ET 501 IMAGE PROCESSING AND COMPUTER VISION

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Image Perception: Monochrome and color vision models, image sampling and quantization, two dimensional orthogonal transforms: FT, FFT, WHT, Haar transform, KLT, DCT,CWT, DWT.

Image Enhancement: Filters in spatial and frequency domains, histogram-based processing, homomorphic filtering, image restorations-convolution, restoration using inverse filtering and Wiener filtering, maximum entropy-based methods.

Color Image Processing: Color models, color transformation, smoothing, sharpening, color segmentation**,** morphological image processing, dilation and erosion, basic morphological algorithms.

Image Segmentation: Point, line and edge detection, edge linking and boundary detection, thresholding, region based segmentation.

Image Attributes Representation: Description - boundary descriptors, regional descriptors, object recognition patterns and pattern classes, recognition based on decision, theoretic and structural methods.

Recommended Books

1. "Digital Image Processing", R.C.Gonzalez and R.E.Woods, Pearson Education, 3rd Edition, 2009.
2. "Digital Image Processing using Matlab", R.C.Gonzalez , R.E.Woods and S.L.Eddins, Second Edition, Mc Graw Hill, 2010.
3. "Image Processing, Analysis and Machine Vision", M. Sonka, V. Hlavac,R. Bole, 2nd Edition.1999.
4. "Digital Image Processing", W.K.Pratt , John Wiley and Sons, 2007.
5. "Fundamentals of digital image processing", A. K. Jain, Seventh Edition, Prince-Hall India, 1989.

ET 502 ADVANCED DIGITAL SIGNAL PROCESSING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Overview of DSP: DFT, properties of DFT, FFT algorithms- DITFFT and DIFFFT**,** linear phase FIR filters, IIR filters, design techniques of FIR filters using windows and frequency sampling technique, design of butterworth IIR filters using impulse invariance and bilinear transformation

techniques, realization of FIR and IIR filter structures.

Multirate DSP: Fundamentals of Multirate systems, Basic multirate operations-
Decimation, interpolation, frequency domain analysis of Decimator and Interpolator, design of decimator and interpolator, Sampling rate conversion by rational factor, poly phase filters; quadrature mirror filters and digital filter banks,

Wavelet Transform: Short time Fourier transform, Introduction to wavelets, Wavelet Transform-restriction on mother wavelets, wavelets and wavelet expansion systems, discrete wavelet transform, multi-resolution formulation of wavelet systems, Haar Wavelet and Daubechies wavelet representations, Parseval's theorem.

Applications of DSP and Multirate DSP: Voice processing, sub band coding of speech signals, over sampling ADC/DAC, dual tone multi frequency and other applications.

Recommended Books:

1. "Digital signal processing: Principles, algorithm and applications", J.G.Proakis and D.G.Manolakis, Third Edition, NJ: Prentice Hall. 1996.
2. "Digital signal processing: A practical approach", E.C.Ifechor and BW.Jervis, Pearson education.
3. "Digital signal processing", S.K.Mitra, Third Edition, Tata McGraw Hill, 2006.
4. "Introduction to Digital Signal Processing", J.R. Johnson, Prentice Hall 1992.
5. "Theory and Applications of Digital Signal Processing", L.R.Rabiner and B. Gold, Prentice Hall, 1992.
6. Introduction to Wavelets and Wavelet Transform, C. S. Burrus, Ramose and A. Gopinath, Prentice Hall Inc.

ET 503 EMBEDDED SYSTEMS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Embedded Systems: Introduction ,definitions ,design steps, processor technology, IC technology, design technology, design productivity gap, custom single purpose processor design, RT level design, FSMD, data paths, optimization, instruction set simulators for simple processors, state machine and concurrent process models, HCFSM, PSM, interupts device drivers.

Evolution of Operating System: Batch, timesharing, multiprogramming, multi tasking and distributed and real time. Unix O.S. Fundamentals: system concepts, system components, O.S. Services, system calls, system Programs, system structures, virtual machines. process concept, interleaved I/O and CPU burst; process states; O.S. services for process management, co-operating processes , thread, inter process communication scheduling algorithm, multi-processor scheduling.

Real-time Operating Systems: Introduction, structures, features, multitasking operating systems, scheduler algorithms, priority inversion, commercial operating systems. Embedded software development tools, debugging techniques.

Segmentation: Concepts of segmentation, virtual memory, management of virtual memory: demand paging performance of demand paging page replacement algorithms thrashing. file organization, concept of files and directories, hierarchical structure of file, space allocation, Free space management. IO, Information management.

Security Issues and Protection Mechanism: Goals of protection domain of protection access matrix implementation of access matrix revocation of access rights security problems authentication program threats, system threats, threat monitoring.

Case-Study: Micro-cosii / Linux: Resource management**,** CPU, memory, device,

Recommended Books:

1. "ARM System Developer's Guide: Designing and Optimizing", N. Sloss, Symes and D. W. Chris, First Edition, Morgan Kaufman Publication, 2004.
2. "Digital Signal Processors", B. Venkataramani and M. Bhaskar, Second Edition, Tata McGraw Hill, 2011.
3. "ARM System-on-Chip Architecture", S.Furber, Second Edition, Pearson Education, 2001.
4. "Embedded System Design", F. Vahid and T.Givargis, Wiley, 2002
5. Technical references on www.arm.com.
6. "Embedded System Design", Raj Kamal, , Second Edition, Tata McGraw Hill, 2008.
7. Technical reference manuals from Texas Instruments

ET 504 ADVANCED COMPUTER ARCHITECTURES

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Overview of Parallel Processing and Pipelining Processing: Architectural classification, applications of parallel processing, instruction level parallelism and thread level parallelism, explicitly parallel instruction computing (EPIC) architecture, case study of Intel Itanium Processor (IA64), performance analysis.

Pipeline Architecture : Principles and implementation of pipelining, classification of pipelining processors, general pipelining reservation table, design aspect of arithmetic and instruction pipelining, pipelining hazards and resolving techniques, data buffering techniques, job sequencing and collision, advanced pipelining techniques, loop unrolling techniques, out of order execution, software scheduling, trace scheduling, predicated execution, speculative loading,

register stack engine, software pipelining, VLIW (Very Long Instruction Word) processor, Case study: superscalar architecture- Pentium, Ultra SPARC

Vector and Array Processor: Basic vector architecture, issues in vector processing, vector performance modeling, vectorizers and optimizers, Case study: cray architecture SIMD computer oganization masking and data network mechanism, Inter PE Communication, interconnection networks of SIMD, static Vs dynamic network, cube hyper cube and mesh interconnection network.

Parallel Algorithms for Array Processors: Matrix multiplication. sorting, FFT multiprocessor architecture loosely and tightly coupled multiprocessors, processor characteristics of multiprocessors, inter processor communication network, time shared bus, crossbar switch, multiport memory model, memory contention and arbitration techniques, cache coherency and bus snooping, massively parallel processors (MPP), COW's and NOW's Cluster and Network of Work Stations), chip multiprocessing (CMP), case study of IBM Power4 Processor, inter processor communication and synchronization.

Multithreaded architecture : Multithreaded processors, latency hiding techniques, principles of multithreading, issues and solutions, parallel programming techniques: message passing program development, synchronous and asynchronous message passing, message passing parallel programming, shared memory programming, data parallel programming, parallel software issues

Recommended Books:

1. "Computer Architecture and Parallel Processing" K.I. Hwang, F. A. Briggs, McGraw-Hill international Edition , 1989.
2. "Advanced Computer Architecture", K. Hwang, Tata McGraw-Hill Edition, 2001
3. "Parallel Computers", V.Rajaraman, L Sivaram Murthy, Prentice Hall, 2004
4. "Computer Organization and Architecture, Designing for Performance" W. Stallings, Sixth edition, Prentice Hall, 2010.
5. "Scalable Parallel Computing" K. Hwang, McGraw-. Hill, 1998.
6. "High performance computer Architecture", H. Stone, Prentice Hall of India
7. "Advanced Computer Architecture" R.Y. Kain , First Edition, Amazon, 1995.

ET 505A STATISTICAL INFORMATION PROCESSING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Stochastic Processes and Decision Theory:

Bayes law, Conditional and joints, mg functions, limit theorems, Chernov bound, convergence of random sequences, random process - stationary – PSD.

Detection & Estimation:

MLE, MAP, correlation detection, min-max detection, hypothesis testing and UMP tests, point and interval estimation, CRLB and parametric estimation (MVUE), K-NN estimation, Time series - Linear regression, BLUE, ARMA model, PCA and Fisher information models, Weiner Process, Yule Walker and Riccati equations, Markov Processes and Hidden Markov model, Cepstrum analysis.

Signal Design for Sources:

Asymptotic equipartition property, information measures, law of large numbers, information spectrum method, information theory & estimation theory, source coding theorem, entropy rate, existence theorem for min. length coding, coding for DMS sources - fixed to fixed, fixed to variable and Kraft-McMillan inequality proof based on partitions and proof given by Karush, variable to variable length encoding, Ziv-Lempel universal coding and proof for asymptotic optimality, Differential entropy and entropy of DMS, Joint source - channel coding theorem, Wolf–Slepian theorem, Error exponents and reliability function due to Gallager.

Quantization:

Nyquist's sampling, Scalar quantization, vector quantization, entropy based quantization, uniform and non-uniform quantization, rate-distortion theory and Shannon's third coding theorem, multi terminal source coding.

Error exponents of noisy sources:

The Weismann-Shamai-Ziv exponents, Compression via error correction, Introduction to pattern recognition & search, database structuring and search: inverse to statistical classification, Bhatnagar bounds on rate-distortion and error rates, Random sort-search methods and complexity analysis, Multiple Description problem and Multi-terminal source coding, Universal lossless trellis coding, Sensor compression. Source coding for – palm print, iris, text etc., Representation for storage/retrieval, RDF - Resource description format and the Semantic web.

Recommended Books:

1. Statistical signal processing – Estimation theory – Kay, P. Sica
2. Statistical signal processing – Manolikis, Ingle, McGraw-Hill, 2000.
3. Estimation and Detection & Modulation Theory (I) & (II) – Harry Van Tress, John Wiley & Sons, 2001.
4. Information theory and reliable communication – R G. Gallager,First edition , Wiley New York, 1968.
5. Elements of Information Theory – T. Cover, J. Thomas, Second Edition, John Wiley & Sons, Jan 2006.
6. Selected Research papers (as per topics and based on the instructor's discretion from IEEE Transac. of Information Theory, Signal Processing, Pattern Recognition (Elsevier press)
7. "50 years of Information theory", Sergio Verdu, Steven Mclaughlin –IEEE Press, 1999,

ET 505B BIOMEDICAL ENGINEERING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Introduction: Cell structure, basic cell function, origin of Bioelectric signals and their recording electrodes, Practical aspects of using electrodes, Basic medical instrumentation system, physiological parameters and suitable transducers for its measurements, operating principles and specifications for the transducers to measure parameters like blood flow, blood pressure, temperature, displacement. Smart sensors

Biomedical recorders: Heart structure, cardiac cycle, ECG (electrocardiogram), PCG (phonocardiogram**).** EEG, EMG.
Imaging techniques**:** X-Ray, CT-Scan, Ultrasonic imaging technique, NMR imaging system.

Signal processing of bio signals: Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's). Amplifiers, transient protection circuits, interference reduction techniques, movement artifact circuits, active filters, rate measurement. Averaging and integrator circuits, Sources of noise in low level measurements, Patient safety measures.

Biomedical signal analysis techniques: Biomedical signal processing by Fourier transforms, Fast Fourier Transform (FFT) and by wavelet transforms (time frequency) analysis. Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Principle component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio –Signals analysis Software based medical signal detection and pattern recognition

Examples of biomedical signals: Removal of artifacts, speech and pathology of vocal tract/ cords, perpetual coding of audio signal, and data compression, spatiotemporal nature of bioelectric signals, specific digital technique for bioelectric signals, detection of events and waves, characterization of signals in frequency domain, modeling biomedical system, pattern classification,

Recommended Books:

1. "Biomedical Digital Signal Processing", W. J. Tompkins, Prentice Hall of India, 2000
2. "Biomedical Signal Analysis: A Case study approach", R. M. Rangayyan, IEEE Press, 2001
3. "Handbook of Biomedical Instrumentation", . S Kandpur, second edition, Tata McGraw-Hill Publication,2003
4. "Biomedical signal processing and signal modeling", E. N. Bruce, New York: John Wiley, 2001.
5. "Time Frequency And Wavelets in Biomedical Signal Processing", M. Akay, Piscataway, NJ: IEEE Press, 1998.
6. "Biomedical Instrumentation And Measurements", Cromwell, weibell, pfeiffer , 2nd edition, Pearson education.1980

ET 505C ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Introduction: Artificial intelligence introduction- foundation of A.I., history , intelligent agents, agent architecture, A.I. application(E Commerce and Medicine), A.I. representation, properties of internal representation futures of A.I. production system and issue in design of search programs. Logic programming: introduction to logic, logic programming, forward and backward reasoning, forward and backward chaining rules.

Heuristic Search Techniques: Heuristic search, hill climbing, best first search, mean and end analysis, constraint satisfaction, A* and AO* Algorithm.
game playing- Minmax search procedure, alpha beta cutoffs, waiting for quiescence, secondary search. Knowledge representation, basic of knowledge representation paradigrams, prepositional logic, inference Rules in Prepositional Logic, Knowledge representation using Predicate logic: predicate calculus, predicate and arguments, ISA hierarchy frame notation, resolution, natural dedication.

Knowledge Representation Using Non Monotonic Logic: TMS(Truth Maintenance system), statistical and probabilistic reasoning ,fuzzy logic, structure knowledge representation ,semantic net ,frames, script, conceptual dependency learningand planning: learning types of learning (Rote, Direct instruction Analogy, Induction, Deduction)planning- block world, strips, implementation using goal stack, nonlinear planning with goal stacks, hierarchical planning, least commitment strategy.

Advance AI Topics: Natural language processing, introduction, steps in NLP, syntactic processing, ATN, RTN, semantic analysis, discourse and pragmatic processing, perception: perception, action, robot architecture introduction to neural networks and perception – qualitative analysis. Neural network architecture and applications.

Expert system: Utilization and functionality, architecture of expert system, knowledge representation, two case studies on expert systems.

Recommended Books:

1. “Artificial Intelligence”, E. Rich , K. Knight, Second Edition,McGraw-Hill,1991
2. “Introduction to Artificial Intelligence”, E. Charniak, D. Mcdermott, Fourth Edition Pearson, 2009.
3. “Artificial Neural Network”, K. Mehrotra , S. Rawika , K.Mohan, Prentice Hall
4. “The Sciences of the Artificial”, H. A. Simon, Third Edition , MITPRESS, 1995.
5. “Prolog Programming For Artificial Intelligence”, I. Bratko, Second Edition Addison Wesley ,1990

ET 506 IMAGE PROCESSING & COMPUTER VISION AND ADVANCED DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme: 02PR Total: 02 **Credit:** 01
Evaluation Scheme: 25ICA+ 25ESE **Total Marks:** 50
Duration of ESE: 3Hrs.

Conduct of Lab: It includes custom made Experiments/ Assignments based on syllabi of ET501 and ET502.

Internal Continuous Assessment (ICA): It should be based on understanding the principles, skills to be developed, punctuality, regular submission and neatness of the journal for each practical/experiment carried out or assignments submitted.

End Semester Examination (ESE): Oral examination based on experiments/assignments covered in ET506.

ET 507 EMBEDDED SYSTEMS AND ADVANCED COMPUTER ARCHITECTURES LAB

Teaching Scheme: 02PR Total: 02 **Credit:** 01
Evaluation Scheme: 25ICA+ 25ESE **Total Marks:** 50
Duration of ESE: 3Hrs.

Conduct of Lab: It includes custom made Experiments/ Assignments based on syllabi of ET503 and ET504.

Internal Continuous Assessment (ICA): It should be based on understanding the principles, skills to be developed, punctuality, regular submission and neatness of the journal for each practical/experiment carried out or assignments submitted.

End Semester Examination (ESE): Oral examination based on experiments/assignments covered in ET507.

ET 508 SEMINAR I

Teaching Scheme: 02PR Total: 02 **Credit:** 02
Evaluation Scheme: 50ICA **Total Marks:** 50

- It includes detailed study of any one topic apart from curriculum in the field of Electronics, Communication or in the allied field of student's own choice approved by the department; presentation based on topic studied in the presence of other students followed by question and answer session.
- Students shall submit the seminar report on the same topic in the format as approved by the institute which shall include
  (i) Literature survey
  (ii) Concept
  (iii) Functional and Technical detail
  (iv) Present status
  (v) Future scope

(vi) Application
(vii) Comparison with similar technique
(viii) References .

- Topic of seminar shall be finalized before last date as specified in academic calendar and it shall not be changed later. However; minute change in the title is permissible with prior approval of HoD.

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by departmental committee consisting of two faculty members of (one of which shall be guide) the department appointed by Principal as per the recommendation of the HoD.
- Examiner shall judge the student on the basis of seminar presentation, effort taken by student for the study of seminar (It will be well assessed by guide) and active participation during the presentation of other students.
- The candidates shall give a presentation on the seminar topic and shall be assessed on the basis of presentation/communication skill, depth of understanding, selection of seminar topic, literature survey, seminar report etc.

ET 509 SELF STUDY

Teaching Scheme: ---- **Credit:** 04
Evaluation Scheme: As stated below **Total Marks: 100**

- Self Study is based on one class test each conducted on the basis of 20 % curriculum declared by respective course coordinator at the beginning of semester of the courses ET501 to ET505 courses.
- Class test shall be conducted foe 20 marks and one hour duration.

ET 551 FUZZY LOGIC SYSTEMS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Introduction: Motivation, Fuzzy Systems, Fuzzy control from an industrial perspective, Uncertainty and Imprecision, Uncertainty in information, Chance Versus Ambiguity, The mathematics of fuzzy control. Classical Sets and Fuzzy Sets: Vagueness, Fuzzy set theory versus Probability theory, Operation and properties of classical and fuzzy sets.

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp relations, Fuzzy relations, Operations on fuzzy relations, Various types of binary fuzzy relations, Fuzzy relation equations, The extension principle and its applications, Tolerance and equivalence relations, Crisp equivalence relation, Crisp tolerance relation, Fuzzy tolerance and equivalence relation, Value assignments.

Fuzzy Logic and Approximate Reasoning: Introduction, Linguistic variables, Fuzzy logic: Truth-values and truth tables in fuzzy logic, Fuzzy propositions. Approximate reasoning: Categorical, qualitative, syllogistic, dispositional reasoning, fuzzy If - then statements, Inference rules, The compositional rule of inference, representing a set of rule, Properties of a set of rule.

Fuzzy Knowledge Based Controllers (FKBC) Design Parameters: Introduction, Structure of a FKBC, Fuzzification and defuzzification module, Rule base, Choice of variable and contents of rules, derivation of rules, data base, choice of membership function and scaling factors, choice of fuzzification and defuzzification procedure, various methods.

Adaptive fuzzy control & Neuro-fuzzy and Fuzzy-neural Control Systems: Introduction, Design and performance evaluation, the main approaches to design self-organizing controller, Model based controllers. Neuro-fuzzy and Fuzzy-neural Control Systems: Adaptive fuzzy systems, optimising the membership functions and the rule base of fuzzy logic controllers using neural networks, fuzzy transfer functions in neural networks, elements of evolutionary computation, case studies.

Recommended Books

1. An Introduction to Fuzzy Control, D. Drainkov, H. Hellendoorn and M. Reinfrank, Second Edition, Narosa Publishing House, 2010.
2. Fuzzy Logic with Engineering Applications, T. J. Ross, Second Edition, Wiley Publication, Inc 2004.
3. Fuzzy set theory and its applications, H. J. Zimmermann, second edition, Allied Publishers limited, New Delhi, 1996.
4. Fuzzy systems theory and its application, T. Terano, K. Asai and M. Sugeno, Academic Press, 1992
5. Fuzzy Sets and Fuzzy Logic: Theory and Applications, G. J. Klir and B. Yuan, Prentice Hall of India, New Delhi, 2002.

ET 552 DIGITAL COMMUNICATION SYSTEMS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Overview of Digital Modulation Techniques: BPSK,DPSK,QPSK, QASK, M-Ary Systems,

Information Source Coding for Discrete Sources: Mathematical models for information, a logarithmic measure of information: average and mutual information, entropy, coding for discrete sources-coding for discrete memory-less sources, discrete stationary sources, shanon-fano and huffman algorithms, arithmetic coding, transform based lossy coding, DCT, quantization

JPEG and MPEG Standard : JPEG standard and its modes, color image coding, B/W and color television standards, video compression, motion estimation and compensation, block

matching algorithms and criteria, MPEG standard-1, 2, 4, audio coding, psychoacoustic models, ADPCM , MPEG-Audio, dolby audio.

Channel Coding and Codes : Channel coding channel models, channel capacity, linear block codes, error correction and detection capability, usefulness of the standard array, cyclic codes, block codes examples such as hamming codes convolution codes, convolutional encoding and decoding algorithms such as Viterbi, sequential and feedback, RS codes and turbo codes .

Recommended Books:

1. "Image and Video Compression standards and Algorithms", V.Bhaskaran, Second Edition Kluwer Academic press,1997.
2. "Digital Communication: Fundamentals and Applications", S.Bernard Sklar, Second Edition, Pearson Education Asia, 2009 .
3. "Digital Communication", S. Haykins, Second Edition, Wiley, 2001
4. "Modern Digital and Analog Communication Systems", B.P. Lathi, Third Edition, Oxford Press, 2010.
5. "Television Engineering", R.R.Gulati, Prentice Hall of India, 2007.

ET 553 MODERN DIGITAL SYSTEMS DESIGN AND HDL

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Digital Design Fundamentals: General implementation procedures, aspects of wired logic and bus oriented structure, linear control system, higher order digital control systems, basic architectural distinction between sequential circuits, Moore Mealy machines, state diagrams, approach to the design of synchronous sequential finite state machines, hazards-transients, static and dynamic hazards, essential hazards, critical, non critical races.

Designing of Various Units of Processor: Control and data path units of a processor, hard wired control unit, memory and IO interface, parallel hardware units, design issues of CISC and RISC Practical design issues. Large Scale System design: ASM charts for designing the digital systems, practical issues such as clock skew, synchronous and asynchronous inputs and switch bouncing.

VHDL Design Flow: A simple combinational and sequential logic designs using HDL, common errors, partitioning mechanisms, composite data types, basic input/output operations. Simulation: Necessity of simulation, basic design issues of simulators, synthesis tools, net list and its analysis, constraints, optimization techniques.

Fault Models, Testing and Verifications: Testing and Design for Testability : Circuit testing fault model, specific and random faults, testing of sequential circuits, BIST, built in logic block observer (BILBO), signature analysis, CAD tools. Reliable Design and Fault Analysis: Hazard analysis failure modes and effect analysis, hazard and operability, fault tree analysis. reliability of digital system.

Estimation: Estimating digital system reliability, transmission lines reflections and terminations system integrity**,** network issues for digital systems. Formal verifications of digital system and nano computing, model-checking, binary decision diagram, theorem proving, circuit equivalence. Introduction to nanometer scale cellular array, carbon nanotube, fundamental of gates using nan cascade.

Recommended Books:

1. "An Engineering Approach to Digital Design", W.I. Fletcher, EEE Prentice Hall of India,1990
2. "VHDL" D.L. Perry, Fourth Edition Tata McGraw Hill Publications, 2002.
3. "Fundamentals of Digital Logic with VHDL Design", Second Edition, S. Brown and Z. Vranesic, Tata McGraw Hill, 2005.
4. "Digital Integrated Circuit Design", K. Martin, Oxford Press 2000.
5. "Switching Theory and Finite Automata", Z. Kohavi, Third Edition, Prentice Hall, 2010.
6. "Digital Logic Design Principles", N.Balabanian, Second Edition, Wiley, 2004
7. "Digital Design Fundamentals", J.F.Wakerly, Fourth Editon, Prentice Hall, 2008.
8. "Computer Organization and Design," D. Patterson, J. Hennessy, Morgan Kaufmann Publishers, 1994

ET 554 COMPUTER NETWORKS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Network Design Issues: VOIP system architecture, protocol hierarchy, structure of a voice endpoint, protocols for the transport of voice media over IP networks. Providing IP quality of service for voice, signaling protocols for VOIP, PSTN gateways, VOIP applications. Introduction, challenges, SCSI protocols and architecture: RAID, Backup and mirroring,. network attached storage including NFS, CIFS and DAFS

Introduction to CDMA and Spread Spectrum System: FHSS, DHSS, IS-95 system architecture, TR-45 Reference Model, IS-95 CDMA forward and Reverse link, CDMA2000 layering structure. Overview of information theory. Lossless compression, run-length encoding, facsimile compression, string-matching algorithms. Lossy compression: DCT, wavelet compression.

Internet security :A model for internet security, security attacks, services, internet standards and RFCs, cryptography, conventional encryption, principles and algorithms, cipher-block, modes of operation, location of encryption devices , key distribution ,Public key cryptography principles and algorithms, RSA algorithm.

Packet switched networks and ISDN:OSI and IP models, ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN,(IEEE 802.11) wireless LAN standards: IEEE 802.11b FDDI, DQDB, SMDS: Internetworking with SMDS**,**ISDN - overview, interfaces and functions, layers and services - signaling system 7 -broadband ISDN architecture and protocols, ATM and frame

relay ,

Advanced network architectures: IP forwarding architectures overlay model, multi protocol label switching (MPLS),integrated services in the internet, resource reservation protocol (RSVP),differentiated services

Recommended Books:

1. "Telecommunications Network Design Algorithms", A. Kershenbaum, Tata McGraw Hill.
2. "IP Telephony: The Integration of Robust VoIP Services", B. Douskalis, Pearson Ed. Asia.
3. "High-Performance Communication Networks", J .Warland, P.Varaiya, Morgan Kaufmann, 1996.
4. "High-Speed Networks: TCP/IP and ATM Design Principles", W.Stallings, Prentice Hall, 1998.
5. "Applications of CDMA in wire les Communication", V.Garg ,K. Smolk, J.Vilkes, 1999.
6. "Network security, essentials", W. Stalling, Third Edition, Pearson education Asia publication, 2009.
7. "ISDN and Broadband ISDN with Frame Relay and ATM", W.Stallings, Fourth Edition Pearson education Asia, 2002.
8. "Communication Networks ", L. Gracia, Widjaja, Tata McGraw-Hill, New Delhi, 2000.
9. "ATM Networks", R. Handel, M. N.Huber, Stefan Schroder ,Third Edition Pearson edu Asia,
10. "High Performance Communication Networks", J. Walrand and P. Varaiya , Second Edition, Harcourt and Morgan Kauffman, London, ,2000.
11. "High-speed Networks and Internets", W.Stallings, Second Edition, Pearson Education Asia, 2003.

ET 555A PATTERN RECOGNITION AND CLASSIFICATION

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Pattern recognition overview: Engineering approach to PR relationship of PR to other areas Pattern recognition applications, pattern techniques, pattern recognition approaches (StatPR, SyntPR, NeurPR). Features and feature extractions techniques: Introduction, zoned features, Graph representation techniques, sequentially detected features, feature extraction, feature vector and feature space.

Bays decision theory: Introduction, bays decision theory continuous case, two category classification, minimum error rate classification, classifier, discriminate functions and decision surfaces (multicategory and two category case). The normal density function (Univariate and multivariate normal density function). Parameter estimation and supervised learning: maximum likelihood estimation, Bayes classifier, general Bayesian learning, problem of dimensionally, non-parametric techniques, density estimation, Parzen window, k-nearest estimation, nearest neighbor rule.

Linear discriminate functions: Linear discriminate functions and decision surface, two category and multi-category case generalized linear discriminate functions, minimizing the perception criteria functions, relaxation procedure. Learning: Unsupervised learning, automatic determination of features, a relational system, transference of learning, associative memory, scientific basis for automatic pattern recognition.

Contextual: Linguistic and array techniques, context, scene, analysis, picture syntax, analysis of synthesis, iterate array techniques.

Coefficient analysis: Higher moments, slit scanning techniques, Fourier transformation, pattern recognition by Fourier optics, autocorrelation, speech recognition.

Recommended Books:

1 "Pattern Classification", R. Duda, P. Hart, David Stork, Second Edition, John Wiley and Sons Inc., 2005

2. "Pattern Recognition: Techniques and Applications", R. Shinghal, Oxford University Press, 2006

3. "Pattern Recognition and Image Processing , D. Luo, "Harwood publishing , England

4. "Image Processing, Analysis and Machin Vision", M. Sonka, V. Hlavac, R. Boyle, Second Edition Thomson Learning, 1999.

5. " Algorithms for Image Processing and Computer Vision", Jr. Parker , Second Edition, John Wiley, 2002

6. "Statistical, structural and neural approaches", Robert Schaloff, Pattern recognition: John Wiley and Sons. Inc.

7. "Pattern recognition techniques" J.R. Ullamann, Butterworth publications, London**,** 1973.

ET 555B BIOMEDICAL SIGNAL PROCESSING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Introduction to biomedical signals: Nature of biomedical signals, examples of biomedical signals–EMG,ECG, EEG, ERPs, PCG,VMG, VAG, objectives of biomedical signal analysis, difficulties in biomedical signal analysis, concurrent, coupled, and correlated processes, illustration of the problem with case-studies. filtering for removal of artifacts- illustration of the problem with case-studies,

Filters and applications: Time-domain filters, frequency-domain filters, optimal filtering, wiener filter, adaptive filters for removal of interference, selecting an appropriate filter, application: removal of artifacts in the ECG, event detection, detection of events and waves, correlation analysis of EEG channels, cross-spectral techniques. The matched filter, detection of the P wave, homomorphic filtering, application- ECG rhythm analysis, identification of heart

sounds, wave shape and waveform complexity, analysis of event-related potentials, morphological analysis of ECG waves, envelope extraction and analysis of activity, application-normal and ectopic ECG beats, analysis of exercise ECG. Frequency-domain characterization, the Fourier spectrum, estimation of the power spectral density function, measures derived forms PSDs.

Modeling biomedical systems: Point Processes Parametric System, Modeling Autoregressive of All pole Modeling, Pole-Zero Modeling, Electromechanical Models of Signal Generation, Application-Heart-rate Variability, Spectral Modeling and Analysis of PC

Analysis of non-stationary signals: Time-variant systems, fixed segmentation, adaptive segmentation, use of adaptive filters for segmentation, application adaptive segmentation of EEG signals, adaptive segmentation of PCG signals. pattern classification and diagnostic decision , pattern classification, supervised pattern classification, unsupervised pattern classification, probabilistic models and statistical decision, logistic regression analysis ,the training and test steps, neural networks, measures of diagnostic accuracy and cost, reliability of classifier and decisionsG.

Recommended Books:

1. "Biomedical Signal Analysis: A Case study approach", R. M. Rangayyan, IEEE Press, 2001
2. "Biomedical Signal Processing and Signal Modeling", E. N. Bruce, Wiley publications, 2007.

ET 555C NANOTECHNOLOGY

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10ISA+60ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

Introduction: Nanoscale, definition of nanotechnology; consequences of the nanoscale for technology and society. beyond moore's law. nano-scale 1D to 3D structures; Technologies for the Nanoscale, Nano-scale fabrications; Nan manipulation. Nanolithography

Nanoscale Materials and Applications Nano composites: Nano-scale Electronics; Safety issues with nanoscale powders; Quantum wells, wires, dots and nanoparticles; Nano-scale bio-medical applications; Applications in energy, informatics, medicine, etc

Different Approaches: "Top-down" approach: Nanolithography, CVD, MEMS, "Wet deposition" techniques (LB, spincoating, dip-coating) "Bottom up approach" – Sol-gel processing, colloidal. Nanoparticles,organic nanomaterial and self assembly Structure and properties characterization of nanomaterial (Diffraction techniques, spectroscopy and modeling)

Imaging Techniques: Scanning and transmission electron microscopy, scanning probe microscopy techniques

Recommended Books:

1."Introduction to Nanotechnology", C.P. Poole Jr. and Franks. J. Qwens, Wiley publications, 2003
2. "Handbook of Nanotechnology" B. Bhushan,Second Edition, Springer, 2007.
3. "Processing and Properties of Structural Nonmaterial", L.L. Shaw, Wiley publications.
4. "Nano materials Handbook", Gogotsi, CRC press 2006.

ET 556 DIGITAL COMMUNICATION SYSTEMS AND MODERN DIGITAL SYSTEM DESIGN & HDL LAB

Teaching Scheme: 02PR Total: 02 **Credit:** 01
Evaluation Scheme: 25ICA+ 25ESE **Total Marks:** 50
Duration of ESE: 3Hrs.

Conduct of Lab: It includes custom made Experiments/ Assignments based on syllabi of ET552 and ET553.

Internal Continuous Assessment (ICA): It should be based on understanding the principles, skills to be developed, punctuality, regular submission and neatness of the journal for each practical/experiment carried out or assignments submitted.

End Semester Examination (ESE): Oral examination based on experiments/assignments covered in ET556.

ET 557 FUZZY LOGIC SYSTEM AND COMPUTER NETWORK LAB

Teaching Scheme: 02PR Total: 02 **Credit:** 01
Evaluation Scheme: 25ICA+ 25ESE **Total Marks:** 50
Duration of ESE: 3Hrs.

Conduct of Lab: It includes custom made Experiments/ Assignments based on syllabi of ET551 and ET554.

Internal Continuous Assessment (ICA): It should be based on understanding the principles, skills to be developed, punctuality, regular submission and neatness of the journal for each practical/experiment carried out or assignments submitted.

End Semester Examination (ESE): Oral examination based on experiments/assignments covered in ET557.

ET 558 SEMINAR II

Teaching Scheme: 02PR Total: 02 **Credit:** 02
Evaluation Scheme: 50ICA **Total Marks:** 50

- It includes detailed study of any one topic apart from curriculum in the field of Electronics, Communication or in the allied field of student's own choice approved by the department; presentation based on topic studied in the presence of other students

followed by question and answer session.

- Students shall submit the seminar report on the same topic in the format as approved by the institute which shall include
  (i) Literature survey
  (ii) Concept
  (iii) Functional and Technical detail
  (iv) Present status
  (v) Future scope
  (vi) Application
  (vii) Comparison with similar technique
  (viii) References .
- Topic of seminar shall be finalized before last date as specified in academic calendar and it shall not be changed later. However; minute change in the title is permissible with prior approval of HoD.

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by departmental committee consisting of two faculty members (one of which shall be guide) of the department appointed by Principal as per the recommendation of the HoD.
- Examiner shall judge the student on the basis of seminar presentation, effort taken by student for the study of seminar (It will be well assessed by guide) and active participation during the presentation of other students.
- The candidates shall give a presentation on the seminar topic and shall be assessed on the basis of presentation/communication skill, depth of understanding, selection of seminar topic, literature survey, seminar report etc.

ET 559 SELF STUDY

Teaching Scheme: ---- **Credit:** 04
Evaluation Scheme: As stated below **Total Marks: 100**

- Self Study is based on one class test each conducted on the basis of 20 % curriculum declared by respective course coordinator at the beginning of semester of the courses ET501 to ET505 courses.
- Class test shall be conducted foe 20 marks and one hour duration.