PUNJAB TECHNICAL UNIVERSITY
KAPURTHALA

Scheme& Syllabus of
B. Tech. Electronics & Electrical Engineering
Batch 2011 onwards

B. Tech. Electrical & Electronics Engineering
Batch 2013 onwards

By
Board of Studies EEE /EIE

Note:

The Scheme and Syllabus of B-Tech Electrical and Electronics Engineering (Batch 2013 onwards) and B-Tech Electronics and Electrical Engineering are identical in every respect.

The students of Electrical and Electronics Engineering (Batch 2013 onwards) can opt for electives majorly on Electrical side and students of Electronics and Electrical Engineering can opt electives of Electronics side.

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B.Tech Electronics & Electrical Engineering (EEE)
Batch 2011onwards

Note: There will be 04 weeks BTEE309 Institutional training after 2nd semester.

Semester –III								
Course Code	**Course Title**	**L**	**T**	**P**	**Marks Distribution**		**Total Marks**	**Credits**
					Internal	External		
BTAM-301	Engineering Mathematics-III	4	1	-	40	60	100	5
BTEE-301	Circuit Theory	4	1	-	40	60	100	5
BTEE-302	Transformers & Direct Current Machines	4	1	-	40	60	100	5
BTEE-303	Electrical Measurements & Instrumentation	4	1	-	40	60	100	5
BTEE-304	Electronic Devices and Circuits	4	1	-	40	60	100	5
BTEE-305	Laboratory-I (Semiconductor Devices and Circuit Theory)	-	-	2	30	20	50	1
BTEE-306	Laboratory-II (Electrical Machines -I)	-	-	2	30	20	50	1
BTEE-307	Laboratory-III (Electrical Measurements)	-	-	2	30	20	50	1
BTEE-308	Institutional Training (Undertaken after 2nd semester)				60	40	100	S/US
	Total	**20**	**5**	**6**	**350**	**400**	**750**	**28**

"S" for Satisfactory and US for unsatisfactory

Punjab Technical University
Course scheme of Electronics and Electrical Engineering

4th sem

S No.	Course Code	Course Title	L	T	P	I	E	To	C
1.	BTEE-402	Linear Control Systems	3	1	-	40	60	100	4
2.	BTEE-403	Electromagnetic Fields	3	1	-	40	60	100	4
3.	BTEC-404	Digital Electronics	3	1	-	40	60	100	4
4.	BTEE-405	Power System –I	3	1	-	40	60	100	4
5.	BTEEE-401	Electrical Machinery- II	3	1	-	40	60	100	4
6.	BTEEE-402	Transducers & Signal Conditioning	3	1	-	40	60	100	4
7.	BTEEE-403	Digital Electronics Lab	-	-	2	20	30	50	1
8.	BTEEE-404	Electrical Machinery- II Lab	-	-	2	20	30	50	1
9.	BTEEE-405	Power System-I Lab	-	-	2	20	30	50	1
10.		General Fitness	-	-	-	100	-	-	S/US
Total -								850	27

5th Sem

Sno.	Course Code	Course Title	L	T	P	I	E	To	C
1.	BTEEE-501	Communication System	3	1	-	40	60	100	4
2.	BTEEE-502	Power system II	3	1	-	40	60	100	4
3.	BTEE-503	Microprocessor	3	1	-	40	60	100	4
4.	BTEE-504	Power electronics	3	1	-	40	60	100	4
5.	BTEE-505	Numerical and Statistical Methods	3	1	-	40	60	100	4
6.	BTEEE-503	Communication system Lab	-	-	2	20	30	50	1
7.	BTEEE-505	Power system II Lab	-	-	2	20	30	50	1
8.	BTEEE-506	Microprocessor Lab	-	-	2	20	30	50	1
9.	BTEEE-507	Industrial Training	-	-	-	60	40	100	S/US
	Total							750	23

6th sem

Sno.	Course Code	Course Title	L	T	P	I	E	To	C
1.	BTEE-601	Electric power and utilization	3	1	-	40	60	100	4
2.	BTEEE-601	Digital Signal Processing	3	1	-	40	60	100	4
3	BTEE-603	Non Linear and Digital control Systems	3	1	-	40	60	100	4
4.	BTEE-604	Microcontroller and PLC	3	1	-	40	60	100	4
5.	BTEEE-OPX	Open elective	3	1	-	40	60	100	4
6.	BTEEE-603X	Elective –I	3	1	-	40	60	100	4
7.	BTEE-608	Microcontroller and PLC Lab	-	-	2	20	30	50	1
8.	BTEE-606	Power Electronics and Drives Lab	-	-	2	20	30	50	1
9.	BTEEE-602	Digital Signal Processing Lab	-	-	2	20	30	50	1
10.		General fitness				100			
Total-								850	27

7th sem/8th sem

Sno	Course Code	Course title	L	T	P	I	E	To	C
1.	BTEE-801	Power System Analysis	3	1	-	40	60	100	4
2.	BTEE-802	High Voltage Engineering	3	1	-	40	60	100	4
3.	BTEEE-801	Antenna & Wave Propagation	3	1	-	40	60	100	4
4.	BTEEE-804X	Elective-II	3	1	-	40	60	100	4
5.	BTEEE-805X	Elective-III	3	1	-	40	60	100	4
6.	BTEEE-806	Project Work	-	-	6	60	40	100	4
7.	BTEE-806	Power System Analysis LAB	-	-	2	20	30	50	1
8.	BTEEE-807	Seminar	-	-	2	100	-	100	2
9.		General Fitness	-	-	-	100	-	100	S/US
Total-								850	27

Open Elective

Sr.no	Subject Code	Subject
1	BTEEE-OPA	Electrical Machines
2	BTEEE-OPB	Elements of communication system
3	BTEEE-OPC	Elements of power systems
4	BTEEE-OPD	Transducers and Signal Conditioning

Elective –I

Sr.no	Subject Code	Subject
1	BTEEE-603A	Electrical Machine Design
2	BTEEE-603B	Microwave and Radar Engineering
3	BTEEE-603C	Object Oriented Programming
4	BTEEE-603D	Analytical Instrumentation
5	BTEEE-603E	Optimization Techniques
6	BTEEE-603F	Deregulation of Power System

Elective –II

Sr.no	Subject Code	Subject
1	BTEEE-804A	Generation and Control of Power
2	BTEEE-804B	HVDC Transmission
3	BTEEE-804C	Mechatronics
4	BTEEE-804D	Biomedical Instrumentation
5	BTEEE-804E	Computer Networks
6	BTEEE-804F	Wireless Communication

Elective –III

Sr.no	Subject Code	Subject
1	BTEEE-805A	Energy Auditing and Management
2	BTEEE-805B	Agrionics
3	BTEEE-805C	Optical Fiber Communication
4	BTEEE-805D	Non conventional Energy Sources
5	BTEEE-805E	Operating Systems
6	BTEEE-805F	Data Mining and Pattern Recognition

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Third Semester

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B.Tech Electronics & Electrical Engineering (EEE)
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BTAM301 Engineering Mathematics-III

Unit I Fourier Series: Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.

Unit II Laplace Transforms: Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

Unit III Special Functions: Power series solution of differential equations, Frobenius method, Legendre's equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind. Recurrence relations, equations reducible to Bessel's equation.

Unit IV Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients.

Unit V

Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

Unit VI Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

Suggested Readings/ Books:

Kreyszing, E., Advanced Engineering Mathematics, Eighth edition, John Wiley, New Delhi.
Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957.
Peter. V. O'Nil, Advanced Engineering Mathematics, Wadsworth Publishing Company.
Taneja, H. C., Engineering Mathematics, Volume-I & Volume-II, I. K.Publisher.
Babu Ram, Advance Engineering Mathematics, Pearson Education.
Bindra, J. S., Applied Mathematics, Volume-III, Kataria Publications.

BTEE301 Circuit Theory

Unit I Circuit Concepts: Independent and dependent sources, Signals and wave forms: Periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity.

Unit II Time and Frequency Domain Analysis: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, Time domain behaviors from poles and zeros, Convolution Theorem.

Unit III Network Synthesis: Network functions, Impedance and admittance function, Transfer functions, Relationship between transfer and impulse response, poles and zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles and zeros, Real liability condition for impedance synthesis of RL and RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Unit IV: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, Pass bands and stop bands, Design of constant-K, m-derived filters, Composite filters.

Suggested Readings/ Books:

Bird John, *Electrical Circuit Theory and Technology*, 2nd Ed., Newnes.
Chakraborty, Abhijit, *Circuit Theory*, 2nd Edition, Dhanpat Rai, 2001.
Chaudhury D. Roy, *Networks and Synthesis*, New Age International.
Edminister J.A., *Electric Circuits*, 4th Edition, Tata McGraw Hill, 2002.
Iyer T.S.K.V., *Circuit Theory*, Tata McGraw Hill, 2006.
Mohan, Sudhakar Sham, *Circuits and Networks Analysis and Synthesis*, 2nd Edition, Tata Mc Graw Hill, 2005.
Van Valkenberg, M.E., *Network Analysis and Synthesis*, PHI learning, 2009.

BTEE302 Transformers and Direct Current Machines

Unit I Transformers: Working principle, construction of single phase transformer, EMF equation, phasor diagrams on no-load and on loaded conditions, open circuit and short circuit tests, equivalent circuit parameters estimation, voltage regulation and efficiency, back to back test. Effect of saturation on exciting current and in-rush current phenomenon. Parallel operation of single phase transformers.

Unit II Auto Transformers: Principle of operation, equivalent circuit and phasor diagrams, comparison with two winding transformer.

Unit III Three-Phase Transformers: Different types of winding connections, Voltage and current ratios, Parallel operation of three phase transformers. Three winding transformer's equivalent circuit, off-load and on-load tap changing transformer, Scott connections. Testing of transformers.

Unit IV DC Generator: Working principle, construction of DC Machines, Armature windings, single and double layer winding diagrams, EMF. and torque equations, armature reaction, effect of brush shift, compensating winding, commutation, causes of bad commutation, methods of improving commutation, methods of excitation of DC generators and their characteristics.

Unit V DC Motor: Working principle characteristics, starting of shunt and series motor, starters, speed control methods: field and armature control. Braking: plugging, dynamic and regenerative braking, Testing: Swinburn's test, Hopkinson test, Field test. Estimation of losses and efficiency.

Suggested Readings/ Books:

Bimbhra P.S., *Electrical Machinery, Khanna Publishers*
Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery*, 6th Edition, McGraw Hill
Langsdorff E.H., *Principles of D.C. machines*, McGraw Hill
Nagrath I.J. and Kothari D.P., *Electrical Machines*, 4th Edition, Tata McGraw Hill,
Say M G, *Alternating Current Machines*, 5th edition, Sir Isaac Pitman and Sons Ltd.

BTEE303 Electrical Measurements and Measuring Instruments

Unit I Units, Dimensions and Standards: Introduction to MKS and Rationalized MKS System, SI Units, Standards of EMF, Resistance, Capacitance and Inductance, Systematic errors

Unit II General Theory of Analog Measuring Instruments: Operating torque, damping and controlling torque, T/W ratio, Pointers and Scales. Principles of operation of various types of electro mechanical indicating / registering instruments viz. PMMC, dynamometer, induction, thermal, etc. for dc and ac measurement of voltage, current, power, frequency, phase and power factor etc., energy meter: their sources of error and compensation, shunts and multipliers, multi-meter.

Unit III Potentiometers: Basic direct current (DC) potentiometer circuit, Modern form of DC potentiometer, measurement of voltage, current, Resistance and calibration of voltmeter and ammeter using DC potentiometer, volt ratio box, Self balancing potentiometer, Alternating current (AC) potentiometers and their applications.

Unit IV Bridges: Sources and Detectors, General equation for bridge balance, Wheatstone bridge and its sensitivity analysis, Kelvin double bridge, AC bridges: applications and conditions for balance, Maxwell's bridge, Hay's bridge, Schering bridge, Wien bridge, DeSauty's bridge, Insulation testing, Sources of errors in bridge circuits, Shielding of bridge elements, Wagner Earthling Device.

Unit V Magnetic Measurements: Flux meter, B-H Curve, Hysteresis loop, Permeameters, AC Testing of Magnetic materials, Separation of iron losses, iron loss measurement by Wattmeter and Bridge methods.

Unit VI Instrument Transformers: Theory and construction of current and potential transformers, ratio and phase angle errors and their minimization, Characteristics of current transformers (CT).and potential transformers (PT) and their Testing.

Suggested Readings/ Books:

Bell David A., *Electronics Instrumentation and Measurements*, Prentice Hall, India
Golding Edward William and Widdis Frederick Charles, *Electrical Measurements and Measuring instruments*, Wheelers India
Helfrick A.D. and Cooper W.D., Modern *Electronic Instrumentation. and Measurement Techniques*, Prentice Hall
Murthy D. V. S., Transducers and Instrumentation, Prentice-Hall, India
Sawhney A. K., *A Course in Electrical and Electronics Measurement and Inst*rumentation, Dhanpat Rai and Sons.

BTEE-304 Electronic Devices and Circuits

Unit I Basic Semiconductor and Diodes: Intrinsic and extrinsic semiconductors, diffusion and drift currents, p-n junction under open-circuit, reverse bias and forward-bias conditions, p-n junction in the breakdown region, Ideal diode, terminal characteristics of junction diode, Load-line analysis of diode circuits, half wave rectifier and full wave rectifiers, Clippers and Clampers, capacitive filters, RC and LC filter, voltage multipliers. Principles, construction and characteristics of Zener diodes, Light Emitting Diodes, Schottky Diode, Varactors

Unit II Bipolar and Unipolar Transistors: Bipolar junction transistor (BJT)- physical structure and modes of operation, Transistor characteristic and parameters, Common Base, Common Emitter and Common Collector Configurations, Transistor biasing, Transistor as a switch, Basics characteristics of an amplifier, Simple transistor model (r_e model), Common Emitter, Common Collector and Common base amplifiers, hybrid equivalent circuit, H-parameters, circuit analysis using h-parameters. Junction field effect transistor (JFET): Characteristics, parameters and biasing. Metal oxide field effect transistor (MOSFET): Characteristics, parameters and biasing. Class a power amplifier, Class B, Class AB Push-pull and Class C-power amplifiers.

Unit III Integrated Circuit and Operational-Amplifiers: Introduction to IC's, Op-Amps, Op-Amp Characteristics, Feedback, Different feedback configurations, Current– to–voltage converter and voltage-to-current converters, voltage and current amplifiers, mathematical operations using Op-Amp: summing, differentiation and integration, Comparators and Schmitt trigger

Unit IV Oscillators and Active Filters: Oscillations, Feedback oscillator Principles,, RC phase shift oscillator, Wien bridge oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillators, frequency stability, Active Filters (1^{st} order) with low pass, high pass, band pass, band stop and all pass. Pin configuration of 555 timer, 555 timer as Oscillator: monostable, bistable and astable multivibrator.

Unit V Regulated Power Supplies: Unregulated power supplies, line and load regulations, Zener diode voltage regulators, transistor series and shunt regulators, current limiting, Op-Amp voltage regulators, integrated circuit (LM-3XX) voltage regulators. Introduction to switching regulators. Working of Switched Mode Power Supply (SMPS).

Suggested Readings/ Books:

Boylestad, Robert.L. *Electronic Devices and Circuit Theory*, Pearson Education
Cathey Jimmie J., *Theory and Problems of Electronic Devices and Circuits*, McGraw-Hill
Floyd Thomas L., *Electronic Devices*, Pearson Education
Gayakwad, Ramakant A. *OP-AMPS and Linear Integrated Circuits*, Prentice Hall of India
Malvino Albert Paul and Bates David, *Electronic Principles*, edition 7^{th}, Tata McGraw Hill
Millman Jacob, *Integrated Electronic Devices and Circuits*, Tata McGraw Hill.

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BTEE-305 Laboratory-I (Semi-conductor Devices and Circuit Theory)

List of Experiments:

1. Measurement of resistance of elements
2. Phasor analysis of RL, RC and RLC circuits in series and in parallel
3. Frequency response of resonant circuits
4. Transients in RL, RC, and RLC Circuits
5. To verify Superposition theorem.
6. To verify Norton's theorem.
7. To verify Thevenin's theorem.
8. To verify maximum power transfer theorem.
9. To study the response of low pass and high pass filters.
10. To study the response of constant K-filters.
11. To study the response of m-derived filters
12. Two-port networks; network parameters and equivalent circuit
13. To draw V-I characteristics of PN junction diode (Ge, Si, switching and signal).
14. To design half wave rectifier.
15. To design full wave and bridge rectifiers.
16. Diode clippers and clampers.
17. To study transistor characteristics in common base and common emitter configurations.
18. To study the FET characteristics.
19. To design, study and compare various transistor biasing techniques.
20. To design regulated power supply using Zener diode/ voltage regulator IC.
21. To study of an emitter follower circuit.

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BTEE-306 Laboratory-II (Electrical Machines-I)

List of Experiments:

1. To Load test on a single phase transformer.
2. To perform Open circuit and short circuit tests on a single phase transformer and hence find equivalent circuit, voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of three phase transformer.
6. To perform Scott connections on three phase transformer to get two phase supply.
7. To study the constructional details of direct current (DC) machine and to draw sketches of different components.
8. To measure armature and field resistance of direct current (DC) shunt generator and to obtain its open circuit characteristics.
9. To obtain load characteristics of direct current (DC) shunt/series /compound generator.
10. To draw speed-torque characteristics of direct current (DC) shunt/series /compound generator.
11. To study direct current (DC) motor starters.
12. To perform Swinburne's test (no load test) to determine losses of direct current (DC) shunt motor.

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BTEE-307 Laboratory-II (Measurements)

List of Experiments:

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. a) To measure High value of DC current by a Low Range DC Ammeter and Shunt.
   b) To measure High value of DC voltage by a Low Range DC Voltmeter and Multiplier
3. a) To measure High value of AC Current by a Low Range AC Ammeter and Current Transformer.
   b) To measure High value of AC Voltage by Low Range Voltmeter and Potential Transformer
4. Measurement of resistance using Wheatstone Bridge.
5. To measure active and reactive power in 3 phase balanced load by one wattmeter method.
6. To measure the active power in three phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.
7. To calibrate and use the Induction Energy Meter.
8. Measurement of resistance using Kelvin's Bridge.
9. Measurement of self inductance using Anderson's Bridge.
10. Measurement of capacitance using Schering Bridge.
11. Plotting of Hysteresis loop for a magnetic material using flux meter.
12. Measurement of frequency using Wien’s Bridge.
13. To study the connections and use of Current and potential transformers and to find out ratio error.
14. Determination of frequency and phase angle using CRO.
15. Measurement of unknown voltage using potentiometer.
16. To find 'Q' of an inductance coil and verify its value using Q- meter.

BTEE-402, LINEAR CONTROL SYSTEMS

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

INTRODUCTORY CONCEPTS: Plant, Systems, Servomechanism, Regulating systems, Disturbances, Open loop control system, Closed loop control systems, Linear and non-linear systems, Time variant and invariant, Continuous and sampled-data control systems, Block diagrams, Some illustrative examples.

MODELING: Formulation of equation of linear Electrical, Mechanical, Thermal, Pneumatic and Hydraulic system, Electrical, Mechanical analogies. Use of Laplace transforms, Transfer function, Concepts of state variable modeling. Block diagram representation, Signal flow graphs and associated algebra, Characteristics equation.

TIME DOMAIN ANALYSIS: Typical test – input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, Pole-zero location and stability, Routh-Hurwitz Criterion.

ROOT LOCUS TECHNIQUE: Extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, Location of roots with given gain and sketch of the root locus plot.

FREQUENCY DOMAIN ANALYSIS: Closed loop frequency response, Bode plots, Stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

COMPENSATION: Necessity of compensation, Series and Parallel compensation, Compensating networks, Applications of lag and lead-compensation.

CONTROL COMPONENTS: Error detectors – potentiometers and synchros, servo motors, a.c. and d.c. techno generators, Magnetic amplifiers.

BOOKS RECOMMENDED

1. Modern Control System, Dorf Richard C. and Bishop Robert H, Addison –Wesley, Pearson New Delhi
2. Modern Control Engineering, Ogata K., Prentice Hall,
3. Automatic Control System, Kuo B. C., Prentice Hall
4. Control System Engineering, Nagrath I.J. and Gopal M., Wiley Eastern Ltd.
5. Linear Control Systems, B. S. Manke, Khanna, 1988

BTEE-403, ELECTROMAGNETIC FIELDS

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

REVIEW OF VECTOR ANALYSIS: Vector analysis, Physical interpretation of gradient, Divergence and Curl, Vector relations in other coordinate systems, Integral theorems: Divergence theorem, Stoke's theorem, Green's theorem and Helmholtz theorem.

ELECTROSTATICS: Introduction to fundamental relations of electrostatic field; Gauss's law and its applications; Potential function, Field due to continuous distribution of charges, Equipotential surfaces, Divergence theorem, Poisson's equation and Laplace's equation, Capacitance, Electrostatic energy, Conditions at boundary between dielectrics, Uniqueness theorem.

STEADY MAGNETIC FIELD: Magnetic induction and Faraday's laws, Magnetic flux density, Magnetic field Strength and magnetomotive force, Ampere's work Law in the differential vector form, Permeability, Energy stored in a magnetic field, Ampere's force law, Magnetic vector potential, Analogies between electric and magnetic fields.

MAXWELL'S EQUATIONS AND POYNTING VECTOR: Equation of continuity for time varying fields, Inconsistency of Ampere's law, Maxwell's equations in integral and differential form for static and time varying fields, Conditions at a Boundary surface, Concept of Poynting vector, Poynting Theorem, Interpretation of ExH

ELECTROMAGNETIC WAVES: Solutions for free-space conditions; Uniform plane Wave Propagation; Wave equations for a conducting medium, Sinusoidal time variations, Polarization, Conductors and dielectrics; Direction cosines, Reflection by perfect conductor -normal and oblique incidence, Perfect dielectric Normal incidence, Perfect insulator –Oblique incidence, Brewster angle, Reflection at a surface of Conductive medium, Surface impedance.

BOOKS RECOMMENDED

1. Electromagnetic Waves and Radiating Systems, Edward C. Jordan and Keith G Balmain, PrenticeHall
Inc.
2. Electromagnetics, Kraus John D., McGraw-Hill Publishers
3. Schaum's Theory and Problems of Electromagnetics,Edminister Joseph A., McGraw-Hill
4. Elements of Engineering Electromagnetics,Rao N. Narayana, Pearson Education

BTEC-404, DIGITAL ELECTRONICS

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

NUMBER SYSTEM & CODES: Binary number system, Octal number system, Hexadecimal number
system, BCD Code, Gray code, Signed & unsigned binary numbers, 1's & 2's complement of a number,
Different types of codes, Binary operations- addition, subtraction, Multiplication, Division, Parity for error detection, Check sum and hamming code for error detection and correction.

COMBINATIONAL CIRCUITS: Concept of positive and negative logic, Introduction to boolean variables, Boolean theorems and DeMorgan Theorem, Sum of product and product of sum form of logic expressions, Duality, Logical functions using Karnaugh map and Quine-McClusky methods, Multiplexers, Demultiplexers, Encoders, Decoders, Adders, Subtractors, Parity generators, Parity checkers, Code converters.

SEQUENTIAL LOGIC CIRCUITS: Flip-flops, JK flip-flops, D flip-flops, T flip- flops, SR flip-flops,
Edge triggered and clocked flip-flops. Registers and counters: Series and parallel registers, Synchronous & asynchronous counters, Up and down counters, Ring counters & Mod- counters.

INTRODUCTION TO VHDL: Overview of digital design with very-high-speed integrated circuits (VHSIC) hardware description language (VHDL), HDL format and syntax, Entity, Data representation in
VHDL, Truth table using VHDL, Decision control structure and sequential circuit using VHDL.

DIGITAL LOGIC FAMILIES: Introduction, Characteristics of digital ICs, Resistor-transistor logic,
Integrated-injection logic, Direct-coupled transistor logic, Diode-transistor logic & transistor-transistor
logic, Emitter-coupled logic and MOS logic

DIGITAL TO ANALOG (D/A) AND ANALOG TO DIGITAL (A/D) CONVERTERS: Introduction,
Weighted register D/A converter, Binary ladder, D/A converter, specifications for D/A converters, Parallel A/D converter, Successive approximation A/D converter single & dual slope A/D converter, AID converter using voltage to frequency conversion, A/D converter using voltage to time conversion, Countertype AID converters.

SEMICONDUCTOR MEMORIES: Introduction, Memory organization, Classification & characteristics of memories, Sequential memories, Read only memories, Read & write memories, Content addressable memories, Programmable array Logic, Programmable logic arrays and Programmable Logic Device, Field Array Programmable Gate array

RECOMMENDED BOOKS:

1. Digital Fundamentals, Floyd Thomas S., Pearson Education
2. Modern digital Electronics, Jain R.P., Tata McGraw Hill
3. Fundamentals of Digital Circuits, Kumar Anand, Prentice Hall of India
4. Principles of Digital Electronics, Malvino Albert Paul, Tata McGraw Hill
5. Digital Logic and Computer Design, Mano Morris, Prentice Hall of India
6. Digital Systems: Principles and Applications, Tocci Ronald J. Widmer Neal S. and Moss Gregory L.,Prentice Hall of India

BTEE-405, POWER SYSTEMS-I (Transmission and Distribution)

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

SUPPLY SYSTEM

Introduction to transmission and distribution systems, Comparison between DC and AC systems for transmission and distribution, Comparison of cost of conductors, Choice of working voltage for transmission & distribution, Economic size of conductors - Kelvin's law, Radial & mesh distribution networks, Voltage regulation.

GENERAL

Conductor materials, Solid, Stranded, ACSR, Hollow and bundle conductors. Different types of supporting structures for overhead lines. Elementary ideas about transmission line construction and erection. Stringing of conductors, Spacing, Sag and clearance from ground, Overhead line insulators, Concept of string efficiency.

TRANSMISSION LINE PARAMETERS

Introduction to line parameters, Resistance of transmission line, Inductance of single phase two wire line, Concept of G.M.D., Inductance of three phase line, Use of bundled conductor, Transposition of power lines, Capacitance of 1-phase and 3-phase lines. Effect of earth on capacitance of conductors.

PERFORMANCE OF TRANSMISSION LINES

Representation of short transmission line, Medium length line (nominal T & II circuits). Long length line by hyperbolic equations and equivalent T & II circuits. Power flow through transmission lines, ABCD constants, Voltage regulation.

CIRCLE DIAGRAM AND LINE COMPENSATION

Receiving end circle diagram for long transmission lines based on ABCD constants, Equivalent T circuits, Power loci, Surge impedance loading, Reactive power requirement of system series and shunt compensation, Synchronous phase modifiers , Rating of phase modifiers.

UNDERGROUND CABLES

Classification of cables based upon voltage and dielectric material, Insulation resistance and capacitance of single core cable, Dielectric stress, Capacitance of 3 core cables, Methods of laying, Heating effect, Maximum current carrying capacity, Cause of failure, Comparison with overhead transmission lines.

RECOMMENDED BOOKS:

1. Electrical Energy System Theory - An introduction, O.L. Elgerd, (TMH)
2. Elements of Power System Analysis, W.D. Stevenson Jr., (TMH)
3. Course in Electrical Power, C.L. Wadhwa, New Age Int.(P)Ltd.

BTEEE-401, ELECTRICAL MACHINERY-II

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

Asynchronous Machines:
Concept of rotating magnetic field in three phase, Construction and principle of operation. Slip frequency, Rotor currents, Rotor MMF and torque production, Equivalent circuit, Torque slip characteristics, Max. torque, Starting torque, Max. power output, Starting, Principle of single phase induction motors, Double field revolving theory, Types of single phase induction motors.

Synchronous Machines:
Introduction, Basic synchronous Machine Model (Realistic Machine), Voltage regulation, Circuit model of synchronous machine, Determination of synchronous reactance, Open circuit characteristic(OCC), Short circuit characteristic (SCC), Short circuit ratio (SCR), Short circuit loss, Determination of armature Reaction, Ampere-turns and leakage reactance of a synchronous machines-Potier method, Nature of armature reaction, Salient pole synchronous machine-two reaction model, Analysis of phasor diagram, Power angle characteristic, Determination of Xd and Xq using slip test, V-curve, Inverted V-curve of synchronous machine, Hunting in synchronous machines, Damper winding, Short circuit transients in synchronous machine, Short circuit under loading conditions, Single phase synchronous generators, Synchronous condenser.

Parallel operation of alternators:
Synchronizing to infinite Bus-Bars, Synchronoscope, Parallel operation of alternators, Operating characteristics, Generating Machine, Motoring machine, Power angle characteristic, Operation at constant load with variable excitation, Generating machine, Motoring machines, Minimum excitation, Observation, Compounding curve, Synchronous condenser, Consideration of armature resistance, Power flow (transfer) equations

Special motors:
Brushless dc motors, Schematic and operation, Circuit model characteristics of brushless dc motor, PM Brushless dc machine, Universal motor and stepper motor, Linear induction motor, Hysteresis motor, Reluctance motors

RECOMMENDED BOOKS:
1. Electrical Machines, I.J Nagrath, D.P. Kothari, TMH Publishing Company, 2002.
2. Electrical Machinery, P.S. Bhimbhra, Khanna Publishers, 2003.
3. Electrical Machinery and Transformers, Bhag S. Guru and Huseyin R. Hiziroglu, New York Oxford
University Press 2004
4. Electrical Machines, Smarjit Ghosh, Pearson Education Singapore PTE. Ltd. 2005.
5. Electric Machinery, A.E. Fitzgerald, Kingsley, Umans, TMH Publishing Company, 2002

BTEEE-402, TRANSDUCERS AND SIGNAL CONDITIONING

Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**1**	**0**
Total Marks	**100**			

Transducers:
Introduction, Classification, Mechanical devices as primary detectors, Basic requirements of a transducer, Electrical transducer, Types of transducers for measuring displacement, strain, vibration, pressure, flow, temperature, force, torque, liquid level, humidity, PH value, velocity (angular and linear), acceleration, Basic principles of resistive transducers, Inductive transducers, Capacitive transducers, Thermoelectric, Piezo electric transducers, Hall effect transducers, Electromechanical transducers, Photoelectric transducer, Digital transducers

Signal Processing Circuits:
Introduction, Ideal OP-Amp, Operational amplifier specifications, Zero crossing detector, Zero crossing detector with hysteresis, Inverting and non inverting amplifier, Voltage follower, Adder, Subtractor, Multiplier, Divider, Integrator, Differentiator, Voltage to current convertor, Current to voltage convertor, Phase shifter, Absolute-value circuit, Peak detector, AC to DC, Logarithmic convertor, Differential amplifier, Instrumentation amplifier, Analog modulator and demodulator

Data Display and Recording System:
Introduction to analog and digital display methods, Analog recorders, C.R.O., Magnetic tape recorders, Digital input output devices, Digital frequency meter, Digital voltmeter

Data transmission and Telemetry:
Introduction, Characteristics of Frequency division multiplexing, Time division multiplexing, Transmission channel and media.

Data Acquisition and Conversion:
Introduction, Signal conditioning of the inputs, Single channel D A S, Multi-channel D A S, Data conversion, Multi-plexer, S/H circuit, A/D convertor.

Recommended Books

1. Transmission and Instrumentation, Murty, D.V.S., Prentice Hall of India Pvt., 2nd edition, 2008
2. Instrumentation devices and systems, C.S. Rangan, G.R. Sarma, V.S.V. mani, TMH new delhi, 2006
3. A course in electrical and electronic measurements and instrumentation, A.K. Sawhney, Dhanpat Rai and sons

BTEEE-403, DIGITAL ELECTRONICS LAB

	L	T	P
Internal Marks: 30			
External Marks: 20	**0**	**0**	**2**
Total Marks: 50			

1. (a) Verification of the truth tables of TTL gates, e.g., 7400, 7402,7404, 7408, 7432,7486.
   (b) Design, fabrication and testing of low frequency TTL clocks using NAND gates.
2. (a) Verification of the truth table of the Multiplexer 74150.
   (b) Verification of the truth table of the De-Multiplexer 74154.
3. Design and verification of the truth tables of half adder and full adder circuits using gates 7483.
4. Study and verification of the operations of ALU 74181 with regards to addition / subtraction comparison.
5. Design fabrication and testing of differentiator and integrator circuits using OP AMP.
6. Design fabrication and testing of clipper and clamper circuits using OP AMP.
7. Design fabrication and testing of
   (a) Monostable multivibrator of t=0.1 msec.approx. using 74121/123. Testing for both positive and
   negative edge triggering, variation in pulse with and retriggering.
   (b) Free running multivibrator at 1 KHz and1 Hz using 555 with 50% duty cycle. Verify the timing
   from theoretical calculations. 8. Design fabricate and test a switch depouncer using 7400.
8. (a) Design and test of an S-R flip-flop using TOR/NAND gates.
   (b) Verify the truth table of a J-K flip-flop (7476)
   (c) Verify the truth table of a D flip-flop (7474) and study its operation in the toggle and asynchronous modes.
9. Operate the counters 7490, 7493 and 74192. Verify the frequency division at each stage. With a t
   low frequency clock (say 1 Hz) display the count on LEDs.
10. (a) Verify the truth table of decoder driver 7447 / 7448. Hence operate a 7 segment LED display
    Through a counter using a low frequency clock.
    (b) Repeat the above with the BCD to Decimal decoder 7442 and an array of LEDs.

BTEEE-404, ELECTRICAL MACHINERY-II LAB

Internal Marks: 30	**L**	**T**	**P**
External Marks: 20	**0**	**0**	**2**
Total Marks: 50			

Note: At least eight experiments are to be performed.

1. To perform no load test on a 3 phase alternator (cylindrical rotor).
2. To perform short circuit test on a 3 phase alternator (cylindrical rotor). Measure the resistance of stator winding of alternator. Find out regulation of alternator at full load at (i) unity power factor (ii) 0.85 Power factor lagging (iii) 0.85 Power factor leading using synchronous impedance method.
3. To synchronize an alternator with the 3 phase supply.
4. To perform the parallel operation of two alternators.
5. To perform the slip test to determine the Xd and Xq.
6. To run a stepper motor in different modes with the help of microprocessor.
7. To analyze the power factor improvement of an industry and design the capacitor bank.
8. Computer aided transformer design
9. Computer aided induction machine design
10. Computer aided synchronous machine design
11. To obtain positive, negative and zero sequence impedances of a three phase synchronous generator
12. To determine the efficiency of induction machine.
13. To draw the torque –slip characteristics of induction machine.

BTEEE-405, POWER SYSTEMS-I LAB

	L	T	P
Internal Marks: 30			
External Marks: 20	**0**	**0**	**2**
Total Marks: 50			

Design/analysis projects relating to the following.

1. Determination of line parameters and sequence impedances of transmission lines.
2. Line loadability.
3. Steady state operation of transmission lines.
4. Symmetrical and Unsymmetrical power system faults.

Fifth Semester

BTEEE-501, COMMUNICATION SYSTEMS

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

Base Band Signals and Systems Introduction, Elements of communication system, Noise and its types, Noise figure and Noise factor, Noise equipment temperature, Modulation & Demodulation, Mixing, Need of modulation, Types of modulation systems, AM, FM their sidebands, Comparison, Sampling theorem, Different Pulse Modulation techniques- PAM, PWM, PPM and PCM, FDM, TDM, Introduction to Fourier series and Fourier transform of periodic signals.

Analog Communication: Transmitters Block diagram explanation of low and high level AM transmitter, AM broadcast transmitter, DSB transmitter, SSB transmitter, and Independent Sideband transmitter, Block diagram explanation of Reactance tube, and Armstrong FM transmitters, Stereophonic FM broadcast transmitter.

Analog Communication: Receivers AM diode detector, characteristics of radio receiver, Sensitivity, Selectivity, Fidelity, and Image rejections, Classification of radio receivers, TRF receiver and Super Heterodyne receiver, Block diagram explanation of AM receiver, AM receiver using PLL, DSB and SSB receiver, Independent sideband receiver, AM broadcast receiver, Noise in AM systems, FM detection, Block diagram explanation of FM receiver and Stereophonic FM broadcast receiver, Noise in FM systems.

Data Communication: Concepts Data representation, Data transmission, Modes of data transmission, Signals encoding, Transmission channel, Directional capability of data exchange.

Digital Communication: Wire pairs, Microwave, Coaxial cables, Satellite communication, Optical fibers, Modulation techniques AM, FM, PM, Digital modulation method ASK, FSK, PSK, Multilevel modulation, Synchronous and asynchronous modulation, Modems and Line Drivers, Data multiplexing techniques- FDM, TDM, STDM, Multiplexed common carrier system, Multiplexing satellite signals concentrations, Data compression Hoffman code Adaptive scanning, Facsimile Compression

RECOMMENDED BOOKS:

1) Analog communication system , Simon Haykin, Prentice hall
2) Communication Engineering, J.S Chitode, Technical Publications
3) Communication Engineering , A.P.Godse U.A.Bakshi , Technical Publications

BTEEE-502, POWER SYSTEMS-II

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

Sub-Station Types, Main equipment in Substation, substation layout, Busbar-arrangements.

Isolators & Fuses Isolating switches functions, Types, Rating and operation. Fuse-types, Rating, Selection, theory and characteristics, Applications.

Circuit Breakers Need for Circuit Breakers, Arc phenomenon, Theory of Arc Interruption, Recovery Voltage and Restriking Voltage, Various Types of Circuit Breakers. Principles and Constructional Details of Air Blast, Minimum Oil, SF6, Vacuum Circuit Breakers etc.

Protective Relays Introduction, Classification, Constructional features; and Characteristics of Electromagnetic, Induction, Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay, Negative sequence relay, Introduction to static and up-based relays.

Protection of Feeders Time graded protection, Differential and Distance protection of feeders, Choice between Impedance, Reactance and Mho relays, Elementary idea about carrier current protection of lines.

Protection of Generators & Transformers Types of faults on generator, Stator and rotor protection, Negative sequence protection, Loss of excitation and overload protection. Types of fault on transformers, Percentage differential protection, Gas relays.

Protection against Over voltage and Earthing Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/Surge Absorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.

RECOMMENDED BOOKS

1) Switchgear and Protection , Sunil S. Rao (Khanna Publishers)
2) Power System Engg., Soni Gupta & Bhatnager (Dhanpat Rai&Sons)
3) A Course in Electrical Power ,C.L.Wadhawa (New Age international Pvt. Ltd)
4) Power system Protection & Switchgear, Badriram & D.V.Vishwakarma (TMH)

BTEE-503, MICROPROCESSOR

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

Introduction Introduction to Microprocessor: Overview of Microprocessor Structure and its operation. Microprocesor evolution and its types**.** 8085 Microprocessor: 8085 MPU, Memory Interfacing, Memory mapped I/O and peripheral mapped I/O 8085 Microprocessor Programming model. Intrduction to 8085 instructions, Programming techniques, Counters and time delays, Stack and subroutines, interrupts of 8085. 8086 Microprocessor: 8086 internal architecture, 8086 system configuration and timing, Minimum and maximum mode, Memory segmentation, Address modes, Instruction set descriptions and assembly language programming based on 8086.

Microprocessor system peripheral and interface Introduction to interfacing, 8155, 8255,8279,8254, DMA controller, Programmable interrupt controller, USART interfacing with 8085 MPU.

RECOMMENDED BOOKS

1. Microprocessor Architecture, Programming and application with 8085 by Gaonkar
2. Introduction to Microprocessor by B. Ram.
3. Microprocessor Interfacing, programming and hardware by D. V. Hall

BTEE – 504, POWER ELECTRONICS

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**1**	**0**
Total Marks:	**100**			

Thyrlstors and their characteristics Introduction to thyristor family V-I characteristics of SCR, SUS, PUT, SCS, GTO, LASCR, DIAC and TRIAC. Principle of operation of SCR. Two transistor analogy. Turn on methods of a thyristor Switching charactgeristics of thyristors during tum-on and turn-off. Gate characteristics. Firing of thyristors. Gate triggering circuits. Series and parallel, operation of SCRs and their triggering circuits. Thyristor specifications; such as latching current and bolding current, dv/dt and di/dt, PTV etc. Protection of SCR from over voltage and over current. Snubber circuits. Power dissipation.

Thyristor commutation techniques Load commutation (Class A), Resonant-Pulse commutation (class B), impulse commutation (class D), Line commutation (class F).

Phase controlled techniques Introduction to phase angle control. Single phase half wave controlled rectifiers. Single phase half controlled and full controlled bridge rectifiers. Three phase full controlled bridge rectifiers. Effect of resistive, inductive and resistive cum inductive loads. Basic circuit and principle of operation of Dual Converter, circulating current mode and non-circulating current mode of operation. Applications of rectifiers and dual converters to speed control of DC motor drives.

Choppers Introduction and principle of chopper operations. Control strategies, two quadrant chopper, Four quadrant chopper. Regenerative chopper. Steady state time domain analysis of type A-chopper, voltage commutated chopper or classical Jones chopper.

Cycloconverters Basic circuit and operation of single phase cycloconverter. Single phase bridge cycloconverter. Three phase to single phase to single phase cycloconverter. Advantages disadvantages of cycloconverters.

Inverters Introduction to inverter. Operating principle and already state analysis of single phase, voltage source, bridge inverter. Modified Mcmurray half-bridge and full bridge inverter. Three phase bridge inverter. Voltage control (PWM control etc.) and reduction of harmonics in the inverter output voltage. Series inverter.

RECOMMENDED BOOKS

1. P.S. Bimbhra, Power Electronics, Khanna Publishers.
2. M.D. Singh, K.B. Khanchandani, Power Electronics, Tata Mc Graw Hill Publishing company limited.
3. M.H. Rashid, Power Electronics, PHI.
4. P.C. Sen, Power Electronics, Tata Mc Graw Hill Publishing company limited.

BTEE-505 NUMERICAL AND STATISTICAL METHOD

Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**4**	**1**	**0**
Total Marks:	**100**			

Floating-Point Numbers: Floating-point representation, Rounding, Chopping, Error analysis, Condition and instability.

Non-Linear Equations: Bisection, Fixed-point iteration and Newton-Raphson methods, Order of convergence.

Linear Systems and Eigen-Values: Gauss-elimination method (using Pivoting strategies) and Gauss-Seidel Iteration method. Rayleigh's power method for Eigen-values and Eigen-vectors

Interpolation: Lagrange's formula with error, divided difference, Newton's divided difference formula

Numerical Integration: Newton-Cote's quadrature formula (with error) and Gauss-Legendre quadrature formula.

Differential Equations: Solution of initial value problem using Taylor Series, Euler's and Runge- Kutta (up to fourth order) methods Statistical Methods

Random Variables: Definition, Probability distribution, Distribution functions, probability distribution function (pdf) and cumulative distribution function (cdf), Expectation and Variance.

Special Probability Distributions: Binomial, Poisson, Geometric, Uniform, Normal and Exponential distributions.

Sampling Distributions: Population and samples, Concept of sampling distributions, Sampling distribution of mean, Chi-square, t and F distributions (pdf only). Tests of Hypotheses: Basic ideas, Important tests based on normal, Chi-square, t and F distribution.

Curve Fitting: Method of least squares, Fitting of simple curves using this method, Regression and Correlation: (Two variables case only)

BOOKS RECOMMENDED:

1. Jain M.K., Iyengar, S.R.K., and Jain R.K., *Numerical Methods for Scientific and Engineering Computation,* New Age International (2008) 5th ed.
2. Conte, S.D and Carl D. Boor, *Elementry Numerical Analysis: An Algorithmic approach,* Tata McGraw Hill, New York (2005).
3. Johnson, R., Miller, I. and Freunds, J., *Probability and Statistics for Engineers,* Pearson Education(2005) 7th ed.
4. Gerald C.F and Wheatley P.O., *Applied Numerical Analysis,* Pearson Education (2008) 7th ed.
5. Mathew, J.H., *Numerical Methods for Mathematics, Science and Engineering,* Prentice Hall Inc.J (2002).
6. Meyer, P.L., *Introductory Probability and Statistical Applications,* Oxford (1970) 2nd ed.
7. Walpole, Ronald E., Myers, Raymond H., Myers, Sharon L. and, Keying Ye, *Probability and Statistics for Engineers and Scientists,* Pearson Education (2007) 8th ed
8. Sastry S.S., *Introductory Methods of Numerical Analysis*, Prentice Hall (India), (2002), 3rd ed.

BTEEE-503, COMMUNICATION SYSTEMS LAB

Internal Marks:	**30**	**L**	**T**	**P**
External Marks:	**20**	**0**	**0**	**2**
Total Marks:	**50**			

List of experiments:

1. Generation of DSB & DSB-SC AM signal using balanced modulator & determine modulation Index & detection of DSB using Diode detector.
2. Generation of SSB AM signal & detection of SSB signal using product detector.
3. To generate a FM Signal using Varactor & reactance modulation.
4. Detection of FM Signal using PLL & foster seelay & resonant detector.
5. To Study Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
6. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
7. Realization Half Adder / Full Adder using Logic gates.
8. Realization Half Subtractor / Full Subtractor using Logic gates
9. Design 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter.
10. Design 4-Bit magnitude comparator using logic gates.Multiplexer: Truth-table verification and realization of Half adder and Full adder using MUX.
11. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using DEMUX.

BTEEE-505, POWER SYSTEMS-II LAB

Internal Marks:	**30**	**L**	**T**	**P**
External Marks:	**20**	**0**	**0**	**2**
Total Marks:	**50**			

List of experiments:

1. To study the performance of a transmission line. Also compute its ABCD parameters.
2. Study of Characteristics of over current and earth fault protection.
3. To study the operating characteristics of fuse. (HRC or open type)
4. To find the earth resistance using three spikes
5. To study over current static relay.
6. To study the different types of faults on transmission line demonstration panel/model.
7. To study the radial feeder performance when
   (a) Fed at one end.
   (b). Fed at both ends
8. To study the performance of under voltage and over voltage relay.
9. To study the characteristics of bimetal mini circuit breakers.
10. To study the characteristics of Distance Relay.
11. To find the breakdown strength of transformer oil.

BTEEE-506, MICROPROCESSOR LAB

Internal Marks:	**30**	**L**	**T**	**P**
External Marks:	**20**	**0**	**0**	**2**
Total Marks:	**50**			

List of Experiments:

1. Study of 8085 Microprocessor Kit.
2. Write a program to add two 8-bit number using 8085 .
3. Write a program to add two 16-bit number using 8085 .
4. Write a program to subtract two 8-bit number using 8085 .
5. Write a program to subtract two 16-bit number using 8085 .
6. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
7. Write a program to multiply two 8 bit numbers by rotation method using 8085
8. Write a program to multiply 16-bit number with 8-bit number using 8085.
9. Write a program to generate fibonacci series using 8085.
10. Write a program to sort series using bubble sort algorithm using 8085.
11. Study 8086 Microprocessor kit
12. Write a program to copy 12 bytes of data from source to destination using 8086.
13. Write a program to find maximum and minimum from series using 8086.
14. Write a program to control the operation of stepper motor using 8085/8086 microprocessors and 8255 PPI.
15. Write a program for finding square of a number using look-up table and verify.
16. Write a program to control the temperature using 8085/8086 microprocessors and 8255 PPI.
17. Write a program to control the traffic light system using 8085/8086 microprocessors and 8255 PPI.
18. Write a program to control speed of DC motor using 8085/8086 microprocessors and 8255 PPI.

BTEE-601 (Electric Power and Utilization)

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**0**
Total Marks: 100			

Electric Drives: Electrical drives & Mechanical drives, Concept of electrical drives, Basic features of industrial drives, review of operating and starting characteristics of different types of electric motors for various drives (AC and DC motors). Estimation of rating and heating of motors, Load equalization (Fly wheel effect), Drives for particular services.

Electric Traction: Introduction to Indian railways system , Electric Locomotive Classes, Various types of Traction system, single phase feeding arrangement prevalent in India. Substation. arrangements, Different Types of Catenary construction and line insulation, Span and dropper design Calculations.

Electric Heating and Welding: Methods of electric heating, types of electric heating, constructional details and performance of resistance heating furnace. Dielectric heating, Alternating current (AC).and Direct current (DC) Welding, Resistance and Arc Welding. Electric Beam Welding, Laser Welding. Typical construction of electrical welding AC and DC set.

Illumination: Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles, Design of lighting schemes and equipment used for indoor, industrial and flood lighting.

Refrigeration and Air conditioning: Refrigeration system, Domestic refrigeration, Air conditioner, Comfort Air conditioning, Effective temperature.

Electrolysis: Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis.

Recommended books:

1. Partab H., *Modern Electric Traction,* Dhanpat Rai
2. De N.K. and Sen P.K., *Electric Drives*, PHI publication
3. Berde M.S., *Electric Motor Drives*, Khanna Publishers
4 Gupta J.B., *Utilization of Electric Power and Electric Traction,* S.K. Kataria and Sons
5. Tripathy S. C., *Electric Energy Utilization and Conservation*, Tata McGraw Hill
6. Taylor E.O., *Utilization of Electric Energy,* Orient Blackswan
7. Hughes Austin, *Electric Motors and Drives: Fundamentals, Types and Applications*, Newnes, (2005)

BTEEE-601 (Digital Signal Processing)

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**0**
Total Marks: 100			

Introduction : Basic elements of DSP system,Advantages and disadvantage of DSP over analog processing,Application of Digital signal processing.

Discrete time Signal and Systems: Elementary discrete time signals, Manipulation of discrete time signals, Classification of discrete time LTI system using convolution sum method, properties of LTI system, Analysis of LTI system using Difference equqtion.

Z-Transform: Direct Z-Transform and importance of ROC, properties of Z-Transform, Inverse Z-transform methods, Rational Z-transform function representation, system function of LTI systems in Z-domain, one sided Z –Transform.

Discrete Fourier Transform: Frequency domain sampling and reconstruction of discrete time signal, DFT as linear transformation, properties of DFT, use of DFT in linear filtering, Fast fourier transform(FFT),decimation in time ,decimation in frequency algorithm,Goertzel algorithm.

Implementation of Discrete time system: Structures for realisation of discrete time system, Direct form,cascade form, parallel form and lattice form structures for FIR and IIR systems, Representation of numbers, Quantisation of filter coefficients.

Design of digital filters: Fundamentals of filter design, Design of FIR filter using Window method,Design of IIR filter by Impulse invariance, bilinear transformation and matched Z transform technique.Analog amd digital domain frequency transformation.

DSP processor architecture fundamentals: Study of ADSP and TMS series of processor architectures.

Recommended Text book:

1. Digital Signal Processing : Proakis and Manolakis ; Pearson education .

Recommended Books:

1. Digital signal processing : Fleachor: pearson education.
2. Digital signal processing : salivahanan, vallavaraj, and gananpriya; TMH.

BTEE-603 (Non-Linear and Digital Control Systems)

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**0**
Total Marks: 100			

State Variable Techniques: State variable representation of systems by various methods, solution of state variable model. Controllability and observability.

Phase Plane Analysis: Singular points, Method of isoclines, delta method , phase portrait of second order nonlinear systems, limit cycle.

Describing Function Analysis: Definition, limitations, use of describing function for stability analysis, describing function of ideal relay, relay with hystersis, dead zone, saturation, coulomb friction and backlash.

Lyapunov's Stability Method: Lyapunov's direct method, generation of Lyapunov's function by Krasovskii's and Variable Gradient methods

Sampled Data Systems: Sampling process, mathematical analysis of sampling process, application of Laplace transform. Reconstruction of sampled signal, zero order, first order hold. Z- transform definition, evaluation of Z-transform, inverse Z-transform, pulse transfer function, limitations of Z-transform, State variable formulation of discrete time systems, solution of discrete time state equations. Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems.

Recommended books:

1. Ogata K., *Modern control engineering*. Prentice Hall (India)
2. Nagrath I.J., Gopal M., *Control system engineering*, New Age Publications
3. Hsu J.C. and Meyer A.U., *Modern control principles and application*
4. Gopal M., *Digital Control and State Variable Methods*, Tata McGraw Hill
5. Kuo B.C. and Golnaraghi F., *Automatic Control System, Wiley* Publications
6. Dorf R.V. and Bishop R.H., *Modern Control Systems*, Adison Wesley

BTEE-604 (Microcontroller and PLC)

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**0**
Total Marks: 100			

Introduction: Microprocessor, Micro-controllers and their comparison. The 8051 Architecture: Introduction, 8051 micro-controller hardware, input/ output, pins, ports and circuits, external memory, counters and timers, serial data input/ output, interrupts

8051 Assembly Language Programming: The mechanics of programming, assembly language programming process, programming tools and techniques, instruction set (data moving, logical operations, arithmetic operations, jump and call instructions)

8051 Microcontroller Design: Micro-controller specification, external memory and memory space decoding, reset and clock circuits, expanding input and output (I/O), memory mapped I/O, memory address decoding, memory access times, testing the design, timing subroutines, lookup tables for the 8051, serial data transmission

Microcontroller Applications: Interfacing keyboards, displays, Digital-to-Analog (D/A) and Analog-to-Digital (A/D), multiple interrupts, serial data communications, introduction to the use of assemblers and simulators Embedded Systems: Introduction to PLDs and FPGA- architecture, technology and design issues, implementation of 8051 core.

Programmable Logic Controllers (PLC): Introduction, operation of PLC, difference between PLC and Hardwired system, difference between PLC and Computer, relay logic and ladder logic, ladder commands and examples of PLC ladder diagram realization, PLC timers, PLC counters, PLC classification.

Recommended books:

1. Kenneth J Ayola, The 8051 Micro Controller- Architecture, Programming and Application,Penram International Publication
2. John B Peatman, Design with Micro Controller, Tata McGraw Hill
3. Ray A. K. and Bhurchandi K. M., Advanced Microprocessors and Peripherals; Architecture, Programming and Interfacing, Tata McGraw Hill
4. Mazidi M. A. and Mazidi J. G., The 8051 Micro-controller and Embedded System, Pearson Education.
5. Udayashankara V. and Mallikarjunaswamy M.S., 8051 Microcontroller Hardware, Software and Applications, TataMcGraw Hill Education Pvt. Ltd., (2010)
6. Surekha Bhanot, Process Control, Oxford Higher Education.
7. Otter, Job Dan, Programmable Logic Controller, P.H. International, Inc, USA
8. Dunning Gary, Introduction to PLCs, Tata McGraw Hill
9. Kumar Rajesh, Module on PLCs and their Applications, NITTTR Chandigarh

BTEE-608 (Microcontroller and PLC LAB)

	L	T	P
Internal Marks: 30			
External Marks: 20	**0**	**0**	**2**
Total Marks: 50			

Note: Atleast TEN experiments are to be performed in a semester. list of experiments is given below:

List of Experiments:

1. Study of 8051/8031 Micro-controller kits.
2. Write a program to add two numbers lying at two memory locations and display the result.
3. Write a program for multiplication of two numbers lying at memory location and display the result.
4. Write a program to check a number for being ODD or EVEN and show the result on display.
5. Write a program to split a byte in two nibbles and show the two nibbles on display.
6. Write a program to arrange TEN numbers stored in memory location in ascending and descending order.
7. Write a program to find a factorial of a given number.
8. Study of interrupt structure of 8051/8031 micro-controllers.
9. Write a program to show the use of INT0 and INT1.
10. Write a program of flashing LED connected to port 1 of the micro-controller.
11. Write a program to control a stepper motor in direction, speed and number of steps.
12. Write a program to control the speed of DC motor.
13. Implementation of different gates using PLC.
14. Implementation of DOL and star delta starter using PLC.
15. Implement basic logic operations, motor start and stop operation using
    (i) Timers
    (ii) Counters
16. Motor forward and reverse direction control using PLC.
17. Write and implement the LD control program for rack feeder.
18. Make a PLC based system for separating and fetching work pieces.
19. Make a PLC based control system for conveyor belt.
20. Implement a PLC based traffic light control.

BTEE-606 (Power Electronics and Drives LAB)

Internal Marks: 30	**L**	**T**	**P**
External Marks: 20	**0**	**0**	**2**
Total Marks: 50			

Note: Atleast TEN experiments are to be performed in a semester. list of experiments is given below:

List of Experiments:

1. To study principle of operation of SCR, plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
4. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
5. Study of the microprocessor based firing control of a bridge converter.
6. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
7. Study of Jones chopper or any chopper circuit to check the performance.
8. Thyristorised speed control of a D.C. Motor.
9. Speed Control of induction motor using thyristors.
10. Study of series inverter circuit and to check its performance.
11. Study of a single-phase cycloconverter.
12. To check the performance of a McMurray half-bridge inverter

BTEEE-602 (DIGITAL SIGNAL PROCESSING LAB)

	L	T	P
Internal Marks: 30			
External Marks: 20	**0**	**0**	**2**
Total Marks: 50			

Note: Atleast TEN experiments are to be performed in a semester. list of experiments is given below:

List of Experiments:

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
2. To develop program modules based on operation on sequences like signal shifting, signal folding, signal addition and signal multiplication.
3. To develop program for discrete convolution and correlation.
4. To develop program for finding response of the LTI system described by the difference equation.
5. To develop program for computing inverse Z-transform.
6. To develop program for finding magnitude and phase response of LTI system described by system function H(z).
7. To develop program for computing DFT and IDFT.
8. To develop program for computing circular convolution.
9. To develop program for conversion of direct form realisation to cascade form realisation.
10. To develop program for cascade realisation of IIR and FIR filters.
11. To develop program for designing FIR filter.
12. To develop program for designing IIR filter.

BTEE-801 (Power System Analysis)

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**0**
Total Marks: 100			

System Modelling:

System modelling of synchronous machines, transformers, loads etc, per unit system, single line diagram of electrical networks, single phase impedance diagrams. Formulation of impedance and admittance matrices for the electrical networks.

Load Flow Studies:

Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutions by the Gauss-Seidal method and Newton Raphson Method.

Fault Analysis:

Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers, Algorithm for short circuit studies, Symmetrical Component transformation, construction of sequence networks of power systems. Symmetrical Analysis of Unsymmetrical Line-to-ground (LG), Line-to line (LL), double line to ground (LLG) faults using symmetrical components.

Power System Stability:

Steady state stability, Dynamics of a synchronous machine, Power angle equations , Transient stability, equal area criterion, Numerical solution of swing equation , factors effecting transient stability.

BOOKS RECOMMENDED:

1. Elgerd O.I., *Electric Energy Systems Theory,* Tata McGraw Hill

2. Nagrath I.J., Kolthari D.P., *Modern Power System Analysis,* Tata McGraw Hill

3. Stevenson W.D., *Elements of Power System* Analysis, McGraw Hill

4. Nagrath I.J. and Kothari D.P., *Power System Engineering, Tata McGraw Hill*

5. Arrillaga J. and Arnold C.P., *Computer Analysis of Power Systems, John Wiley & Sons*

6. Stagg Glenn W. and Ei-Abiad Ahmed H., *Computer Methods in Power System Analysis, Tata* McGraw Hill

BTEE-802 (High Voltage Engineering)

Internal Marks: 40	**L T P**
External Marks: 60	**3 1 0**
Total Marks: 100	

Extra High Voltage (EHV) Transmission and Corona Loss:
Need for EHV Transmission. Use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, Corona loss. Factors affecting the corona loss. Radio interference due to corona. Shunt and series compensation in EHV lines. Tuned power lines. Insulation Co-ordination.

High Voltage Direct Current (HVDC) Transmission:
Advantages, disadvantages and economics of HVDC Transmission system. Types of Direct Current (DC) links, converter station equipment, their characteristics.

Insulating materials for High Voltage :
Applications of insulating materials used in power transformers rotating machines, circuit breakers, cables, power capacitors.

Conduction and breakdown in Gases, Liquids and Solid Dielectrics:
Solids Intrinsic, electromechanical and thermal breakdown composite dielectrics, solid dielectrics used in practice.

Liquids:
Conduction and breakdown in pure and commercial liquids, suspended particle theory, cavitation and bubble theory, stressed oil volume theory, Liquids used in practice.

Gases:- Ionization process, Townsend's current growth equations, Ist and 2nd ionization coefficients. Townsend's criterion for breakdown. Streamer theory of breakdown, Pashen's law of Gases. Gases used in practice.

Generation of High Voltages:
High Voltage Direct Current (HVDC), High Voltage Alternating Current (HVAC), Power frequency and High frequency: Impulse voltage and impulse current Generation, Tripping and contact of Impulse Generator. Measurement of voltage and current: High voltage direct current, Alternating current and Impulse voltage and currents.

BOOKS RECOMMENDED:

1. Bagamudre, Rakesh Das *Extra High Voltage A.C. Transmission Engineering*, New Age International Publishers.
2. Kimbark E.W., *High Voltage Direct Current Transmission*, Wiley-Interscience
3. Kamaraju V. and Naidu M.S., *High Voltage Engineering*, Tata McGraw-Hill Education
4. Jha R.S., *High Voltage Engineering, Dhanpat Rai*
5. Kuffel, E. and Abdullah, M., *High Voltage Engineering*, Pergamon Press
6. Wadhwa C. L., *High Voltage Engineering*, New Age Publications.
7. Padiyar, K.R. *HVDC Power Transmission Systems: Technology and System Interactions*, New Age International

BTEEE-801 (Antenna and Wave Propagation)

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**0**
Total Marks: 100			

Introduction:
Physical concept of Radiation in single wire, two wire, and dipole, Current Distribution on a thin wire antenna.

Fundamental Parameters of Antenna:
Radiation Pattern, Radiation Power Density, Radiation intensity, Directivity, Gain, Antenna efficiency, Beamwidth, Bandwidth, Polarisation, Antenna Input Impedance, Elementary idea about self and mutual impedance, Radiation efficiency, Effective aperture, Antenna Temperature.

Linear Wire Antennas:
Retarded potential, Infinitesimal dipole, Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole.

Antenna Arrays:
Array of two point sources, Array factor, n-element linear array with uniform amplitude and spacing, Analysis of Broadside array, Ordinary end-fire array, Hansen-woodyard end fire array, n-element linear array with non-uniform spacing, Analysis of Binomial and Dolph-Tschebyscheff array, Scanning Array, Superdirective array.

Aperture Antennas:
Field Equivalence principle, Rectangular and circular aperture antennas, Horn antenna, Babinet's Principle, Slot Antenna, Reflector antenna.

Ground wave Propagation:
Friis Free space equation, ,Reflection from earth's surface, Surface and Space wave propagation for vertical and horizontal dipole, Field strength of Space wave, Range of space wave propagation, Effective earth's radius, Effect of earth imperfections and atmosphere on space wave propagation, Modified refractive index, Duct propagation, Tropospheric propagation.

Ionospheric Propagation:
Structure of ionosphere, propagation of radio waves through ionosphere, Refractive index of ionosphere, Reflection and refraction of waves by ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, Lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

BOOKS RECOMMENDED:

1. Antenna Theory , Balanis C.A ,John Wiley & sons.
2. Electromagnetics and radiating systems, Jordan E.C. PHI.

Reference Books:
1. Antenna and radio wave propagation, Collins R.E., McGraw Hill.
2. Antenna Theory , Krauss J.D. McGraw Hill.

BTEE-806 (POWER SYSTEM ANALYSIS LAB)

Internal Marks:	**30**	**L**	**T**	**P**
External Marks:	**20**	**0**	**0**	**2**
Total Marks:	**50**			

Note: Atleast TEN experiments are to be performed in a semester. List of experiments is given below:

List of Experiments:

1. Design of transmission systems for given power and distance.
2. Short circuit calculations and calculations of circuit breaker ratings for a power system network.
3. Design of substations
4. Design of distribution systems
5. Y-bus formation
6. Z-bus formulation
7. Load flow analysis by Gauss Seidal method
8. Load flow analysis by Newto Raphson method
9. Fault analysis for line-to-line (L-L), Line-to-Ground (L-G) etc
10. Design of underground cabling system for substation.
11. To obtain power system stability on High Voltage Alternating current (HVAC) system with the help of Flexible Alternating Current Transmission Systems (FACTS) devices.
12. Optimal Capacitor placement on a system having variable reactive power and low voltage profile.
13. To obtain relay co-ordination on a power system.
14. To obtain optimal generator pricing on hydro-thermal and renewable energy systems.
15. To find synchronous reactances (Transient, sub-transient) during fault analysis.

BTEEE-OPA (Electrical Machines)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Magnetics and Energy Conversion: Magnetic circuit, Analogies between electric and magnetic circuits, Magnetic Hysteresis and Hysteresis loss, Interaction of magnetic fields, Motor action, Generator action, Eddy currents and eddy current losses, Multi-polar machines.

Transformers: Construction of power and distribution transformers, Principle of transformer action, Concept of ideal transformer, EMF equation, Transient behavior when loading and unloading, Phasor diagrams, Equivalent circuit, Determination of transformer parameters, Regulation and efficiency, Per-unit impedance of transformer windings, Auto transformer, Parallel operation of transformers, Transformer nameplates.

Three Phase Induction Motors: Construction and principle of operation, Slip-torque equation, characteristics, Phasor diagram at standstill and on load, Equivalent circuit, Parasitic toques, No load and blocked rotor tests, Starting, Methods of speed control, Applications, Name plate data.

Speciality Motors: Single phase induction motor, Shaded-pole motors, Hysteresis motor, Reluctance motor, Universal motor, Stepper Motor and their characteristics, applications

DC Machines: Flux distribution and generated voltage in DC machines, Commutation, Dynamic behavior when loading and unloading a DC motor, Armature reaction, Dynamic behavior during speed adjustment, Mechanical power and developed torque, losses and efficiency, Starting a DC Motor, Series/Shunt/Compound machines, Dynamic braking, Plugging and Jogging, Standard terminal markings and connections of DC motors.

Synchronous Machines: Introduction to synchronous machines.

Books Recommended:

1. Hubert C I, "*Electric Machines: Theory, Operation, Applications, Adjustment, and Control, 2/e*", Pearson Education India (2003)
2. Sarma M S and Pathak M, *"Electrical Machines"*, Cengage Learning India (2008).
3. Bhatacharya S, "*Eletrical Machines",* Tata McGraw Hill (2008).
4. Nagrath I J and Kothari D P, "*Electric Machines*", Tata McGraw Hill (1985).
5. Bimbhra P S, *"Electrical Machinery"*, Khanna Publishers, Delhi, 6th Ed. (2003)

BTEEE-OPB (Elements of communication system)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Base Band Signals and Systems:
Introduction, Elements of communication system, Noise and its types, Noise figure and Noise factor, Noise equipment temperature, Modulation & Demodulation, Mixing, Need of modulation, Types of modulation systems, AM, FM their sidebands, Comparison, Sampling theorem, Different Pulse Modulation techniques- PAM, PWM, PPM and PCM, FDM, TDM,
Introduction to Fourier series and Fourier transform of periodic signals.

Analog Communication: Transmitters
Block diagram explanation of low and high level AM transmitter, AM broadcast transmitter, DSB transmitter, SSB transmitter, and Independent Sideband transmitter, Block diagram explanation of Reactance tube, and Armstrong FM transmitters, Stereophonic FM broadcast transmitter.

Analog Communication: Receivers
AM diode detector, characteristics of radio receiver, Sensitivity, Selectivity, Fidelity, and Image rejections, Classification of radio receivers, TRF receiver and Super Heterodyne receiver, Block diagram explanation of AM receiver, AM receiver using PLL, DSB and SSB receiver, Independent sideband receiver, AM broadcast receiver, Noise in AM systems, FM detection, Block diagram explanation of FM receiver and Stereophonic FM broadcast receiver, Noise in FM systems.

Data Communication
Concepts Data representation, Data transmission, Modes of data transmission, Signals encoding, Transmission channel, Directional capability of data exchange.

Digital Communication
Wire pairs, Microwave, Coaxial cables, Satellite communication, Optical fibers, Modulation techniques AM, FM, PM, Digital modulation method ASK, FSK, PSK, Multilevel modulation, Synchronous and asynchronous modulation, Modems and Line Drivers, Data multiplexing techniques- FDM, TDM, STDM, Multiplexed common carrier system, Multiplexing satellite signals concentrations, Data compression Hoffman code Adaptive scanning, Facsimile Compression

Suggested Books:
1. Simon Haykin , **Analog communication system** , Prentice hall.
2. J.S Chitode ,**Communication Engineering**,Technical Publications.
3. A.P.Godse U.A.Bakshi ,**Communication Engineering** , Technical Publications.

BTEEE-OPC (Elements of Power System)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

SUPPLY SYSTEM:
Introduction to Transmission and Distribution systems, Comparison between DC and AC systems for Transmission and Distribution, comparison of cost of conductors, choice of working voltage for transmission and distribution, economic size of conductors - Kelvin's law, Radial and mesh distribution networks, Voltage regulation.

CONDUCTORS AND TRANSMISSION LINE CONSTRUCTION:
Conductor materials; solid, stranded, ACSR, hollow and bundle conductors. Different types of supporting structures for overhead lines. Elementary ideas about transmission line construction and erection. Stringing of conductors, spacing, sag and clearance from ground, overhead line insulators, concept of string efficiency.

TRANSMISSION LINE PARAMETERS:
Introduction to line parameters, Resistance of transmission line, inductance of single phase two wire line, concept of G.M.D., Inductance of three phase line, Use of bundled conductor, transposition of power lines, capacitance of 1-phase and 3-phase lines. effect of earth on capacitance of conductors.

PERFORMANCE OF TRANSMISSION LINES:
Representation of short transmission line, medium length line (nominal T & II circuits). long length line by hyperbolic equations and equivalent T & II circuits. Power flow through transmission lines, ABCD constants, Voltage regulation.

CIRCLE DIAGRAM AND LINE COMPENSATION:
Receiving end circle diagram for long transmission lines based on ABCD constants, equivalent T circuits, power loci, surge impedance loading, reactive power requirement of system series and shunt compensation, Synchronous phase modifiers , rating of phase modifiers.

UNDERGROUND CABLES:
Classification of cables based upon voltage and dielectric material, insulation resistance and capacitance of single core cable, dielectric stress, Capacitance of 3 core cables, methods of laying, heating effect, Maximum current carrying capacity, cause of failure, comparison with overhead transmission lines.

RECOMMENDED BOOKS

1.Elgerd O.L., *Electrical Energy System Theory - An introduction*, Tata McGraw-Hill Publication
2. Gupta B.R., Power System Analysis & Design, Wheeler Publishing.
3. Nagrath I.J. and Kothari D.P., Power System Analysis Tata McGraw-Hill Publication
4. Stevenson Jr. W.D., *Elements of Power System Analysis*, Tata McGraw-Hill Publication
5. Wadhwa C.L., *Course in Electrical Power*, New Age International (P)Ltd.

BTEEE-OPD (Transducers and Signal Conditioning)

Internal Marks 40 **L T P**
External Marks 60 **3 1 0**
Total Marks 100

Transducers:
Introduction, Classification, Mechanical devices as primary detectors, Basic requirements of a transducer, Electrical transducer, Types of transducers for measuring displacement, strain, vibration, pressure, flow, temperature, force, torque, liquid level, humidity, PH value, velocity (angular and linear), acceleration, Basic principles of resistive transducers, Inductive transducers, Capacitive transducers, Thermoelectric, Piezo electric transducers, Hall effect transducers, Electromechanical transducers, Photoelectric transducer, Digital transducers

Signal Processing Circuits:
Introduction, Ideal OP-Amp, Operational amplifier specifications, Zero crossing detector, Zero crossing detector with hysteresis, Inverting and non inverting amplifier, Voltage follower, Adder, Subtractor, Multiplier, Divider, Integrator, Differentiator, Voltage to current convertor, Current to voltage convertor, Phase shifter, Absolute-value circuit, Peak detector, AC to DC, Logarithmic convertor, Differential amplifier, Instrumentation amplifier, Analog modulator and demodulator

Data Display and Recording System:
Introduction to analog and digital display methods, Analog recorders, C.R.O., Magnetic tape recorders, Digital input output devices, Digital frequency meter, Digital voltmeter

Data transmission and Telemetry:
Introduction, Characteristics of Frequency division multiplexing, Time division multiplexing, Transmission channel and media.

Data Acquisition and Conversion:
Introduction, Signal conditioning of the inputs, Single channel D A S, Multi-channel DAS, Data conversion, Multi-plexer, S/H circuit, A/D convertor.

RECOMMENDED BOOKS:
1. Transmission and Instrumentation, Murty, D.V.S., Prentice Hall of India Pvt., 2nd edition, 2008
2. Instrumentation devices and systems, C.S. Rangan, G.R. Sarma, V.S.V. mani, TMH new delhi, 2006
3. A course in electrical and electronic measurements and instrumentation, A.K. Sawhney, Dhanpat Rai and sons

BTEEE-603A (Electrical Machine Design)

Internal Marks 40 **L T P**
External Marks 60 **3 1 0**
Total Marks 100

Review of Magnetic and insulating materials.

Principles of design of Machines:

Factors and limitations in design, specific magnetic and electric loadings, output, real and apparent flux densities, separation of main dimensions for D.C., induction and synchronous machines.

Heating, Cooling and Ventilation:

Temperature rise calculation, continuous, short time and intermittent ratings, types of ventilation, hydrogen cooling and its advantages.

Design of Transformers:

General considerations, output equation, main dimensions, leakage reactance, winding design, tank and cooling tubes, calculation of magnetizing current, losses, efficiency and regulation.

Design Three-phase induction motors:

General considerations, output equation, choice of specific electric and magnetic loadings, No. of slots in stator and rotor, elimination of harmonic torques, design of stator and rotor windings, leakage reactance, equivalent resistance of squirrel cage rotor, magnetizing current, temperature rise and efficiency. Introduction to computer aided electrical machine design.

BOOKS RECOMMENDED:

1. Sawhney A.K., *A Course in Electrical Machine Design,* Dhanpat Rai.

2. Aggarwal R.K., *Principles of Electrical Machine Design*, S. K. Kataria and Sons.

3. Deshpande M.V., *Design And Testing of Electrical Machines*- PHI Learning Pvt. Ltd.

4. Upadhyay K.G., *Design of Electrical Machine,* New Age International.

5. Hamdi Essam S., *Design of small electrical machines*,Wiley publications

BTEEE-603B (Microwave And Radar Engineering)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Microwave Tubes:
Limitations of conventional tubes, construction, operation and properties of Klystron Amplifier, reflex Klystron, Magnetron, TWT, BWO, Crossed field amplifiers.

Microwave Solid State Devices:
Limitation of conventional solid state devices at MW, Transistors(Bipolar, FET) , Diodes(Tunnel, Varactor, PIN), Transferred Electron Devices(Gunn diode), Avalanche transit time effect (IMPATT, TRAPATT, SBD)

Microwave Components:
Analysis of MW components using s-parameters, Junctions (E, H, Hybrid), Directional coupler, Bends and Corners, MW posts, S.S. tuners, Attenuaters, Phase shifter, Ferrite devices(Isolator, Circulator, Gyrator), Cavity resonator, Matched termination.

Microwave Measurements:
Power measurements using calorimeters and bolometers, Measurement of SWR, Frequency and wavelength, Microwave bridges.

Introduction to Radar Systems:
Basic Principle: Block diagram and operation of Radar, Radar range Equation, PRFs and Range Ambiguities, Applications of Radar.

Doppler Radars:
Doppler determination of velocity, CW radar and its limitations, FMCW radar, Basic principle and operation of MTI radar, Delay line cancellers, Blind speeds and staggered PRFs.

Scanning and Tracking Techniques:
Various scanning techniques(Horizontal, vertical, spiral, palmer, raster, nodding), Angle tracking systems(Lobe switching, conical scan, monopulse), Range tracking systems, Doppler(velocity)tracking systems.

Text books:
1. Microwave devices and circuits: Samuel Liao;PHI
2. Microwave devices and radar engg: M.Kulkarni;Umesh Publications
3. Introduction to radar systems: Merill I. Skolnik

Reference Books:
1. Foundation of Microwave Engg : R.E.Collin;McGraw Hill
2. Microwave Engg: K.C Gupta

BTEEE-603C (Object Oriented Programming Using C++)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Basics of C & C++
Introduction, Basics, Data Type, Bit Field integer, Operations, Control Structures, Storage Classes, User Defined Data Type, Reserved Words and Standard 110 Statements in C & C++ .

Object Orient Programming With C++
Introduction ,Object Oriented Programming Concept, Objective of OPP, Programming Structure in C++, Data Abstraction

Overloading and Information Hiding
Introduction, Function Overloading, Information Hiding

Memory Management in C++
Introduction ,Constructor-Automatic Initialization of Objects, Dynamic Memory Management , Default Constructor, Copy Constructor, Constructor and Information Hiding, Destructor-Automatic Clear up of an Object

Inheritance
Introduction, Inheritance-Data and Code Sharing , Class Derivation ,Ambiguity in Class Member Access ,Virtual Base Class-A Remedy , Class Initialization in Inheritance Arguments for the Base Class

Bindings and Polymorphism
Introduction , Bindings in C++, Polymorphism

Generic Facility
Introduction ,Concept of Generic Facility, Generic Function ,Overloading a Generic Function, Generic Classes

File Handling in C++
Introduction , Concept of Stream in C++, File Positioning Functions , Error Handling During File Operation

BOOKS RECOMMENDED

1. Herbert Schildt, **C++ The Complete reference**, 4th Edition, TMH.
2. E. Balaguruswami, **Object oriented programming using C++,** TMH.
3. Bjarne Stroustroup, **The C++ Programming language**, Pearson Education.
4. Robert C Lafore, **Turbo C++,** Galgotia Publications.
5. E. Balaguruswami, **Ansi C,** TMH.

BTEEE-603D (Analytical Instrumentation)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction:
Difference between analytical and other instruments , sampling system for liquids and gases, sampling components, faithful sampling
Humidity and Moisture Measurements:

Humidity measurement:
Factors-absolute specific, relative humidity and dew point, dry and wet psychrometer, hair Hygrometer, dew point meter. Moisture measurement: definition, electrical method, NMR method, IR method.

Elemental and Gas Analysis:
Gas chromatography- Principles & components, Thermal cavity gas analyzers, heat of reaction method, Estimation of hydrogen, methane, CO2, Carbon monoxide etc. in binary or gas mixture, paramagnetic oxygen analyzer, Electro chemical method, polarography, Density measurement.

Composition Measurement:
Newtonian and Non Newtonian measurement of viscosity and consistency, laboratory and online measurement of pH :- definition and methods ,redox potential, conductivity, conductivity cell and applications, density measurement: solids, liquids and gases.

Spectral Analysis:
Classification of techniques, Principles of components, emission spectrometry:- flame emission , atomic type, dispersive techniques, scheme for UV, IR and near IR, comparison of methods, X-ray analyzers NMR spectrometry, Spectroscopy ,Mass Spectrometery.

BOOKS RECOMMENDED

1. Handbook of Analytical Instruments, Second Edition, By R.S. Khandpur, TMH.
2. Analytical Instrumentation By Gillian McMahon, Wiley Education.
3. Analytical Instrumentation Handbook, Second Edition**,** By Galen Wood Ewing.
4. Analytical Instrumentation: An Introduction, by R.P. Khare, CBS
5. Priciples of Industrial Instrumentation by Pataranbis, TMH
6. Analytical Instrumentation by Bela G. Liptak, CBC

BTEEE -603E (Optimization Techniques)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction:

An overview of optimization problems, some simple illustrative examples.

Linear Programming:

Introduction, graphical method, Simplex method, method of artificial variables, alternate optima, redundancy in linear programming, degeneracy and cycling, the simplex tableau in condensed form.

Nonlinear programming:

Introduction, Lagrange multipliers, Karaush –kuhn-tucker (KKT) optimality conditions, convexity, sufficiency of the KKT conditions, Duality and convexity.

Approximation Techniques:

Introduction, line search methods, gradient based methods, approximation under constraints.

Dynamic Programming:

Sequential optimization, representation of multistage decision process; Types of multistage decision problems; concept of sub optimization and principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP); Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP.

BOOKS RECOMMENDED:

1. Introduction to optimization by Pablo Pedregal, Publisher:springer
2. Numerical optimization with applications by Suresh Chandera, Jaydeva and Aparna Mehta Publisher, Narosa
3. An Introduction to optimization by Edvin K.P. Chong, and Stainslaw H. Zak Publisher, John Wiley
4. Optimization theory and practice by Mohan C. Joshi and Kanan M Moudgalya Publisher , Narosa

BTEEE -603F (Deregulation of Power System)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction:
Basic concept and definition, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system, advantages of competitive system.

Transmission Pricing:
Marginal pricing of Electricity, Noda pricing, embedded cost, Postage stamp method, contract path method, boundary flow method, MW mile methods, MVA –mile method, comparison of different methods.

Regulation of Power Sector:
Generation of ownership and operation deregulated method, pool model, pool and bilateral trades model, multilateral trade model.

Different Experience in Deregulation:
China, California, New Zealand and Indian Power System.

BOOKS RECOMMENDED:

1. Power system Restructuring and Deregulation-edited by Loi Lei Lai John Wiley & Sons Ltd.
2. Understand Electric Utilities and Deregulation by Lorrin Philison and H Lee wilis,CRC PRESS
3. Structured electrical power system operation, trading and voletality by Mohammad and Muwaffaq Alomoush, Marcel Dwkker Inc, New Delhi

BTEEE-804A Generation and Control of Power

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction to Power Generation Units:
Characteristics and its variations,

Economic Operation of Power Systems:

Fuel consumption, Characteristics of thermal unit, Incremental fuel rate and their approximation, minimum and maximum power generation limits.

Economic Dispatch:

Economic dispatch problem with and without transmission line losses, Unit Commitment and solution methods. Hydrothermal scheduling: fixed-head and variable head, Short-term and Long-term,

Power System Control:

Power system control factors, interconnected operation, tie-line operations, Reactive power requirements, during peak and off peak hours, Elementary ideas of load frequency and voltage, reactive power control; block diagrams of P-f and Q-V controllers, ALFC control, Static and Dynamic performance characteristics of automatic load frequency control (ALFC) and automatic voltage regulator (AVR) controllers, Excitation systems.

Power System Security:
Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and linear programming.

Power flow analysis in AC/DC systems:
General, modelling of DC links, solution of DC load flow, discussion, per unit system for DC quantities, solution techniques of AC-DC power flow equations.

BOOKS RECOMMENDED:
1. Nagrath, I.J. and Kothari, D.P., *Power System Engineering*, Tata McGraw Hill (2007).
2. Stevenson W.D. and Grainger J.J., *Power System Analysis*, McGraw Hill (2007).
3. Arrillaga J. and Smith Bruce, *AC-DC Power System Analysis*, IEE Press
4. Elgerd, O.I., *Electric Energy Systems Theory: An Introduction*. 2nd Ed., Tata McGraw Hill, 1983.

BTEEE-804B (HVDC Transmission)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Direct Current (DC) power transmission technology:
Introduction, comparison of Alternating Current (AC) and Direct Current (DC) transmission, application of DC transmission, application of DC transmission, description of DC transmission system, Configurations, planning for High Voltage Direct Current (HVDC) transmission, modern trends in DC transmission. Introduction to Device: Thyristor valve, valve tests, recent trends.

Analysis of High Voltage Direct Current (HVDC) converters:

Pulse number, choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, characteristics of a twelve-pulse converter, detailed analysis of converters with and without overlap.

Converter and HVDC system control:

General, principles of DC link control, converter control characteristics, system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link, power control, higher level controllers, telecommunication requirements.

Converter faults and protection:

Introduction, converter faults, protection against over-currents, over-voltages in a converter station, surge arresters, protection against over-voltages.

Smoothing reactor and DC line:

Introduction, smoothing reactors, DC line, transient over voltages in DC line, protection of DC line, DC breakers, Monopolar operation, effects of proximity of AC and DC transmission lines.

Component models for the analysis of AC/DC systems:

General, converter model, converter control, modelling of DC network, modelling of AC networks.

RECOMMENDED BOOKS:

1. Bagamudre, Rakesh Das *Extra High Voltage A.C. Transmission Engineering*, New Age International Publishers.

2. Kimbark E.W., *High Voltage DC Transmission*, Wiley-Interscience

3. Kamaraju V. and Naidu M.S., *High Voltage Engineering,* Tata McGraw-Hill Education

4. Jha R.S., *High Voltage Engineering, Dhanpat Rai*

5. Kuffel, E. and Abdullah, M. High Voltage Engineering, Pergamon Press

BTEEE-804C (Mechatronics)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction:
Concept and scope of automation, Socio economic consideration, Low cost automation.

Fluid Power Control:
Fluid power control elements and standard graphical symbols, Construction and performance of fluid power generators, Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control: Servo valves and simple servo systems with mechanical feedback, governing differential equation and its solution for step position input, Basic hydraulic and pneumatic circuits.

Pneumatic Logic Circuits:
Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations.

Fluidics:
Boolean algebra, Truth tables, Conda effect, Fluidic elements - their construction working and performance characteristics: Elementary fluidic circuits.

Transfer Devices and Feeders:
Their Classification: Construction details and application of transfer devices and feeders (Vibratory bowl feeder, reciprocating tube feeder and centrifugal hopper feeder).

Electrical and Electronic Controls:
Introduction to electrical and electronic controls such as electromagnetic controllers - transducers and sensors, microprocessors, programmable logic controllers (PLC), Integration of mechanical systems with electrical, electronic and computer systems.

Robotics:
Introduction, classification based on geometry, devices, control and path movement, End effectors - types and applications, Sensors - types and applications, Concept of Robotic/Machine vision, Teach pendent.

Industrial Applications:
of Robots for material transfer, machine loading / unloading, welding, assembly and spray painting operations.

RECOMMENDED BOOKS:
1. Anthony Esposito, **Fluid Power with applications**, Pearson.
2. S.R. Majumdar, **Pneumatic Control,** Tata Mc Graw Hill.
3. S.R. Deb, **Robotics and Flexible Automation**, Tata mc Graw Hill

BTEE-804 D (Biomedical Instrumentation)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Transducers: Strain gauge for respiratory flow transducer, piezo resistive transducer for intracardiac catheter, thermistor as temperature sensing elements - its characteristics and compensation for non-linearity.

Piezoelectric transducer: its equivalent circuits and impedance frequency characteristics. Its applications as intra cardiac microphone, heart assist device and ultrasonic instruments. Variable inductance transducer, different configuration and application for measurement of muscular tremor. linear variable differential transformer (LVDT) and its signal processing circuitry. Magnetostrictive and variable capacitance transducers, stretched diaphragm transducer and its characteristics.

Measurement and recording of bioelectric signals: electrocardiogram (ECG), electromyogram (EMG), electroencephalogram (EEG) and instruments for picking up and reproducing bioelectric signals, specific design characteristics, sources of noise and its removal.

Measurement and recording of non-electric signal: Measurement and recording of pressure, temperature, respiration rate, pulse rate and blood flow. Electromagnetic blood flow meter, thermography, pH measurements, gas analysis, ESR (erythrocyte sedimentation rate) measurement, plethysmograph, X-Ray, tonometer and dialysis. Ultrasonics and echoencephalography radiography imaging isotopes and nuclear medicine.

Equipment for effecting the human body: Stimulator, defibrillator, pacemaker, diathermy.

Prosthetics: Upper and lower extremity prostheses, harness control, EMG-controlled externally powered prosthesis, basic concept of monofunctional and multifunctional devices.

Biotelemetry: Radio-telemetry of biological signal, signal source, antenna and frequency design considerations, example of single channel FM units.

RECOMMENDED BOOKS:

1. Webster JG (Ed.), “Medical Instrumentation, Application and Design”, 3rd ed., Singapore: John Wiley & Sons, 2003
2. Carr JJ and Brown JM., “Introduction to Biomedical Equipment Technology”, 4/e, New Delhi: Pearson Education India, 2001.
3. Webster JG (Ed.), “Encyclopedia of Medical Devices and Instrumentation”, Vols. 1-4, New York: Wiley, 1988
4. Bronzino JD (Ed.), “Medical Devices and Systems”. Florida: CRC Press, 2006
5. Chatterjee S and Miller A, “Biomedical Instrumentation”, Cengage Learning, 2010.
6. Waugh A and Grant A, “Ross and Wilson Anatomy and Physiology in Health and Illness, 11e, Elsevier, 2006

BTEEE-804E (Computer Networks)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Data communication concepts: Digital & Analog, Parallel & serial, Synchronous Simplex, Half duplex & Full duplex.

Computer Networks: Introduction, N/W Topology, Wired N/W Vs wireless N/W. Classification of computer N/W's- LAN, MAN, WAN. Internet,Intranet & Extranet. & Protocol suits (eg TCP/IP, IPX/SPX), Need of Protocols & their significance in
Networking.

N/W Reference Models:- OSI reference Model, TCP/IP reference Model, comparison of OSI & TCP/IP Ref Models.

H/W: Ethernet cabling, The NIC, Repeater, Router, Bridges, Switches, Transcievers, hubs, Cable Modems. Comminication Switching Techniques: Circuit Switching, Packet Switching & Message
switching. standards (IEEE 802 PROJECT): Ethernet, CSMA/CD, Token Ring, Token Bus, & their frame formats. FDDI.

Data link & N/W layer Services provided to N/W layer, Framing, Data link control: Flow control, Error Detection, HDLC & SDLC, concept of Routing & congesition control.

Transport layer Transport layer Protocols like TCP, UDP, connection Oriented Transport Protocol, TCP services.

N/W Protocols: Low level Protocols. SLIP, PPP NETBEUI, High level Protocols:- IP & IP Addresses, ARP,RARP
.
Traditional Application: Terminal Acess:Telnet, File transfer: FTP, Email: SMTP & MIME & POP3

Modern Applications: Web Applications :- HTTP. Internet and its Applications .

Unix Networking concepts: Introduction to sockets.

RECOMMENDED BOOKS:

1. William Stallings "Computer Networking with Internet Protocols And Technology", Pearson Education.
2. Keneth C. Mansfield, Jr. James L. Antonakos "An Introduction to Computer Networking", PHI.

BTEEE-804F (Wireless Communication)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction: Mobile Radio Systems around the world, Examples of Wireless Communication Systems; Paging Systems, Cordless Telephone Systems, Cellular Telephone Systems, Comparison of common Wireless Communication systems

Digital Communication through fading multipath channels: Fading channel and their characterstics- Channel modelling, Digital signalling over a frequency non selective slowly fading channel- frequency selective slowly fading channel- Calculation of error probabilities- Tapped Delay line model- The RAKE demodulator- performance-Concept of diversity branches and signal paths- Combining methods- Selective diversity combining-pre-detection and post-detection combining- Switched combining- maximal ratio combining- Equal gain combining.

Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access, Packet Radio Protocols; Pure ALOHA, Sloted ALLOHA, Capacity of Cellular Systems

Wireless Networking: Introduction, Difference between Wireless & Fixed Telephone Networks, Development of Wireless Networks, Traffic Routing in Wireless Networks, Wireless Data Services, Common Channel signaling, Broad band ISDN & ATM, Signaling System No. 7(SS-7), Personal Communication Services/ Networks, Protocols for Network Access, Network Databases.

Wireless Systems & Standards: AMPS and ETACS, United states digital cellular (IS- 54 & IS 136), Global system for Mobile (GSM); Services, Features, System Architecture, and Channel Types, Frame Structure for GSM, Speech Processing in GSM, CDMA Digital standard (IS 95); Frquency and Channel specifications, Forward CDMA Channel, Reverse CDMA Channel, CT2 Standard for Cordless Telephones, Personal Access Communication System, Pacific Digital Cellular, Personal Handyphone Systems, PCS and ISM Bands, Wireless Cable Television.

Wireless Local Area Networks (WLAN): Components and working of WLAN, transmission media for WLAN, Modulation techniques for WLAN (DSSS, FHSS), IEEE 802.11 standards and protocols for WLAN (MACA, MACAW). Mobile Network and Transport layer: Mobile IP, Mobile TCP, traffic routing in wireless networks, wire less ATM. Wireless Local Loop(WLL) : WLL Architecture, WLL Technologies and frequency spectrum.

Future trends: Blue Tooth technology, 4G mobile techniques, Wi-Fi Technology.

RECOMMENDED BOOKS:

1. Theodore S.Rappaport, "Wireless communications:Principles and practice", third Indian reprint Pearson Education Asia 2003.

2. Raj Pandya, "Mobile and Personal Communication systems and services", Prentice Hall of India, 2001.

BTEEE-805A (Energy Auditing and Management)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act- 2001 and its features.

Energy Management and Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of energy savings companies (ESCOs).

Electrical system: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues

Compressed air system: Types of air compressors, Compressor efficiency, efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency

High Voltage Alternating Current and Refrigeration System: Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting refrigeration and air conditioning system performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities.

RECOMMENDED BOOKS:

1. Abbi, Y.P. and Jain, S., *Handbook on Energy Audit and Environment Management*, Teri Bookstore 2. Diwan, P., *Energy Conservation*, Pentagon Press (2008).
3. Younger, W., *Handbook of Energy Audits*, CRC Press (2008)
4. Sawhney and Maheshwari, *Solar Energy and Energy Conservation*, Prentice Hall (India)
5. Rao S. and B. B. Parulkar, *Energy Technology*, Khanna Publishers
6. Sukhatme S. P., *Solar Energy*, Tata McGraw Hill

BTEEE-805B (Agrionics)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction: Necessity of instrumentation and control for food processing and agriculture sensor requirement, remote sensing, biosensors in Agriculture, standards for food quality.

Soil science and sensors: pH, conductivity, resistivity, temperature, soil moisture and salinity, ion concentration, measurements, methods of soil analysis. Instrumentation for environmental conditioning of seed germination and growth.

Processes:
a) Flow diagram of sugar plant, sensors and instrumentation set-up for it.
b) Flow diagram of fermenter and control (Batch process)
c) Oil extraction plant and instrumentation set-up
d) Pesticides manufacturing process and control
e) Flow diagram of Diary and confectionary industry and instrumentation set-up.
f) Juice extraction control set-up

Water Management: Water distribution and control, Auto-Drip irrigation systems, irrigation canal management, upstream and downstream control concepts, supervisory control.

Farm Machinery: Automation In Earth Moving Equipment and farm implements, pneumatic, hydraulic and electronic control circuits in harvesters, cotton pickers, tractors etc. Application of SCADA and PLC in packaging industry.

Green houses and Instrumentation: Ventilation, cooling and heating wind speed, temperature and humidity, rain gauge, carbon dioxide enrichment measurement and control. Leaf area, length, evapo-transpiration, temperature, wetness and respiration measurement and data logging. Electromagnetic, radiation, photosynthesis, infrared and UV biosensor methods in agriculture. Agro meteorological instrumentation weather stations

RECOMMENDED BOOKS:

1. Remote Sensing of soil salinization, Impact on land management by Dr. Graciela mettermicht, CRC
2. Practices of irrigation and on farm water management by Dr. M H Ali, Springer

BTEEE-805C (Optical Fiber Communication)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction: Need of Fiber Optic Communications, Evolution of Light wave Systems, Basic Concepts; Analog & Digital Signals, Channel Multiplexing, Modulation Formats, Optical Communication Systems, Light wave System Components; Optical Fibers as a Communication Channel, Optical Transmitters, Optical Receivers.

Optical Fibers: Geometrical-Optics Description; Step-Index Fibers, Graded Index Fibers, Wave Propagation; Maxwell's Equations, Fiber Modes, Single-Mode-Fibers, Dispersion in Single-Mode Fibers; Group Velocity Dispersion, Material Dispersion, Wave guide Dispersion, Higher-order Dispersion, Polarization-Mode Dispersion, Dispersion-Induced Limitations; Basic Propagation Equation, Chirped Gaussian Pulses, Limitations on the Bit Rate, Fiber Bandwidth , Fiber Losses; Attenuation Coefficient, Material Absorption, Rayleigh Scattering, wave guide Imperfections,
Nonlinear Optical effects; Stimulated Light Scattering, Nonlinear Phase Modulation, Four Wave Mixing, Fiber Manufacturing; Design Issues, Fabrication Methods, Cables and Connectors

Optical Transmitters: Basic Concepts; Emission and Absorption Rates, p-n Junctions, Non radiative Recombination, Semi conductor Materials, Light Emitting Diodes; Power-current Characteristics, LED spectrum, Modulation Response, LED Structures, Semi Conductor Lasers; DFB Lasers, Coupled Cavity semiconductor Lasers, Tunable Semiconductor Lasers, Vertical Cavity Semiconductor Lasers, Laser Characteristics, Small & Large Signal Modulation, Spectral Line width, Source Fiber Coupling.

Optical Receivers: Basic concepts, p-n Photo Diodes, p-i-n Photo Diodes, Avalanche Photo Diode, MSM Photo detector, Receiver Design, Receiver Noise; Noise mechanism, Receiver sensitivity; Bit error rate, Minimum Receiver Power, Sensitivity Degradation, Receiver Performance.

Light Wave Systems: System Architecture, Loss limited Light wave systems, Dispersion limited Light wave systems, Power Budget, Long Haul systems, Sources of Power Penalty; Model Noise, Dispersive Pulse Broadening, Mode Partition Noise, Frequency Chirping, Reflection Feedback Noise.

Multi channel Systems: WDM Light wave systems, Optical TDM Systems, Subscriber Multiplexing, Code Division Multiplexing.

RECOMMENDED BOOKS:

1. Govind P. Agrawal, Fiber Optics Communication Systems John Wiley & Sons (Asia) Pvt Ltd.

2. Senior J. Optical Fiber Communications, Principles & Practice, PHI.

3. Keiser G., Optical Fiber Communication Mc graw-hill.

BTEEE-805D (Non-Conventional Energy Sources)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Introduction: Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.

MHD Generators: Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of Magneto-Hydro-Dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.

Thermo-Electric Generators: Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect

Photovoltaic Effect And Solar Energy: Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.

Fuel Cells: Principle of action, Gibb's free energy, general description of fuel cells,types, construction, operational characteristics and application.

Miscellaneous Sources: Geothermal system, hydro-electric plants, wind power, tidal energy, Bio-mass energy

RECOMMENDED BOOKS:

1. Gupta B. R., *Generation of Electrical Energy,* S. Chand.
2. Rai, G.D., *Non Conventional Energy Sources,* Khanna Publishers (2005).
3. Rao, S. and Parulekar, *B.B., Energy Technology: Non Conventional, Renewable and Conventional,* Khanna Publishers (2005).
4. Wadhwa, C.L., *Generation, Distribution and Utilization of Electric Energy,* New Age International (P) Limited, Publishers (2007).
5. *Simon , Christopher A., Alternate Source of Energy,* Rowman and LittleField Publishers Inc.(2007). 6. *Venikov, V.A. and Putyain, E.V., Introduction to Energy Technology,* Mir Publishers (1990).
7. Chakrabarti A., Soni M. L., Gupta P. V. and Bhatnagar U. S., *Power System Engineering,* Dhanpat Rai and Co.
8. Kothari D.P., Singal K.C. and Ranjan R., Renewable Energy Sources and Emerging Technologies, Prentice Hall (India)

BTEEE - 805E (Operating Systems)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Operating System Concepts An Introduction: What is an OS, Need of OS, Different views of an OS, Evolution of OS, Batch Processing, Multiprocessing, Multiprogramming, Time Sharing, Real Time Systems, Network OS, Parallel Processing, Distributed Processing.

Operating System Structures: OS services, System Calls, System Structures, Layered Architecture of an OS.

Introduction to process: Concept of process, Process states and there transitions, PCB, Process Scheduling, Operations on process: Process creation and termination, Threads: User level and kernel level threads.

CPU scheduling: Introduction, CPU scheduler, Scheduling criteria, Scheduling algorithms: FCFS, SJF, Priority scheduling, RR scheduling, Multilevel queue scheduling, Multilevel feedback queue scheduling

Process Synchronization: Co-operating process, Concurrency, Semaphores

Deadlocks: Introduction, Deadlock characteristics, Recognization methods, Dealing with deadlocks, Deadlock prevention, avoidance, detection and deadlock recovery.

Memory Management Basics: Introduction, Logical vs physical address space, Program relocation & mgmt techniques, Continuous storage allocation, Fixed partition contiguous storage allocation, Variable partition CSA, Non contiguous storage allocation, paging, segmentation.

Virtual Memory: Introduction, Swapping, Demand paging, Pure demand paging, Page replacement algo`s, FIFO, Optimal, LRU algo's.

File System Interface & implementation: File concepts, File naming, File attributes, File access methods, Directory structure.

Device Mgmt & Storage Structure: I/O subsystems, I/O channels, Secondary storage, Disk structure, Disk scheduling, FIFO, Shortest seek time first SSTF scan, C-SCAN, Look &C-look Disk scheduling algo's.

Protection & Security Introduction: Introduction, Goals of protection, Access rights, Access matrix, Security & its goals, Authentication, Passwords, Encryption, Viruses, worms, Dealing with viruses.

Case Study: UNIX &WIN NT

RECOMMENDED BOOKS:

1. Peter Galvin "Operating systems Concepts" Addison wessly
2. Ekta Walia "Operating systems Concepts"

BTEEE – 805F (Data Mining and pattern Recognition)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Data Mining: What is data mining, on what kind of data, Data Mining Functionalities

Data Warehouse: Difference Between operational database systems and data warehouses, A multidimensional data model, Data Warehouse architecture, data warehouse architecture, Data Warehouse implementation.

Data preprocessing: Data cleaning, data integration and transformation, data reduction.

Data Mining Query Language: Characterization and Comparison, Generalization, Mining association rules in large databases, constraint based association Mining Classification and prediction Classification by decision Tree Induction, Bayesian classification, classification by Back propagation Cluster analysis Partitioning Methods, Hierarchical methods, and Density and Grid based methods, Mining complex types of data, applications and trends in data mining, Social impacts of data mining.

Pattern recognition: Its importance and applications, applications in Bioinformatics, recognizing important bio-informatics sequences, other applications of pattern discovery.

Laboratory Work: Implementation of various data mining techniques like classification, clustering, generalization, cleaning etc.

BOOKS RECOMMENDED:.

1. Pal. Sankar K. and Mitra P., *Pattern Recognition Algorithms for Data Mining*, Chapman and Hall/CRC
2. Elden L. *Matrix Methods in Data Mining and Pattern Recognition.* SIAM, 2007.