ET 501P IMAGE PROCESSING AND COMPUTER VISION

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

Digital image processing builds upon the tools and techniques learnt by students in linear systems and probability courses. The course provides a mathematical basis for further study and research in image and video processing, computer vision.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Linear algebra and matrix operations, linear time-invariant systems, Fourier transform analysis and filtering

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. analyze general terminology of digital image processing.
2. examine various types of images, intensity transformations and spatial filtering.
3. evaluate the methodologies for image segmentation, restoration etc.
4. implement image process and analysis algorithms.
5. apply image processing algorithms in practical applications.

COURSE CONTENT

Digital image fundamentals, two dimensional orthogonal transforms. Image Enhancement: Histogram processing, smoothing and sharpening of spatial and frequency domain filters, homomorphic filtering, a model of the image degradation/restoration process, noise models, inverse filtering, Wiener filtering, geometric mean filter, geometric transformations, Color Image Processing: Color models, color transformation, smoothing, sharpening, color segmentation**.** Morphological image processing: dilation and erosion, basic morphological algorithms, Image 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. R. C. Gonzalez and R. E. Woods, “Digital Image Processing”, Pearson Education, Third Edition, 2009
2. R. C. Gonzalez, R. E. Woods and S. L. Eddins, “Digital Image Processing using Matlab”, Second Edition, McGraw-Hill, 2010
3. M. Sonka, V. Hlavac, R. Bole, “Image Processing, Analysis and Machine Vision”, Second Edition, 1999
4. W. K. Pratt, “Digital Image Processing”, John Wiley and Sons, 2007.
5. A. K. Jain, “Fundamentals of Digital Image Processing”, Seventh Edition, Prince-Hall India, 1989.

ET502P DIGITAL INTEGRATED CIRCUIT DESIGN

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course is advanced level electronics and telecommunication engineering which will further strengthen the knowledge of the students. The course explores knowledge of digital integrated circuit design. The course comprises of digital techniques, test generation and fault simulation, testing, modeling and design.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of digital electronics concepts

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. solve engineering design problems.
2. test generation and fault simulation, testing, modeling and validate design.
3. design automation concepts and use of programming languages.
4. analyze statistically for optimal design of systems.

COURSE CONTENT

Digital methodology: Introduction, design specification, partition, entry, simulation and functional verification, design integration and verification, gate level synthesis and technology mapping, posts synthesis design validation, test generation and fault simulation. Combinational logic and sequential logic**,** Boolean algebra, sum of product (SoP), product of sum (PoS), glitches and hazards, building blocks for logic design, fundamentals of sequential logic design, latches, flip-flops, buses, design of sequential machines, Moore-mealy machines. Introduction to logic design**,** structural models of combinational logic, logic simulation, design verification and test methodology, propagation delay, logic design with behavioral models of combinational and sequential logic, behavioral modeling, Boolean equation based behavioral models of combinational logic, latches and level sensitive circuits, cyclic behavioral models of flip-flops and latches, algorithmic state machine charts for behavioral modeling. Synthesis of combinational and sequential logic, synthesis of combinational logic, synthesis of sequential logic. Reduce instruction set computer (RISC), stored program machine, post synthesis design validation, fault simulation and testing, circuit defect and testing.

Recommended Books

1. Michael D. Cilletti, “Advanced Digital Design with the Verilog HDL”, Eastern Economy Edition, Prentice Hall India, 2010
2. W. I. Fletcher, “An Engineering Approach to Digital Design”, Eastern Economy Edition Prentice Hall of India, 1990
3. D. L. Perry, “VHDL (Programming by Example)”, Fourth Edition, Tata McGraw-Hill Publications, 2002
4. S. Brown and Z. Vranesic, “Fundamentals of Digital Logic with VHDL Design”, Second Edition, Tata McGraw-Hill, 2005
5. K. Martin, “Digital Integrated Circuit Design”, Oxford Press, 2000

ET 503P EMBEDDED SYSTEMS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course is advanced level electronics and telecommunication engineering which will further strengthen the knowledge of the students. The course explores knowledge of digital integrated circuit design. The course comprises of digital techniques, test generation and fault simulation, testing, modeling and design.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of programmable logic systems, microprocessors and microcontrollers

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. demonstrate engineering problems and determine solutions.
2. test generation and fault simulation, testing, modeling and design.
3. design self diagnostic tests and validation of total system.
4. formulate automation concepts and use of programming languages.
5. simulate mathematical modeling in complex system analysis and optimal design of systems.

COURSE CONTENT

Embedded systems: Introduction, definitions, design steps, processor technology, IC technology, design technology, design productivity gap, custom single purpose processor design, real-time level design, finite state machine with datapath (FSMD), data paths, optimization, instruction set simulators for simple processors, state machine and concurrent process models, hierarchical / concurrent finite state machine models (HCFSM), program-state machine (PSM), embedded processors like ARM7/9, memory systems, basic peripherals, interfacing with analog world, interrupts and exceptions, device drivers. Real-time operating systems (RTOS): Introduction, structures, features, multitasking operating systems, scheduler algorithms, priority inversion, commercial operating systems. Embedded software development tools, emulation and debugging techniques. Memory management: Concepts of segmentation, virtual memory, and 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 input output, file 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, real time without RTOS.

Recommended Books

1. N. Sloss, Symes and D. W. Chris, "ARM System Developer's Guide: Designing and Optimizing", First Edition, Morgan Kaufman Publication, 2004
2. Raj Kamal, "Embedded System Design", Second Edition, Tata McGraw-Hill, 2008
3. F. Vahid and T. Givargis, "Embedded System Design", Wiley, 2002
4. B. Venkataramani and M. Bhaskar, "Digital Signal Processors", Second Edition, Tata McGraw-Hill, 2011
5. S. Furber, "ARM System-on-Chip Architecture", Second Edition, Pearson Education, 2001
6. Steve Heath, "Embedded Systems Design", Second Edition, Elsevier, 1998

ET 504P BIOMEDICAL ENGINEERING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

Biomedical engineering constitutes human beings earliest efforts to understand the living world in terms of the basic sciences and to comprehend the body mechanism in terms of their technological creations. Biomedical engineering involves the study and application of engineering processes for diagnosis and therapy.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of linear electronics, human anatomy and physiology

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. demonstrate basic and intermediate concepts in biomedical engineering.
2. analyze the problems that arrives with biomedical equipment.
3. develop trouble shooting skills useful for clinical engineer.
4. function on multidisciplinary teams with health and safety, and understand the impact of engineering solutions in a global, economic, environmental, and societal context.

COURSE CONTENT

Basics of biomedical: Cellular measurement, recording electrodes, basic medical instrumentation system, biomedical transducers, electrical and ionic properties of cellular membranes, sources and theories of bioelectrical potential, biochemical electrodes, signal processing of bio signals: Acquisition and signal conversion of bio signals, interference reduction techniques, movement artifact circuits, rate measurement, sources of noise in low level measurements, patient safety measures. Therapeutic and prosthetic devices: Cardiac pacemakers, defibrillators, hemodynamics and hemodialysis, ventilators, infant incubators, surgical instruments, therapeutic application of the light amplification by stimulated emission of radiation (LASER). Electroencephalogram (EEG) and electromyogram (EMG): Anatomy of function of brain, bioelectric potentials from brain, resting rhythms, clinical EEG, EMG, phonocardiogram (PCG). Cardiovascular: Anatomy of function of heart, blood flow, pressure, cardiac output, cardiac cycle, electrocardiogram (ECG), elements of intensive care monitoring, measurement of heart sounds, heart structure. Examples of biomedical signals: Artifacts removal, speech and audio signal, and data compression, spatiotemporal nature of bioelectric signals, digital technique for bioelectric signals, events and waves detection. Medical imaging system: radiography, magnetic resonance imaging (MRI), computed tomography, ultrasonography, principal of ultrasonic measurement, ultrasonic and its application in medicine, temperature measurement.

Recommended Books

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, “Biomedical Instrumentation and Measurements”, Second Edition, Pearson Education, 1980
2. John G. Webster (editor), “Medical Instrumentation: Application and Design”, Kindle Edition, 2009
3. Richard Aston, “Principles of Biomedical Instrumentation and Measurement”, Merrill Publication, 1990
4. Joseph J. Carr, John M. Brown, “Introduction to Biomedical Equipment Technology”, Fourth Edition, Pearson, 2001

ET 505P (A) NANOTECHNOLOGY

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+ 60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course is designed for students in the field of material engineering to acquire quality knowledge in nanotechnology. Since nanotechnology is multidisciplinary, students studying other engineering courses can benefit from the opportunities offered by this course as it provides sound knowledge of nanotechnology. Students can understand the basic properties of nano-materials and its applications.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Basic and computer science

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. decide the utility of nano-materials for various applications.
2. analyze the process of manufacturing of nano-materials.
3. examine various types of micro devices for various applications.

COURSE CONTENT

Nanoscale, definition of nanotechnology, consequences of the nanoscale for technology and society, Moore's law, nano-scale 1D to 3D structures, size effects, specific surface energy and surface stress, technologies for the nanoscale, nano-scale fabrications and manipulation. Nanolithography. Nanoscale Materials and applications, nano composites: specific features of nanoscale growth, nano-scale electronics, safety issues with nanoscale powders, quantum wells, wires, dots and nano-particles, nano-scale bio-medical applications, applications in energy, informatics, medicine, etc. nanoscale properties. Different approaches: Top-down approach: Nanolithography, chemical vopour deposition (CVD), micro-electro mechanical system (MEMS), Wet deposition techniques, bottom up approach, sol-gel processing, colloidal, nano-particles, organic nano-material and self assembly structure and properties characterization of nanomaterial (diffraction techniques, spectroscopy and modeling).

Recommended Books

1. Charles P. Poole Jr. and Frank J. Qwens, "Introduction to Nanotechnology", Wiley Publications, 2003
2. B. Bhushan, "Handbook of Nanotechnology" Second Edition, Springer, 2007
3. L. L. Shaw, "Processing and Properties of Structural Nanomaterial", Wiley Publications, 1995

ET505P (B) COMPUTER ARCHITECTURES

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course is advanced level electronics and telecommunication engineering which will further strengthen the knowledge of the students. The course explores knowledge of digital integrated circuit design. The course comprises of digital techniques, architectural design concepts and system performance improvement through hardware design.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of digital electronics and CPU, memory design concepts

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. solve computer architectural design problems.
2. perform computer CPU and memory system design.
3. demonstrate hardware and software design alternatives and procedures.
4. apply mathematics in high performance computer system analysis and optimal design.

COURSE CONTENT

Overview of parallel and pipelining processing: Architectural classification, case study of Intel Itanium processor (IA64), performance analysis. Pipeline architecture: Principles and implementation of pipelining, hazards and resolving techniques, data buffering techniques, job sequencing and collision, advanced pipelining techniques, loop unrolling techniques, out of order execution, software , scheduling, predicated execution, speculative loading, register stack engine, software pipelining, very long instruction word (VLIW) processor, Case study: superscalar architecture- Pentium. Vector and array Processor: Basic vector architecture, Case study: Cray architecture Single instruction, multiple data (SIMD) computer organization masking and data network mechanism, inter process element (PE) communication, interconnection networks of SIMD, static and dynamic network, cube hyper cube and mesh interconnection network. Parallel algorithms for array processors: Matrix multiplication. sorting, multiport memory model, memory contention and arbitration techniques, cache coherency and bus snooping, massively parallel processors (MPP), cluster and network of work stations (COW's and NOW's), chip multiprocessing (CMP), multithreaded architecture, parallel programming techniques: message passing program development, synchronous and asynchronous message passing, software issues.

Recommended Books:

1. K.I. Hwang, F. A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill 1995

2. K. Hwang, “Advanced Computer Architecture”, Tata McGraw-Hill Edition, 2001
3. V. Rajaraman, L Sivaram Murthy, “Parallel Computers”, Prentice Hall, 2004
4. W. Stallings, “Computer Organization and Architecture (Designing for Performance)” Sixth Edition, Prentice Hall, 2010
5. K. Hwang, “Scalable Parallel Computing”, McGraw-Hill, 1998
6. H. Stone, “High Performance Computer Architecture”, Prentice Hall

ET505P (C) ROBOTICS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course is advanced level electronics and telecommunication engineering which will further strengthen the knowledge of the students. The course explores knowledge of robotics. The course comprises study of mechanical and instrumentation systems including digital techniques.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of automation and control concepts

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. solve, build, design and model robotic problems.
2. demonstrate and validate robotic systems hardware and software.
3. design automation concept and use of programming languages.
4. model mathematically for analysis and optimal design of robotic systems.

COURSE CONTENT

Introduction, background, robot arm kinematics and dynamics, manipulator trajectory planning and motion control, robot sensing, robot programming languages, machine intelligence, robot arm kinematics: the direct kinematics problem, the inverse kinematics solution, robot arm dynamics: Generalized D' Alembert equations of motion, planning of manipulator trajectories: General considerations on trajectory planning, planning of manipulator Cartesian path trajectories control of robot manipulators and sensing: Control of the puma robot arm, computed torque technique, near-minimum-time control, variable structure control, nonlinear decoupled feedback control, resolved motion control, adaptive control, control of actuators in robotic mechanism: Robotic joint, stepper motor, brushless dc motors, hydraulic/pneumatic actuators, introduction to sensing, range sensing, proximity sensing, touch sensors, optical position, velocity, accelerometer sensors force and torque sensing. low level vision and high level vision: Image acquisition, illumination techniques, imaging geometry, basic relationships between pixels, preprocessing, segmentation, description, segmentation and description of three dimensional structures, recognition, interpretation. robot programming languages: Characteristics of robot-level languages, characteristics of task-level languages, robot intelligence and task planning, introduction, problem reduction, use of predicate logic, means-ends analysis, problem solving, robot learning, robot task planning.

Recommended Books

1. Richard D Klafer, Thomas A. Chmielewski, Michael Negin, "Robotic Engineering", Indian Reprint, Prentice Hall of India, 1998

2. K. S. Fu, R. C. Gonzalez, C. S. G. Lee, “Robotics- Control , Sensing, Vision , and Intelligence’’, McGraw-Hill International Editions, 2000
3. R. K. Mittal, I. J. Nagrath, “Robotics and Control”, McGraw-Hill, Reprint 2012
4. Mikell P. Groover, Mitchell Weiss, Nagel Odrey, “Indusrial Robotics : Technology, Programming, Applications”, Third Edition, McGraw-Hill, 2012
5. Mark K. Spong, M. Vidyasagarwiley, “ Robotics Dyanamics and Control”, First Reprint, Wiley, 1998
6. R. R. Murphy, “Introduction to Robotics”, Eastern Economy Edition, Prentice Hall India, 2012

ET506P IMAGE PROCESSING AND COMPUTER VISION, AND BIOMEDICAL ENGINEERING LAB

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

Conduct of Lab

It includes custom made Experiments/ Assignments based on syllabi of ET501P and ET504P.

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.

ET 507P EMBEDDED SYSTEMS AND DIGITAL INTEGRATED CIRCUIT DESIGN LAB

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

Conduct of Lab

It includes custom made Experiments/ Assignments based on syllabi of ET502P and ET503P.

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.

ET 508P SEMINAR I

Teaching Scheme: 02 PR Total: 02 **Credit:** 01
Evaluation Scheme: 50 ICA **Total Marks:** 50

COURSE DESCRIPTION AND OBJECTIVES

In this course, students will study recent trends in electronics, telecommunication or allied field which will provide them the appropriate exposure to the global scenario. In addition, the students will participate in five activities viz observation, question, critique, research, and presentation that will improve their oral presentation skills. The oral dissemination and defense of scientific and engineering concepts is a fundamental communication tool that the students will employ throughout their professional career.

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. present, discuss and analyze main issues and important themes of research in the field addressed in the seminar.
2. correlate and describe the field in a reflexive manner.
3. compare different methodological and theoretical approaches within the field.

COURSE CONTENT

- It includes detailed study of any one recent topic apart from the UG/PG curriculum in the field of electronics, telecommunication or allied field of student's own choice approved by the department and presentation based on topic studied in the presence of other students followed by question/answer session.
- The seminar shall introduce the important aspects, main issues and problems of the industry, field, research, etc of the selected topic.
- Students shall submit the seminar report on the same topic in the format as approved by the institute which shall include following points.

i. Introduction to topic, concept and principles
ii. Literature survey/ Background
iii. Functional and technical details
iv. Present status, comparison with similar technique, and applications
v. Conclusion and future scope
vi. References

Topic of seminar shall be finalized before last date as specified in academic calendar and it shall not be changed later. However, minor change in the title is permissible with prior approval of Head of Department (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 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.

ET551P DIGITAL COMMUNICATION AND CODING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100

COURSE DESCRIPTION

The course comprises of analysis of digital modulation schemes, information theory, source and channel coding techniques. The course enables the students to select, design and formulate a suitable source coding technique for data compression and a suitable channel coding technique for error detection and correction.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of analog and digital modulation schemes

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. identify a suitable combination of modulation schemes for a digital communication system design.
2. select, design and implement a suitable source and channel coding technique according to the application.
3. demonstrate the ability to solve the source and channel coding examples for the given problems.

COURSE CONTENT

Overview of digital modulation techniques**:** Binary phase shift keying **(**BPSK), differential phase shift keying (DPSK), quadrature phase shift keying (QPSK), quadrature amplitude phase shift keying **(**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, discrete cosine transform (DCT), quantization, joint picture expert group (JPEG) and motion picture expert group (MPEG) Standard: JPEG standard and its modes, color image coding, monochrome and color television standards, video compression, motion estimation and compensation, block matching algorithms and criteria, MPEG standard-1,2,4, audio coding, psychoacoustic models, adaptive differential pulse code modulation (ADPCM), MPEG-Audio, Dolby audio, channel coding: Channel coding, models, 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, convolution encoding and decoding algorithms such as Viterbi, sequential and feedback, Reed Solomon codes and turbo codes.

Recommended Books

1. Simon Haykin, “Digital Communication”, Second Edition, Wiley Publication, 2001
2. Bernard Sklar, “Digital Communication: Fundamentals and Applications”, Second Edition, Pearson Education Asia, 2009
3. B. P. Lathi, “Modern Digital and Analog Communication Systems”, Third Edition, Oxford Press, 2010
4. R. R. Gulati, “Television Engineering”, Prentice Hall of India, 2007

ET 552P DIGITAL SIGNAL AND SPEECH PROCESSING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100

COURSE DESCRIPTION

This course is at advanced level electronics and telecommunication engineering, which will further strengthen the knowledge of the students. The course explores knowledge of digital signal processing fundamentals, modeling, analysis, synthesis, and coding of speech.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of signal and systems, vocal track, linguistic

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. solve engineering speech modeling problems.
2. assess mathematical and theoretical concepts of speech processing.
3. apply fundamental ideas of digital signal processing.
4. demonstrate analytical ability and optimal design of systems related to speech.
5. modify speech processing system using advance methods and techniques for parameter estimation.

COURSE CONTENT

Overview of digital signal processing (DSP): Signal transforms, filter and filter design techniques. Digital models for speech signal: The acoustic theory of speech production, lossless tube model, digital models, time domain models, digital representation of speech waveform, short time Fourier transform (STFT). Homomorphic speech processing, linear predictive coding of speech, digital speech processing for man machine communication by voice, Daubechies wavelet representations, fundamentals of multi rate systems, basic multi rate operations decimation, interpolation, frequency domain analysis of decimator and interpolator, design of decimator and interpolator, Parseval's theorem, speech processing applications and multi rate DSP.

Recommended Books

1. L. R. Rabiner, and R. W. Schafer, “Digital Processing of Speech Signals”, Pearson Education, Fourth Reprint 2009.
2. J. G. Proakis, and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithm and Applications”, Third Edition, NJ: Prentice Hall. 1996.
3. E. C. Iflechor and B. W. Jervis, “Digital Signal Processing: A practical approach”, Pearson Education, 2002
4. L. R. Rabiner and B. Gold, “Theory and Applications of Digital Signal Processing”, Prentice Hall of India, 1987

ET 553P COMPUTER NETWORKS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course introduces students to the networking field. It covers basic concepts of computer networking. The topics covered include architecture of the Internet, popular applications, congestion control protocols, routing and switching, wireless networking. Upon completion of this course students should be able to perform tasks related to networking, mathematics, terminology, and models, media, ethernet, sub netting.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Basic and computer science

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. describe the major computer networks components
2. develop the mechanism required for exchange of data among computers, servers and other data among computer
3. examine the internal mechanism and technology of computer networks

COURSE CONTENT

Network design issues: Voice over internet protocol (VoIP) system architecture, protocols for the transport of voice media over IP network, signaling. Public switched telephone network (PSTN) gateways, VoIP applications. Small computer system interface (SCSI) protocols and architecture: Redundant array of independent disks (RAID), backup and mirroring, network attached storage including network file system (NFS), common internet file system (CIFS) and direct access file system (DAFS). Introduction to code-division multiple access (CDMA) and spread spectrum system, overview of information theory. Lossless compression, lossy compression, wavelet compression. Internet security: A model for internet security, security attacks, cryptography, packet switched networks and integrated services digital network (ISDN), open systems interconnection (OSI), ethernet (IEEE 802.3), token ring (IEEE 802.5), wireless local area network (LAN) (IEEE 802.11) wireless LAN standards: IEEE 802.11b, fiber distributed data interface (FDDI), distributed-queue dual-bus network (DQDB), switched multimegabit data service (SMDS), integrated services digital network (ISDN) - overview, interfaces and functions, layers and services - signaling system 7 - broadband ISDN architecture and protocols, asynchronous transfer mode (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, differentiated services.

Recommended Books

1. W. Stallings, Prentice Hall, “High-Speed Networks: TCP/IP and ATM Design Principles”, 1998
2. W. Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM”, Fourth Edition Pearson education Asia, 2002
3. L. Gracia, Widjaja, “Communication Networks ", Tata McGraw-Hill, New Delhi, 2000
4. J. Walrand and P. Varaiya, “High Performance Communication Networks”, Second Edition, Harcourt and Morgan Kauffman, London, 2000
5. Andrew S. Tanenbaum, “Computer Networks” , Fifth Edition, Pearson Education India, 2013
6. Kurose and Ross, “Computer Networking-A top-down approach”, Seventh Edition, Pearson, 2017

ET554P STATISTICAL INFORMATION PROCESSING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course is aimed at characterizing and applying probabilistic techniques in modern decision systems such as information systems, receivers, filtering and statistical operations. Statistical information processing is introduced for applications to signal processing and communications systems. The course also aims at developing frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of mathematics and statistics, probability theory, basics of mathematical modeling

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
2. demonstrate mathematical modeling and problem solving using such models.
3. evolve comparatively key results developed in this course for applications to signal processing, communications systems.
4. develop frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

COURSE CONTENT

Review of random variables: Probability concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; vector-space representation of random variables, vector quantization, Tchebaychef inequality theorem, central limit theorem, discrete and continuous random variables. Random process: expectations, moments, periodicity, discrete-time random processes stationary process, autocorrelation and auto covariance functions, spectral representation of random signals, properties of power spectral density, Gaussian process and white noise process. Random signal modeling: Auto-regressive moving-average (ARMA) models, hidden Markov model and its applications, linear system with random input, forward and backward predictions, Levinson durbin algorithm. Statistical decision Theory: Bayes' criterion, binary hypothesis testing, M-ary hypothesis testing, mini-max criterion, Neyman-Pearson criterion, composite hypothesis testing. Parameter estimation Theory: maximum likelihood estimation, generalized likelihood ratio test, criteria for good estimation, Bayes' estimation, minimum mean-square error estimate, minimum, mean absolute value of error estimate maximum a

posteriori estimate, multiple parameter, best linear unbiased, least-square, and recursive least-square estimation.

Recommended Books

1. Mourad Barkat , “Signal Detection and Estimation”, Artech House, Second Edition, 2005
2. Miller and Chielder, “Probability and Random Processes with Applications to Signal Processing and Communication”, Kindle Edition, 2012
3. George W. Snedecor and William G. Cochran, “Statistical Methods”, Eighth Edition, Wiley Blackwell, 2014
4. Papoulis and S. U. Pillai, “Probability, Random Variables and Stochastic Processes”, Fourth Edition, McGraw-Hill, 2002
5. D. G. Manolakis, V. K. Ingle and S. M. Kogon, “Statistical and Adaptive Signal Processing”, McGraw-Hill, 2000

ET 555P(A) BIOMEDICAL SIGNAL AND IMAGE PROCESSING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

Biomedical signal and image processing involves the analysis of measurements to provide useful information upon which clinicians can make decisions to process these signals using a variety of mathematical formula and algorithms. This course could lead to better diagnosis evaluation, monitoring, and control of diseases. It forms the basis of how engineering aids the field of health care.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of signal and systems, computational engineering

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. understand fundamental aspects biomedical imaging across imaging modalities.
2. design and apply a image processing strategy to extract new biomedical knowledge for improvement of human health.
3. interpret the biomedical imaging problem based on reconstruction and analytical process.
4. choose the research in the field of biomedical imaging.

COURSE CONTENT

Introduction to major modalities for biomedical signal and imaging techniques: electrocardiogram (ECG), nuclear magnetic resonance (NMR), magnetic resonance imaging (MRI), computed tomography (CT) and ultrasound imaging. Speech spectrographic analysis, noise and error propagation in biomedical signal and image data. Fundamental statistical methods for biomedical signal and image data analysis. Biomedical signal processing in time and frequency domain: Fourier and wavelet transform. Biomedical image processing: segmentation, registration and pattern recognition. Mathematical modeling using biomedical signal and image data analysis.

Recommended Books:

1. R. M. Rangayyan, "Biomedical Signal Analysis: A Case study approach", Eastern Economy Edition Press, 2001
2. E. N. Bruce, "Biomedical Signal Processing and Signal Modeling", Wiley Publications, 2007
3. Thomas Martin Deserno (Editor), "Biomedical Image Processing (Biological and Medical Physics, Biomedical Engineering)", Springer, 2011
4. Kayvan Najarian, Robert Splinter, "Biomedical Signal and Image Processing" Second Edition 2012
5. R. Gonzalez, and R. E. Woods, "Digital Image Processing", Second Edition, Prentice Hall, 2002
6. L. R. Rabiner, and R. W. Schafer, " Digital Processing of Speech Signals", Prentice Hall of India, 1978

ET 505P(B) OPERATING SYSTEMS

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course is advanced level electronics and telecommunication engineering which will further strengthen the knowledge of the students. The course explores knowledge of computer systems software and operating systems.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of digital electronics, microprocessor and embedded systems.

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. solve operating system design problems.
2. assess theoretical concepts of resource sharing and scheduling of processor.
3. apply basic ideas of embedded system.
4. develop analytical ability and optimal design of memory management systems.

COURSE CONTENT

Operating system (OS) overview: Fundamentals, objectives and functions, evolution, process concept, interleaved input output and central processing unit (CPU) burst, process states, services for process management, co-operating processes, thread, symmetric multi processing (SMP) and Microkernel's, concurrency problems: mutual exclusion and synchronization, deadlock and starvation, memory management: requirements, partitioning, contiguous and non-contiguous, paging, segmentation – concepts, 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, secondary storage management, distributed operating system: fundamentals, models, message passing, remote procedure calls, shared memory, synchronization, design issues security issues, and protection mechanism, goals of protection, implementation of access matrix, security problems authentication program threats, system threats, threat monitoring.

Recommended Books

1. William Stallings, "Operating Systems", Pearson/ Prentice Hall of India, Fourth Edition, 2002
2. Pradeep K. Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, Eastern Economy Edition, 2007
3. Abranham Silberschat, Peter B. Galvin, "Operating System Concepts", Addition Wiley Publishing Company, 2000
4. Milenkovic, "Operating System Concepts and Design", McGraw-Hill, 1998

ET555P (C) ARTIFICIAL INTELLIGENCE AND NEURAL NETWORK

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE+10 ISA+60 ESE **Total Marks:** 100
Duration of ESE: 3Hrs.

COURSE DESCRIPTION

This course will introduce students to artificial intelligence. It provides comprehensive foundation to artificial neural networks.

DESIRABLE AWARENESS/SKILLS/PRE-REQUISITES

Knowledge of digital electronics concepts.

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. solve engineering design problems using machine learning.
2. test generation and fault simulation, testing, modeling and design of AI machines
3. assess programming languages and natural language processing.
4. apply mathematics for analysis and optimal design of AI systems.

COURSE CONTENT

Introduction: Artificial intelligence (AI), AI application (e-commerce and medicine), representation, properties of internal representation, future systems and issues in design of search programs. Logic programming: introduction to logic, logic programming, forward and backward reasoning, forward and backward chaining rules. Heuristic search techniques, game playing- Min-max search procedure, alpha beta cutoffs, waiting for quiescence, secondary search. Knowledge representation, basic of knowledge representation paradiagrams, knowledge representation using non monotonic logic, statistical and probabilistic reasoning, fuzzy logic, structure knowledge representation, semantic net, frames, script, conceptual dependency learning and planning, 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 neuro-linguistic programming (NLP), syntactic processing, augmented transition network (ATN), semantic analysis, discourse and pragmatic processing, perception, robot architecture, introduction to neural networks and perception and applications.

Recommended Books

1. E. Rich, K. Knight, "Artificial Intelligence", Second Edition, McGraw-Hill, 1991
2. E. Charniak, D. Mcdermott, "Introduction to Artificial Intelligence", Fourth Edition Pearson, 2009
3. Herber A. Simon, "The Sciences of the Artificial", Third Edition , MIT Press, 1995
4. I. Bratko, "PROLOG Programming for Artificial Intelligence", Second Edition, Addison Wesley Longman Publication, 1990

ET 556P DIGITAL SIGNAL AND SPEECH PROCESSING, AND COMPUTER NETWORKS LAB

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

Conduct of Lab

It includes custom made Experiments/ Assignments based on syllabi of ET552 and ET55.

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.

ET 557P DIGITAL COMMUNICATION AND CODING, AND STATISTICAL INFORMATION PROCESSING LAB

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

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.

ET 558P SEMINAR II

Teaching Scheme: 02 PR Total: 02 **Credit:** 01
Evaluation Scheme: 50 ICA **Total Marks:** 50

COURSE DESCRIPTION AND OBJECTIVES

In this course, students will study recent trends in electronics, telecommunication or allied field which will provide them the appropriate exposure to the global scenario. In addition, the students will participate in five activities viz observation, question, critique, research, and presentation that will improve their oral presentation skills. The oral dissemination and defense of scientific and engineering concepts is a fundamental communication tool that the students will employ throughout their professional career.

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. present, discuss and analyze main issues and important themes of research in the field addressed in the seminar.
2. correlate and describe the field in a reflexive manner.
3. compare different methodological and theoretical approaches within the field.

COURSE CONTENT

1. It includes detailed study of any one recent topic apart from the UG/PG curriculum in the field of electronics, telecommunication or allied field of student's own choice approved by the department and presentation based on topic studied in the presence of other students followed by question/answer session.
2. The seminar shall introduce the important aspects, main issues and problems of the industry, field, research, etc of the selected topic.
3. The topic of seminar – II shall be other than that of seminar – I. However, it may be further study of the topic of seminar – I or totally different than the topic of seminar – I.
4. Students shall submit the seminar report on the same topic in the format as approved by the institute which shall include following points.
    i. Introduction to topic, concept and principles
    ii. Literature survey/ Background
    iii. Functional and technical details,
    iv. Present status, comparison with similar technique, and applications
    v. Conclusion and future scope
    vi. References
5. Topic of seminar shall be finalized before last date as specified in academic calendar and it shall not be changed later. However, minor 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 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 601P DISSERTATION – I

Teaching Scheme: (12 hours laboratory work + 4 guide contact hours) / week **Credit:** 09
Evaluation Scheme: 100 ICA + 50 ESE **Total Marks:** 150

*****The details of Dissertation-I are given along with the details of ET651P - Dissertation-II in a combined manner.

ET602 INTELLECTUAL PROPERTY RIGHTS

Teaching Scheme: 01L; Total: 01 **Credits:** 02
Evaluation Scheme: 50 ICA **Total Marks:** 50

COURSE DESCRIPTION

The course is designed to introduce fundamental aspects of Intellectual Property Rights to students who are going to play a major role in development and management of innovative projects in industries. The course introduces all aspects of the IPR Acts. It also includes case studies to demonstrate the application of the legal concepts in engineering, technology and creative design. The course is designed to apply knowledge for sustainable development.

DESIRABLE AWARENESS/SKILLS

General awareness of science, technology, and law

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. understand intellectual property rights and related issues
2. illustrate copyright, authors' rights, licensing and retention of rights
3. analyze the creative commons licensing system

COURSE CONTENT

Overview of intellectual property: Introduction and the need for intellectual property right (IPR), IPR in India – genesis and development, IPR in abroad, some important examples of IPR, licensing and enforcing intellectual property, commercializing inventions, infringement of intellectual property rights, enforcement measures, unfair competition, relationship between unfair competition and intellectual property laws. Patents: Definition and necessity, inventions protected by a patent, searching a patent, drafting a patent, filing a patent, the different layers of the international patent system (national, regional and international options), granting, infringement, macro-economic impact of the patent system, Rights of a patent and extensiveness of patent protection. Utility Models and Copyright: Differences between a utility model and a patent, trade secrets and know-how agreements, copyright - definition, necessity and duration, related rights, distinction between related rights and copyright, rights covered by copyright. Trademarks: Definition, necessity and rights of trademark, kind of signs used as trademarks, types of trademark, function does a trademark perform, protection of trademark, registration of trademark, extensiveness and duration of protection of registered trademark, well-known marks and their protection, domain name and its relation to trademarks.

Recommended Books

1. Karla C. Shippey, "A short course in International Intellectual Property Rights", Third Edition, World Trade Press, 2008
2. N. K. Acharya, "Intellectual Property Rights", Fifth Edition, Asia Law House, 2010
3. T. M Murray and M. J. Mehlman, "Encyclopaedia of Ethical, Legal and Policy Issues in Biotechnology", John Wiley and Sons, 2000

4. Ajit Parulekar and Sarita D'Souza, "Indian Patents Law – Legal and Business Implications", Macmillan India Ltd, 2006.
5. B. L. Wadehra, "Law Relating to Patents, Trade Marks, Copyright, Designs and Geographical Indications", Universal Law Publishing Pvt. Ltd., India , 2000
6. P. Narayanan, " Law of Copyright and Industrial Designs", Eastern Law House, Delhi, 2010

Note:

- **ICA –** Internal Continuous Assessment (50 marks) shall include two evaluation tools viz. assignments (25 marks) and two internal written examinations (25 marks) conducted by course teacher. Assignment tool shall support for regular submission of assignments and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (assignment). The performance shall be assessed assignment wise using internal continuous assessment format **(S 10).** First internal written examination shall be conducted at middle of semester on 50% syllabus and second internal written examination shall be conducted at end of semester on remaining 50% syllabus.

ET603P RESEARCH METHODOLOGY

Teaching Scheme: 01 L + 01 T, Total: 02 **Credits:** 02
Evaluation Scheme: 50 ICA **Total Marks:** 50

COURSE DESCRIPTION

This course is aimed at introducing the basic concepts and methods of research. The course also deals with several aspects of research such as formulating a research problem, literature review, and sampling, and data collection, statistical analysis of data, graphical representation of results, report writing, anti-plagiarism check and research ethics.

DESIRABLE AWARENESS/SKILLS

Knowledge of statistics, general awareness of research

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. formulate a research problem.
2. analyze research related information.
3. adapt research ethics.

COURSE CONTENT

Foundation of research: concept and objectives of research, scientific research, significance of research methodology in engineering research. types and methods of research classification of research, pure and applied, formulative, descriptive, diagnostic, evaluation, action, experimental, historical research, etc. Analytical study of statistical method, surveys, case study, field studies. Literature review: concept, need and objectives of literature reviewing, literature search procedure. Research planning: planning process, selection of a problem for research, formulation of the selected problems, hypothesis formation, measurement, research design/plan. Sampling: sampling techniques or methods, choice of sampling techniques, sample size, sampling and non-sampling errors, estimation of population proportion and population mean, estimation of standard error and confidence interval. Data collection: meaning and significance of data, methods of data collection, design of experiments, simulation. Processing of data: Editing, classification and coding, transcription, tabulation, statistical software, graphical representation, measures of relationship, simple regression analysis, multiple correlation and regression, partial correlation, statistical analysis of data. Measures of central tendency, measures of dispersion, measures of association/relationship. Report writing: Research report format, principles of writing, documentation, data and data analysis reporting in the report, anti-plagiarism check and research ethics.

Recommended Books

1. C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publishers, 2004
2. Fisher R. A, "Statistical Methods for Research Workers", Cosmo Publications, New Delhi, 2007
3. D. C. Montogomery, "Design and Analysis of Experiments", John Wiley, 2001
4. Minitab® online manual

ET651P DISSERTATION – II

Teaching Scheme: (16 hours laboratory work + 4 guide contact hours) / week **Credits:** 10
Evaluation Scheme: 100 ICA + 150 ESE **Total Marks:** 250

ET601P DISSERTATION – I AND ET651P DISSERTATION – II

COURSE DESCRIPTION

The dissertation should be based on the knowledge acquired by the student during the course work and should contribute to the needs of the society. The dissertation aims to provide an opportunity of designing and building, complete system or subsystem in the domain area.

DESIRABLE AWARENESS/SKILLS

Knowledge of the domain of dissertation

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. synthesize acquired knowledge and skills and apply to solve new technical problem.
2. select a suitable technique from different methodologies, and forms of analysis to produce a suitable research design.
3. present the experimental work done in a written report.
4. present / publish the work in international/ national conference and/or reputed journals.

Dissertation will consist of a system development in Software/ Hardware.

In Dissertation – I, the student should present the progress report of the dissertation including problem statement, literature survey, project overview and scheme of implementation. Before the end of the semester, student shall submit one copy of progress report in the prescribed format, reporting the total work completed by him/her.

Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, and a record of continuous progress.

Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress / performance of the student based on report, presentation and depth of understanding.

Dissertation – II

In continuation with the work completed in semester III, student shall complete the implementation of ideas given in synopsis of dissertation, so that working model of dissertation

shall be complete before the end of semester. Students shall submit final dissertation report in prescribed format which shall include the work completed in semester III also.
Dissertation report shall include -

(i) Literature review
(ii) Concepts, problem definition
(iii) Functional and technical details
(iv) Results and discussion, conclusions and contributions
(v) Comparison with contemporary techniques
(vi) Future scope
(vii) References

The candidate has to present / publish at least one paper in reputed national / international journal/ conference based on the dissertation work before submission of the dissertation report.

Phase – II deliverables: Record of continuous progress, dissertation report as per the specified format, developed system in the form of hardware and/or software.

Phase – II evaluation

i. Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by guide throughout the semester and by a departmental committee before the end of the semester appointed by the Head of Department.
- Guide shall judge the student on the basis of regularity, work completed, presentation, effort taken by student, etc.
- The candidates shall give a presentation on the dissertation topic before a departmental committee along with demonstration of working model.
- The student shall be assessed on the basis of presentation/communication skill, depth of understanding, selection of dissertation topic, literature survey, work completed, result and dissertation - II report, etc.

ii. End Semester Examination (ESE)

- The ESE shall be evaluated by a panel of two examiners viz. guide and external examiner.
- The candidates shall present the work on the dissertation topic before the examiners and shall be assessed on the basis of presentation/communication skill, depth of understanding, selection of dissertation topic, literature survey, work completed, result and dissertation - II report, etc.