PUNJAB TECHNICAL UNIVERSITY
KAPURTHALA

Scheme& Syllabus of
B. Tech. Electronics & Electrical Engineering

Batch 2011 onwards

By
Board of Studies EEE /EIE

Punjab Technical University

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

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Third Semester

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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 Circuit*s, 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.

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.

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.

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.