PANJAB UNIVERSITY, CHANDIGARH-160014 (INDIA)
(Estd. under the Panjab University Act VII of 1947-enacted by the Govt. of India)

FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABI

AND THE

REGULATIONS

FOR

Regular & Modular
M.E. (Electronics & Communication Engineering)
2016-17

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**SCHEME OF EXAMINATION FOR**
**MASTER OF ENGINEERING (ELECTRONICS & COMMUNICATION)**

**Scheme of Examination 2016-17**

**FIRST SEMESTER:**

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* Practical marks are for continuous and end semester evaluation

**Total Marks: 750**  
**Total Credits: 21**

**Elective-I**
- ECE 6104: Advanced Mathematics
- ECE 6107: Bioinformatics
- ECE 6108: Modeling & Simulation of Communication Systems
- ECE-6109: Information Theory & Coding
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* Practical marks are for continuous and end semester evaluation

**Total Marks: 750**  
**Total Credits = 21**

**Elective-II**
- (ECE-6205) Network Programming
- (ECE-6207) PLC & SCADA
- (ECE-6211) VLSI Design
- (ECE-6213) Nano Electronics

**Elective-II Lab**
- (ECE-6205) Network Programming Lab
- (ECE-6207) PLC & SCADA Lab
- (ECE-6211) VLSI Design Lab
- (ECE-6213) Nano Electronics Lab

**Elective -III**
- (ECE-6204) Advanced Computer Networks
- (ECE 6214) Multimedia Communication
- (ECE-6215) Satellite Communications
- (ECE-6216) Design & Applications of New Materials
- (ECE-6218) RF & Microwaves
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* Practical marks are for continuous and end semester evaluation

**Total Marks: 300**  
**Total Credits = 18**

**Elective- IV**
- (ECE-7101) Neural Network & Fuzzy Logic
- (ECE-7103) Simulation & Modeling
- (ECE-7104) Smart Systems Technologies

**Elective-V**
- (ECE-7107) Advanced Antenna Systems
- (ECE-7108) Cryptography & Network Security
- (ECE-7109) Imaging and Additive Manufacturing
- (MTE-7201) HRD & Training Methods
- (MTE-7202) Research Methodology

### FOURTH SEMESTER:

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* Practical marks are for continuous and end semester evaluation

**Total marks: 200**  
**Credits = 15**

**Internal Assessment of Thesis (ECE 7201) will be graded as follows:**

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**Total M.E. Marks: 2000**  
**Total M.E. Credits: 75**
M.E. Modular Programme
In each of the Modular programme, there are a total of 12 theory subjects, each of 100 marks (including sessional of 50 marks), 9 practical subjects, each of 50 marks, two research seminars, Preliminary Thesis and Thesis with a total of 1900 marks. A candidate will study 12 theory subjects in 1st to 6th spells; Preliminary Thesis work in 7th spell, and Thesis in 8th spell. The courses of study and evaluation scheme for ME Modular programme are the same as described for ME Regular programme and is detailed here.

Spell-1

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Elective-I
ECE 6104: Advanced Mathematics
ECE 6107: Bioinformatics
ECE 6108: Modeling & Simulation of Communication Systems
ECE-6109: Information Theory & Coding

Spell-3

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**Elective-II**

(ECE-6205) Network Programming  
(ECE-6207) PLC & SCADA  
(ECE-6211) VLSI Design

**Elective-II Lab**

(ECE-6255) Network Programming Lab  
(ECE-6257) PLC & SCADA Lab  
(ECE-6261) VLSI Design Lab

**Elective-III**

(ECE-6204) Advanced Computer Networks  
(ECE-6213) Nano Electronics  
(ECE 6214) Multimedia Communication  
(ECE-6215) Satellite Communications  
(ECE-6216) Design & Applications of New Materials

**Spell-6**

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**Elective-IV**

(ECE-7101) Neural Network & Fuzzy Logic  
(ECE-7102) RF & Microwaves  
(ECE-7103) Simulation & Modeling
(ECE-7104) Smart Systems Technologies

**Elective-V**

(ECE-7107) Advanced Antenna Systems
(ECE-7108) Cryptography & Network Security
(ECE-7109) Imaging and Additive Manufacturing
(MTE-7201) HRD & Training Methods
(MTE-7202) Research Methodology

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**Internal Assessment of Thesis (ECE 7201) will be graded as follows:**

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</table>
FIRST SEMESTER

ECE-6101  ADVANCED DIGITAL SIGNAL PROCESSING

Max Marks/credit: 50/3

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART A**

Transform Theory:
Review of Z-Transform, Solution of Linear Difference Equations, Fourier series and Fourier Transform, Discrete Fourier Transform, Radix-2 FFT.
Introduction to Radix-4 and Split Radix FFT, Discrete Cosine Transform, DCT as Orthogonal Transform, Walsh Transform, Hadamard Transform, Wavelet Transform. (6)

Digital Filters:

Multirate Digital Signal Processing:
Sampling Rate Alteration Devices, Multirate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, The Polyphase Decomposition, Arbitrary Rate Sampling Rate Converter, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform. (7)

**PART B**

Linear Prediction and Optimum Linear Filters:
Forward and Backward Linear Prediction, Properties of Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction. (5)

Adaptive Digital Filters:
Concepts of Adaptive Filtering, LMS Adaptive Algorithm, Recursive Least Squares Algorithm, Applications, Introduction to Active Noise Control (5)

Power Spectrum Estimation:

DSP Chips:
Introduction to fixed point and floating point processors, TMS320C6x series: Architecture, Instruction set, Memory, Addressing Modes, Interrupts, Applications. (6)

Practice Task:
(Implement the following programs in MATLAB)
2. Circular Convolution.
3. DFT and FFT of Discrete time sequences.
4. Design of FIR Filters.
5. Design of IIR Filters.
8. Decimation and Interpolation of Discrete time sequences.
9. Implementation of an Arbitrary rate Sampling Rate Converter.
10. Illustrate Adaptive Filtering using LMS Algorithm.

Recommended Books:
8. “Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK”, R Chassaing, and D Reay, Wiley India.

ECE-6102 FIBER-OPTIC COMMUNICATION SYSTEMS

Max Marks/credit: 50/3

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

Course Objective
- To explain the need and significance of Optical Communication system.
- To impart knowledge of types, basic laws, and transmission characteristics of optical fibers.
- To study different lightwave systems, system components and applications.
- To develop research interest and expertise in the field of WDM systems design.

PART A

Review of Optical Fiber Communication: Need of optical transmission, Fiber optic communication system, Advantage of OFC, Basic optical laws and transmission parameters, Geometrical optics description: Step Index Fiber & Graded Index Fiber, Mode Theory for optical propagation, Modes in planar wave, Phase & Group Velocity.

Signal Degradation in OFS:

**Optical Transmitter:**
Basic Concept: Emission and absorption Rates, p-n junctions, Non-radiative recombination, semiconductor materials, LED: Power current relationship, LED spectrum, LASER Diodes, ILD & its characteristics, Optical Gain, Feedback and Laser threshold, working principle of Distributed feedback lasers & VCSEL.

**PART B**

**Optical Receivers:**

**Transmission System Design**
Link power budget, Rise time budget, Modulation Formats: Direct and External Modulation, need for modulation/encoding, NRZ, RZ, CSRZ, DPSK, QAM modulation formats. Fiber Loss-Induced Limitations, Balanced Coherent Receiver, Dispersion-Induced Limitations, ASE-Induced Limitations, Equivalent Noise Figure, Impact of Amplifier Spacing, Direct Detection Receiver.

**Optical Amplifier:**
Basic application and types of optical amplifiers, Semiconductor optical amplifiers, Erbium doped fiber amplifiers: architecture and types, Raman Amplifier, Amplifier-noise.

**Optical Components & Networks:**
Coupler/splitter, optical switches, optical add/drop multiplexers, fiber grating, WDM & DWDM systems, optical CDMA & TDMA.

**Recommended Books**
1. Govind P. Agrawal, "Fiber optic communication systems" third edition, Wiley India.
5. Stamatios V. Kartalopoulos, "Free Space optical networks for ultra broad band services", Wiley Publication.
6. Z. Ghassemlooy, W. Popoola, S. Rajbhandari, "optical wireless communications: system and channel modeling with MATLAB", CRC Press.

**Practical task:**
1. Simulation exercise on comparison of different dispersion compensation techniques : Pre-DCF, Post-DCF and symmetric dispersion compensation.
2. Simulation exercises on the designing on WDM systems and performance evaluation through eye diagram, optical spectrum, OSNR, Q-factor & BER rate.
ECE-6103        ADVANCED DIGITAL COMMUNICATION

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Elements of a Digital Communication System     5
Communication channels and their characteristics, mathematical models for communication channels, recent trends in digital communication, Deterministic and Random Signal Analysis, Band pass and Low pass Signal Representation, Signal space representation of waveforms.

Digital modulation Schemes                     10
Representations of digitally modulated signals, memory less modulation methods, PAM,PM,QAM, multidimensional signaling, Signaling scheme with memory, CPFSK,CPM, Power spectrum of Digitally modulated signals, PSD of a digitally modulated signals with memory, PSD of linearly modulated signals.

Optimum Receivers for Additive White Gaussian Noise Channels   10
Waveforms and vector channel models, waveforms and Vector AWGN channels, Optimum detection for the Vector AWGN channel, Implementation of the optimal receiver for AWGN channels, the correlation receiver, matched filter receiver, frequency domain interpretation of the matched filter, Performance analysis of wire-line and radio communication systems.

PART B

Carrier and symbol synchronization       8
Signal parameter estimation, the likelihood function, carrier recovery and symbol synchronization in signal demodulation, carrier phase estimation, maximum likelihood carrier phase estimation, phase locked loop, effect of noise on the phase estimation, symbol timing estimation, maximum likelihood timing estimation, non–decision directed timing estimation.

Multichannel and Multicarrier System       8
Multichannel Digital Communication in AWGN channels, binary signals, M-ary orthogonal signals, Multicarrier communication, single-carrier versus multicarrier modulation, Capacity of a Nonideal linear filter channel, orthogonal frequency division multiplexing (OFDM), modulation and demodulation in an OFDM system, Spectral characteristics of multicarrier signals, Bit and Power allocation in multicarrier modulation.

Spread Spectrum Signals for Digital Communication  4
Model of spread spectrum digital communication system, direct sequence spread spectrum signals, frequency hopped spread spectrum signals, CDMA system based on FHSS signals, Synchronization of spread spectrum systems.

Practical Task:
1. Digital Modulation techniques using MATLAB
2. Study of Spread spectrum signals
3. Simulation of digital communication system

Books:

ECE 6104 ADVANCED MATHEMATICS

Max Marks/credit: 50/3

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Series solution of differential equations, Power series methods, Legendre’s polynomial, Generating functions, Recurrence relations. (08)

Frobenius method, Series solution of Bessel’s differential equation, Modified Bessel’s functions, Generating functions, Recurrence relations. (08)

Equations reducible to Bessel’s equation. (04)

Sturm Liouville’s problem, orthogonal functions, Orthogonality of eigen functions, Eigen function expansions. (06)

PART B

Conformal mapping, Exponential function, Trigonometric functions, Hyperbolic functions, Inverse trigonometric functions, Logarithmic function, Power function, Bilinear and Schwarz-Christoffel transformation, Applications to engineering problems. (08)

Matrices, Functions of square matrices, Quadratic and Hermitian forms, Solution of linear simultaneous equations by Gaussian elimination and its modifications, Crout’s triangularization method, Iterative method’s-Jacobi’s method, Gauss-Seidel method, Eigenvalue by iteration. (10)

System simulation, Technique of simulation, Monte Carlo method, Comparison and simulation with analytical method, Numerical computation techniques. (08)

Recommended Books:
3. Narsingh Deo, System Simulation with Digital Computer, Prentice Hall of India
5. Geoffrey Gordon System Simulation, Prentice Hall of India

ECE-6105 DIGITAL SYSTEM DESIGN

Max Marks/credit: 50/3

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

Objectives:
• To understand theoretical and practical aspects of all the combinational & sequential circuits.
• Ability to identify and design the code using different modeling styles and synthesize the VHDL code.
• Acquired knowledge about FSM and how to design a code for FSM.
• To understand the future outlook and challenges for designing of digital system.

PART A

Introduction to Digital Design Concepts:
Design Constraints and Logic Representation of System. (02)

Analog interfacing:
A/D conversion concepts, Analog & Digital Conversion related errors. (03)

Combinational Logic Design and Implementation:
Multiplexer/Decoder, PLA/Pal/GAL, ROM, CPLD and FPGA level customized design, ALU, VHDL models and simulations of combinational circuits. (18)

PART B

Sequential Logic Design and Implementation:
Practical Synchronous and asynchronous circuit design. Design and Implementation of sequential digital system, state representation, analysis of digital systems, synchronization, design criteria, design procedure. High level modeling of digital systems, controller realization, Timing & Frequency consideration, system examples. VHDL models and simulation of sequential circuits (18)

Design for Testability:
Fault and Fault coverage in digital circuits, internal scan test methodology, BIST and Boundary scan (JTAG) techniques. (04)

Practice Task:
Practical tasks related to theory.

Recommended Books:
1. Combinational design & testing using PLA/PAL/ROM chips.
2. Combinational design, simulation, synthesis & implementation.
3. An Engineering Approach to Digital Design –W.J.Fletcher
4. Digital Design –M. Morris Mano
5. Digital Design principles and practices by J.F.Wakerly
6. Digital Systems-Principles and applications-Ronald Tocci.

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ECE 6107 BIOINFORMATICS

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

The NCBI Data Model:
Introduction, PUBs: Publication of perish, SEQ-Ids, BIOSEQs, Sequences, BIOSEQ-SETs, Collection of Sequences, SEQ-ANNOT, Annotating the sequence, SEQ-DESCR, Describing the sequence, using the Model. (04)

The GenBank Sequence Database:

Submitting DNA Sequences to the Databases:
Introduction, DNA/RNA, Population, phylogenetic and Mutation Studies, Protein- only submissions, submission on the World Wide Web, submission on Sequin updates, Consequences of the data model, EST/STS/GSS/HTG/SNP and Genome Centers. (09)

Structure Databases:
Introduction to Structures, PDB: Protein data bank at the research collaboratory for structural file formats, Visualizing structural information, Database structure viewers, advanced structure modeling, Structures similarity searching. (10)

PART B

Genomic Mapping and Mapping Databases:
Interplay of mapping and sequencing Genomic map elements, Types of maps complexities and pitfalls of mapping, Data repositories, and mapping projects and associated resources, Practical uses of mapping resource. (05)

Sequence Alignment and Database Searching:
Introduction, The evolutionary basis of sequence alignment, The modular nature of proteins, optimal alignment methods, Substitution scores and gap penalties Statistical significance of alignments, Database similarity searching, FASTA, BLAST, Database searching artifacts, Position –Specific scoring matrices, Spliced alignments. (08)

Predictive Methods using DNA Sequences:
GRAIL, FGENEH/GENES, MZEF, GENSCAN, PROCRUSTES, Strategies and considerations. (05)

Expressed Sequence Tags (ESTs):
EST, EST Clustering, TIGR Gene Indices, STACK, ESTs and Gene Discovery, The human Gene Map, Gene prediction in Genomic DNA, ESTs and Sequence Polymorphisms, Assessing levels of Gene expression using ESTs. (06)

Recommended Books:
2. David W. Mount, “Bioinformatics: Sequence & Genome Analysis.”

ECE 6108 MODELING AND SIMULATION OF COMMUNICATION SYSTEM

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART-A

Modelling Of Communication System
Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system Models.

Simulation of Random Variables And Random Process
Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov AND ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

PART-B

Estimation of Performance Measures
Quality of an estimator, estimator of SNR, Probability density functions of analog communication system, BER of Digital communication systems, Montre Carlo method and Importance sampling method, estimation of power, Spectral density of a process

Communication Networks
Queuing models, M/M/I and M/M/I/N queues, little formula, Burke’s theorem/G/I queue, Embedded Markov Chain analysis of TDM systems, Polling, Random access systems

Network of Queues
Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flow Chart, Routing model, Network layout and Reliability

Reference Books:

ECE-6109 INFORMATI ON THEORY & CODING

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part

PART A

The Communication process and the nature of information. (02)

Information Sources, measurement of information and the Entropy Function:
Entropies defined, and why they are measures of information, marginal entropy, joint entropy, Conditional entropy and the Chain Rule for Entropy. (06)

Sources with and without Memory:
Sources coding theorem, Prefix, Variable and Fixed- length Codes. Error Correcting Codes. (06)

Channel Types, Properties, Noise and Channel Capacity:
Perfect communication through a noisy channel. The binary symmetric channel, their classification and capacity of a noiseless discrete channel. The Hartley and Shannon laws for channel capacity. (08)

PART B

Continuous Information; Density; Noisy Channel Coding Theorem:
Extensions of the discrete entropies and measures to the continuous case. Signal-to-noise ratio; power spectral density, Gaussian channels, Relative significance of bandwidth and noise limitations. The Shannon rate limit and efficiency for noisy continuous channels (06)

Error Control Coding:
Linear blocks codes and their properties, hard-decision decoding, cyclic codes, Convolution codes, Soft-decision decoding, Viterbi decoding algorithm. (08)

Advanced Coding Techniques and Cryptography:
BCH codes, Trellis coded modulation, introduction to cryptography, overview of encryption techniques, symmetric cryptography, DES, IDEA, asymmetric algorithms, RSA algorithm. (09)

Recommended Books:
2. Richard B. Wells, Applied Coding and Information Theory for Engineers, Pearson
4. R.G. Gallager, Information Theory and Reliable Communication, Wiley
8. Thomas Cover & Joy Thomas, Elements of Information Theory, John Wiley & Sons
SECOND SEMESTER

ECE-6201 EMBEDDED SYSTEM DESIGN

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

Part A

Introduction to Embedded System:
Their classification & characteristics, Concepts and Processes of system level design of embedded system. (04)

Microcontrollers:
Introduction to PIC 16F8XX Flash Microcontrollers, CPU architecture, Register file structure, Instruction Set, Programs, Timers and Interrupts, Interrupt Service Routine, Features of Interrupts, Interrupt vector & Priority, Timing Generation & Measurements, Interfacing Methods, I/O Interface, LCD interfacing, Seven segment interfacing, I²C Bus, DAC, ADC, UART. (11)

Program Modeling Concepts in Single and multiprocessor system Software- Development Process:
Modeling Processes for software Analysis before software implementation, Program model for event controlled, Modeling of Multiprocessor Systems. (08)

Part B

Embedded Core Based Design:
System-on-Chip, Application specific Integrated circuit, Overview of Embedded Processors like ARM, MIPS and Intel MMX series, Architecture, Organization and instruction set, Memory management, High level logic synthesis. Data parallel issues e.g SIMD, MIMD, MISD, SISD. Introduction to FPGA, Basics of FPGA, RTOS overview (15)

Applications of Embedded Systems in Embedded Networking

Practice Task:
1. Write a program to operate LED with the help of PIC controller
2. Write a program to control LED with a switch using PIC controller
3. Write a program to implement 8 bit binary counter using PIC
4. Write a program to interface seven segment display with PIC
5. Write a program to implement macros in any software
6. Write a program to implement ADC using PIC
7. Write a program to interface keypad with PIC
8. Write a program to use INTO interrupt in PIC
9. Implementation on FPGA

Recommended Books:
1. Microcontrollers (Theory and Applications)- Ajay V. Deshmukh
2. An Embedded System Primer, by David E. Simon
3. Embedded system Design by Steve Heath
4. PIC Microcontroller by John B. Peatman
5. ARM system architecture by Steve Furber (Addison Wesley)
6. Programming Embedded System in C/C++ by M.Barr
7. Real Time Systems by H. Kopetz
8. Embedded Systems- Raj Kamal
9. Embedded Systems by K. V. Shibu

ECE-6202 DIGITAL IMAGE PROCESSING

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction:
Fundamental concept of digital image processing, Fields of Digital Image Processing, Component of image processing system, Image acquisition. (04)

Image Transformation, Filtering and Restoration:
Relationship between pixels, Mathematical Tools used in image processing, Camera Angles and Perspective Transformation, Intensity Transformation Functions, Histogram Processing, Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Frequency domain filters, Noise Models, Restoration in the presence of noise and degradations, Inverse Filtering. (12)

Color Image Processing
Color Fundamentals, Color Models, Color Transformations, Smoothing and Sharpening. (06)

PART B

Wavelets and Multiresolution Processing
Background, Multiresolution expansions, Wavelet transform in one dimension, Wavelet Transforms in two dimensions, Wavelet Packets. (06)

Image Compression
Coding redundancy, Spatial and Temporal redundancy, Psychovisual Redundancy, Huffman Coding, Arithmetic coding, Transform coding, Predictive coding, Wavelet Coding, JPEG Compression. (06)

Morphological Image Processing
Erosion, Dilation, Opening & Closing, Morphological Algorithms: Boundary & Region Extraction, Convex Hull, Thinning, Thickening, Skeletons, Pruning. (05)

Image Segmentation & Representation
Point, Line and Edge Detection, Thresholding, Edge and boundary Linking, Hough transforms, Region Based Segmentation, Representation, Boundary Descriptors, Regional Descriptors. (06)

Practice Task:
(Based on MATLAB)
1. Intensity transformation
2. Histogram Processing.
3. Spatial Filtering.
5. Image Restoration.
6. Image Denoising
7. Color Image Processing
8. Wavelet Transform
9. Image Compression
10. Morphological Image Processing
11. Point, Line and Edge Detection
12. Image Segmentation
13. Image Representation and Description

Recommended Books:
1. Digital Image processing by R.C. Gonzalez and R.F. Woods (Pearson Education)
5. Digital Image Processing by W. K. Pratt
6. Digital Image Processing using MATLAB by Woods & Gonzalez (Pearson Education)

ECE-6203 WIRELESS & MOBILE COMMUNICATION

Max Marks/credit: 50/3

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Mobile Communication:
Types of Mobile Communication Systems, Mobile radio systems around the world, Trends in cellular radio and personal communications. (03)

Cellular Design Fundamentals:
Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, mechanism for capacity improvement - cell splitting, cell sectoring, and micro cell zone concept. (05)

Multiple access schemes: TDMA, FDMA, CDMA, WCDMA, OFDMA, Random Multiple access Scheme, Packet Radio Protocols, CSMA, Reservation Protocols, Capacity of Cellular systems. (09)

GSM Architecture & Protocols, GSM Burst structure, Carrier and Burst Synchronization, Design Consideration, Security Aspects, Power Control strategies. (06)

PART B
**CDMA Digital Cellular Standards**, Services and Security Aspects, Network Reference Model and Key Features, Advantages over TDMA, CDMA WLL System. (05)

**Multipath Propagation:** Fading, Large scale path loss, reflection, Diffraction, Scattering, Outdoor Propagation model-Okumura Model, Hata Model, Indoor Propagation Models. Small-scale multipath propagation, Types of small scale fading, Rayleigh and Ricean distributions, Diversity Schemes. (11)

**Wireless Networks:**
WiFi, WiMax, Bluetooth, Long Term Evolution (06)

**Practice Task:-**
1. Simulation and implementation of baseband digital signals
   (i) Types of baseband signals: unipolar, polar, bipolar, RZ, NRZ, etc.
   (ii) Distortion and noise, Eye diagram.

2. Simulation and implementation of modulated digital signals
   (i) PSK, ASK and FSK modulations.
   (ii) Quadrature modulations (QASK and QPSK).
   (iii) QAM modulation.

3. Global System for Mobiles (GSM)
   (i) Cellular telephony. GSM Architecture.
   (iii) AT Commands
   (iv) Working of GSM mobile station.

4. Channel Characteristics
   (i) Multipath channel propagation characteristics
   (ii) Bit-error rate measurement

5. Wireless Networks
   (i) Bluetooth wireless network.
   (ii) Wi-Fi

6. Educational field visit to a Mobile Switching Center (MSC)

7. Study of Cellular Tower –offering public services.

**Recommended Books:**

1. Mobile and personal Communication Systems and services by Raj Pandya (PHI)
2. Wireless Communication by Rappaport (PHI)
3. Mobile Communication by Lee (TMH)
4. Wireless & Mobile System by Dharam Prakash Aggarwal, Qing-Anzeng, (Thomson)
ECE-6205 NETWORK PROGRAMMING

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART B

TCP/IP PROGRAMMING:
The TCP/IP reference model and protocol suite. IP address classes and Sub-netting. Concepts of sockets and port numbers. Port number and association. TCP header.
UDP header, sockets. Connectionless and connection-oriented services. Socket creation.
Binding, connection establishment, Data transfer, closing sockets. I/O multiplexing, Network library routines. Examples of client/server implantations. (16)

Interprocess Communication:
Remote procedure Call, Window Sockets, Named pipe, Mailslots, NetBIOS, and IPX/SPX. (08)

PART B

Windows programming:


Web Programming:
HTML, XML, Scripting. (05)

Practice Task: (To be covered under theory class)
1. Develop an SMTP client and a server.
2. Develop a POP client and a server
3. Develop a proxy server

Recommended Books:
1. SINHA, ALOK K. Network Programming in Windows NT, Addison-Wesley
2. STEVENS, R.W. TCP/IP Illustrated, Vol.1: The Protocols, Addison-Wesley
3. STVENS, R.W. TCP/IP Illustrated, Vol.2
4. STEVENS, R.W. TCP/IP Illustrated, Vol.3
5. HTML in 24 Hours, SAMS.
ECE-6207  PLC & SCADA

Max Marks/credit: 50/3

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction:
Fundamental Control Concepts, PLC System, CPU-Architecture, Programmers and Monitors, PLC Input and Output Modules-Analog and Digital, power Supply of PLCs, Internal Timers, Counters, and Flags. Criteria for Selection of PLC, PLC vs. PC. Memory requirements. (07)

SCADA:

PART B

Programming Procedures:
Different programming formats like ladder diagram, statement list, Boolean etc. Programming based on ladder diagrams using relay, timers counters sequencers, data transfer, comparison, arithmetic, logical instructions & software flags, Programming equipments like computer, hand-held programmer, on-board programming, Human machine interface, Program Scanning, Proximity Sensors and their connection to PLC, PLC as PID Controller. (19)

NETWORKING:
Networking of PLCs, Types of Networking, and Cell control by PLCs. (04)

Recommended Books:
1. Introduction to Programmable Logic Controllers by Gray Dunmig, Boston, Delmar
2. Manuals on PLCs by Siemens/Allen Bradley
3. Programming Logic Controllers by Hackworth and Hackworth Jt.

ECE-6257  PLC & SCADA Lab

List of Experiments
(Based on Theory classes)
ECE-6211 VLSI DESIGN

Max Marks/credit: 50/3

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part

PART A

Introduction to VLSI:
Introduction to solid state electronics, CMOS Logic, VLSI Design Flow.
MOS FET theory: Ideal V-I Characteristics, C-V Characteristics, Non-ideal I-V Characteristics,
CMOS processing technology: P-well, N-well, Twin Tub and silicon on Insulator processing, layout
Design rules, CMOS Process enhancement. (10)

CMOS Circuit and Logic design:
Combinational Circuit Design: Introduction, circuit Families like static CMOS, Ratioed circuits, CVSL,
Dynamic Circuits, Pass Transistor circuit.
Sequential Circuit design: Sequencing methods, Max-Delay constraints, Min-delay constraints, time
borrowing, and clock skew.
Data Path Subsystems: Adders, Subtractors, Comparators, flip-flops, Shifter, counters, Multiplier (12)

PART B

Design Methodology & Tools:
Design Methodology: Introduction, structured Design, Programmable logic, fully Custom design, CAD
tools in VLSI Design Process.
Floor Planning: Introduction, Block Placement and Channel Definitions, Global Routing, Switchbox
routing, Power Distribution, clock Distribution.
Architecture Design: Introduction, HDLs, High level synthesis, Logic Synthesis. (11)

VLSI Simulation and Algorithm:
Hierarchy of simulation tools, Switch level simulations, Layout synthesis, Placements and routing
algorithms, spice simulation. (12)

Recommended Books:
1. CMOS VLSI design by Neil H.E. Weste, David Harris, Ayan Banerjee (Pearson Education)
2. Modern VLSI Design by Wayne Wolf (Pearson education)
3. FPGA-Based system design by Wayne Wolf (Pearson Education)
4. Introduction to VLSI Systems by Mead and Conway (Addison wisely)
5. VLSI Design by Puckneel.

ECE-6211 VLSI DESIGN Lab

Practice Task:
Design & Simulation of combinational and sequential circuits using
1. Front End VLSI tools like Xilinx ISE, ISE simulator or Modelsim simulator.

ECE-6204 ADVANCED COMPUTER NETWORKS

Max Marks/credit: 50/3
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Overview:

Data Link Layer:

Local/ Personal Area Networks:
IEEE LAN standards: Ethernet (802.3), Gigabit Ethernet, Wireless LAN (802.11), Bluetooth, and Broadband Wireless (802.16). (05)

Wide Area Networks: X-25, Frame Relay, ATM. (04)

Network Layer:

PART B

Internetworking and Internet Protocols:
Tunneling, Fragmentation. The IPv4 Protocol, IPv4 addresses, IPv6 Protocol, Mobile IP, OSPF, BGP, ARP, DHCP, Internet Control Protocols, Classless Inter-domain Routing (CIDR), Network Address Translation (NAT), Subnetting and Supernetting. (08)

Transport Layer:
Transport layer protocol issues: Addressing, Connection Establishment, Connection Release, Flow control and Multiplexing. Internet Transport Protocols: TCP and UDP. (05)

Network Applications:
DNS, Electronic Mail, TELNET, FTP, SNMP, World-wide Web, Multi-media. (06)

Network Security:
Introduction to Network Security, Cryptography, Symmetric-key and Asymmetric Key Algorithms, Digital Signatures. (05)

Recommended Books:
3. Data Communications And Networks, 2nd Ed, Forouzan. Tata Mcgraw Hill.
8. Sheldon, Tom Encyclopedia Of Networking, Tmh

**ECE- 6213 NANO ELECTRONICS**

Max Marks/credit: 50/3

**Note for paper setter:** Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART A**

Materials for Nano-Electronics:
Crystal lattices, Bonding in Crystals, Electron energy bands, Semiconductor: Si, Si-Ge, Hetrostructures. Strained Si, III-V Semiconductors, Carbon- Nano- tube, Silicon nanowires. (08)

Properties of Individual Nanoparticles:
Introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, preparation of quantum nanostructures, Introduction to carbon nano tubes, Fabrication, Structure, Electrical properties, vibrational properties, Mechanical properties. (08)

Bio-logical Materials:
Biological building blocks-polypeptide, nucleic acids- DNA, Biological nanostructure, Biological methods for Nano scale fabrication. (08)

**PART B**

Tools:
TEM, Infrared and Raman Spectroscopy, Photoemission and X-RAY spectroscopy, Electron microscopy, SPMs, AFMs, Electrostatic force microscopy, Magnetic force microscopy. (06)

Nano-scale Devices
Introduction, Nanoscale MOSFET-Planer and non-planer, Resonant-tunneling diodes, Single electron transistor, Quantum-dot Nano-electromechanical systems, Molecular/Bio molecular electron devices. (15)

**Recommended Books:**
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART-A
Introduction to various multimedia Communication Techniques, Applications, Networks, Protocols and Standards, bandwidth and compression issues.

Multimedia Information Representation – Different types of multimedia information, Information representation.

Compression Techniques – Encoding and decoding techniques, Text compression techniques, Image compression techniques, Audio and Video Compression, Standards for Multimedia Compression, Huffman, Run length, Variable length, Lossy/ Lossless compression.

PART-B
Multimedia File Formats - Various files formats for multimedia and their applications, BMP, PNG, TIFF, JPEG, DFX, AVI, MPEG Audio/ Video Standards, Challenges for encryption and decryption.

Network Operating Systems - Overview of network operating systems (Windows NT/Unix/Linux), Mobile IP33N Operating System, Android Operating system.

ATM Networks - Concepts, history, Architecture, Convergence and challenges

Reference Books:
angle and slant Range, Eclipse, Orbital Perturbations, Placement of a Satellite in a Geo-Stationary orbit.

**Unit-II: Satellite Sub-Systems**
Attitude and Orbit Control system, TT&C subsystem, Attitude Control subsystem, Power systems, Communication subsystems, Satellite Antenna Equipment.

**Satellite Link**
Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use).

**Unit-III: Propagation effects**
Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference.


**REFERENCES:**

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**ECE-6216 DESIGN & APPLICATIONS OF NEW MATERIALS**
Max Marks/credit: 50/4

**Course Objective:**
To realize the important of materials used for developing different engineering applications related to medical, structural, defence needs etc.

**PART-A**

1. **Nano-materials:**
Definition, historical perspective, effects of nano science and nanotechnology on various fields; Application and synthesis of CNTs. Materials selection and related factors such as design, processing and economics; case histories related to CNT selection. Classification of nano-structured materials.

   Bio-Nano materials, top down and bottom up approaches of generation, Mechanical properties of nano-materials; other important properties of nano-structured materials. Study of micromechanics, additional strength, theory, perforated and notched composites, experimental techniques, fracture, manufacturing and processing, structural mechanics/vibration, nanomaterials, smart structures/systems/materials.

2. **Engineering polymers and ceramics:**

Thermoplastic, thermosetting polymers and elastomers; High strength engineering ceramics. Advanced analysis of composite materials; anisotropic elasticity; behaviour of composite plates and beams under bending, buckling, and vibration; advanced elasticity solution techniques; thermal behaviour of polymer composites; strength prediction theories and failure mechanisms in composites.

Introduction, synthesis and application of Transparent Ceramics.

PART B

3 Fabrication methods:
Fundamentals of rheology and visco-elasticity of polymer solution and metal; Master curve and its use for design of polymer parts: polymer fabrication by techniques such as compression, moulding, extrusion, calendaring, thermoforming, injunction moulding, reaction injection moulding (RIM), blow moulding etc. Compounding of plastics and role of additives in processing.

4 Introduction to Finite Element Method:
Basic concept, Historical background, engineering applications, general Description, Comparison with other methods.

5 Finite Element Techniques:
Model boundary value problem, finite element discrete element shapes, sizes And node locations, interpolation functions, derivation of element equations, connectivity, boundary conditions, FEM solution, post-processing, Compatibility and completeness requirements, convergence criteria, higher order and isoparametric elements, natural coordinates, Langrange and Hermit Polynomials.

Recommended Books:

ECE-6218 RF AND MICROWAVES

Max Marks/credit: 50/4

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A
Review of boundary conditions: Wave-guides and Cavity resonates (rectangular, circular & cylindrical) passive Circuits (design principles), impedance transformers, filters, hybrids, isolates. Detail discussion on S-matrix.

High frequency semi-conductor devices: Intel valley Scattering, Gunn diodes, IMPATT diodes, Step recovery diodes. Lumped elements: Equivalence circuits of Capacitors and Inductors, Design of lumped element resonators and circuits, Basic blocks in RF system and their VLSI implementation, Design of mixer, Basic topologies VCO and phase noise, Various RF Synthesizer architecture and frequency dividers, Design issues in integrated RF filters. Thin & Thick film technologies.

PART B

Design aspects: Transmission lines fir microwave circuits, Strip lines, Micro-strip lines, Slot line & Coupled lines. Characteristics impedance, Lumped parameters etc. Design considerations and implementation using simulation tools, Design of power dividers, combiners, and directional couplers

Microwave measurements: SWR, Return loss, impedance, Scattering parameters, attenuation and familiarization with equipments such as vector network analyzer, Spectrum analyzer, power meters and their block diagrams discussion. Fabrication techniques in microwave.


Recommended Books:
1. B.Bhat & S.Koul, Stripline- Loke Transmission lines for MICS, John Wiley
3. Y.Konishi, Microwave integrated Circuit, Marcel Dekker
4. S.Y.Liao, Microwave Circuit Analysis and Amplifier Design, PHI
5. B.Razavi, RF Micro-Elements, PHI.
THIRD SEMESTER

ECE-7101       NEURAL NETWORKS & FUZZY LOGIC

Max Marks/credit: 50/4

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Fundamentals of Neural Networks:
Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN - Classification, Clustering, Pattern Recognition, Function Approximation. Basic approach of the working of ANN – Training, Learning and Generalization. (10)

Supervised Learning:

PART B

Unsupervised Learning:
Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen’s Self-organizing Maps. (09)

Neurodynamical models:
Stability of Equilibrium states, Hopfield Network, Brain-state-in-a-Box network, Bidirectional associative memories. (06)

Fuzzy Logic:
Basic concepts of Fuzzy Logic, Fuzzy Vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic. (10)

Practice Task: (To be covered under theory class)
1. Design and train NN for AND or gate using perceptron
2. Design and train perceptron to classify odd and even numbers
3. Design and train NN for alphabet recognition using back propagation
4. Design and train Hopfield network for recognizing patterns such as ‘+’ and ‘–’
5. Design and train NN for EXOR classification using back propagation

Recommended Books:
1. Satish Kumar – Neural Network : A classroom approach
2. Jacek M.Zurada- Artificial Neural Networks
3. Simon Haykin- Artificial Neural Network
4. Rajasekaran & Pai – Neural networks, Fuzzy logic and genetic algorithms
6. T. J. Ross – Fuzzy logic with engineering applications.
ECE-7103 SIMULATION & MODELLING
Max Marks/credit: 50/4

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Modelling:
State and events, abstraction, Modelling approaches, Graphical Analogue, Scaled, Model characteristics. (08)

System Simulation:
Technique of simulation, montecarlo method, Comparison and simulation with analytical method, numerical computation techniques. (10)

Probability Concepts in Simulation:
Stochastic variables, Discrete and continuous probability functions, Numerical evaluation, Random number generators, discrete distribution generation. (06)

PART B

Arrival pattern and Service Times:
Arrival patterns: poisson, Exponential distribution, Coefficient of variations, Service times, Queuing, Solution of queuing, Solution of Queuing problems. (04)

Discrete System Simulation:
Discrete events, Representation of time, Arrival patterns, Gathering statistics, Measuring utilization and occupancy. (05)

Analysis of Simulation Output:
Nature of the problems, Estimation methods, Simulation run statistics, Time series analysis, Discrete and continuous random variables, Probability mass function, Distribution functions, Reliability, Discrete and continuous Markov Chains. (10)

Statistical Interference:
Regression, correlation and analysis of variance. Simulation kernels, Strong predicted events, Event cancellation. (05)

Practice Task (To be covered under Theory)
Simulation using package software such as IE3D, FDTD, VHDL, SDL, EDL & other Communication Software.

Recommended Books:
1. Geoffrey Gordon System Simulation, Prentice Hall of India
2. Kishor S. Trivedi, Probability and statistics with Reliability, Queuing and computer Science Applications, Prentice Hall of India(EEE)
3. Narsing Deo, System Simulation with Digital Computer, Prentice Hall of India
ECE-7104 Smart System Technologies

Max Marks/credit: 50/4

Objectives
This course shall introduce various MEMS, NEMS based smart system technologies. This would help them to process the acquired data from real world so as to make the system smart.

Part-A

Introduction: Main definitions for smart sensors and its properties, quasi-digital sensors, MTS, MEMS and system-on-chip (SoC); Sensors classifications from output point of view and quasi-digital sensors classification; Sensors architectures for integrated and smart sensors; Informative parameters (unified and frequency-time domain parameters of signal); Advantages of frequency as informative parameter including high noise immunity, high power of signal, wide dynamic range, high reference accuracy, simple interfacing, simple Integration and coding.

Smart and Quasi-Digital Sensors Sate-of-the-Art: Temperature sensors, pressure sensors and transducers, accelerometers, rotation speed sensors, intelligent opto (light and color) sensors, humidity sensors, mass variation chemical, gas and biosensors, magnetic sensors and others (tilt, torque, level, flow, conductivity, etc.) as well as multiparameters sensors. This lets to formulate main requirements for modern sensors systems.

Classical Frequency-to-Digital Conversion Methods: standard counting method, indirect counting method, combined method and interpolation method. Metrological performances (quantization error and other components of conversion error, conversion time, frequency range) and measures how to reduce the quantization error. It is shown that the use of weight functions can improve metrological characteristics. Phase shift-to-digital conversion.


Part-B

Smart Sensor Systems: One-channel, multi-channel and software level sensor interfacing. Multilayer sensor based network architecture. A case study of smart sensor system - Anti-Lock Braking System (ABS) including rotation speed sensor, conversion method and sensor interfacing.

Virtual Instruments: Definition of virtual instrument. Differentiate virtual instruments from measuring systems based on PC interfacing, standalone measuring instruments, measuring systems with GUI and microcontroller-based measuring...
systems with virtual measuring channel. Industrial DAQ boards. Virtual instruments examples: virtual thermometer, data logger for pressure sensors, virtual tachometer and video-graphic paperless recorder.

**Sensor Buses, Protocols and Networks:** Sensor buses and protocols: I2C, SPI, SMBus, Maxim/Dallas 1-Wire and 3-Wire buses, CAN Bus. MODBus (protocol), SSI (bus and protocol), Fieldbus. Comparative analyze of different sensor buses. Comparative analyze of two wireless standard ZidBee and Bluetooth.

Digital Sensors and Smart Sensors System Design: Practical realizations of different smart sensors systems and digital sensors: optical sensors systems with color-to-digital and light-to-digital converters; a DAQ system for temperature sensors; accelerometers based systems; rotation speed digital sensors and systems; digital humidity sensors and data loggers; temperature and humidity multisensors system; pressure sensors systems and digital gauges; digital magnetic sensors and systems; multiparameters sensors systems.

**IEEE 1451 Standard and Frequency Sensors:** Brief introduction to IEEE 1451 standard and its extension for any sensors and transducers from frequency-time signal domain. Direct Sensor-to-Microcontroller Interface for resistive, capacitance, inductance, resistive bridges sensing elements. Future Trends - The future development of main systems' components as the Universal Frequency-to-Digital Converter (UFDC-2) and Universal Sensors and Transducers Interface (USTI). Integration of all components of sensor system into a single system-on-chip (SoC) with advanced processing and conversion methods.

**Project Work:**
Students will work on different problems from industries and come up with some practical solutions.

**Course Outcomes:** students will be able to
1. Analyze real life problems requiring smart systems.
2. Identify components to implement solutions.

**Recommended Books:**
2. Understanding the Smart Sensors by Frank. R, Artech House; Second edition; 2000
4. Introduction to Instrumentation, Sensors and Process Control by Dunn. C. W; Artech House; 2006
Max Marks/credit: 50/4

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Review of vector potentials & antenna parameters. Linear antennas viz. λ/2 & λ/4 (Input impedance, far fields, radiation resistance, directivity and efficiency). Antenna array (different types, discussion on binomial & Dolph- Tschebysheff array), Super directivity (Efficiency & directivity), design considerations. (05)

Antenna Synthesis and continuous sources (Line-source, Discretization of continuous sources), Schelkunoff polynomial method, Fourier transform method, Taylor Line-source, Triangular, cosine and cosine-squared amplitude distributions, continuous aperture. (05)

Broad-band antennas (Bi-conical, Sleeve Dipole, Cylindrical dipole, rhombic antenna, helical antenna, Yagi-Uda array), Frequency Independent antenna (planar and conical spiral, log periodic). (05)

Different antenna: (Field equivalence principle) Radiation equations, Directivity, Rectangular and Circular aperture (Radiation from apertures and distribution), Horn antenna (E-plane, H-plane, Corrugated, Di-electric loaded-field & directivity calculation). (07)

PART B

Micro-strip antenna, Basic characteristics, Rectangular and Circular patches, Transmission line and cavity model, Feeding techniques and recent advancement (05)

Antenna fabrication techniques (Linear, Horn & Microstrip patch), Measurements (Impedance, Gain, polarization and Radiation pattern). Matching techniques. Antenna ranges. (05)

Smart Antenna (Principle, Block diagram), Design considerations and recent development. (04)

Wave Propagation:
Modes of Propagation: Surface Wave Propagation, Sky Wave (Ionoospheric) Propagation-Virtual height, Maximum usable Frequency, Skip Distance, Optimum working frequency, Space Wave (Tropospheric) Propagation- line of sight distance. (07)

Simulation Software based discussion of antenna and radar (Design and Calculation) (02)

Recommended Books:
1. C.A Balanis, Antenna Theory-Analysis, John Wiley
2. J.D.Karus- Antenna, McGraw Hill
4. Antennas and Radio Wave Propagation by K D Prasad Satya Prakashan
PART - A

Introduction:

Symmetric Key Cryptography:

Asymmetric Key Cryptography:

Message Authentication:
Authentication requirements and functions. Message Authentication Code. Hash functions. Hash and MAC algorithms: MD5, Secure Hash Algorithm (SHA) and HMAC.

Digital Signatures and Authentication:

PART - B

Email Security:
Pretty Good Privacy (PGP) operation. S/MIME specifications and functionality.

IP Security:
Architecture, Authentication Header, Encapsulating Payload, Security Associations, Key Management.

Web Security:

Intrusion Defence Mechanisms:
Intrusion Detection techniques.

Malicious Software:
Viruses and related threats. Virus countermeasures. Distributed Denial of Service Attacks.

Firewalls:

Recommended Books:
Max Marks/credit: 50/4

Course Objectives:
To understand the complete process of image capturing and developing complex high precision structures through additive manufacturing

PART-A

2. Converting Between data classes and Image Types Introduction to M Function Programming using MATLAB • Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations Histogram Processing, o Discrete Fourier Transform, Discrete Cosine Transform, Haar Transform, Hadamard Transform, Enhancement by point processing, Spatial filtering, Enhancement in the frequency domain, Color Image Processing

3. Image Segmentation, Discontinuity detection, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion for segmentation

PART-B


5 2D & 3D Transformations of geometry: Translations, Scaling, Reflection, Rotation, Homogeneous representation of transformation, Concatenation of transformations, Perspective, Axonometric projections, Orthographic and Oblique projections. Polymer and Photopolymerization, (SLS), LCVD, DMD.

6 Design of Surfaces: Differential geometry, Parametric representation, Curves on surface, Classification of points, Curvatures, Developable surfaces, Surfaces of revolution, Intersection of surfaces, Surface modelling, 16-point form, Coons patch, B-spline surfaces. Design of Solids: Solid entities, Boolean operations, B-rep of Solid Modelling, CSG approach of solid modelling, Advanced modelling methods. Data Exchange Formats and CAD Applications: Data exchange formats, Finite element analysis, reverse engineering, modelling with point cloud data, Rapid prototyping. 3D Scanning and Digitizing Devices CAD Model Construction from Point Clouds, Data
Recommended Books:

MTE-7201  HUMAN RESOURCE DEVELOPMENT AND TRAINING METHODS

Max Marks/credit: 50/4

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction to Human Resource Development
Evolution Pre-industrial and Information age.
Mission and Purpose, Components of HRD, HRD problems and issues related to Indian Industry and technical education, HRD in the context of new industrial policy. (05)

Stages of HRD
Initial or Induction Training for job-related /professional development Training for horizontal and vertically mobility of employees. (05)

Training & Training Strategies
Training: Concepts, Assumptions- prevailing and alternative, phase in training, modalities of training, drawbacks in existing systems of training benefits of training, Six goals content and process orientation. (05)

Training Methods
Off-the –job Training Methods-Coaching, Counseling, mentoring, reflective practices, subjects groups, observing classes of seniors/experts etc. Characteristics, merits and demerits of training methods (08)

PART B

Developing Group and Climate
Social process: Three facets, Indicators of group development, the training Climate: personal and interpersonal dimensions (07)
Evaluation of Training
Concept, purposes, types and issues in evaluation
Steps in designing evaluation of training. (07)

Systematic approach to Design of Training Programme:
Concept of system, benefits of systematic approach to design of training programme, steps in systematic approach – need analysis, task analysis, entry behavior analysis, resource and constraints analysis, analysis of goals and objectives, Synthesis of criterion tests, Synthesis of contents, Synthesis of training methods and media, implementation of training methods and media, implementation of training, assessment of trainees’ performance, evaluation of training, improvement in training. (09)

Recommended Books:

MTE 7202 RESEARCH METHODOLOGY

Max Marks/credit: 50/4

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part

PART-A

Introduction to Educational Research
Concept, types – basic, applied and action, Need for educational research (3)

Reviewing Literature
Need, Sources – Primary and Secondary, Purposes of Review, Scope of Review, steps in conducting review. (3)

Identifying and Defining Research Problem
Locating, analyzing stating and evaluating problem. Generating different types of hypotheses and evaluating them. (5)

Methods of Research
Descriptive research design - survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research (5)

Sampling Techniques
Concept of population and sample’s sampling techniques - simple random sampling, stratified random sampling, systematic sampling and cluster sampling, snow ball sampling, purposive sampling, quota sampling techniques. Determining size of sample. (6)

**PART-B**

**Design and Development of Measuring Instruments**, Tests, questionnaires, checklists, observation schedules, evaluating research instruments, selecting a standardized test. (6)

**Procedure Of Data Collection**
Aspects of data collection, coding data for analysis (3)

**Statistical Methods of Analysis**
Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and uses of normal curve.
Inferential statistics: t-test, Chi-square tests, correlation (rank difference and product moment), ANOVA (one way), Selecting appropriate methods. (7)

**Procedure for Writing a Research Proposal**
Purpose, types and components of research proposal. (3)

**Procedure for Writing a Research Report**
Audiences and types of research reports, Format of research report and journal articles. (2)

**Strategies for Evaluating, Research** disseminating and utilizing research – An Overview (2)

**Practice Tasks**
- Define a research problem in polytechnic education/industry after studying problem situation and literature
- Given the purpose, objectives of research, write hypotheses
- Select research designs for the given research objectives
- Identify the measuring instruments for the given research objectives/hypotheses
- Identify the appropriate statistical methods of analysis for the given research proposal.
- Critically analyse the given research reports on various aspects such as hypothesis, design, measuring tools, statistical analysis, interpretation etc. to identify the gaps or weaknesses in the study.

**Recommended Books:**

3. CPSC: Developing Skills in Technician Education Research Modules 1 to 11 Singapore, Colombo Plan Staff College for Technician Education

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