India) Pvt. Ltd., Third Edition, 2013

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Course Hand-out

Information Theory and Coding | EC 1705 | 3 Credits | 3 0 0 0

Session: July – Dec. 2019 | Faculty: Dr Sanyog Rawat, Mr. C P Gupta | Class: Core Course

Course Outcomes: At the end of the course, students will be able to

[EC1705.1] Apply the principles of random signal theory to quantify the information and analyse communication system.

[EC1705.2] Develop various channel models and analyse for research skills.

[EC1705.3] Apply the Information theory in data compression, transmission and channel encoding, storage and processing, which is also useful in employability.

[EC1705.4] Discuss different algorithms and their performances use in error control applications.

A. Syllabus

Random Signal Theory: Introduction to random variables, discrete and continuous random variables, probability distribution, Cumulative Distribution Function, Joint Distribution, Independent random variable and conditional distribution, Characteristics of random variable: Mean variance and standard deviation, Binomial, Poisson and Normal distributions, Random Processes, Markov Processes. Information Theory: Introduction to information theory and probability, entropy, rate of information, Joint and conditional entropy, Mutual information: noise free channel, channel with independent input and output, Channel capacity: Binary symmetric channel, binary erasure channel, noise free channel, cascaded channels, and binary channel. Coding: Introduction, code efficiency, Shannon theorem, capacity of Gaussian channel, Bandwidth and S/N trade off, Shannon-Fano coding, Huffman coding, LZ coding, Error control coding, Automatic Repeat Request and Forward error correction codes, Block codes and parity check codes, Hamming Weight, Hamming Distance, Minimum distance decoding, Single Parity codes, Hamming Codes, Repetition Codes, Linear block codes, Cyclic code, Convolution code.

B. TEXT BOOKS

T1. M Kulkarni & K S Shivaprakasha, "Information Theory and Coding", Wiley India Pvt. Ltd, 1st ed.

T2. R D Singh and S D Sapre, "Communication Systems", 2nd ed., Tata Mcgraw Hill

C. REFERENCE BOOKS

R1. R. Bose, "Information Theory, Coding and Cryptography", Tata Mcgraw Hill, 2nd ed.

R2. P. Z. Peebles, Jr., "Probability, Random Variables and Random Signal Principles", McGraw-Hill, Inc., 2nd ed.

R3. F.M. Reza, "Information Theory", McGraw Hill

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Course Hand-out

Microwave Engineering | EC 1706 | 4 Credits | 3 1 0 4

Session: July – Dec. 2019 | Faculty: Dr Dinesh Yadav, Dr. Neetu Marwah | Class: Core Course

Course Outcomes: At the end of the course, students will be able to

[EC1706.1]. Foster knowledge about electromagnetic waves, transmission lines, their propagation and field patterns to promote sustainable development in high frequency and improvised skill set

[EC1706.2]. Skillfully design different waveguide components, their characteristic measurement, hence develop employability skills in high frequency industries

[EC1706.3]. Design and implement various microwave components to support entrepreneurship

[EC1706.4] Analyse the operation of different microwave generators and devices at high frequency

A. SYLLABUS

Guided waves: Construction single and double stub matching. Introduction to Transverse Electric, Transverse Magnetic and Transverse Electromagnetic waves in conducting planes, characteristics of TE, TM and TEM waves, wave impedance, attenuation , TE, TM and TEM waves in rectangular and circular wave guide, characteristics of TE and TM mode and excitation of wave guides **Strip lines and micro strip lines**: Characteristic impedance, losses and quality factor Q of micro strip lines, coplanar strip lines and shielded strip lines, parameters and its properties **Passive components**: Resonators, Directional Couplers, E-plane Tee, H-plane Tee and Hybrid Tee, Hybrid ring, Attenuators, Circulator, Faraday rotation principle, Isolators **Microwave active Devices**: Limitations of conventional vacuum tube devices; Two cavity klystron: Reentrant cavities, velocity modulation process, bunching process, output power and beam loading **Reflex klystron**: Velocity modulation, power output and efficiency and electronic admittance. **Traveling wave tube**: Slow wave structure, amplification process, convection current, axial electric field, wave modes and gain consideration **Magnetron**: Mode of oscillation, Types of Magnetron, Strapping and Rising Sun Magnetron **Parametric amplifiers**: Physical structure, nonlinear reactance and Manley Rowe relations, its applications **Microwave diodes and transistors**: Tunnel diode, Varactor diode, Gunn diode, IMPATT diode, Microwave transistors and FETs.

B. TEXT BOOKS

T1. S. Y. Liao, Microwave Devices and Circuits, Prentice Hall, 2004.

T2.D. M. Pozar, Microwave Engineering, John Wiley & Sons, 2004.

C. REFERENCE BOOKS

R1. J. Ryder, Network lines and Fields, Prentice Hall, 1999.

R2.Jordan & Balmain, Electromagnetic waves and Radiating System, Prentice Hall, 1968.

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Course Hand-out

Optical Fiber Communication and Networks | EC 1707 | 4 Credits | 3 1 0 4

Session: July – Dec. 2019 | Faculty: Dr Prashant Povel Dwivedi | Class: Core Course

B. **Course Outcomes:** At the end of the course, students will be able to:

[EC1707.1] Understand basic laws of optical physics for lifelong learning and encouraging entrepreneurship. In terms of modes of operation of Optical fibres, causes for signal degradation, types of losses and pulse broadening effect

[EC1707.2] Learn about the types of light sources, principle of conversion of light energy to electrical energy, optical detectors and develop the experimental skills needed in scope of entrepreneurship.

[EC1707.3] Learn the operation of optical receiver, various effects of introducing noise in the system, performance of digital receiver, use of analogue and digital links

[EC1707.4] Understand the Wavelength Division Multiplexing (WDM) principle and apply them in advanced devices to develop employability skills.

A. SYLLABUS

Introduction to optical communication: Basic principles of light propagation, Propagation of Light in an Optical Fiber: Ray Model, Numerical aperture, phase-front (wave front) based study of Total Internal Reflection, Wave Model and its Analysis, V number of an Optical fiber. **Signal distortion on optical fibers:** Material Dispersion, Intermodal Dispersion, Intermodal Dispersion, Material Attenuation, Micro bending, Macro bending, Analysis of Signal distortion in optical fibers using OTDR, Practical issues in implementation of fiber link. Optical Sources: Introduction of Optical sources, **Light Emitting Diode:** Quantum Efficiency, material, electrical and spectral characteristics, modulation. Lasers: Introduction to Laser, Spontaneous emission, Absorption, Stimulated emission, Different type of lasers: ruby laser, He-Ni laser, semiconductor laser. **Optical Receiver:** Photon detector, Photo Diodes, Photo detector and its noise Analysis, Optical Receiver, Digital data transmission in optical domain, SNR, BER analysis, Performance Analysis and the EYE-diagram, Receiver Sensitivity Degradation, Fiber Optic link Design, power penalty. Optical networks - Basic networks-sonnet/ SDH-wavelength routed networks -Nonlinear effects on network performance-performance of various systems (WDM DWDM + SOA) - Optical CDMA- Solitons-Ultra high capacity networks

B. Text books:

T1. G.P Agrawal , "*Fiber optics communication*", third edition, John Wiley & sons,2002 .

T2. M.N. Islam (Ed), "*Raman Amplifiers for communications*", Springer-verlag, New York, 2003.

C. Reference books:

R1. Keiser, "*Optical Fiber Communication*", fourth edition, Mc Graw Hill, 2017.

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Course Hand-out

Low Power VLSI Design | EC 1754 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Dr. Shilpi Birla | Class: Program Elective

Course Objectives: At the end of the course, students will be able to

[EC1754.1] Identify the need of low power design sources of power dissipation and methodologies.
[EC1754.2] Describe the MOS devices and its parametric effects and various power dissipation.
[EC1754.3] Examine various low power circuit level reduction techniques
[EC1754.4] Classify various logic level low power reduction techniques.
[EC1754.5] Implementation of the low power techniques in designing circuits to enhance the employability skills in VLSI.

A. Syllabus

Introduction: Need for Low Power design, Sources of power dissipation in Digital Integrated circuits. Emerging low power approaches, Hierarchical Low Power Design Methodologies; Device & technology impact on low power: Physics of power dissipation in CMOS devices, Dynamic and static power dissipation, Transistor sizing & gate oxide thickness. Impact of technology Scaling and Device innovation; Probabilistic power analysis: Random logic signals, probability and frequency, probabilistic power analysis techniques, signal entropy; Circuit level power reduction techniques: Power consumption in circuits. Design of Flip Flops and Latches. Low power digital cell library, Low Power Dynamic logic families and Adiabatic Logic Families. Logic level power reduction techniques: Gate reorganization, pre-computation logic, signal gating, logic encoding, state machine encoding, reduction of power in address and data buses; Low power clock distribution: Power dissipation in clock distribution, Single driver versus Distributed buffers, Zero skew versus Tolerable skew; Low power architecture and systems: Power and performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

B. Text Books

T1: G. K. Yeap, "*Practical Low Power Digital VLSI Design*", KAP, 2002.
T2: Rabaey, Pedram, "*Low power design methodologies*" Kluwer Academic, 1997.

C. Reference Books

R1:K. Roy, Sharat Prasad, "*Low Power CMOS VLSI Circuit Design*" Wiley, 2000.
R2: Kiat, S. Yeo, W. L. Goh, "*CMOS/BiCMOS ULSI Low Voltage Low Power*", Pearson, 2002.

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Course Hand-out

Wireless Sensor Network | EC 1759 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Mr. Rohit Mathur | Class: Program Elective

Course Objectives: At the end of the course, students will be able to

[EC 1759.1]. To describe the basic Networks, WSN technology and network design and also supporting protocols, with emphasis placed on standardization basic sensor systems, their design and provide a survey of sensor technology

[EC 1759.2]. Analyse the medium access control protocols and address physical layer issues by Understanding and Specifying characteristics and their mathematical performance

[EC 1759.3]. Analysis of clustering mechanisms and the different schemes that have been employed Learn key routing protocols for sensor networks and main design issues to investigate complex routing problems by Specifying and identifying characteristics and their mathematical performance

[EC 1759.4]. Describe and analysis the transport layer protocols for sensor networks, and their design requirements

[EC 1759.5]. Node identification (localization), naming and addressing management and data aggregation schemes and data bases management for wireless sensor networks.

[EC 1759.6]. Describe and analysis the Quality-of-Service (QoS) issues, challenges and parameters with their design requirements relevant to professional practices, which creates employability.

A. Syllabus

Introduction to Sensor Networks: Unique Constraints and Challenges, Advantages of Sensor networks, Sensor network applications, Collaborative processing, Key definition of sensor networks, A tracking scenario, problem formulation, Distribution representation and inference of states, Tracking multiple objects, Sensor models, Reference compression and metrics. **Network Sensor:** Key assumptions, Medium access control, General Issues, geographic Energy aware routing, Attribute based routing. Infrastructure Establishment, **Sensor Tasking and Control:** Topology control, Clustering, Time Synchronization, Localization and localization services, Task driven sensing Roles of Sensor nodes and Utilizes, Information based sensor tasking, joint routing and Information Aggregation. **Sensor Network Data Bases:** Sensor Data base challenges, Querying the Physical Environment, Query Interfaces, High level Data Base organization, In Network aggregation, Data Centric storage, Data indices and Range queries, Distributed hierarchical aggregation, temporal Data. **Sensor Network Platforms And Tools:** Sensor node hardware, sensor network programming challenges, node level software plat form, node level simulators, Programming beyond individual modes state, centric programming, Emerging applications of wireless sensor networks.

B. Text Books

T1. H. Karl, A. Willig "Protocol and Architectures – for Wireless Sensor Networks". Wiley India Edition. 2005. ISBN 978-81-265-3369-5

T2. C.M. Cordeiro, D.P. Agrawal "Ad hoc and Sensor Networks – Theory and Applications". World Scientific publication. 2011. ISBN 978-93-8226-480-4

C. Reference Books

R1. F. Zhan.Leonidas Guibas "Wireless Sensor Networks – An information processing approach". Elseveir Inc – 2004. ISBN 1-55860-914-8

R2. H. Edger, D. Calleway "*Wireless Sensor Networks – Architecture and Protocols* ". Auerbach Publications (August 26, 2003) ISBN 0849318238

R3. O.K. Tonguz, G. Ferrari "*Ad Hoc Wireless Network - A Communication-Theoretic Perspective". Wiley Student publication. 2006. ISBN 978-81-265-3204-7*

R4 M.G. Gouda "*Elements of Network Protocol Design". Wiley Student Edition. John Wiley & Sons Publication. 2006 ISBN 9812-53-148-3*

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Department of Electronics & Communication Engineering

Course Hand-out

Analog VLSI Design | EC 1762 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Dr Lokesh Garg | Class: Program Elective

Course Outcomes: At the end of the course, students will be able to

[EC1762.1] To develop skills on small signal model and finding out small signal parameters of a MOS transistor.

[EC1762.2] Analyze the different configurations of single stage amplifiers and compare them with respect to gain, voltage swing and stability.

[EC1762.3] Analyze the advanced circuits like differential amplifier, current mirrors, op-amps using the concepts developed for single-stage amplifiers and provide employability in VLSI companies.

[EC1762.4] Analyze the input and output resistance of analog circuits.

A. SYLLABUS

Introduction to Analog Design: Design flow, Digital v/s Analog Design, General Concepts, Levels of Abstraction, robust Analog Design. **MOS device physics:** MOS Device Models, MOS Device Layout , MOS Device Capacitances ,MOS Small-Signal Model, MOS SPICE models, NMOS versus PMOS Devices, Long-Channel versus Short-Channel Devices. **Single-Stage Amplifiers:** Basic Concepts, Common-Source Stage, Common-Source Stage with Resistive Load , CS Stage with Diode-Connected Load. **Differential Amplifiers:** Single-Ended and Differential Operation, Basic Differential Pair, Qualitative Analysis ,Quantitative Analysis, Common-Mode Response ,Differential Pair with MOS Loads, Gilbert Cell. **Passive and Active Current Mirrors:** Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties. Frequency Response of Amplifiers: General Considerations, Miller Effect, Association of Poles with Nodes. **Noise:** Statistical Characteristics of Noise, Noise Spectrum, Types of Noise, Thermal Noise, Flicker Noise. **Feedback:** General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback. **Operational Amplifiers:** General Considerations, Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps.

B. TEXT BOOKS

T1. S. B. Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw-Hill, 2002.

C. REFERENCE BOOKS

R1. D. A.Johns, Ken Martin, *Analog Integrated Circuit Design*, Johns Wiley & Sons, 2002.

R2. R. J. Baker, Harry W.Li & David E.Boyce, *CMOS circuit design, Layout, and Simulation*, IEEE Press, PHI Pvt Ltd, 1998.

R3. P. E. Allen & Douglas R. Holberg , *CMOS Analog Circuit Design*, Second edition, *Oxford University Press*,2004.

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School of Electrical, Electronics & Communication

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Course Hand-out

ASIC Design | EC 1764 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Dr. Renu Kumawat | Class: Program Elective

Course Outcomes: At the end of the course, students will be able to

[EC1764.1]. Describe the design flow, types and the programming technologies of an FPGA and its construction.

[EC 1764.2]. Understand issues involved in ASIC design, verification as well as the impact of technology scaling on ASIC design.

[EC 1764.3]. Demonstrate knowledge of computational and optimization algorithms and tools applicable to solve CAD related problems.

[EC 1764.4]. Apply FPGA and ASIC Design skills for real life VLSI circuits and become employable in VLSI industries.

[EC 1764.5]. Evaluate between the types of FPGAs and ASICs available in the market to choose the optimal one as per the requirement of the circuit design.

[EC 1764.6]. Establish skill for CAD tool development and enhancement

A. SYLLABUS

Introduction to ASIC design: Types of ASICs, ASIC/FPGA design flow, Programmable ASICs, Programmable ASIC Interconnect, ASIC economics; **ASIC library design:** Transistor as resistors, Transistor as parasitic capacitance, Logic Effort, library cell design; **Logic synthesis and simulation:** FSM Synthesis, Timing Analysis, Static Timing Analysis, Clock tree Synthesis; **Algorithms for VLSI design automation:** Physical design - Basic Concepts, Partitioning, Floor planning, Placement, Routing algorithms, Layout compaction. Case study; **Signal integrity and interconnect problems:** Transmission line effects, Impedance mismatch, cross talk and issues in high speed design; **Introduction to Verification:** Verification challenges, advanced functional verification, unified verification methodology.

B. TEXT BOOKS

T1. M. J. S. Smith, "*Application Specific ICs*", Pearson, 1997.

T2. N. Sherwani, "*Algorithm for VLSI Physical Design Automation*", Kluwer Academic Publishers, 1998.

C. REFERENCE BOOKS

R1. N. Horspool & P. Gorman, "*The ASIC Handbook*", Prentice Hall, 2001.

R2. S. H. Gerez, "*Algorithms for VLSI Design Automation*", John Wiley & Sons, 1999.

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Course Hand-out

Modern Wireless Communication System | EC 1765 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Dr Tarun Kumar Dubey | Class: Program Elective

Course Outcomes: At the end of the course, students will be able to

[EC 1765.1]. Classify problems related to the Wireless systems and the prospects of entrepreneurship;

[EC 1765.2]. Estimate problems based on the signaling techniques;

[EC 1765.3]. Analysis of Logical and Conditional methods for cellular systems to provide solutions in terms of employability;

[EC1765.4]. Outline the conceptual details of the modern communication systems for skill development.

A. SYLLABUS

Transmission Fundamentals: Cell phone Generations: 1G, 2G, 2.5G, 3G & 4G Transmission Fundamentals: Time domain & Frequency domain concepts, Radio, Analog Vs Digital, channel capacity, transmission media, carrier-based signalling, spread-spectrum signalling. Network Concepts: Communication Networks: LANs, MANs, WANs, circuit switching, packet switching, ATM Cellular Networks: Cells, duplexing, multiplexing, voice coding Multiple Access Techniques: FDMA, TDMA, SDMA, CDMA, spectral efficiency. Personal Communication Services: GSM, HSCSD, GPRS, D-AMPS, CDMA One, CDMA Two, Packet Data Systems. 3G & BEYOND: W-CDMA, CDMA 2000, EDGE, Wi-Fi, WiMAX, OFDM, Intelligent cell concept, applications of intelligent micro-cell Systems, in-Building Communication, CDMA cellular Radio Networks. Mobile Data Services & Short-Range Networks: Mobile Data Services: Messaging, wireless web, WAP, site design Short range Wireless Networks: Unlicensed spectrum, WLANs, cordless telephony, IrDA, Bluetooth Smart Phones: Future phones, mobile OSs, smart phone applications.

B. TEXT BOOKS

T1. A. Dornan, "The essential guide to wireless communications applications: from cellular systems to WiFi", second Edition, Prentice Hall, 2002.

T2. Misra, "Wireless Communications and Networks: 3G & Beyond", Tata McGraw-Hill, 2009.

T3. T. S. Rappaport, "Wireless Communications: Principles and Practice", second Edition, Pearson Education, 2009.

C. REFERENCE BOOKS

R1. W. Stallings, "Wireless communications and networking", Prentice Hall, 2002.

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Course Hand-out

Radar and Satellite Communication | EC 1767 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Dr Vivekanand Tiwari | Class: Program Elective

Course Outcomes: At the end of the course, students will be able to

[EC 1767.1]. Analaze the importance of microwave signal, learn important microwave devices and classify problems related to the communication systems and the prospects of entrepreneurship;

[EC 1767.2]. Estimate problems and the working principle of different RADAR systems and their applications;

[EC 1767.3]. Understanding the Satellite fundamentals and the types of satellite systems to provide solutions in terms of employability;

[EC 1767.4]. Explaining the working of a Satellite communication system and its other subsystems, highlighting the applications of satellites in different areas for development of skills.

A. SYLLABUS

Introduction to Radar: Introduction, block diagram, applications, radar frequencies, different types of radar, basic pulsed radar system, radar equation, system losses **Radar Antennas :** Introduction, parameters of radar antennas, different types of radar antennas, Radomes. **RadarTransmitter :** Introduction, radar RF source, **Radar Receiver :** Introduction, radar receiver noise, **and Duplexrs :** Introduction types, used in modern radar, **Radar Display Units :** Introduction, types of scope **Navigation :** Introduction, history, methods of navigation **Satellite Communications:** The Origin of satellite communications, brief history of satellite communications, advantages and disadvantages, current status of satellite communication, active and passive satellites **Satellite Subsystems:** Introduction , satellite subsystems, altitude and orbit control system, telemetry, tracking and command, communication subsystem, communication subsystem components **Earth Station Technology :** Introduction, earth station design requirements, earth station antenna design, earth station sub-system, tracking monitoring and control

Satellite Applications : Introduction, satellite for earth observation, satellite for weather forecast, satellite for scientific studies, satellite for military applications, direct broadcast satellite system, very small aperture terminal, global positioning system.

B. TEXT BOOKS

T1. M. I. Skolnik, "*Introduction to Radar Systems*", 3rd Ed., *McGraw Hill*, 2003.

T2. T. Pratt "*Satellite communication systems*" , John Wiley and Sons (2006).

C. REFERENCE BOOKS

R1. P. Z. Peebles Jr., "*Radar Principles*", *John Wiley*, 2004.

R2. E. Byron, "*Radar: Principles, Technology, Applications*", *Prentice- Hall education*, 2004.

R3. D. Barton, "*Radar system analyses and Modeling*", *Artech house*, 2005.

R4. M. Antonio, "*Bistatic radar emerging technology*", *John Wiley*, 2008.

R5. Dennis Roddy, "Satellite communications", McGraw-Hill international edition.

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School of Electrical, Electronics & Communication

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Course Hand-out

Digital Image Processing | EC 1768 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Ms. Neha Singh | Class: Program Elective

Course Outcomes: At the end of the course, students will be able to

[EC 1768.1]. Correlate image perception, acquisition and analysis to develop projects and hence develop employability skills **(analysis)**

[EC 1768.2]. Execute digital image manipulation and mathematical operations **(Application)**

[EC 1768.3]. Validate Image enhancement and restoration techniques for processing **(evaluation)**

[EC 1768.4]. Recognize the steps (compression, segmentation and morphological techniques) for image processing for lifelong learning and encouraging entrepreneurship **(Application)**

[EC 1768.5]. Evaluate use of image processing filters **(evaluation)**

A. SYLLABUS

Basics of image processing: Fundamentals of digital image processing, image perception, Image sensing and acquisition, sampling and Quantization, image representation, basic relationship between pixels. **Image enhancement and restoration**: Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters: Smoothing, Sharpening filters, Homomorphic filtering; Image restoration. **Image transforms**: Fourier transform, Fast Fourier Transform, Short Time Fourier Transform, Cosine Transform , discrete wavelet transform; **Image Compression Algorithms and standards**: Lossless compression: Variable length coding, LZW coding, Bit plane coding, predictive coding, DPCM. Lossy Compression: Transform coding, Wavelet coding. Basics of Image compression standards: JPEG, JPEG2000. Morphological processing and segmentation: Preliminaries, erosion, dilation, Hit-And-Miss transformation, Basic Morphological Algorithms; Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region based segmentation; **Color image processing**: Color Fundamentals. Color Models, Pseudo color Image Processing., processing basics of full color image processing. **Applications**: Character recognition, Biomedical Image processing, Watermarking, multi-resolution analysis.

B. TEXT BOOKS

T1. R. C. Gonzalez, R. E. Woods, *"Digital Image Processing"* 2nd Edition - *Pearson Education 2003*.

T2. S. Sridhar, Digital Image Processing. Oxford University Press, 2011

C. REFERENCE BOOKS

R1. W. K. Pratt, *"Digital Image Processing"* John Willey (2001)

R2. M. Sonka, V. Hlavac, R. Boyle, B. colic *"Image Processing Analysis and Machine Vision"* –, Thompson Learniy (1999).

R3. A.K. Jain, *"Fundamentals of Digital Image Processing"* PHI, New Delhi (1995).

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Course Hand-out

Hybrid Soft Computing Techniques | EC 1792 | 3 Credits | 3 0 0 3

Session: July – Dec. 2019 | Faculty: Dr. Himanshu Chaudhary | Class: Open Elective

Course Outcomes: At the end of the course, students will be able to

[1792.1]. Compare and Employ various factors of the brain and neuron function with mathematical methods.

[1792.2]. Compare, analyse and evaluate various neural network models and their training methods with examples.

[1792.3]. Develop artificial neural networks based applications in Matlab for encouraging employability skills.

[1792.4]. Learning and implement the Fuzzy logic and its applications with examples.

[1792.5]. Discuss and experiment the fundamental concepts of optimization techniques with examples.

[1792.6]. Experiment and evaluate with applications of Hybrid systems based on neural network, fuzzy logic and various optimization techniques with examples for encouraging entrepreneurship.

A. SYLLABUS

Neural Network: Introduction: history, structure and function of single neuron, neural net architectures, neural learning, use of neural networks, supervised learning networks, Associative memory networks, unsupervised learning networks, Special networks like Simulated Annealing Network, Cascade Correlation network, and Optical neural network. Applications of Neural Network. Fuzzy Logic: Introduction to Fuzzy logic, Classical Sets and Fuzzy sets, Classical relation and Fuzzy relations, Membership functions, Defuzzification, Fuzzy arithmetic and Fuzzy measures, Fuzzy rule base and approximate reasoning, Fuzzy decision making, Fuzzy logic controls systems. Engineering optimization: Introduction to optimization, Classical optimization techniques, Linear programming techniques, Nonlinear programming optimization techniques, geometric Programming techniques, Dynamic programming techniques, Integer programming techniques, stochastic programming techniques, Optimal control techniques, Modern method: Genetic algorithms, Simulated Annealing, Particle swarm optimization, Ant colony optimization, Fuzzy based optimization techniques, Neural network based optimization techniques.

B. TEXT BOOKS

1) S. S. Rao "Engineering optimization theory and practice", John Wiley & Sons; fourth Edition; 2009.
2) S.N. Deepa, S.N. Sivanandam, "Principles of Soft Computing", Wiley; second edition 2011.
3) S.N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB" Springer-Verlag Berlin Heidelberg, 2007.
4) S. Jain, "Modelling and Simulation using MATLAB – Simulink", Wiley, 2015.

C. REFERENCE BOOKS

1) S. Rajasekaran , G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms : Synthesis and Applications", PHI, 2013
2) S. Roy, U.Chakraborty, "Soft Computing: Neuro-Fuzzy and Genetic Algorithms", Pearson; first edition, 2013.
3) K. Deb,"Optimization for Engineering Design: Algorithms and Examples", PHI; second edition, 2013.
4) R. Shinghal, "Introduction to Fuzzy Logic", PHI, 2013.

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School of Electrical, Electronics and Communication Engineering (SEEC)
Department of Electronics and Communication Engineering
Course Hand-out
Minor Project | EC 1680 | 1 Credits | 0 0 2 1
Session: Jan 2020 – May 2020 | Faculty: Faculty members of department | B.Tech. Third Year

Course Outcomes: At the end of the course, students will be able to:

[EC1680.1]. To conduct a Literature Review of the suggested recent topic/design in the area

[EC1680.2]. Compare and contrast the several existing solutions for research/design challenge

[EC1680.3]. Demonstrate an ability to work with deadlines and manage the conduct of the study

[EC1680.4]. To report and present the findings/outcomes of the study conducted in the preferred domain using recent skills to enhance the employability skills or entrepreneurship possibilities.

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School of Electrical, Electronics & Communication Engineering (SEEC)

Department of Electronics & Communication Engineering

Course Hand-out

Major Project/ Dissertation | EC1881 | Credits | 12

Session: Jan 2020 – May 20 | Faculty: Dr. Tarun Kumar Dubey | Class: VIII semester

Course Outcomes: At the end of the course, students will be able to

[EC 1881.1] Identify the basics of the concepts related to the selected topic of the project and identify the open issues

[EC 1881.2] Identify the depth of the problem and to propose the solution to increase the employability

[EC 1881.3] Solve real time problems related to industry and contribute to open community with ethical values by undergoing systematic study

[EC 1881.4] Work in team with proper contribution from individuals and managing the project with lifelong learning

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