CAD of Digital Systems
ECC-801

Unit 1

Introduction: Information requirements of mfg organizations; business forecasting and aggregate production plan; MPS, MRP and shop floor/ Production Activity Control (PAC); Mfg as a system, productivity and wealth creation; production processes on volume-variety axes; importance of batch and job shop production; CIM definition and CIM wheel, evolution and benefits; CIM as a subset of Product Life Cycle (PLC) mgt; design for mfg (DFM) and concurrent engg; product design in conventional and CIM environment; terms like CAD, CAE, CAM, CAP, CAPP, CATD and CAQ.

Unit 2

Graphics and standards: Raster scan, coordinate systems for model (M/ WCS) user and display; database for graphic modeling; PDM, PIM, EDM; define EDM, features of EDM; basic transformations of geometry- translation, scaling, rotation and mirror; introduction to modeling software; need for CAD data standardization; developments in drawing data exchange formats; GKS, PHIGS, CORE, IGES, DXF STEP DMIS AND VDI; ISO standard for exchange of Product Model data-STEP and major area application protocols.

Unit 3

Geometric Modeling: Its use in analysis and mfg; 2D and 3D line, surface and volume models; linear extrusion and rotational sweep; Constructive Solid Geometry (CSG); basics of boundary presentation- spline, Bezier, b-spline, and NURBS; sculpture surfaces, classification, basics of coons, Bezier, b-spline and ruled surfaces; tweaking, constraint based parametric modeling; wire-frame modeling, definition of point, line and circle; polynomial curve fitting; introduction to rapid prototyping.

Unit 4

Numeric control and part programming: Principles of NC machines, CNC, DNC; NC modes of point to point, -line and 2D, 3D contouring; NC part programming; ISO standard for coding, preparatory functions(G)- motion, dwell, unit, preset, cutter compensation, coordinate and plane selection groups; miscellaneous (M) codes; CLDATA and tool path simulation; ISO codes for turning tools and holders; ATC, modular work holding and pallets; time and power estimation in milling, drilling and turning; adaptive control, sequence control and PLC; simple part programming examples.

Unit 5

Group Technology: Importance of batch and job shop production; merits of converting zigzag process layout flow to smooth flow in cellular layout, Production Flow Analysis (PFA) and clustering methods; concept of part families and coding; hierarchical, attribute and hybrid coding; OPITZ, MICLASS and DCLASS coding; FMS; material handling; robots, AGV and their programming; agile mfg; Computer Aided Process Planning (CAPP), variant/ retrieval and generative approach

References: 1. S.Kant Vajpay; Principles of CIM; PHI

2. Rao PN; CAD/CAM;TMH

3. Groover MP; Automation, Production Systems & CIM; P.H.I.

4. Rao PN, Tiwari NK, Kundra TK; Computer Aided Manufacturing; TMH

5. Alavudeen A, Venkteshwarn N; Computer Integrated Mfg; PHI

6. Radhakrishnan P, Subramanian S and Raju V; CAD/CAM/CIM;

List of Experiments (please expand it):

1. 2D and 3D modeling on CAD software

2. Use of CAM software for writing CNC programs

3. Study of automatic and semi automatic control system and writing the electrical analogy.

4. Production & layout for GT for group of jobs to be manufactured

5. A case study / tutorial using CAPP Software

6. Writing M & G codes for given operations.

7. Robot and AGV programming

Satellite Communication
ECC-802

Unit-I

Overview of satellite systems: Introduction, Frequency allocations for satellite systems. Orbits and launching methods: Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits, local mean solar point and sun-synchronous orbits, standard time.

Unit-II

The Geostationary orbit: Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage, launching orbits. Polarization: antenna polarization, polarization of satellite signals, cross polarization discrimination. Depolarization: ionospheric, rain, ice.

Unit-III

The Space segment: introduction, power supply, attitude control, station keeping, thermal control, TT&C subsystem, transponders, antenna subsystem, Morelos and Satmex 5, Anik-satellites, Advanced Tiros-N spacecraft. The Earth segment: introduction, receive-only home TV systems, master antenna TV system, Community antenna TV system, transmit-receive earth station.

Unit-IV

The space link: Introduction, Equivalent isotropic radiated power (EIPR), transmission losses, the link power budget equation, system noise, carrier-to-noise ratio (C/N), the uplink, the downlink, effects of rain, combined uplink and downlink C/N ratio, intermodulation noise, inter-satellite links. Interference between satellite circuits.

Unit-V

Satellite services VSAT (very small aperture terminal) systems: overview, network architecture, access control protocols, basic techniques, VSAT earth station, calculation of link margins for a VSAT star network. Direct broadcast satellite (DBS) Television and radio: digital DBS TV, BDS TV system design and link budget, error control in digital DBS-TV, installation of DBS-TV antennas, satellite radio broadcasting.

References: 1. D. Roddy: Satellite Communications, 4th Edition, TMH, New Delhi.

2. T. Pratt, C. Bostian and J. Allnut: Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd.

3. W. L. Pritchard, H. G. Suyderhoud and R. A. Nelson: Satellite Communication Systems Engineering, 2nd Edition, Pearson Education.

4. D.C. Agarwal: Satellite Communications, Khanna Publishers.

5. R. M. Gangliardi: Satellite Communications, CBS Publishers.

6. M. R. Chartrand: Satellite Communication, Cengage Learning.

7. Raja Rao: Fundamentals of Satellite communications, PHI Learning.

8. Monojit Mitra: Satellite Communication: PHI Learning

Experiment list

1.To set up a active & passive satellite communication link and study their difference

2. To study the communication satellite link design : process of transmitting a signal to a satellite (UPLINKING) , reception of same signal via satellite (DOWN LINKING) arid functioning of transponder of a satellite.

3. To measure the baseband analog (voice) signal parameters in a satellite link.

4. To measure the C/N ratio

5. To measure the SIN ratio.

6. To transmit & receive the Function Generator waveforms through a satcom link.

7. To send telecommand and receive the telemetry Data.

8. To study the phenomenon of Linear and Circular polarization of antennas.

Department Elective-VII
ECC-803(A) Coding Theory & Techniques

UNIT-I

Introduction : Information Theory, Information and entropy, joint and conditional entropy, differential entropy, relative entropy, mutual information, relationship between entropy and mutual information.

UNIT-II

Source coding: Shannon's source coding theorem, Huffman coding, Shannon Fano coding. Channel Coding Channel capacity, binary symmetric channel, binary erasure channel, Shannon's channel coding theorem.

UNIT-III

Linear Block Codes: Definition, properties, matrix description of linear block codes, generator and parity check matrix, encoding of linear block codes, decoding of linear block codes, syndrome decoding, standard array, co-sets, perfect codes, systematic block code, Hamming code.

UNIT-IV

Cyclic Codes: Introduction, properties of cyclic codes, polynomials and division algorithm, and decoding of cyclic codes, matrix description of cyclic codes, burst error correction, cyclic redundancy check. Circuit implementation of cyclic codes.

UNIT-V

Convolution Codes: Introduction, tree codes and trellis codes, polynomial description of convolution codes, distance notation, generating function, matrix description, viterbi decoding. Course Outcomes: After successfully completing the course students will be able to understand concept of fundamental of Information Theory and Coding. Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

References

1. Das, Mullick and Chatterjee: Principles of Digital Communication, New Age International Publishers.
2. Cover and Thomas: Elements of Information Theory, Wiley India.
3. Ranjan Bose: Information Theory, Coding and Cryptography, TMH.
4. Lin and Costello: Error Control Coding, Pearson Education.
5. Moon: Error Correction Coding, Wiley India.

6. Wells: Applied Coding and Information Theory for Engineers, Pearson Education

Voice & Data Communication
ECC-803 (B)

Unit-I

Telephone instruments and signals Introduction, the subscriber loop, standard telephone set, basic call procedure, call progress tones and signals, cordless telephones, caller identification, electronic telephones. Telephone circuit Introduction, the local subscriber loop, channel noise and units of power measurements, transmission parameters, voice frequency circuitarrangements, crosstalk.

Unit-II

Public telephone network Introduction, transmission system environment, public telephone network, instruments, local loops, trunkcircuits, local central and operator-assisted exchanges, automated central office switches and exchanges, telephone numbering plan, telephone services, telephone switching hierarchy, common channel signaling system. Multiplexing of telephone channels Introduction, time division multiplexing, T1 digital carrier, digital hierarchy, digital carrier line encoding, T carrier systems, digital carrier frame synchronization, bit versus word interleaving, statistical TDM, codecs and combo chips, frequency division multiplexing, FDM hierarchy, composite baseband signal, formation of master group, wavelength division multiplexing

Unit-III

Multiplexing of telephone channels Introduction, time division multiplexing, T1 digital carrier, digital hierarchy, digital carrier line encoding, T carrier systems, digital carrier frame synchronization, bit versus word interleaving, statistical TDM, codecs and combo chips, frequency division multiplexing, FDM hierarchy, composite baseband signal.

Unit-IV

Data Communications Components, protocols and standards, standards organizations, line configuration, topology, transmission mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface standards, modems, cable modem, transmission media- guided and unguided, transmission impairment, performance, wavelength and Shannon capacity.

Unit-V

Error detection and correction Types of error, error detection- redundancy check (longitudinal, vertical and cyclic), checksum, error correction-hamming code.Switching Circuit switching

(space-division, time division and space-time division), packet switching .

References:

1. Tomasi: Advanced Electronic Communication Systems, PHI Learning.
2. Forouzan: Data Communications and Networking, TMH.
3. Tomasi: Introduction to Data Communication Systems, Pearson Education.
4. William Stallings: Data and Computer Communications, Pearson Education
5. Brijendra Singh: Data Communications and Networks, PHI Learning.

Engineering and Acoustics
ECC-803 (C)

Unit-I

Audio and acoustics subdisciplines, survey Fundamental quantities, Fourier review, mass and vibration Damping, complex exponential solutions, forced oscillation.

Unit-II

Resonance, electrical circuit analogies Acoustic wave equation.

Unit-III

Armonic plane waves, intensity, impedance Spherical waves, sound level, dB examples Radiation from small sources.

Unit-IV

Baffled simple source, piston radiation Near field, far field Radiation impedance.

Unit-V

Recap and review Demos, speed of sound measurement.

Reference

1. Foundations of engineering acoustics
Book by Frank Fahy
2. Engineering Acoustics: An Introduction to Noise Control
Book by Michael Moser

TV & Radar Engineering
ECC-804 (A)

Unit I

Basic Television System Introduction: Scanning principles: sound and picture transmission, scanning process, camera pick-up devices, video signal, transmission and reception of video signals, brightness perception and photometric quantities, aspect ratio and rectangular scanning, persistence of vision and flicker, vertical resolution, the Kell factor, horizontal resolution and video bandwidth, interlaced scanning. Composite Video Signal: Lines and scanning, video signal components, horizontal sync and blanking standards, vertical sync and blanking standards, video modulation and vestigial side band signal, sound modulation and inter-carrier system. Television Standards: Standard channel characteristics, reception of the vestigial side band signals, television broadcast channel, consolidated CCIR system-B standard, various television broadcast systems. Television Pick-up devices and Cameras: Camera lenses, auto-focus systems, television camera pick-ups, Silicon Vidicon, CCD image sensors, video processing of camera pick-up signal.

Unit II

Colour Television Colour fundamentals: mixing of colours and colour perception, chromaticity diagram, colour television camera, colour TV signals and transmission, NTSC, SECAM and PAL system, Trinitron picture tube, automatic degaussing, plasma, LCD displays. Television transmission and reception: requirement of TV broadcast transmission, design principle of TV transmitters, IF modulation, power output stages, block diagram of TV transmitter, co-channel interference and ghost images during propagation of television signals, antenna requirements for television system, block schematic and function requirements for television receivers, trends in circuit design, colour television receiver.

Unit III

Digital Television Technology Merits of digital technology, fully digital television system, digital television signals, digitized video parameters, digital video hardware, transmission of digital TV signals, bit rate reduction, digital TV receivers, video processor unit, audio processor unit. Other television systems: Closed Circuit television system (CCTV), Cable television system (CATV), multiplexed analog component encoding television system (MAC TV), High definition television system (HDTV), High definition multiplexed analog component television (HD-MAC TV), High Performance Computer Controlled TV (HPCC TV), 3-D stereoscopic television techniques.

Unit IV

RADAR The Radar range equation, block diagram and operation, performance factors: prediction of range performance, minimum detectable signal, receiver noise, probability density functions, signal to noise ratios. Radarcross section of targets, transmitter power, pulse repetition frequency and range ambiguities, antenna parameters.

Unit-V

The CW radar: the Doppler effect, FM-CW radar. The Moving Target Indicator (MTI) Radar: delay line cancellers. Unit V Radar Receivers The radar receiver, noise figure, mixers, low noise front ends, displays- type A and PPI representations, duplexer and receiver protectors. Other Radar systems: Synthetic aperture radar, HF over the horizon radar, Air Surveillance Radar (ASR), Bistatic radar.

References:

1. M. Dhake: Television and Video Engineering,

2nd Edition,TMH, New Delhi.

2. M. I. Skolnik: Introduction to Radar Systems, TMH, New Delhi.

3. R. G. Gupta: Television Engineering and Video Systems, TMH, New Delhi.

4. R. R. Gulati: Monochrome and Colour Television, New Age International.

5. Grob and Herndon: Basic Television and Video Systems, McGraw Hill International.

6. P. Z. Peebles, Jr.: Radar Principles, Wiley India Pvt. LTD.

7. Edde: Radar- Principles, Technology Applications, Pearson Education.

Microwave Solid-State Devices
ECC-804 (B)

Unit-I

Microwave Transmission System General representation of E M field in terms of TEM, TE and TM components, Uniform guide structures, rectangular wave guides, Circular Wave guides, Solution in terms of various modes, Properties of propagating and evanescent modes, Dominant modes, Normalized model voltages and currents, Power flow and energy storage in modes frequency range of operation for single mode working, effect of higher order modes, Strip line and micro strip linesgeneral properties, Comparison of coaxial, Micro strip and rectangular wave guides in terms of band width, power handling capacity, economical consideration etc.

Unit-II

Microwave Networks and Component Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, nonreciprocal, loss less, Passive networks, Examples of two, three and four port networks, wave guide components like attenuator, Phase shifters and couplers, Flanges, Bends, Irises, Posts, Loads, Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Multi-hole directional coupler, Directional couplers, Microwave resonators- rectangular. Excitation of wave guide and resonators by couplers. Principles of operation of nonreciprocal devices, properties of ferrites, Isolators and phase shifters.

Unit-III

Microwave Solid State Devices and Application PIN diodes, Properties and applications, Microwave detector diodes, detection characteristics, Varactor diodes, parametric amplifier fundamentals, Manley-Rowe power relation MASER, LASER , Amplifiers, Frequency converters and harmonic generators using Varactor diodes, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT.

Unit-IV

Microwave Vacuum Tube Devices Interaction of electron beam with electromagnetic field, power transfer condition . Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in reflex klystrons, mode-frequency characteristics . Effect of repeller voltage variation on power and frequency of output. Principle of working of magnetrons. Electron dynamics in planar and cylindrical magnetrons, Cutoff magnetic field, Resonant cavities in magnetron, -mode operation Mode separation techniques, Rising sun cavity and strapping. Principle of working of TWT amplifier. Slow wave structures, Approximate gain relationship in forward wave TWT.

Unit-V

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

References: 1. Y. S. Liao: Microwave Devices, PHI.

2. R. E. Collins: Foundations of Microwave Engineering, 2nd Edition, Wiley Publications.

3. J.H. Reich: Microwave Principles, East West Press.

4. D. M. Pozar: Microwave Engineering, 3rd Edition, Wiley Publications.

Optical Instrumentation & Measurement
ECC-804 (C)

Unit-I

Introduction to vector nature of light, Propagation of light, Propagation of light in a cylindrical dielectric rod, ray model, wave model. Theory of image formation, Review of aberration, Comma, acclamation, distortion, Chromative aberration, Osages

Unit-II

Different types of optical fibres, model analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation.

Unit-III

Optical fiber in instrumentation use of optical fibers as sensors , modulation techniques for sensors fiber optic power measurement. Stabilized calibrated light sources end-to-end measurement of fiber losses, optical signal processing.

Unit-IV

Optical power meters, optical attenuators, optical spectrum analyzer, optical switching & logic gate and measurement techniques like optical time domain reflectometry, (OTDR), attenuation measurements .

Unit-V

Optical Sources & detectors: LED and LASERS, photo detectors, pin detectors detector responsitivity – noise, optical receivers. Integrated optical devices .

References:

1. An Introduction to Fiber Optics by Cherin

2. Optical fiber – System Technology, design and applications by C.K. Rao

3. Optical Fiber Sensors, Vol.12 by Culshaw B. and Dakin J. (Ed.), Arctech House

4. Fundamentals of Fiber Optics in Telecommunications and sensor, by B.P. Pal, Wiley Eastern
5. Optical Fiber Communication by G. Kelser, McGraw Hill

6. Liu- Principles & Application of Optical Communication 1st ed., TMH

Nano Technology

ECC-805 (A)

Unit-I

Introduction The 'Top down' and 'Bottom up' approach, Why Nanoelectronics?, Nanotechnology potential. Band structure and density of states at Nanoscale: energy bands, density of states at low dimensional structure. Electrical transport in Nanostructure: Electrical conduction in metals, insulator/ionic crystals and semiconductors. Conduction mechanism in bulk, thin film and low dimensional system. Introductory quantum mechanics for Nanoscience: size effect in smaller systems, quantum behavior of nanometric world.

Unit-II

Tunnel junction and application of tunneling: Tunneling through a potential barrier, potential energy profiles of material interfaces, applications of tunneling. Quantum wells, wires and dots: Semiconductor hetrostructure and quantum wells, quantum dots and nanoparticles.

Unit-III

Single electron transistor: Coulomb Blockade, single electron transistor, other SET and FET structures.

Unit-IV

Ballastic and spin transport: Classical and semi-classical transport, ballistic transport, carbon nanotubes and nanowires, transport of spin and spintronics. The era of new Nanostructures of carbon: Buck minsterfullerence, Nanodiomond, BN Nanotubes, Molecular Machine, Nanobiometrics.

Unit V

Fabrication technology: Top-down vs bottom-up technology. Lithographic process: Lithography, Nanolithography, split gate technology, self assembly, limitation of lithographic process. Non-lithographic techniques: Plasma arc discharge, sputtering, evaporation, chemical vapour deposition, pulsed laser deposition, molecular beam epitaxy, sol-gel technique, electrodeposition and other process.

References:

1. G. W. Hanson: Fundamentals of Nanoelectronics, Pearson Education.

2. K. K. Chattopadhyay and A. N. Banerjee: Introduction to Nanoscience and Nanotechnology, PHI Learning.

3. Vlaadiniz U. Mitin: Introduction to Nanoelectronics, Cambridge University Press.

4. M. Dragman and D. Dragman: Nanoelectronics- Principles and devices, Artech House.

5. Karl Goser: Nanoelectronics and Nanosystems, Springer.

6. Daniel Minoli: Nanotechnology application to telecommunication and networking, Wiley Interscience.

7. John H. Davis: Physics of low dimension semiconductor, Cambridge Press.

8. Carl C. Cosh: Nanostructure materials processing property and applications, Noyes Publications.

Optimization Techniques
ECC-805 (B)

Unit-I

Mathematical preliminaries Linear algebra and matrices ,Vector space, eigen analysis , Elements of probability theory , Elementary multivariable calculus .

Unit-II

Linear Programming Simplex method , Introduction to linear programming model , Duality Karmarkar's method .

Unit-III

Unconstrained optimization Conjugate direction and quasi-Newton methods• ,Gradient-based methods , One-dimensional search methods .

Unit-IV

Constrained Optimization Lagrange theorem , FONC, SONC, and SOSC conditions .

Unit-V

Projection methods , KKT conditions , Non-linear constrained optimization models ,Non-linear problems .

Reference Books:

1. An introduction to Optimization by Edwin P K Chong, Stainslaw Zak

2. Nonlinear Programming by Dimitri Bertsekas

Biomedical Image Processing
ECC-805 (C)

Unit I

Digital Image Processing Elements of a Digital Image Processing system, Structure of the Human eye, Image formation and contrast sensitivity, Sampling and Quantization, Neighbours of a pixel, Distance measures, Photographic file structure and exposure, Filem characteristics, Linear scanner, Video camera, Image processing applications.

Unit II

Image Transforms Introduction to Fourier transform-DFT, Properties of two dimensional FT, Separability, Translation, Periodicity, Rotation, Average value, FFT algorithm, Walsh transform, Hadamard transform, Discrete Cosine transform.

Unit III

Image Enhancement Definition, Spatial domain methods, Frequency domain methods, Histogram modification technique, Neighborhood averaging, Media filtering, Lowpass filtering, Averaging of multiple images, Image sharpening by differentiation and high pass filtering.

Unit IV

Image Restoration Definition, Degradation model, Discrete formulation, Circulant matrices, Block circulant matrices, Effect of diagnolization of circulant and block circulant matrices, Unconstrained and constrained restorations , Inverse filtering, Wiener filter, Restoration in spatial domain.

Unit V

Image Encoding Objective and subjective fidelity criteria, Basic encoding process, The mapping, The quantizer, The coder, Differential encoding, Contour encoding, Run length encoding, Image encoding relative to fidelity criterion, Differential pulse code modulation.

Unit VI Image Analysis and Computer Vision Typical computer vision system, Image analysis techniques, Spatial feature extraction, Amplitude and Histogram features, Transform features, Edge detection, Gradient operators, Boundary extraction, Edge linking, Boundary representation, Boundary matching, Shape representation.

Reference books:

1. Rafael, C. Gonzlez., and Paul, Wintz, "Digital Image Processing", Addison-Wesley Publishing Company.

2. Jain Anil K., "Fundamentals of Digital Image Processing", Prentice Hall.

3. Sosenfeld, and Kak, A.C., "Digital Image Processing", Academic Press.

4. William K. Pratt., "Digital Image Processing", John Wiley and Sons.

5. Sonka, Hlabac & Boyle-Image Processing Analysis & machine Vision- Vikas publication.

ECC- 806- Industrial Training Project - II

Industrial Training Project - II should be the outcome of the training done/performed during after 7^{th} semester .It should be submitted in hardware form (proto type)or simulation form along with proper data and certificates issued during project training. It should cover the electrical engineering aspects learned during training. A Power point presentation should also be submitted at the time of submission. It can be in the form of major project.

ECC- 807 General Proficiency

This course objective is to develop the ability to handle all the tasks associated with the job and Ethics refers to behaviour that adheres to societal norms and human conscience. In other words, a way of working that is honest and transparent.