

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Wireless Communication & Networks

Course Code: EC701

L-T Scheme: 3-0

Course Credits: 3

Introduction:

This course examines operating system design concepts, data structures and algorithms, and systems programming basics. The Topics to be covered (tentatively) include:

- Computer and operating system structures
- Process and thread management
- Process synchronization and communication
- Memory management
- Virtual memory
- File system
- I/O subsystem and device management
- Selected examples in networking, protection and security

Objectives:

In this course, we will study the basics of Cellular Concept, Channel assignment schemes, Handoff, different types of channel characteristics and propagation model, multiple Access Technologies in cellular communication. This course also makes you acquainted with 2G and 3G systems, such as GSM, GPRS, CDMA, UMTS and introduces with the basics of WLAN technology: IEEE 802.11 standards and protocols, as well as gives an insight on Mobile Internet Protocol.

Learning Outcomes:

Knowledge:

1. Able to explain the basic Cellular concept, different types channel assignment strategies, handoff process and different types of handoff.
2. Able to explain wireless channel and its characteristics
3. Able to explain multiple access techniques used for different generation of wireless cellular communication.
4. Able to explain different generation of cellular communication and their architecture.
5. Able to explain different protocols used for WLAN.

Course Contents:

Unit 1: Brief introduction to mobile wireless communication and systems:

Description of cellular system, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent channel interferences, Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, handoff process, different types of handoff.

Characteristics of wireless channel and propagation path loss models: Different Multi-path propagation mechanisms, Multi-path effects on mobile communication, Fading, different types of fading, small and large scale fading, slow and fast fading, narrowband and wideband fading, Inter symbol interference, fast fading model, Doppler effect due to velocity of mobiles, Rayleigh envelop, free space propagation model, two ray ground reflection model, log distance path loss model, log normal shadowing model, macro and micro cell propagation models, types of base stations and mobile station antennas.

Unit 2: Evolution strategies – First Generation (1G) to Fourth Generation (4G), Personal Area Networks: PAN, Low Tier Wireless System: Cordless Telephone, Second Generation (2G), Digital European Cordless Telecommunications (DECT), Public wide-area Wireless Networks: 1 G to 3G cellular networks

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Multiple Access Technologies in cellular communication:

Time division multiple access (TDMA), narrowband and wideband TDMA, synchronous and asynchronous TDMA, Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA), Direct-sequence CDMA, spread spectrum technique, spectral efficiency of different wireless access technologies: Spectral Efficiency in FDMA system, Spectral Efficiency in TDMA system, Spectral Efficiency for DS-CDMA system.

Cellular Communication Networks and Systems:

Second generation (2G) Network: Global system for mobile communication (GSM): Architecture and Protocols Air Interface, GSM spectrum, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multi-frame, Control (Signaling) Channel Multi-frame, Frames, Multi-frames, Superframes and Hyper-frames, GSM Call Set up Procedure, Location Update Procedure, Routing of a call to a Mobile Subscriber.

The concept of packet data services The 2.5 G General Packet Radio Services: GPRS Networks Architecture, GPRS Interfaces and Reference Points, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer through GPRS Network and Routing, The IP Internetworking Model

Overview of CDMA systems:

IS-95 Networks and 3G – The Universal Mobile Telecommunication System (UMTS), CDMA based IS-95 Systems, forward link and reverse link for IS-95, handoff process in CDMA based IS-95 network. UMTS Network Architecture –Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 4 and 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, UMTS Time Slots

Unit 3: IEEE 802.11 standards, WLAN family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection (CSMA/CD) and CSMA collision avoidance (CSMA/CA), Frequency Hopping Spread Spectra, 802.11 PHY and MAC layers, IEEE 802.11 Distributed Coordination function (DCF) and Point coordination function (PCF), Back off algorithm, Virtual carrier sense, MAC frame format. Security and QoS issues, WLAN applications.

Wireless Broadband Networks and Access:

Evolution of broadband wireless, IEEE 802.16 standards : WiMAX , Spectrum Allocation, IEEE 802.16 Standard Architecture, Overview of WiMAX PHY, IEEE 802.16 MAC Layer, IEEE 802.16 Scheduling Services, Unsolicited Grant Service (UGS), Real-time Polling Service (rtPS), Non-realtime Polling Service (nrtPS), Best Effort (BE) Overview of 3G Long Term Evolution (3G LTE) for broadband wireless communication, Orthogonal Frequency Division Multiple Access (OFDMA).

Unit 4: Basic Mobile IP, Mobile IP Type-MIPv4 and MIPv6, Mobile IP: Concept, Four basic entities for MIPv4, Mobile IPv4 Operations, Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing, Configuring PDP Addresses on Mobile Station, Mobility Classification, Seamless Terminal Mobility Management, Limitations of current TCP/IP networks for mobility support, Mobility solution, Accessing External PDN through GPRS/UMTS PS Domain, Transparent Access, Use of Mobile IP for Non-transparent access, Dynamically accesses IP address from External Network.

Text Books

1. Silberschatz, P. Galvin and Greg Gagne, “Operating System Concepts”, Wiley International Company.
2. A.S. Tanenbaum, Modern Operating Systems, Prentice Hall India.

References

1. J. Archer Harris, Operating systems – Schuam’s outlines, Tata Mc Graw Hill.
2. Gary Nutt, Operating Systems – A modern perspective, Pearson Education.

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Course Description

Title of Course: Microelectronics & VLSI Design

Course Code: EC702

L-T Scheme: 3-0

Course Credits: 3

Introduction:

This course examines microelectronics & VLSI design concepts, and MOS fabrication basics. The topics to be covered (tentatively) include:

- Introduction to VLSI Design
- Micro-electronic Processes for VLSI Fabrication
- CMOS for Digital VLSI Circuits
- Analog VLSI Circuits

Objectives:

The Course Educational Objectives are:

1. To acquire knowledge on basics of microelectronics & VLSI design.
2. To get acquainted with IC fabrication process and layout design rules.
3. To gain knowledge on design concept of CMOS digital circuits.
4. To gain knowledge on analog CMOS circuits.

Learning Outcomes:

Knowledge:

Once the student has successfully completed this course, he/she will be able to answer the following questions or perform following activities:

1. Able to explain the basic concepts of Microelectronics & VLSI design.
2. Able to describe VLSI design steps.
3. Able to describe the IC fabrication steps and different layout design rules.
4. Able to design various CMOS based digital circuits.
5. Able to describe various CMOS analog circuits.

Application:

1. To design and implement CMOS based circuits.
2. To fabricate NMOS, PMOS, and CMOS.

Course Contents:

Pre-requisite: Knowledge about MOS, MOS-Characteristics, MOS Capacitors, Short Channel MOS, CMOS inverters, MOS Gates etc. done in ES201 (Basic Electronics Engineering of second semester), EC302 (Solid State Devices of third semester), and EC303 (Analog Electronics of third semester).

Unit 1: Introduction to VLSI Design: VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical).

Unit 2: Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist ; Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator; Layout Design Rule: Stick diagram with examples, Layout rules.

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Unit 3: CMOS for Digital VLSI Circuits: Recapitulation of MOS transistor; CMOS, CMOS inverter characteristics; CMOS logic circuits, NAND & NOR Gates , Complex logic circuits, CMOS Full Adder, CMOS Transmission GATE, Advanced CMOS Logic circuits; Sequential CMOS logic circuits, SR Latch circuit, clocked JK Latch/ Master-Slave JK, CMOS D-latch & Edge triggered flip-flop.

Unit 4: Analog VLSI Circuits: Analog VLSI design steps; Basic building blocks of Analog VLSI chips; MOS switch; Active load / resistors; Voltage dividers; CMOS Current source & sink; CMOS Voltage references/voltage dividers [Basic circuits only]; CMOS Differential amplifier; Output amplifiers [Basic circuits only]; CMOS OPAMP; Switched capacitor filter.

Text Books

1. Wayne Wolf; Modern VLSI Design, Pearson Education. [For unit-I]
2. S.M.Kang & Y.Leblebici; CMOS Digital Integrated Circuit, Tata McGraw Hill. [For unit-II and unit-III]
3. P.E. Allen & D.R. Holberg; CMOS Analog Circuit Design , Oxford Uni. Press. [For unit-IV]

References

1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons.
2. CMOS Circuit Design, Layout & Simulation, R. J. Baker, H. W. Lee, D. E. Boyee, PHI.

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Course Description

Title of Course: RF & Microwave Engineering

Course Code: EC703A

L-T Scheme: 3-0

Course Credits: 3

Introduction:

This course examines basic properties of Microwave, Microwave Waveguides, and Semiconductor Microwave Devices. The Topics to be covered (tentatively) include:

- Graduate will be able to understand the basic properties of Microwave.
- Graduate will be able to understand Microwave Waveguides
- Graduate will acquire knowledge on Waveguide Passive Components
- Graduate will acquire knowledge of Planar structure
- Graduate will get knowledge on Microwave Tubes
- Graduates will be able to understand Semiconductor Microwave Devices

Objectives:

- The course will introduce RF designs and wireless technology, RF modulation and testing (Bloom Taxonomy level 2)
- This course presents the theory and practice of Microwave Engineering including Antenna (Bloom Taxonomy level 2)
- VSWR methods and the application of this to the design of modern communication systems. (Bloom Taxonomy level 2)
- Simulation exercises are included in Matlab and Simulink throughout for practice (Bloom Taxonomy level 3)

Learning Outcomes:

Knowledge:

Once the student has successfully completed this course, he/she will be able to answer the following questions or perform following activities:

1. Able to Understand the basic concepts of Radio frequency and Microwave systems
2. Able to describe Analyse RF designs in particular for power efficiency, modulation etc.
3. Able to Analyze the RF testing techniques to RF designs.
4. Able to Analyze behavior of BJT and MOSFETs at RF frequencies.

Application:

1. Microwave technology for medical science (diagonostic application, Theraputic application etc.)
2. To develop, Point-to-point communication, Satellite, Cellular access technologies, Radar technology.
3. Car avoidance radar, Traffic surveillance, Air traffic security “cameras”
4. Heating & detection of foreign bodies in food New and novel application areas are constantly being added

Course Contents:

Unit 1: RF & Microwave Spectrum, Historical Background, Typical applications of RF & Microwaves [MicrowaveEngineering,3Rd Ed David M. Pozar, Willey & Sons Inc(Chater-1)]

Unit 2: Microwave Waveguides: Rectangular and Circular Waveguides– Mode structures, Cut-off frequency, Propagation Characteristics, wall currents, Attenuation constant, waveguide excitations [MicrowaveEngineering,3Rd Ed David M. Pozar, Willey & Sons Inc(Chater-2)]

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Unit 3: Waveguide Passive Components: Waveguide Resonators – Rectangular & Cylindrical; Resonant frequencies, Mode structures, Q factor, Co-axial Resonators; Excitation & coupling of cavities, Design of resonators. Periodic Structures-Filters, N-port networks – circuit representations, Z-matrix, Y-matrix, S-matrix, transmission matrix,; their relationships; attenuators, phase shifter, directional couplers, Bethe-hole coupler, Magic tee, hybrid ring, circulators, isolators, antennas: Horns- sectoral horns, Pyramidal horns, Parabolic reflector, Patch antennas, antenna arrays. Scattering matrix representations of passive components. Transitions: coaxial lines to waveguide, to micro-strip lines. Design of transitions. [MicrowaveEngineering,3Rd Ed David M. Pozar, Willey & Sons Inc(Chater-2 & 3)]

Unit 4: Planar structure: Strip lines, Micro-strip lines, coplanar structure, Slot lines, Suspended strip lines, Fin lines – Configurations, Field patterns, propagation characteristics, Design considerations. Comparison of characteristics of lines. [Microwave Engineering, Manojit Mitra, Dhanpatrai & Co(Chapter-6,7)]

Unit 5: Microwave Tubes: Limitations of conventional tubes in microwaves; Multi-cavity Klystron, Reflex klystron; Magnetron, Travelling wave tube, Backward wave oscillator – working principles, characteristics. [Microwave Engineering, Manojit Mitra, Dhanpatrai & Co(Chapter-3,4,5)]

Unit 6: Semiconductor Microwave Devices: Tunnel diode; Gunn diode–design considerations for their waveguide mount. Avalanche diode – IMPATT, TRAPATT, Microwave bipolar transistor, hetero-junction bipolar transistor, Microwave field-effect transistor–JFET, MOSFET, MESFET, Parametric amplifiers; ICs[10]

[MicrowaveEngineering,3Rd Ed David M. Pozar, Willey & Sons Inc(Chater-11)]

[Microwave Engineering, Manojit Mitra, Dhanpatrai & Co(Chapter-5,7)]

Text Books

1. Robert E Collin Foundation of Microwave Engineering, 2ed edition, McGraw Hill, Inc.
2. S Das & A Das Microwave Engineering Tata-McGraw Hill
3. MicrowaveEngineering,3Rd Ed David M. Pozar, Willey & Sons Inc

References

1. ML Sisodia& GS Raghuvansi Microwave Circuits and Passive Devices, New Age
2. Microwave Engineering, Manojit Mitra, Dhanpatrai & Co

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Course Description

Title of Course: Information Theory & Coding

Course Code: EC703B

L-T Scheme: 3-0

Course Credits: 3

Introduction:

The course aims at providing students a foundation in information theory. The Topics to be covered include:

- Source Coding techniques
- Channel capacity
- Channel coding
- Linear codes and block codes
- Error correction
- Convolution codes

Objectives:

The course aims at providing students a foundation in information theory – the theory that provides quantitative measures of information and allows us to analyze and characterize the fundamental limits of communication systems, to understand various source coding techniques for data compression, channel coding techniques and their capabilities.

Learning Outcomes:

Knowledge:

1. Will be able to understand the concept of uncertainty and information, mutual information and source coding.
2. Understand different types of channel models, channel types, channel coding, information capacity and the Shannon limit.
3. You will acquire knowledge on error control codes, linear codes and block codes.
4. will acquire knowledge of cyclic codes-generation and decoding, goaly codes.
5. will get knowledge on primitive elements, minimal polynomials, Generator polynomials in terms of minimal polynomials and generation of BCH codes.
6. will be able to understand Tree codes, trellis code, polynomial description of convolutional codes, generation of convolution code, turbo code and turbo decoding

Application:

1. Able to explaininformation theoretic analysis of communication system.
2. Able to describdesign a data compression scheme using suitable source coding technique
3. Able to designdesign a channel coding scheme for a communication system.

Course Contents:

Unit 1: Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.

Unit 2: Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

Unit 3: Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Unit 4: Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

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Unit 5: Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Unit 6: Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Text Books

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Introduction to Information Theory - M Mansurpur; McGraw Hill.

References

1. Information Theory - R B Ash; Prentice Hall.
2. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

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Course Description

Title of Course: Radar Engineering

Course Code: EC704A

L-T Scheme: 3-0

Course Credits: 3

Introduction:

This course examines radar equation, clutter and detection and MTI, and FM radar. The Topics to be covered (tentatively) include:

- Introduction: historical background, radar terminology, radar band designations.
- The radar equation: point targets, radar cross section, distributed targets, propagation, coverage diagrams.
- Noise, clutter and detection: theory of detection, sea and land clutter models, CFAR Processing
- Displays: A-scope, B-scope, PPI, modern displays.
- Doppler radar and MTI: Doppler effect, delay-line cancellers, blind speeds, staggered PRFs, Adaptive
- Doppler filtering. Pulse Doppler processing and STAP: airborne radar, high, low and medium PRF operation, Space-Time
- Adaptive Processing. Pulse compression: principles, the ambiguity function, the matched filter, chirp waveforms, SAW
- technology. Waveform design: nonlinear FM, phase codes, waveform generation and compression
- FM radar: principles, radar equation, effect of phase and amplitude errors.
- Synthetic Aperture Radar: principles, SAR processing, autofocus, spotlight mode, airborne and space borne systems and applications, interferometry, ISAR. Tracking radar: conical scan, mono pulse, -tracker, track-while-scan, Kalman filters
- Avionics and radio navigation: Air Traffic Control, primary and secondary radar, GPS Phased array
- radar: phased array principles, array signal processing, multifunction radar, scheduling. Electronic Warfare: ESM, ECM, ECCM; super resolution, IFM, types of jammers, calculation of performance, adaptive arrays, LPI radar.

Objectives:

This course is aimed at graduate-level engineers with a background in electronic engineering or physics. The emphasis is on physical principles, and on modern radar systems and signal processing techniques, for both civilian and defense applications.

Learning Outcomes:

Knowledge:

1. Understand the essential principles of operation of radar systems Apply appropriate mathematical and computer models relevant to radar systems to calculate system performance, and assess the limitations of particular cases Understand the design of radar signals, and FM radar
2. Understand the principles of Synthetic Aperture Radar, its use in geophysical remote sensing and surveillance applications, and the digital processing used to form SAR images Design simple radar systems and the associated signal processing, at block diagram level
3. Understand the principles of Electronic Warfare, stealth and counter stealth, and bistatic radar, and apply the appropriate design equations to calculate performance Analyse the performance of simple tracking radar systems
4. Apply the relevant design equations to phased array antennas, and understand the advantages and constraints of phased array radar understand the principles of radio navigation systems (including secondary radar and GPS)

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Application:

1. To determine the shape of the object.
2. Commercial airliners are equipped with radar devices that warn of obstacles in or approaching their path and give accurate altitude readings
3. Radar-assisted ground-controlled approach (GCA) systems.
4. Measure distances and map geographical areas (shoran) and also used for Ballistic Missile Early Warning System (BMEWS).

Course Contents:

Unit 1: Introduction to Radar

Historical background, radar terminology, radar band designations, Radar block diagram, radar equation: detection of signals in noise And signal-to-noise ratio, Probabilities of detection & False alarm, integration of radar pulses, radar cross section, distributed targets, Transmitted power, pulse-repetition frequency, antenna parameters & system losses, introduction to radar clutter.

[Introduction to Radar Systems-3/E, M.I. Skolnik, Tata McGraw Hill (Chapter-1,2)]

Unit 2: Radar Types Pulse radars and CW radars, Advantages of coherent radar, Doppler radar and MTI: Doppler effect, delay-line cancellers, blind speeds, staggered PRFs, Digital filter bank, Moving Target Detector, limitations of MTI, tracking with radar, mono pulse tracking, conical scan, limitation to tracking accuracy.

[Introduction to Radar Systems-3/E, M.I. Skolnik, Tata McGraw Hill (Chapter-2,3,6)]

Unit 3: Radar signals & clutter: Basic radar measurement, theoretical accuracy of radar measurements, Range and velocity ambiguities, the ambiguity diagram, pulse compression-principles, the matched filter, chirp wave forms, Wave form design: nonlinear FM, phase codes, wave form generation and compression Descriptions of land & sea clutter, statistical models for surface clutter, detection of target in clutter.

[Introduction to Radar Systems-3/E, M.I. Skolnik, Tata McGraw Hill (Chapter-8,9,15)]

Unit 4: Devices and Radar Systems Radar transmitter: Solid-state RF power source, Magnetron, other RF power sources, Radar receiver: Super heterodyne receiver, receiver noise figure, duplexers & diplexers, Receiver protectors, Applications: Electronic Warfare: ESM, ECM, ECCM; super resolution, IFM, types of jammers, Stealth and counter-stealth: stealth techniques for air craft and other target types, low frequency and UWB radar, System design examples.

[Introduction to Radar Systems-3/E, M.I. Skolnik, Tata McGraw Hill (Chapter-8,10,24,25)]

Text Books

1. Introduction to Radar Systems-3/E, M.I. Skolnik, Tata McGraw Hill.

References

1. Electromagnetic Waves & Radiating Systems, E .C Jordan & K.G. Balmain, Pearson Education, 2nd Edition(2009)

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Course Description

Title of Course: Embedded Systems

Course Code: EC704B

L-T Scheme: 3-0

Course Credits: 3

Learning Outcomes:

Knowledge:

Although the students are engaged with a fun and rewarding lab experience, the educational pedagogy is centered on fundamental learning objectives. After the successful conclusion of this class, students should be able to understand the basic components of a computer, write C language programs that perform I/O functions and implement simple data structures, manipulate numbers in multiple formats, and understand how software uses global memory to store permanent information and the stack to store temporary information. Our goal is for students to learn these concepts:

1. Understanding how the computer stores and manipulates data,
2. The understanding of embedded systems using modular design and abstraction,
3. C programming: considering both function and style,
4. The strategic use of memory,
5. Debugging and verification using a simulator and on the real microcontroller
6. How input/output using switches, LEDs, DACs, ADCs, motors, and serial ports,
7. The implementation of an I/O driver, multithreaded programming,
8. Understanding how local variables and parameters work,
9. Analog to digital conversion (ADC), periodic sampling,
10. Simple motors (e.g., open and closed-loop stepper motor control),
11. Digital to analog conversion (DAC), used to make simple sounds,
12. Design and implementation of elementary data structures.

Course Content:

Unit 1. Introduction to Embedded System: Embedded system Vs General computing systems, History of Embedded systems, Purpose of Embedded systems, Microprocessor and Microcontroller, Hardware architecture of the real time systems.

Unit 2. Devices and Communication Buses: I/O types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watch dog timer, real time clock, serial bus communication protocols, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth.

Unit 3. Program Modeling Concepts; Fundamental issues in Hardware software co-design, Unified Modeling Language (UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

Unit 4. Real Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multi processing and multitasking, task communication, task synchronization, qualities of good RTOS.

Unit 5. Examples of Embedded System: Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc. Popular microcontrollers used in embedded systems, sensors, actuators.

Unit 6. Programming concepts and embedded programming in C, C++, JAVA.

TextBooks

1. EmbeddedSystems: Rajkamal(TMh)

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ReferenceBooks

1. IntroductiontoEmbeddedSystems:ShibuK.V.(TMH)
2. Embedded System Design Aunifiedhardwareandsoftwareintroduction:F.Vahid
(JohnWiley)
3. EmbeddedSystems:L.B.Das(Pearson)
4. EmbeddedSystemdesign:S. Heath(Elsevier)
5. Embeddedmicrocontrollerandprocessordesign:G.Osborn(Pearson)

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Biomedical Instrumentation

Course Code: EC704C

L-T Scheme: 3

Course Credits: 3

Introduction:

This course will cover various systems of the human physiology, signals of biological origin obtained from these systems, biosensors, transducers, bio electrodes used to acquire such signals, and amplifiers for measuring bio potentials. Electrical safety of medical devices; measurements of the blood pressure, blood flow, respiratory system, clinical laboratory equipment, medical imaging, and bioethics will also be discussed. The main objective of this course is to introduce student to basic biomedical engineering technology. As a result, student can understand, design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body.

Objectives:

In this course we will study the basic knowledge of the operating principles of electrical and other transducers, analog and digital instrumentation, applied signal acquisition and processing, electrical safety in the medical environment, electrical properties of nerve and muscle physiology; and instrumentation used in cardiopulmonary, neurological, surgical, and rehabilitation areas of medicine

Learning Outcomes:

Knowledge:

Students will be able to

1. Apply the principles of electronic circuits and devices to the use
2. Apply the principles of electronic circuits in the design of instrumentation in the biomedical area.
3. To introduce students to the measurements involved in some medical equipment.
4. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
5. Application of established engineering methods to complex engineering problem solving.
6. Fluent application of engineering techniques, tools and resources.
7. Explore new developments for better management or assessment of conditions.
8. Describe the origin of biopotentials
9. Understand the purpose of biopotential electrodes
10. Explain the functional components of various biomedical instruments
11. Identify a range of methods which are used to diagnose, monitor or manage conditions.
12. Explore new developments for better management or assessment of conditions.

Application:

1. Ability to understand diagnosis and therapy related equipment.
2. Understanding the problem and ability to identify the necessity of an equipment to a specific problem
3. Demonstrate a basic understanding of disease, medical conditions or physiological conditions.
4. Understand the functional components of various instruments
5. Suggest a range of methods, which are used to diagnose, monitor or manage conditions.
6. Demonstrate a critical appreciation of various biomedical instruments
7. Design bio potential amplifiers
8. Identify common signal artifacts and their sources

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9. Acquire various bioelectric signals from the body surface
10. Interpret characteristic features in the most common biomedical signals
11. Understand the design principles of cardiac pacemakers, neurostimulators and defibrillators
12. Explain measurement principles for blood flow, pressure and volume
13. Describe measurement modalities for respiratory variables and ventilation
14. Explain measurement basis and purpose of biochemical sensors
15. Explain disease, medical conditions or physiological conditions.

Course Contents:

Unit 1(Fundamentals): Introduction to Physiological Systems–Organism, Cardiovascular, Respiratory, Renal, Hepatic, Gastrointestinal, Endocrinal, Nervous, Muscular, Cellular Biological Signals–Bioelectric events, Biomechanical Systems, Cellular & Membrane phenomenon. The Action Potential and Propagation through Nervous System. The Peripheral Nervous Systems and sensory mechanisms. Biomaterials. Fundamentals of Electrophysiology–EKG, EEG, EMG, Evoked potentials. Quantification of Biological Signals.

Unit 2 (Measurement & Analysis): Biological Sensors- Bio-electrodes, Bio sensors and Transducers for Cardiology, Neurology, Pulmonary, Oxygen saturation & gaseous exchange, flow measurement, goniometry, Endoscopy, Impedance Plethysmography. Biological Amplifiers–Instrumentation Amplifiers for Electrophysiology (ECG, EMG, EEG, EOG), Filters, Power Supplies. Recording and Display systems, Digital Conversion for storage, Electrical Hazards in measurements, Isolation Circuits, calibration, alarms & Multi-channel re-constitution. Hospital requirements–Multi-parameter bed-side monitors, Central Nursing Stations, Defibrillators, Ventilators, Catheters, Incubators.

Unit 3(Life-Support&Treatment): Cardiac Support: Implantable & programmable Pacemakers, External & Internal Defibrillators, Coronary Angiography. Electro-physiotherapy: Shortwave & ultrasonic diathermy, Transcutaneous Nerve Stimulators in pain relief, Traction Systems, Ultrasound in bone fracture generation, hypothermia & hyperthermia systems. Lasers in treatment and surgery: Ophthalmic, Ablators, Endoscopic Assists and Artificial limbs-Orthoses, passive and powered Prostheses.

Unit 4(Imaging): Fundamentals of X-Rays, Radiological Imaging, Digital Radiology, DSA. Computer Tomography, Image Processing, solid state sensors, whole-body scans Gamma camera & radio-isotope imaging Ultrasonography- Transducers, Signal Conditioners, 2D & 3D scans, Doppler & Color Doppler Fundamentals of Magnetic Resonance Imaging and PET- scans

Text Books

1. R S Khandpur: -Handbook of Biomedical Instrumentation (Tata–Mcgraw Hill Education) [Partly Downloadable]
2. ME Valentiniuzzi: - Understanding the Human Machine- A Primer for Bioengineering [Freely Downloadable in PDF] (World Scientific Publishing Co. Pte. Ltd, Singapore)

References

1. L Cornwell, F. J. Weibell & E. A. Pfeiffer: -Biomedical Instrumentation and Measurements (Prentice Hall / Medical)
2. J G Webster & J W. Clark: - Medical Instrumentation– Application & Design (Houghton Mifflin Pub)

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3. J J Carr & J M Brown: - Introduction to Bio-medical Equipment Technology (Regents / Prentice Hall)
4. J Tompkins & J G Webster: - Design of Micro-controller based Medical Instrumentation (Prentice Hall Inc)
5. W.B.Blesser: - A systems approach to Biomedicine (McGraw Hill, NY)
6. JHU Brown, JE Jacobs & L Stark: - Biomedical Engineering (Davis Co, Philadelphia, USA)
7. LA Geddes & LE Baker: - Principles of Applied Biomedical Instrumentation (John Wiley & sons, NY)
8. JH Milsum: - Biological Control Systems (McGraw Hill, NY)
9. R Plonsey: - Bioelectric Phenomena (McGraw-Hill Co, NY)

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Artificial Intelligence

Course Code: EC705A

L-T Scheme: 3-0

Course Credits: 3

Objectives: In this course we will study the basic components of an intelligent system, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes: The students will have a detailed knowledge of the concepts of artificial intelligence, various applications of AI in different fields, Aware of a variety of approaches to AI techniques

Course Contents:

Unit-1 (Introduction to AI): Definitions, Goals of AI, AI Approaches, AI Techniques, Branches of AI, Applications of AI. Introduction of Intelligent Systems: Agents and Environments, Good Behavior: the concept of Rationality, The Nature of Environments, The structure of Agents, How the components of agent programs work.

Unit-2 (Problems Solving, Search and Control Strategies)

Solving Problems by Searching, Study and analysis of various searching algorithms. Implementation of Depth-first search, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bi-directional search Informed (Heuristic) Search Strategies: Greedy best-first search A* search: Minimizing the total estimated solution cost, Conditions for optimality: Admissibility and consistency, Optimality of A*, Memory-bounded heuristic search, Heuristic Functions, Generating admissible heuristics from sub problems: Pattern databases, Learning heuristics from experience. Beyond Classical Search: Local Search Algorithms and Optimization Problems: Hillclimbing search Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Non-deterministic Actions: AND-OR search trees, Searching with Partial Observations. Adversarial Search and Constraint Satisfaction Problems, Study of min-max algorithm Adversarial Search: Games, Optimal Decisions in Games, The mini-max algorithm, Optimal decisions in multiplayer games, Alpha-Beta Pruning, Move ordering, Imperfect Real-Time Decisions, Evaluation functions, Cutting off search, Forward pruning, Search versus lookup, Stochastic Games, Evaluation functions for games of chance, Partially Observable Games Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Variations on the CSP formalism, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, Alpha-beta pruning and CSP, Implementation aspects of minimax algorithm and CSP.

Unit- 3 (Knowledge Representations Issues, Predicate Logic, Rules)

Knowledge representation, KR using predicate logic, KR using rules. Reasoning System - Symbolic, Statistical: Reasoning, Symbolic reasoning, Statistical reasoning.

Unit-4 (Quantifying Uncertainty, Learning Systems)

Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, Other Approaches to Uncertain Reasoning, Rule-based methods for uncertain reasoning, Representing vagueness: Fuzzy sets and fuzzy logic, Study of fuzzy logic and Decision trees, Implementation aspects of Decision trees. Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The decision tree representation, Expressiveness of decision trees, inducing decision trees from examples.

Unit-5 (Expert Systems)

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Course Description

Introduction, Knowledge acquisition, Knowledge base, working memory, Inference engine, Expert system shells, Explanation, Application of expert systems. Fundamentals of Neural Networks: Introduction and research history, Model of artificial neuron, Characteristics of neural networks, learning methods in neural networks, Singlelayer neural network system, Applications of neural networks. Fundamentals of Genetic Algorithms: Introduction, Encoding, Operators of genetic algorithm, Basic genetic algorithm.

Text Books

1. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.

References

1. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann.
2. Russell, Stuart J. Norvig, Peter, AI: A Modern Approach, Pearson Education.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Robotics

Course Code: EC705B

L-T Scheme: 3

Course Credits: 3

Introduction:

This course introduces fundamental concepts in robotics. The objective of the course is to provide an introductory understanding of robotics. Students will be exposed to a broad range of topics in robotics with emphasis on basics of manipulators, coordinate transformation and kinematics, trajectory planning, control techniques, sensors and devices, robot applications and economics analysis.

Course covers fundamentals of robot working, programming and integration in a manufacturing process. It starts with examples of robotics idea over history and continue with a numerous of examples in nowadays robot applications on different areas of human activities. Topics to be covered include robot mechanical, power, measuring and control system, robot kinematics, dynamic, control and programming. Special chapter of mobile robots will cover mobile robot kinematics, path planning and control. Overview of nowadays research in robotics and view of the robotics impact in human future.

Objectives:

1. To be familiar with the automation and brief history of robot and applications.
2. To give the student familiarities with the kinematics of robots.
3. To give knowledge about robot end effectors and their design.
4. To learn about Robot Programming methods & Languages of robot.
5. To give knowledge about various Sensors and their applications in robots.

Learning Outcomes:

Knowledge:

1. Students will be equipped with the automation and brief history of robot and applications.
2. Students will be familiarized with the kinematic motions of robot.
3. Students will have good knowledge about robot end effectors and their design concepts.
4. Students will be equipped with the Programming methods & various Languages of robots.
5. Students will be equipped with the principles of various Sensors and their applications in robots.
6. Importance of robotics in today and future goods production robot configuration and subsystems
7. Principles of robot programming and handle with typical robot
8. Working of mobile robots

Application:

Current and potential applications include:

1. Military robots
2. Space Robotics
3. Underwater Robotics
4. Electric Mobility
5. Logistics, Production and Consumer (LPC)
6. Search and Rescue (SAR) & Security Robotics
7. Assistance- and Rehabilitation Systems
8. Agricultural Robotics

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9. Domestic robots, cleaning and caring for the elderly
10. Medical robots performing low-invasive surgery
11. Nano robots

Course Contents:

Unit 1: Introduction

Brief history, types, classification and usage, Science and Technology of robots, Some useful websites, text books and research journals.

Unit 2: Elements of robots—links, joints, actuators, and sensors

Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators—stepper, DC servo and brush less motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors—encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

Unit 3: Kinematics of serial robots

Introduction, Direct and inverse kinematics problems, Examples of kinematics of common Serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach or fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.

Unit 4: Kinematics of parallel robots

Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop- closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-form and numerical solution, Inverse kinematics of parallel manipulator sand mechanisms, Direct kinematics of Gough-Stewart platform.

Unit 5: Velocity and static analysis of robot manipulators

Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and for cetrans formation matrix of a Gough-Stewart platform, Singularity analysis and statics.

Unit 6: Dynamics of serial and parallel manipulators

Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation(direct and inverse) of dynamic equations of motion, Examples of aplanar2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS)and Computer algebra software Maple.

Unit 7: Motion planning and control

Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position /force control, Advanced to picsinn on-linear control of manipulators.

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Course Description

Unit 8: Modeling and control of flexible robots

Models of flexible links and joints, Kinematic modeling of multi-link flexible robots, Dynamics and control of flexible ink manipulators, Numerical simulations results, Experiments with a planar two-link flexible manipulator.

Unit 9: Modeling and analysis of wheeled mobile robots

Introduction and some well-known wheeled mobile robots(WMR),two and three-wheeled WMR on flat surfaces, Slip and its modeling, WM Ronuneventerra in, Design of slip-free motion on uneven terrain, Kinematics, dynamics and statics ability of a three-wheeled WMR's on uneventerra in, Simulations using Matlab and ADAMS.

Unit 10: Selected advanced topics in robotics

Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of Planar 2DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewartplatformbasedsensors.Over-constrainedmechanismsanddeployablestructures,Algorithmto obtain redundant links and joints, Kinematics and statics of deploy able structures with pantographs or sciss or-like elements(SLE's).

Text Books

- 1. K.S Fu, R.C.CS, G Lee-Robotics Control, Sensing, Vision & Intelligence, McGraw-Hill.**
- 2.M.P. Groover, M.Weins, R.N. Nagel, N.C. Odrey–Industrial Robotics, McGrawHill**

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Database Management System

Course Code: EC705C

L-T Scheme: 3-0

Course Credits: 3

Introduction

Database Management Systems (DBMS) consists of a set of interrelated data and a set of programs to access that data. They underpin any computer system and are therefore fundamental to any program of study in computer science. An understanding of DBMS is crucial in order to appreciate the limitations of data storage and application behavior and to identify why performance problems arise.

Students who complete this course are expected to develop the ability to design, implement and manipulate databases. Students will apply and build databases for various day to day real life scenarios and real life applications. The course will by and large be structured but will introduce open-ended data base problems.

Course Objectives:

- Ability to build normalized databases.
- Knowledge of Entity Relationship Modeling.
- Familiarity with SQL, embedded SQL and PLSQL.
- Familiarity with query processing and query optimization techniques.
- Understanding of transaction processing.
- Ability to handle recovery and concurrency issues.
- Familiarity with ODBC, JDBC.

Outcomes:

- Develop the ability to design, implement and manipulate databases.
- Introduce students to build database management systems.
- Apply DBMS concepts to various examples and real life applications.

Expected Student Background (Preconditions)

- Introduction to any programming language (Preferably, C)
- Data Structures

Course Contents:

Unit 1: Introduction to DBMS- Concept & overview of DBMS, Data Models & database Language, Database Administrator, Database Users, architecture of DBMS, Three levels of abstraction.

Unit 2: Entity Relationship Model – Basic concepts, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model-

Structure of relational Databases, Relational Algebra, Relational Algebra Operations, Views, Modifications of the Database.

Unit 3: SQL and Integrity Constraints: Concept of DDL, DML, DCL ,Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Sub queries.

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Course Description

Unit 4: Relational Database Design: -Functional Dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF.

Unit 5: Transaction: -Transaction concept, transaction model, serializability, transaction isolation level, Transaction atomicity and durability, transaction isolation and atomicity.

Concurrency control and recovery system:

Lock based protocol, dead lock handling, time stamp based and validation based protocol, failure classification, storage, recovery algorithm, recovery and atomicity, backup.

Unit 6: Internals of RDBMS:-Physical data structures, Query optimization: join algorithm, Statistics and cost based optimization.

Unit 7: File Organization & Index Structures:-File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Text Books:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill, 2010
2. Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, Pearson, Addison-Wesley, 2010

References:

1. C.J. Date, "An Introduction to Database Systems", 8th Edition, Addison-Wesley, 2003
2. Ramakrishnan & Gherke, Database Management Systems, 2nd Edn., McGraw
3. Connolly and Begg, "Database Systems", 4th Edn., Addison-Wesley, 2005
4. Toby, Lightstone and Jagadish, "Database Modeling and Design", 5th Edn, Elsevier, 2011
5. Coronel and Rob, "Database Systems", 9th Edn., Cengage, 2011
6. IEEE / ACM Transactions on Database Systems (TODS).
7. DBMS related Journals.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Power Electronics

Course Code: EE603

L-T Scheme: 3-0

Course Credits: 3

Introduction:

This course examines power electronics switches basic structure, working methodology, series and parallel module of switches, various switching device parameter characteristics, various type of converter topology for DC as well as AC for driving DC and AC load (RL, RLE and RLC) and advantage, disadvantages of using power converter for various application. The Topics to be covered (tentatively) include:

- Definition and concept of power electronics.
- Advantages and disadvantages of using power electronics converters, power diodes, power transistors power MOSFETS, IGBT and GTO.
- Brief description of Thyristor, SCR series and parallel operation, SCR gate triggering circuits, different commutation techniques of SCR
- Phase controlled converters single phase and three with DC motor load
- DC-DC converters for different quadrant of operation buck and boost type for DC load
- Inverters single phase as well as three phase system for induction motor load.
- AC controller's single phase and three phase system RL, RLE and RLC load.
- Application of power electronics converters.

Objectives:

In this course we will study the basic concepts of power electronics systems, their advantages, disadvantages and application, various power electronics switches basic working principle, structure, V-I characteristics. Various type of triggering and commutation technique, operation and study the output waveforms of single phase and three phase rectifier, inverter for R, RL and RLC load. Operation of chopper circuits, AC voltage controller circuit. We will learn the harmonic analysis's for output waveforms of converters to obtain distortion less output also we will learn to design heat sink for power electronics switches. This way different modules in the power electronics interact and work together to provide the basic services of power electronics system.

Learning Outcomes:

Knowledge:

1. Understand the basic operating principle power electronics converters, advantages, disadvantages and application of power electronics converters.
2. You will examine the various constructions and operating principles of power electronic switches various dynamic and static characteristics of switching devices.
3. You will differentiate between various switches as per different application, Series and parallel operation of switches, Gate triggering circuit for SCR, various types of commutation technique etc.
4. Become aware various AC/DC converter topology and their various parameter for single phase and three phase R, RL, RLC and RLE loads . Basic operating principles semi controlled or fully controlled converters.
5. Know the problems in the design DC to DC converters or choppers for multi quadrant operation for DC motors, analysis of their output wave forms.
6. Learn working principle of DC/AC converters or Inverters single phase and three phase, difference between VSI and CSI, their output waveform analysis, harmonic analysis using fourier transform method to design proper harmonic elimination filter.
7. Learn various PWM technique for inverters RL, RLC and RLE load
8. Understanding various application of power converters in HVDC transmission system, drives for cement mill, steel plant, power plant, online UPS system etc.

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Application:

1. To design, implement various AC to DC power converters for various industrial applications, renewable energy, fuel cell etc, online UPS charging etc..
2. To design, implement various DC to DC power converters for various industrial applications like crane, solar power, HVDC transmission
3. To design, implement various DC to AC power converters for various industrial applications like crane, wind power, static VAR controller for HVAC transmission
4. To select the proper semiconductor switches for proper application, selection of heat sink for switches.

Course Contents:

Unit 1: Introduction- Concept of power electronics, application of power electronics, uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems, power diodes, power transistors, power MOSFETS, IGBT and GTO.

Unit 2: PNP devices-Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications. Two transistor model of SCR, SCR turn on methods, switching characteristics, gate characteristics, ratings, SCR protection, series and parallel operation, gate triggering circuits, different commutation techniques of SCR.

Unit 3: Phase controlled converter- Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, effects of freewheeling diodes and source inductance on the performance of converters. External performance parameters of converters, techniques of power factor improvement, single phase and three phase dual converters.

Unit 4: DC-DC converters- Principle of operation, control strategies, step up choppers, types of choppers circuits based on quadrant of operation, performance parameters, multiphase choppers and switching Mode regulators.

Unit 5: Inverters- Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections. Principle of operation of single phase and three phase bridge inverter with R and R-L loads, performance parameters of inverters, methods of voltage control and harmonic reduction of inverters. Brief idea of Resonant Pulse inverters.

Unit 6: AC controllers- Principle of on-off and phase control, single phase and three phase controllers with R and R-L loads. Principle of operation of cyclo converters, circulating and non circulating mode of operation, single phase to single phase step up and step down cyclo converters, three phase to single phase Cyclo converters, three phase to three phase Cyclo converter.

Unit 7: Applications- Speed control of AC and DC motors. HVDC transmission. Static circuit breaker, UPS, static VAR controller.

Text Books

1. Power Electronics, M.D. Singh and K.B. Khanchandani, Tata Mc Graw Hill. 2007.
2. Power Electronics, M.H. Rashid, PHI, 3rd Edition.
3. Power Electronics, P.S. Bhimra, Khanna Publishers, 3rd Edition.

References

1. Modern Power Electronics & AC drives, B.K. Bose, Prentice Hall
2. Power Electronics, Mohan, Undeland & Riobbins, Wiley India

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3. Element of power Electronics, Phillip T Krein, Oxford, 2007
4. Power Electronics systems, J.P. Agarwal, Pearson Education, 2006
5. Power Electronics, M.S. Jamal Asgha, PHI, 2007
6. Analysis of Thyristor power conditioned motor, S.K. Pillai, University Press.
7. Power Electronics : Principles and applications, J.M. Jacob, Thomson

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: VLSI Design Lab

Course Code: EC792

L-T-P scheme: 0-0-3

Course Credit: 2

Objectives: The overall course objective is to teach electrical engineering students fundamental concepts of hardware description languages and advanced techniques in digital system design. Specific objectives include the following:

1. Learn VHDL (Very high speed integrated circuit Hardware Description Language).
2. Utilize VHDL to design and analyze digital systems including arithmetic units and state machines.
3. Learn field programmable gate array (FPGA) technologies and utilize associated computer aided design (CAD) tools to synthesize and analyze digital systems.
4. Learn testing strategies and construct test-benches.
5. Conduct laboratory experiments using an FPGA based development board to prototype digital systems and to confirm the analysis done in class.
6. Prepare informative and organized lab reports that describe the methodologies employed, the results obtained, and the conclusions made in a laboratory experiment.

Learning Outcomes: The students will have a detailed knowledge of the concepts of IEEE and ANSI standard HDL. Upon the completion of Operating Systems practical course, the student will be able to:

- **Understand** and implement basic digital logic circuits of VLSI.
- **Model** complex digital systems at several levels of abstractions; behavioral and structural, synthesis and rapid system prototyping.
- **Develop and Simulate** register-level models of hierarchical digital systems.
- **Design and model** complex digital system independently or in a team
- Carry out **implementations** of registers and counters.
- **Simulate and synthesize** all type of digital logic circuits used in VLSI.
- Finally **design** an ALU.

Course Contents:

Exercises that must be done in this course are listed below:

Exercise No.1: Design of basic Gates: AND, OR, NOT.

Exercise No. 2: Design of universal gates

Exercise No. 3: Design of XOR and XNOR gate.

Exercise No. 4: Design of 2:1 MUX .

Exercise No. 5: Design of 2 to 4 Decoder.

Exercise No. 6: Design of Half-Adder and Full Adder.

Exercise No. 7: Design of 8:3 Priority Encoder.

Exercise No. 8: Design of 4 Bit Binary to Grey code Converter.

Exercise No. 9: Design of all Flip-Flops.

Exercise No. 10: Design of Shift register.

Exercise No. 11: Design of ALU.

Text Book:

1. J. Bhaskar, A VHDL Primer, 3rd edition, Prentice Hall.

Recommended Systems/Software Requirements:

1. Intel based desktop PC with minimum of 1GHZ or faster processor with at least 1GB RAM and 8 GB free disk space.
2. Xilinx ISE14.2 software in Windows XP or Linux Operating System.

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Course Description

Title of Course: Artificial Intelligence Lab

Course Code EC795A

L-T-P Scheme: 0-0-2

Course Credit: 1

Objectives: In this course we will implement the basic components of an intelligent system, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes: The students will have a detailed knowledge of the concepts of artificial intelligence. Various applications of AI in different fields, aware of a variety of approaches to AI techniques.

Course Contents:

Unit-1: Introduction to AI and intelligent agents

Unit-2: Problem solving, Problem spaces and blind search techniques, informed search techniques, Constraint satisfaction problems

Unit-3: Knowledge representation and reasoning techniques, Logic programming, Logical agents, Game playing, planning,

Unit-4: Learning, Reasoning under uncertain situations,

Unit-5: Expert systems, Decision support systems, Domain specific AI applications.

List of AI Problems for Lab-

Problem 1: Solve "Tower of Hanoi" with only 2 disks.

Problem 2: Solve "Tower of Hanoi" with only 3 disks.

Problem 3: Solve "4-Queens" puzzle.

Problem 4: Solve "8-Queens" puzzle.

Problem 5: Solve "4-color map" problem.

Problem 6: Solve "8 – puzzle" take any initial and goal state.

Problem 7: Calculate the sum of n elements in an integer array. Also calculate its Polynomial function the determine its complexity using "*Big-O*".

Problem 8: Find out the largest element in an square 2-D array. Also determine the "Big- O" of the algorithm. [Take size greater the 2x2]

Problem 9: Solve "Latin Square" problem.

Problem 10: Solve "Sudoku Problem" use any initial positions.

Problem 11: Solve "15-puzzle" problem using any initial and goal state.

Problem 12: Solve "Sudoku Problem" use any initial positions.

Problem 13: Code the following games software: Checkers, Chess.

Problem 14: Code the following games using software: Othello, Backgammon.

Problem 15: Code the following games using software: Bridge, Go.

Problem 16: Code the following games using software: Hex, 6x7.

Problem 17: Code the following games using software: Tetris, Tick-Tack-Toe.

Problem 18: Code the following games using software: rubik-cube, same game, mines.

Problem 19: Code the following games using software: Matches, Mines.

Text Books

1. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.

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2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.

References

1. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann
2. Russell, Stuart J. Norvig, Peter, Artificial Intelligence: A Modern Approach,
3. Pearson Education
4. Negnevitsky, Michael, Artificial Intelligence: A Guide to Intelligent Systems, Addison-Wesley.

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Course Description

Title of Course: Database Management System Lab

Course Code: EC795C

L-T-P Scheme: 0-0-3 Course Credits: 2

Objective:

At the end of the semester, the students should have clearly understood and implemented the following:

1. Stating a database design problem.
2. Preparing ER diagram
3. Finding the data fields to be used in the database.
4. Selecting fields for keys.
5. Normalizing the database including analysis of functional dependencies.
6. Installing and configuring the database server and the front end tools.
7. Designing database and writing applications for manipulation of data for a stand alone and shared database including concepts like concurrency control, transaction roll back, logging, report generation etc.
8. Get acquainted with SQL. In order to achieve the above objectives, it is expected that each students will chose one problem. The implementation shall being with the statement of the objectives to be achieved, preparing ER diagram, designing of database, normalization and finally manipulation of the database including generation of reports, views etc. The problem may first be implemented for a standalone system to be used by a single user. All the above steps may then be followed for development of a database application to be used by multiple users in a client server environment with access control. The application shall NOT use web techniques. One exercise may be assigned on creation of table, manipulation of data and report generation using SQL.

Learning Outcomes:

- Ability to build normalized databases.
- Knowledge of Entity Relationship Modelling.
- Familiarity with SQL, embedded SQL and PLSQL.
- Familiarity with query processing and query optimization techniques.
- Understanding of transaction processing.
- Ability to handle recovery and concurrency issues.
- Familiarity with ODBC, JDBC.

Course Contents:

Exercises that must be done in this course are listed below:

Exercise No.1:ER Model: An entity-relationship model (ERM) is an abstract and conceptual representation of data. Entity-relationship modeling is a database modeling method, used to produce a type of conceptual schema or semantic data model of a system

Exercise No. 2:EER Model: In computer science, the enhanced entity-relationship (EER) model is a high-level or conceptual data model incorporating extensions to the original entity-relationship (ER) model, used in the design of databases. It was developed by a need to reflect more precisely properties and constraints that are found in more complex databases.

Exercise No. 3:Relational Model: The relational model for database management is a database model based on first-order 4predicate logic, first formulated and proposed in 1969 by E.F. Codd. The model uses the concept of a mathematical relation, which looks somewhat like a table of values - as its basic building block, and has its theoretical basis in set theory and first-order predicate logic.

Exercise No. 4:1 NF: First normal form (1NF or Minimal Form) is a normal form used in database normalization. A relational database table that adheres to 1NF is one that meets a certain minimum set

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of criteria. These criteria are basically concerned with ensuring that the table is a faithful representation of a relation and that it is free of repeating groups.

Exercise No. 5: 2NF: Second normal form (2NF) is a normal form used in database normalization. 2NF was originally defined by E.F. Codd in 1971. A table that is in first normal form (1NF) must

Exercise No. 6: 3NF: The Third normal form (3NF) is an important form of database normalization. 3NF is said to hold if and only if both of the following conditions hold:

- The relation R (table) is in second normal form (2NF)
- Every non-prime attribute of R is non-transitively dependent (i.e. directly dependent) on every candidate key of R.

Exercise No. 7: BCNF: A relation R is in Boyce-Codd normal form (BCNF) if and only if every determinant is a candidate key. The definition of BCNF addresses certain (rather unlikely) situations which 3NF does not handle.

Exercise No. 8: SQL-1: In this lab., we discuss basic SQL operations like creating a table, deleting a table, changing the schema of the table, primary key and foreign key constraints on a table and creating indexes on tables.

Exercise No. 9: SQL-2: Its scope includes efficient data insert, query, update and delete, schema creation and modification, and data access control. In this lab., we discuss SQL operations for populating the tables like inserting into a table, deleting values from a table, and updating the content of the tables.

References

1. "Database Systems: A Practical Approach to design, Implementation and Management". Thomas Connolly, Carolyn Begg; Third Edition, Pearson Education.
2. "Fundamentals of Database Systems" Elmasri, Navathe, Pearson Education.
3. Bipin C Desai, "An Introduction to Database Systems", Galgotia. Publications Pvt Limited, 2001
4. "An Introduction to Database Systems", C.J.Date, Pearson Education.
5. "A first course in Database Systems", Jeffrey D. Ullman, Jennifer Windon, Pearson, Education.
6. "Data Management: databases and organization", Richard T. Watson, Wiley.
7. "Data Modeling Essentials", Graeme C. Simxion, Dreamtech.
8. Introduction to Data Base Management, Naveen Prakash, Tata McGraw Hill
9. "Oracle 10g manuals".

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Course Description

Title of Course: Power Electronics Lab

Course Code: EE795D

L-T-P scheme: 0-0-3

Course Credit: 2

Objectives:

1. To learn and understand the characteristics of an SCR, Triac.
2. To provide an understanding of the design aspects of different triggering circuits of an SCR.
3. To provide an efficient understanding of performance of single phase half controlled symmetrical and asymmetrical bridge converter.
4. To provide an efficient understanding of performance of three phase controlled converter with R & R-L load.
5. To learn and understand the performance of a Cycloconverter, Dual converter.

Learning Outcomes: The students will have a detailed knowledge of the concepts of characteristics of an SCR, Triac devices. Aware of a variety of approaches to triggering circuits of an SCR. Student will learn the basics behind performance of single phase half controlled symmetrical and asymmetrical bridge converter, Dual converter. Upon the completion of Power Electronics practical course, the student will be able to:

- **Understand** and implement characteristics of an various power electronic switches like SCR, Triac.
- **Use** modern tools and circuit to understand the performance of Dual converter (Used for crane drive, conveyor belt drive).
- **Understand** the concepts of single phase half controlled symmetrical and asymmetrical bridge converter
- **Analyze** and simulate three phase AC controller with R and R-L load (RL load like induction motor load and its speed variations)
- **Implement** a Cycloconverter and study the performance used for VVVF drive for induction motor.
- **Simulate** different triggering circuits of an SCR and **Implement** the triggering circuits for SCR, Power Mosfet, IGBT .
- **Understand** the performance of step down chopper with R and R-L load (chopper used for HVDC transmission, renewable energy like solar and wind energy system) .

Course Contents:

Exercises that must be done in this course are listed below:

Exercise No.1: Study the characteristics of an SCR.

Exercise No.2: Study the characteristics of a Triac

Exercise No. 3: Study of performance of single phase controlled converter with and without source inductance (simulation)

Exercise No. 4: Study of performance of single phase half controlled symmetrical and Asymmetrical bridge converter.(simulation)

Exercise No. 5: Study of performance of three phase controlled converter with R & R-L load.(simulation)

Exercise No. 6: Study of performance of single phase AC voltage controller with R and R-L load (simulation)

Exercise No. 7: Study of performance of a Dual converter.

Exercise No. 8: Study of performance of step down chopper with R and R-L load.

Text Book:

1. Fundamental of Power Electronics with MATLAB, Randall Shaffer, Cengage Learning.
2. SPICE for Power electronics and electric power, M.H. Rashid & H.M. Rashid, Taylor & Francis.
3. Power Electronics: Principles and application, Jacob, Cengage Learning
4. Power Electronics, Daniel W. Hart, Tata McGraw Hill Edition.

5. Modeling & Simulation using MATLAB-SIMILINK , S. Jain, Wiley India
6. MATLAB & SIMULINK for Engineers, A.K. Tyagi, Oxford University Press.

Recommended Systems/Software Requirements:

1. Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100 MB free disk space.
2. Matlab 32 bit or 64 bit 2009a/2009b.
3. Testing kit for TRAIC,SCR,DUAL converter, Chopper, Inverter and converter circuit, Microcontroller train kit(PV59RD2V51),uc8051,128kb memory.
4. Chip burning kit.
5. Spare equipments components like MOSFET(IRF540,MCTE2E,IN407,2K,10k,50uf 230V).

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Seminar on Industrial Training

Course Code: EC781

L-T –P Scheme: 0-0-3

Course Credits: 2

Course Description & Objectives:

1. **Understand** the history of medical research and bioethics related to the HeLa cells. Understand the diverse social and economic, racial and gender contexts within which Henrietta Lacks lived and died. Understand the themes of this seminar. Appreciate the legacy and implications of these medical, ethical and social understandings on today's society.
2. **Identify**, understand and discuss current, real-world issues.
3. **Distinguish** and **integrate** differing forms of knowledge and academic disciplinary approaches (e.g., humanities and sciences) with that of the student's own academic discipline (e.g., in agriculture, architecture, art, business, economics, education, engineering, natural resources, etc.). And apply a **multidisciplinary strategy** to address current, real-world **issues**.
4. Improve oral and written **communication** skills.
5. Explore an appreciation of the **self** in relation to its larger diverse social and academic contexts.
6. Apply principles of **ethics** and **respect** in interaction with others.

Course Outcomes:

After the completion of this course, the student should be able to:

1. **Learn and integrate.** *Through independent learning and collaborative study, attain, use, and develop knowledge in the arts, humanities, sciences, and social sciences, with disciplinary specialization and the ability to integrate information across disciplines.*
2. *Use multiple thinking strategies to examine real-world issues, explore creative avenues of expression, solve problems, and make consequential decisions*
3. **Learn and integrate.** Communicate. *Acquire, articulate, create and convey intended meaning using verbal and non-verbal method of communication that demonstrates respect and understanding in a complex society.*
4. *Use multiple thinking strategies to examine real-world issues, explore creative avenues of expression, solve problems, and make consequential decisions.*

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Course Description

5. **Clarify purpose and perspective.** *Explore one's life purpose and meaning through transformational experiences that foster an understanding of self, relationships, and diverse global perspectives.*

6. **Practice citizenship.** *Apply principles of ethical leadership, collaborative engagement, socially responsible behavior, respect for diversity in an interdependent world, and a service-oriented commitment to advance and sustain local and global communities.*

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Group Discussion

Course Code: HU781

L-T –P Scheme: 0-0-3

Course Credits: 2

A group discussion aims at a structured but informal exchange of knowledge, ideas, and perceptions among the participants on any issue, topic or sub-topic. Contributions are pooled together and examined in terms of their relevance and validity to the discussion objectives. If planned and organized in a structured way and certain essential conditions are met, it can provide a highly enriching and stimulating experience to the participants. Lets us see, the objectives, different steps involved in it and its limitations.

Objectives of a Group Discussion

- Produce a range of options or solutions, addressing a particular problem or an issue.
- Generate a pile of ideas by examining issues in greater depth, looking at different dimensions of these issues.
- Broaden the outlook of the participants through cross-fertilization and exposure to new and different experiences and ideas and enrich their understanding of the issues under discussion.
- Develop their skills in interpersonal communication and in expressing their views in a clear and succinct manner.
- Effective means of changing attitudes through the influence of peers in the group
- Valuable means of obtaining feedback for the training team on verbal skills, motivation level and personal traits of the participants and characteristics of the group

Steps in organizing a Group Discussion

- Setting up the Groups
- Planning a Group Discussion
- Preparation of Group Reports
- Presentation and Consolidation of Group Reports

Limitations

- If the group is large, not all the members may get the opportunity to participate and contribute to the discussion.
- If the task is not clearly defined, the discussion may lack focus and, as a result, it may be unproductive.
- Difficulties can arise if the leader is unskilled in guiding the discussion and/or not familiar with the topic or the issues.
- Some members may dominate and, in a way, hijack the discussion.

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Course Description

- As this is a group task, some members may take it easy and not feel constrained to participate.

Learning outcomes

After studying this course, you should be able to:

- understand the key skills and behaviours required to facilitate a group discussion
- prepare effectively before facilitating a meeting
- consider some of the difficult behaviours that can occur in meetings
- think of some possible strategies for dealing with these.

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Course Description

Title of Course: Project Part- I

Course Code: EC781

L-T –P Scheme: 6P

Course Credits: 4

Project: an activity where the participants have some degree of *choice* in the outcome. The result is complete and functional, that is, it has a beginning, middle and end. Usually, it spans multiple lab periods and requires work outside scheduled lab periods. Since there are choices in implementation, *design* is inherently a component of a project. A project is inherently different from an *analysis* or *exercise*, in which the solution has a predictable form. Projects span a wide variety of possibilities: design and build, identify a system, do a forensic analysis, evaluate a product or assess some environmental situation.

Program Objective 1

Graduates shall make their way to the society with proper scientific and technical knowledge in mechanical engineering.

Program Objective 2

Graduates shall work in design and analysis of mechanical systems with strong fundamentals and methods of synthesis.

Program Objective 3

Graduates shall adapt to the rapidly changing environment in the areas of mechanical engineering and scale new heights in their profession through lifelong learning.

Program Objective 4

Graduates shall excel in career by their ability to work and communicate effectively as a team member and/or leader to complete the task with minimal resources, meeting deadlines.

Program Outcomes:

1. Ability to apply knowledge of mathematics, science and mechanical engineering fundamentals for solving problems.
2. Ability to Identify, formulate and analyze mechanical engineering problems arriving at meaningful conclusions involving mathematical inferences.
3. Ability to design and develop mechanical components and processes to meet desired needs considering public health, safety, cultural, social, and environmental aspects.
4. Ability to understand and investigate complex mechanical engineering problems experimentally.
5. Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
6. Ability to understand the effect of mechanical engineering solutions on legal, cultural, social, public health and safety aspects./li>

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Course Description

7. Ability to develop sustainable solutions and understand their impact on society and environment.
8. Ability to apply ethical principles to engineering practices and professional responsibilities.
9. Ability to function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. Ability to comprehend, design documentation, write effective reports, make effective presentations to the engineering community and society at large.
11. Ability to apply knowledge of engineering and management principles to lead teams and manage projects in multidisciplinary environments.
12. Ability to engage in independent and life-long learning in the broad context of technological changes and advancements.