THIRD YEAR OF BACHELOR'S DEGREE COURSE IN ELECTRONICS AND TELECOMMUNICATION

SEMESTER V:

Sub Code	Subjects	Scheme Of Instruction			Scheme Of Examination					
					Th Dur (Hr)	Marks				
		L	T	P		Th	S	P	O	Total
ETC 5.1	Probability Theory & Random Processes	3	1	0	3	100	25	-	-	125
ETC 5.2	Control System Engineering	3	1	2	3	100	25	-	-	125
ETC 5.3	Transmission Lines & Wave guides	3	1	2	3	100	25	-	-	125
ETC 5.4	Digital Communication	3	1	2	3	100	25	-	50	175
ETC 5.5	Signals & Systems	3	1	0	3	100	25	-	50	175
ETC 5.6	Computer Organisation & Design	3	1	2	3	100	25	-	-	125
		18	6	8	-	600	150	-	100	850

SEMESTER: VI

Sub Code	Subjects	Scheme Of Instruction			Scheme Of Examination					
					Th Dur (hrs)	Marks				
		L	T	P		Th	S	P	O	Total
ETC 6.1	Data Structures using C^{++}	3	1	2	3	100	25	-	-	125
ETC 6.2	Advanced Microprocessors	3	1	2	3	100	25	-	50	175
ETC 6.3	Electronic Instrumentation	3	1	2	3	100	25	-	50	175
ETC 6.4	Power Electronics	3	1	2	3	100	25	-	-	125
ETC 6.5	Antenna & Wave Propagation	3	1	0	3	100	25	-	-	125
ETC 6.6	Digital Signal Processing	3	1	2	3	100	25	-	-	125
		18	6	10	-	600	150	-	100	850

ETC 5.1:PROBABILITY THEORY AND RANDOM PROCESS

Lectures per week	:4 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be answered from each module	:1
Total number of questions to be answered	:5

Measure of central tendency, measures of dispersion, moments, skewness and kurtosis.

Correlation and Regression: Regression lines, linear correlation co-efficient and its properties.
Axiomatic and empirical approach to probability, addition and multiplication theorems, conditional probability and Baye's theorem.
Random variables: Both discrete as well as continuous probability distribution, density function, expectation, variance and moment generating function.

MODULE II

Two dimensional random variables: Discrete and continuous –joint probability distribution, joint density function, marginal distributions and density functions, conditional distributions and density functions, expectation and variance, statistical independence and sum of independent random variables.
Discrete distributions: Binomial, Poisson, Geometric-expectation, variance, moment generating function and moments about the mean as well as the origin.
Continuous distributions: Normal (Gaussian)- Exponential, uniform –expectation, variance, moment generating function and moments about the mean as well as the origin.

MODULE III

Testing of Hypothesis: Type I and Type II errors, Large sample theory, tests involving normal distribution; small sample theory, student's distribution, Chi-Square distribution, F-distribution and tests involving these distributions.
Testing for goodness of fit and test for independence, using chi-square distribution.
Analysis of Variance-One factor and two factor experiments.

MODULE IV

Stochastic Processes: States, state –space, auto-correlation and auto-covariance functions; associated correlation coefficient, cross –correlation and cross-covariance functions; associated correlation co-efficient, strict sense stationarity, statistical independence, second order processes and wide sense stationarity. Discrete time Markov chains, Poisson processes. Queuing theory: M/m/n queues with the number of servers n being finite.

Books:

1. Probability and Statistics in Engineering and Management Science by William W. Hines and Douglas C. Montgomery.

2. Queuing Systems vols I and II by L. Kleinrock
3. Stochastic Processes by J.Medhi
4. Probability, Random variables and Stochastic Processes by Athanasios Papoulis.
5. Probability, Random variables and Random Signal Principles by Peyton Z. Peebles, Jr.
6. Statistics by Murray R. Spiegel and Harry J. Stephens, Schaum's outlines.
7. Probability and Statistics with Reliability, Queuing and Computer Science Applications by Kishor S. Trivedi

ETC 5.2:CONTROL SYSTEM ENGINEERING

Lectures per week	:4 Hours
Practical per week	:2 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be answered from each module	:1
Total number of questions to be answered	:5

MODULE I

Introduction to control systems; types of control systems, basic concept of open-loop and closed-loop control systems; mathematical modeling and representation of mechanical (translational & rotational) and electrical systems; Conversion of mechanical to analogous electrical systems (force-voltage and force-current analogy); block diagrams, signal flow graphs and transfer functions.

MODULE II

Transient response of first and second order systems; performances criteria, sensitivity, accuracy and performance indices; Type -0, -1 and –2. control systems; Steady state error and error co-efficient; Stability concept, Routh-Hurwitz criteria; root-locus techniques.

MODULE III

Frequency-domain analysis, polar-plots, Bode-plots and Nyquist-plots; Relative stability using Nyquist-plot, phase- and gain-margin. Constant-M and constant-N circles; Nichol's chart.

MODULE IV

Design of basic compensators, Cascade compensation in time and frequency domain;

Lead, Lag and Lead-Lag compensation design in time and frequency domain

Books:

1. Control Systems-Principles and Design by M. Gopal, Tata Mc Graw Hill

2. Control Systems Engineering by I.J. Nagrath and M. Gopal, The New Age International (P) Ltd., New Delhi
3. Automatic Control Systems by B.C.Kuo ,PHI

Reference Books:

1. Modern Control Engineering by K.Ogala, PHI
2. Control Systems by A.Nagoor Kani, RBA Publications, Chennai

ETC 5.3:TRANSMISSION LINES AND WAVEGUIDES

Lectures per week	:4 Hours
Practical per week	:2 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be answered from each module	:1
Total number of questions to be answered	:5

MODULE I

Transmission-line theory:

Analysis of a uniform transmission-line made up of a cascade of incremental sections; line constants; characteristic impedance and propagation constant; The general solution; Input impedance; Infinite line and its equivalence to a matched line; Plots of voltage- and current – phasors along a line; Wavelength and velocity of propagation; Expressions for the attenuation constant α and the phase constant β in terms of line constants.

Waveform distortion; the distortionless lines; the telephone cable; Inductance loading.

Reflection on an unmatched line; voltage- and current- phasors; Energy view point of Reflection; Reflection coefficient: Input and transfer impedance of a line; Open- and short-circuit lines.

MODULE II

Transmission-lines at High Frequencies:

(i) Lines of zero Dissipation (Loss-less Lines):

Line constants; voltage- and current- distributions on a Loss-less line for various terminations; Current- and voltage-phasors on the line; standing wave, Standing Wave Ratio (SWR); Directional coupler.

Input impedance for various terminations; Power and impedance measurements on the line; Reflection losses.

MODULE III

The light wave, Quarter-wave and Half-Wave lines, Impedance matching; Single-stub matching on line; The Smith-circle diagram and its applications; Single-stub matching with Smith chart; Double-stub impedance matching.

(ii) Lines of small Dissipation:

Line constants; characteristic impedance, propagation constant; voltages and currents on the line; Input impedances of open- and short-circuited lines; Quarter and half-wave lines; Tapped quarter-wave lines and their applications.

MODULE IV

Guided Waves:

Waves between parallel planes; TE and TM waves; Characteristics of TE and TM waves; TEM waves; velocities of propagation.

Waveguides:

Rectangular guides: TM waves, TE waves; Impossibility of TEM waves in Waveguides; Methods of excitation.

Circular guides: TM and TE waves.

Wave impedances and characteristic impedance; Transmission line analogy; Waveguide discontinuities.

Text books:

1. Networks, Lines and Fields by J.D. Ryder, PHI Pvt. Ltd., 1997
2. Electromagnetic Waves Radiating Systems by E.C. Jordan and K.G. Balmain, PHI, New Delhi, 1979.

Reference book:

1. Electronics and Radio Engineering by F.E. Terman, Mc Graw Hill Book Co., 1955.
2. Fields and Waves in communication circuits by Ramo & Whinnery, John, Wiley & Son, Tokyo, 1965.

ETC 5.4 DIGITAL COMMUNICATION

Lectures per week	:4 Hours
Practical per week	:2 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Maximum marks for the oral	:50
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be	

answered from each module :1
Total number of questions to be answered :5

MODULE I

Sampling theorem, Mathematical and graphical proof of sampling and reconstruction using Impulse train; Sampling and reconstruction using pulse train; Basic principles of PAM, PWM and PPM, their generation and detection.

TDM, comparison of TDM with FDM; Typical multiplexed systems; Signal –to-noise ratio calculations for PAM, PWM and PPM and their comparisons.

MODULE II

Pulse code modulation, generation and detection of PCM, quantization, companding, differential PCM; Delta modulation, Adaptive delta modulation; Signal-to-Noise Ratio calculations of PCM, DM and TDM-PCM, their comparisons.

Fundamentals of Binary ASK, PSK and FSK, generation and detection of BASK, BPSK and BFSK; Fundamentals of QPSK and DPSK, generation and detection of QPSK and DPSK, generation and detection of QPSK and DPSK, M-Ary PSK signaling schemes, equalization principles; Baseband data transmissions.

MODULE III

Information; Marginal, conditional and joint Entropies; Channel capacity, efficiency; Discrete communication channels; Shannon's limit, continuous communication channels, Channel with finite memory.

General principles of coding, necessary and sufficient condition for noiseless coding, Shannon's noiseless coding theorem, Coding efficiency, Shannon-Eano and Huffman coding; Error control, Hamming codes, Linear block codes, Cyclic Redundancy codes, Majority logic coding and decoding; Two dimensional coding, Algebraic coding, Trellis diagram.

MODULE IV

Simple telephone communication, Simplex, half-duplex and full-duplex telephone circuits, Side tones, relays, bridges, Local battery exchange, Central battery exchange, signaling tones, Facsimile.

Principles of common control, Touch tone dial telephone, Dual-tone-multi-frequency signaling, stored program control, Centralized and distributed SPC, Single stage and multistage networks, Time division space switching, Time division time switching, Time multiplexed space switching, Time multiplexed time switching,

Network Time division traffic, Grade of service and blocking problem.

Books:

1. Principles of Communication Systems by Taub and Shilling, Tata Mc Graw Hill.
2. Principles of Communication Systems by B.P. Lathi, PHI l publication.
3. Principles of Digital Communication Systems by B.P. Lathi, PHI International publications.
4. Communication Systems by Bruce Carlson, Tata Mc Graw Hill
5. Digital and Analog Communication Systems by K. Sam Shanmugham, Wiley Eastern.

6. Principles of Digital Communications by Das, Mullic and Chattergy, Wiley Eastern Publications
7. Telecommunication Switching Systems and Networks by Thiagarajan Vishwanathan, PHI Publications.

ETC 5.5: SIGNALS AND SYSTEMS

Lectures per week	:4 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Maximum marks for the oral	:50
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be answered from each module	:1
Total number of questions to be answered	:5

MODULE I

Introduction: Definitions and concepts of different types of signals; Continuous-time and discrete-time signals; Transformation of independent variable; Exponential and sinusoidal signals; unit impulse and unit step functions.

Systems: Continuous-time and Discrete-time systems and basic system properties.
MATLAB programs.

Linear time invariant (LTI) systems: Introduction; Discrete-time LTI systems, the convolution sum; continuous –time LTI systems; the convolution integral; Properties of LTI systems
MATLAB programs.

MODULE II

Fourier Series: Introduction; response of LTI systems to complex exponentials; Fourier series representations of continuous-time periodic signals; Convergence of the Fourier series; properties.

Fourier series representation of discrete-time periodic signals; propertied of discrete-time Fourier series. MATLAB programs
Continuous-time Fourier Transform: Representation of a periodic signals; Fourier transform of periodic signals and their properties; Convolution property; multiplication property. MATLAB programs.

MODULE III

Discrete-time Fourier transforms: Representation of aperiodic signals; Fourier transform of periodic signals; properties; convolution property; multiplication property.

Introduction to Discrete Fourier Transforms (DFT): Frequency-domain sampling, properties of DFT; Circular convolution and linear convolutions.

Sampling: Introduction, representation of continuous-time signals by its samples; Sampling theorem, reconstruction of a simple from its samples using interpolation; the effect of undersampling; aliasing, Discrete-time processing of continuous-time signals; Sampling of discrete-time signals; MATLAB exercises.

MODULE IV

The Laplace Transform: Introduction; Laplace Transforms; the region of convergence; Inverse Laplace transforms; Analysis and characterization of LTI systems using the Laplace transforms; Unilateral Laplace transform.

The Z-transform: Introduction; Z-transform; the region of convergence; the Inverse Z-transform; properties of Z-transform; Analysis and characterization of LTI systems using Z-transforms, unilateral Z-transforms. MATLAB programs.

Books:

1. Signals and Systems by Alan V. Oppenheim, A. S. Willsky, PHI
2. Digital Signal Processing by John G. Proakis & D. G. Manolakis.
3. Principles, Algorithms and Applications by PHI

References Books:

1. Digital Signal Processing by S.Salivahanan, A.Vallavaraj and C. Gnanapriyua, Tata Mc Graw Hill.
2. Signals and Systems by I.J.Nagrath, Sharan, R. Ranjan, and S.Kumar, Tata Mc Graw Hill

ETC 5.6:COMPUTER ORGANISATION AND DESIGN

Lectures per week	:4 Hours
Practical per week	:2 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be answered from each module	:1
Total number of questions to be answered	:5

MODULE I

Register Transfer Language, Bus Transfer (Bus System with multiplexer & 3- state_buffers), Memory Transfer (Memory Read & Write), Arithmetic Micro operations (Binary Adder, Incrementer & Composite Arithmetic circuit for all arithmetic micro_operations), Logic micro operations (Hardware implementation using flip-flops & Applications i.e. Selective Complement, Clear, Mask, Insert, Compare); Shift Micro operations (Logical, Circular,

Arithmetic along with Hardware implementation), Arithmetic logic shift unit, Control functions and its generation.

Instruction codes, Computer Registers, Computer Instruction, (MRI, RRI, IOI), Timing & Control, Instruction Cycle (Fetch, Indirect, Execute and interrupt), Execute cycles for RRI, MRI and IOI, input, output and interrupt, design of basic computer

MODULE II

Micro programmed Control Unit: Micro programmed Control Organisation, Control Memory, Address Sequencing, Conditional Branching, Mapping of Instruction, Microinstruction format, Symbolic Microinstructions, symbolic Micro program, Binary Micro program, Design of Micro programmed control unit, Micro program Sequencer.

For fixed point numbers
Computer Arithmetic: Addition & Subtraction with Signed Magnitude Data (algorithm, hardware implementation & hardware algorithm), Addition & Subtraction with 2's complement data (algorithm, hardware implementation), Booth's multiplication Algorithm for signed 2's complement data (hardware included), hardware implementation & hardware algorithm for multiplication of signed magnitude data, Division Algorithm (hardware implementation for signed magnitude data and hardware algorithm).
Floating Point Number: Definition of Mantissa, Exponent,
Normalized mantissa & Biased exponent.
Representation of floating point number in registers.

Memory Organisation: memory Hierarchy, Main Memory [RAM & ROM], including Memory map & interfacing to CPU, Associative memory [only definition], Cache memory [Associative, Direct & Set-Associative Mapping], Virtual Memory [only definition]

MODULE III

CPU: General register organisation, control word, stack organisation [Memory, Stack, Push & Pop Instructions, Reverse Polish Notation], Instruction Formats, Addressing Modes, Data Transfer Instructions, Data Manipulations Instructions, Program Control Instructions
Types of Interrupts
8085 Microprocessor pinout and signals, internal structure, Demultiplexing Address/Data bus, Generating Control Signals, Timing Diagrams for Opcode Fetch, Memory Read and Write Signals. Instructions cycle, Machine cycle and T-states for different instructions.

Interfacing of memory to 8085.

MODULE IV

Introduction to 8085 instructions & writing in assembly language.

- Data transfer instructions; Arithmetic instructions, Logic instructions, Branch instructions, Machine instructions.
- Counters & Time delays using 1 register, using register pair & a loop within a loop technique.
- Instructions related to stacks & subroutines.

- Interrupts [RST, Vectored interrupts i.e. TRAP, RST 7.5,6.5,5.5), SIM & RIM instructions].

Text Books:

1. Computer System Architecture, Morris Mano. M. PHI
2. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, Penram International Publishing (India).

Reference Books:

1. Computer Organisation by Hamacher, Vranesic and Zaky, McGraw Hill.
2. Computer Architecture and Organisation by J. Hayes, McGraw Hill International Edn.
3. Introduction to microprocessor by Aditya Mathur, Tata McGraw hill.
4. Microprocessor and Microcomputer based System Design by Rafiquzzaman, USB, New Delhi.
5. Computer Organization and Architecture by William Stallings.
6. Microprocessors and Microcomputers by B. Ram, Tata McGraw Hill.

ETC 6.1 DATA STRUCTURES USING C++

Lectures per week	:3+1 Hours
Practical per week	:2 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be answered from each module	:1
Total number of questions to be answered	:5

MODULE I

Object Oriented Programming:
Basic data types: Objects, classes; Declarations and definitions; the main () function; Arithmetic operators; Logical operators; Conditional expressions (if, if-else, switch, operator ?); Loops (while, do..while, for); Comma operator; Arrays (one-dimensional, two-dimensional); Input and output.

MODULE II

Constructors and Destructors: Constructor functions; Dynamic memory allocation; Pointers; the new operator.
Argument passing in function calls: Passing by value and reference; the const key word; Copy constructors.
Function and operator overloading: the overload assignment operator.

Inheritance: Code reuse; Constructors and inheritance; Function overloading in derived classes; Pointers and virtual functions; Destructors and virtual destructors.

MODULE III

Stacks and Queues: Structure and implementation; Postfix notation; Circular Queues.
Templates: Definition and use; Template functions.
Sets: Basic operations; Designing the set data structure.
Linked Lists: Single linked lists; Linked stacks and Queues; Doubly linked lists; Circular linked lists.
Trees: Binary trees; Definitions; Tree operations.
Graphs: Definitions; Implementation; Graph Traversals (Depth-first and Breadth-first); Topological sorting (Depth-first and Breadth-first);

MODULE IV

Searching: Sequential search; Binary search; Templates for searching algorithms (Sequential search and Binary search).
Sorting: Insertion sort; Selection sort; Merge sort; Quick sort-basics, Implementation in an array.
Tables and Hashing: The table data structures; Hashing- principles, choosing a hash function; collision resolution with open addressing (Linear and quadratic probing) and chaining.

Text Books:

1. Data Structures using C++ by Sartaj Sahni, Tata McGraw Hill.
2. Introduction to Data Structures and Algorithms with C++ by Glenn W. Rowe, Prentice Hall, India.

Reference Books:

1. Data Structures using C and C++ by Y. Langsam, M. Augenstein and A.M.Tenenbaum, Prentice Hall, India.
2. Fundamentals of Data Structures by E. Horowitz, and Sartaj Sahni, Galgotia Publications.

ETC 6.2 ADVANCED MICROPROCESSORS

Lectures per week	:3+1 Hours
Practical per week	:2 Hours
Maximum marks for the paper	:100
Maximum marks for the sessionals	:25
Maximum marks for the oral	*:50*
Duration of the paper	:3 Hours
No. of modules	:4
No. of question per module	:2
Maximum no. of questions to be answered from each module	:1
Total number of questions to be answered	:5

MODULE I

The processor 8086**:** Architecture, signal descriptions, physical memory organization, operating modules of 8086 and timings. Addressing modes of 8086, instruction set, Assembler Directives.

MODULE II

Assembly language programs for 8086.
Special architectural features and related programming: Introduction to stack, Interrupts and interrupt service routines. Interrupt programming, Macros, procedures.
Introduction to system software.

MODULE III

Multiprocessing systems: Software aspects of multiprocessor systems.
Numeric processor 8087: architecture, signal description, register set, exception handling, interconnection of 8087 with CPU
I/O processors 8089: Architecture, bus arbitration and control, arbitration schemes.
Multiuser/multitasking Operating System concepts.
Intel 80286 microprocessors: architecture, signals, system connections.
Intel 80386 32- bit microprocessor: architecture, signal description, register organization modes of operation, segmentation, paging, virtual 8086 mode.

MODULE IV

Pentium microprocessor register organization, super scalar architecture, branch prediction floating point unit, memory management.
Pentium Pro microprocessor: Architecture, pipeline.
Introduction to Pentium II, III and IV
Comparison of 16 bit Intel processors with other contemporary 16 bit processors (MC68000, Z800)

Text Books:

1. Advanced Microprocessors and Peripherals –A .K. Ray and K. M. Bhurchandi
2. Microprocessors and Interfacing programming and Hardware-Douglas V. Hall

Reference books:

1. The Intel Microprocessors 8086/8088,80186/80188,80286, 80386,80846;Pentium and Pentium processors by Barry B. Bray
2. Microcomputer Systems The 8086 /8088 family Architecture, Programming and Design by Yu-Cheng Liu and Glenn A. Gibbon
3. Advanced Microprocessors and Interfacing by Badri Ram

ETC 6.3: ELECTRONIC INSTRUMENTATION

Lectures per week:	4 Hours
Practicals per week:	2Hours
Maximum marks for theory paper:	100
Maximum marks for sectionals:	25
Maximum marks for the oral	*50*
Duration of paper:	3 Hours
Total no of modules:	4
No. Of questions from each module:	2
Total no of questions to be answered:	5(At least one question From each module)

MODULE I

Primary & Secondary Frequency standards, Signal generators: Frequency synthesized signal generators, sweep frequency signal generators,

Electronic Voltmeters (Analog): Chopper stabilized DC (Low frequency) voltmeter, different methods of chopping, true RMS responding voltmeters, current probes Electronic Voltmeter (digital):Non-integrating type: Ramp type, Staircase Ramp, Continuous balance, Successive Approximation

Integrating type: Voltage to frequency, Potentiometer Integrating, Dual Slope integrating

Digital Multimeter: Block Diagram, General specification of a DVM, Sensitivity & Resolution of a DVM

Electronic Voltmeter (High Frequency measurement): Sampling Voltmeter

MODULE II

Oscilloscope: Block diagram, Classification of CRO's, CRT control circuits, Electrostatic focusing, Delay lines, single trace, multiple trace & multiple beam CRO's, Time base circuits, Synchronizing circuits, Z-modulation.

CRO probes: Active & Passive probes, Compensation for probes. Screen for CRTs Graticule

Analog storage oscilloscope: Basic storage principle, Bistable Phosphor tube, Variable persistence tube (half tone tube), fast transfer tube

Digital storage oscilloscope, sampling oscilloscope applications of CRO's: Phase & frequency measurements using triggered sweep method and by using Lissajous patterns, current measurements

Study of front panel controls of a CRO, standard specification of a single beam CRO

Spectrum Analyzer: General Block Diagram, Swept Super heterodyne Spectrum Analyzer, Spectrum Analyzer for higher frequencies, FFT based Spectrum Analyzers, frequency Resolution & Bandwidth, Sweep Desensitization, sensitivity of spectrum Analyzer, Application of spectrum Analyzers

Curve Tracers: Block Diagram

MODULE III

Transducers: Types of transducers, factors to be considered in selecting a transducer.

Displacement Transducer: Basic displacement measurement scheme, different types of displacement transducers: strain gauge, linear variable differential transformer, Capacitive, Inductive, Piezoelectric, Potentiometer, Basic measuring circuit of each of the above mentioned transducers.
Velocity Transducers: Basic principle of measuring velocity, Tachogenerator, Stroboscopic method of measuring rpm (revolutions/minute)
Pressure Transducers: Inductive, resistive and capacitive transducers for measuring pressure.
Temperature Measurement Transducers: Resistance Temperature Detectors, Thermistors, Thermocouples, characteristics, interfacing to electronic circuits.
Flow measurement transducers: Turbomagnetic Flowmeter, Electromagnetic Flowmeter, and Ultrasound Flowmeter.
Digital Transducers: Disc type encoder, Incremental shaft encoder.
Data Acquisition Systems (DAS): Basic block diagram of Data Acquisition System, Analog and digital DAS, Objective of DAS, Signal Conditioning of the inputs, Instrumentation Amplifier, Isolation Amplifier, Multiple channel DAS, Scanners

MODULE IV

Programmable Logic Controllers (PLC): Introduction to PLC's, Uses, Advantages, Block Diagram, Input and Output Modules of a PLC,

Introduction to logic: Conventional Ladder versus PLC ladder logic, AND, OR, NOT, EX-OR logic, Combinational Logic, priority logic.

Programming a programmable controller, IEC1131-3 Programming standard.

PLC Instructions: Basic Relay instructions, Timer and counter instructions, Comparison and Data Handling instructions, Sequencer instructions.

Writing PLC programs using Ladder Logic for simple applications, Interpreting Ladder Diagram.

Virtual Instrumentation: Virtual Instruments, SAMI (Standard Architecture for Measurement for Instrumentation) model i.e. Block Diagram

Automatic Test Systems: Block Diagram, Instruments used in Computer controlled instrumentation.

Books:

1. Modern Electronic instrumentation & Measurement by Helfrick Cooper, Prentice Hall of India.
2. Electronic Instrumentation by Kalsi, Tata McGraw Hill.
3. Electronic Measurements & Instrumentation by D.Patranabis,
4. Introduction to Programmable Logic Controllers by Gary Dunning, Thomson Learning.
5. Instrumentation Reference Book-Edited by B. E. Nolting, Second Edition, Butterworth Heinemann Publications.
6. Student's Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf & Richard F. M. Smith, Prentice Hall of India.

7. Principle of Measurement and Instrumentation by Alan S. Morris, Prentice Hall of India, 2nd Edition.

ETC 6.4: POWER ELECTRONICS

Lectures per week:	4 Hours
Practicals per week:	2Hours
Maximum marks for theory paper:	100
Maximum marks for sectionals:	25
Duration of paper:	3 Hours
Total no of modules:	4
No. Of questions from each module:	2
Total no of questions to be answered:	5(At least one question From each module)

MODULE I

Introduction to Thyristor family. Constructional details of SCR. Principle and operation and VI-characteristics, Two-transistor model of SCR. Firing of SCR: R & RC, UJT firing.
Turn off of SCR: Using Class A, B, C, D, E, F commutation circuits

MODULE II

Protection and mounting schemes for SCR. Series and parallel operation of SCR. Triac and its applications. Gate turnoff Thyristor. Line commutated AC to D converter: Single {Phase Half Wave converter. Single Phase Full wave Controlled converter.

MODULE III

DC to DC converter-choppers: Principle of operation. Single Quadrant (type A & B) To Quadrant choppers (type C & D). Four quadrant choppers (type E)
Control Strategies: PWM, constant pulse width variable frequency. Current limit control.
Variable pulse width & frequency.

Single Phase AC Regulators with R & RL load.

MODULE IV

DC to AC converter-inverter: Single phase Bridge Inverter. Series & Parallel.
Single phase Inverter. Three Phase Bridge Inverter for 180^0 & 120^0 mode.
Output voltage control in single-phase inverter: Re4eduction of Harmonics by PWM method. Elimination of Harmonics. Current Source Inverter. Speed Control of DC machines using SCR.
Cyclo-convertors: Principle of operation & Step-up Cyclo converters.

Books:

1. An introduction to Thyristor and their applications by S. Rammoorthy.
2. Thyristorised Power Controllers by G.K. Dubey
3. Power Electronics by Mohammed Rashid.

Reference books:

1. Thyristor by R.K. & K.K. Sugandhi.
2. Thyristor Engineering by Berde

ETC 6.5: ANTENNA AND WAVE PROPAGATION

Lectures per week:	4 Hours
Maximum marks for theory paper:	100
Maximum marks for sectionals:	25
Duration of paper:	3 Hours
Total no of modules:	4
No. Of questions from each module:	2
Total no of questions to be answered:	5(At least one question From each module)

MODULE I

Basic Antenna concepts: Patterns, beam area, radiation intensity, beam efficiency, directivity, gain, resolution; Aperture (effective, scattering, loss, collecting and physical), aperture efficiency, effective height, maximum effective aperture of a short dipole and a linear half-wave antenna, effective aperture and directivity, Friss transmission formula, wave polarization. Point Sources: Power patterns, power theorem, radiation intensity, different power patterns (hemispherical, unidirectional and bi-directional cosine, sine, sine-squared unidirectional $(\text{cosine})^2$ and $((\text{cosine})^n)$, directivity, gain field and phase-patterns, Effect of earth on field patterns.

The short dipole: Field components, radiation resistances, Thin linear center-fed antenna: Field components, quarter-wave monopole, half-wave dipole and full-wave antenna; field at any distance, radiation resistance of half-wave antenna, antennas with a uniform traveling wave.

MODULE II

Arrays of point sources: Isotropic point sources of: (i) same amplitude and phase (ii) same amplitude but opposite phase (iii) same amplitude and in phase quadrature (iv) equal amplitude and any phase (v) unequal amplitude and any phase; pattern multiplication, Linear array: Point sources of equal amplitude and spacing. Broad-side array, End-fire array, End-fire array with increased directivity, scanning arrays; null directions and directions of maxima.

Loop antenna: field of a small loop, field pattern of circular and square loop, ferrite-rod antenna.

Helical Antenna: Geometry, transmission and radiation modes, design of monofilar axial mode type, Wide-band characteristics, tapered monofilar axial mode type.

MODULE III

Construction, characteristics and construction of: Slot antennas, slotted-cylindrical antenna, Aperture antennas, Horn antennas (rectangular and circular), Reflector antennas (Corner, paraboloidal, cylindrical parabolic), Cassegrain feed, Lens antennas, dielectric rod antennas; Yagi-Uda array, V- and Rhombic-antenna, Turnstile antennas; Baluns and traps. Antenna Measurements: Far-field pattern, phase, directivity, gain, terminal impedance, current distribution, polarisation; System temperature and signal-to-noise ratio.
Broad-band and Frequency-independent Antennas: Planar spiral, conical-spiral, log-periodic antenna and array.

MODULE IV

Ground-wave propagation: Plane-earth reflection, space wave, surface wave, Elevated dipoles above plane earth, Line-of sight propagation, wave tilt of the surface wave, spherical-earth propagation, Tropospheric waves, Abnormal refraction and reflection, Duet propagation, Tropospheric scattering, Fading and diversity reception.
Ionospheric Propagation: Layers, permittivity and conductivity, collision and plasma frequency, reflection and refraction, refractive index, electron density, determination of critical frequency and virtual height, Maximum usable frequency, skip distance, optimum frequency, regular and irregular variations, Sky-wave transmission, effect of Earth's magnetic field, whistlers, incoherent scatter, VLF propagation.

Reference Books:

1. Electromagnetic Waves and Radiating Systems by E.C.Jordan & K.G.Balmain, Prentice Hall of India
2. Antennas by Kraus by Mc Graw Hill Book Co.
3. Electronic & Radio Engineering by F.E.Terman, Mc Graw Hill Book Co.
4. Antenna & Wave Propagation by K.D. Prasad, Satyanarayan Publications
5. Antenna Theory: Analysis & Design by Constatine A. Balanis, John Wiley & Sons, Inc.

ETC 6.6: DIGITAL SIGNAL PROCESSING

Lectures per week:	4 Hours
Practical per week:	2 Hours
Maximum marks for theory paper:	100

Maximum marks for sectionals:	25
Duration of paper:	3 Hours
Total no of modules:	4

MODULE I

Discrete-Time signal and its application to LTI system
Discrete-Time Fourier transform (DTFT), Discrete Fourier Transform (DFT), Relationship [between the DTFT and DFT and their inverses, DFT properties, Linear and circular convolution, Linear filtering methods based on DFT.
Z-Transforms [Z,T]
Introduction, definition of Z-Transform, properties, Region of convergence, evaluation of inverse ZT, rational ZT

MODULE II

Efficient computation of DFT: Fast Fourier transform [F.F.T] direct computation of DFT, Divide and conquer approach of DFT, Radix-2 FFT algorithm: Decimation in Time [D.I.T] and Decimation in frequency [D.I.F] , Shuffling of the data and bit reversal, Introduction to basic butterfly computation in radix-4 FFT algorithm, Goertzel algorithm and Chirp-Z Transform algorithm, Effect of Quantisation in DFT.

Realisation of Discrete Time System introduction, Basic Realisation block diagram and the signal flow graph, Basic structures of IIR filter: Direct, canonical, cascade and parallel realizations.

MODULE III

Design of Digital Filters
General considerations: causality and its implications, characteristics of practical frequency selective filters.
Design of FIR filters: Symmetric FIR Filters, design of linear phase-FIR filters using windows, frequency sampling method.
Design of IIR filter:
IIR filter design by impulse invariance, bilinear transformation, Butter worth filter, Chebyshev filters and Elliptic filters.

Frequency selective filters: Ideal filter characteristics, low pass, high pass and bandpass filters,

Notch filters, Comb filters.

MODULE IV

Multirate Digital Signal Processing

Introduction, Decimation by factor D, Interpolation by factor I, sampling, sampling rate conversion by rational factor I/D, Application of Multirate signal processing, Design of Phase

shifters, interfacing of digital systems with different sampling rates, Sub band coding of speech signals, over sampling A/D and D/A conversion.

Application of DSP

Voice processing, introduction to wavelet transforms. Definition of an image, Image representation, introduction to 2-D Fourier Transform.

Books:

1. Digital Signal Processing, Algorithm and Applications byJohn C. Proakis & Dimities G. Manolakis, PHI
2. Digital Signal Processing by S. Mitra, TMH

Reference books:

1. Digital Signal Processing by Salivahanan
2. Signal Processing & Linear systems by B.P.Lathi, Oxford
3. Understanding Digital Signal Processing by Lyons, Addison Wesseley
4. Theory and Application of Digital Signal Processing by Rabiner and Gold, PHI
5. Introduction to Digital Signal Processing by Johny R. Johnson, PHI

Discrete Signal Process