Baba Ghulam Shah Badshah University
Rajouri (J&K)-185131

Syllabus Fourth Semester
B. Tech. Degree Course

Department of Electrical Engineering

College of Engineering and Technology
School of Mathematical Sciences & Engineering
Baba Ghulam Shah Badshah University
Rajouri (J&K)-185131

Curriculum Structure

Semester-IV

Theory Courses

Course Code	Title	Scheme of Exam				Hrs./Week		
		Duration (Hrs.)	IA	UE	Total Marks	L	T	P
ERE-421	Mathematics-IV	3	40	60	100	4	0	0
ERE-422	Network Analysis & Synthesis	3	40	60	100	3	1	0
ERE-423	Engineering Material Science	3	40	60	100	3	1	0
ERE-424	Power System-I	3	40	60	100	3	1	0
ERE-425	Electrical Machines-II	3	40	60	100	3	1	0
ERE-426	Electrical Measurements-I	3	40	60	100	3	1	0
Total			**240**	**360**	**600**			

Laboratory Courses

ERE-431	Network Analysis & Synthesis	2	25	25	50	0	0	2
ERE-432	Electrical Machines-II	2	25	25	50	0	0	2
ERE-433	Electrical Measurements	2	25	25	50	0	0	2
Total			**75**	**75**	**150**			
Total (Theory + Lab)			**315**	**435**	**750**			

Semester IV

Course Title: Mathematics-IV **Max. Marks: 100**
Course Code: ERE-421 **External Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**

Objective: The course is designed to provide basic knowledge of theory of complex variables, Numerical analysis and Z-transform to engineering students.

Unit-I

Complex Analysis-I: Function of complex variable, Limit, Continuity and differentiability of functions of complex variable, Analytic function, Cauchy-Riemann equations, harmonic function, Construction of analytic functions by Milne-Thomson method, Conformal mapping and Bilinear transformations.

Unit-II

Complex Analysis-II: Complex integration, Line integral, Cauchy's integral formula, Derivatives of integral, Cauchy's inequality, Lowville's theorem, Taylor's and Laurent's series, Zeros and Singularities of complex functions, Residue and Cauchy's Residue theorem, Evaluation of real integrals by using Residue theorem.

Unit-III

Numerical Analysis-I: Finite-differences and operators, Finite and divided differences table, Differences of a polynomial, Factorial notation, Relation between operators, Newton's and Lagrange's interpolation formulae, Numerical differentiation and integration, Trapezoidal rule, Simpson's one-third rule, Simpson's third-eight rule.

Unit-IV

Numerical Analysis-II: Difference equations and their solutions. Solutions of algebraic and transcendental equations by iterative, Bisection, Regula-Falsi and Newton-Raphson methods, Numerical solution of ordinary differential equations by Picard's method, Euler's method, Modified Euler's method and Runge-Kutta method.

Unit-V

Z-Transform: Introduction and definition of z-transform, Some standard forms, Linearity property, Damping rule, some standard results , shifting u_n to the right and to the left, Multiplication by n. Two basic theorems, Inverse Z-Transform, Convolution theorem, Application to difference equations.

Reference Books:

1. **Grewal B.S**.- Higher Engineering Mathematics
2. **Narayan Santi** -Theory of Functions of Complex Variables
3. **Saxena H.C**- Difference Calculus.

Note for Paper Setter: The Question paper shall comprises of 10 questions. Two questions will be set from each unit .The student has to attempt five questions at least one from each unit

Semester IV

Course Title: Network Analysis & Synthesis **Max Marks: 100**
Course Code: ERE-422 **University Exam: 60**
Duration Of Exam: 3hours **Internal Assessment: 40**

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications of electrical networks and their synthesis.

Unit-I

Network Theorems & Network Topology: Network Theorems Superposition, Reciprocity and Millman's, theorems, Thevenin's and Norton's theorems; Maximum Power transfer theorem (A.C Analysis only)
Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

Unit-II

Capacitive, Inductive Transients & First Order Circuits: Capacitive Transients, Inductive Transients, Combination of Capacitance & Inductance, Initial and Final Conditions, Exponential Functions, Timing Intervals of First and 2^{nd} Order Circuits. Laplace Transform application to solve differential equations and analysis of electric circuits.

Unit-III

Two Port Networks Parameters: Z Parameter, Y parameter, h – parameter, ABCD parameter, Equivalent circuit using these parameters. Condition for reciprocity and symmetry of two port network in different parameters. Interconnection of two port

networks. Cascade connection of two port networks parallel connection of two port networks. Series and series parallel connections. Inter conversion of parameters.

Unit-IV

Network Synthesis: Transfer Functions, Natural and Forced Responses, Poles and Zeros of Transfer Functions, Foster and Caure's Forms, Stability, Hurwitz's Polynomials.

Unit-V

Filter Synthesis: Introduction, Classifications of filters, Characteristic Impedance and propagation constant of pure reactive Networks, Ladder Network, T–Section, Pie Section, Terminating Half Section, Pass Bands and Stop Bands, Design of constant K, n – Derived Filters, Composite Filters.

Text Book:

1. **Valkenberg,** Network Analysis, PHI.
2. **Dorf R. C. & Svoboda J. A.**, Introduction to Electric Circuits, John Wiley & sons 6e

Reference Books:

1. **Stanley,** Network Analysis with applications, Pearson Education.
2. **Mittal G. K.**, Network Analysis, Khanna Publications.

Note for paper setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit .The student has to attempt five questions at least one from each unit.

Semester IV

Course Title: Engineering Material Science **Max Marks: 100**
Course Code: ERE-423 **University Exam:60**
Duration of Exam: 3 hours **Internal Assessment: 40**

Objective: The course has been designed to get student acquainted with the properties of various engineering materials and their applications in Engineering Sciences.

Unit-I

Crystal Structure of Solids: - Atomic packing, crystal lattice, Different type of crystal Bands, structure of silicon & Germanium, Energy Bands in solids, one dimensional lattice, Electron in periodic potential, concept of hole, Three dimensional Lattice and Brullioun Zones Elastic Wave and Photons (Elementary Ideas).

Unit-II

Insulating Materials: - Introduction to Insulators, dielectric behavior, Properties of Insulating Materials, Insulators in Static & Alternating fields, classification as per temperature rise, Practical Dielectrics, Liquid: Solid and Gaseous and their applications.

Unit-III

Dielectric Materials: - Polarization, Quantitative and qualitative discussion of dielectric constants of polyatomic molecules, Internal fields in solids and Liquids. Ferroelectrics & Piezoelectric Materials, spontaneous polarization, Frequency dependence of polarizabilities, complex dielectric constant of non-dipolar solids, Dipolar relaxation, dielectric losses, Dielectric Break downs.

Unit-IV

Magnetic Materials: - Review of magnetic field concepts, Orbital dipole, and angular momentum of simple atomic models, classification of magnetic materials, spontaneous magnetism, Curie- Weiss Law, coercive forces; antiferro magnetic materials, ferromagnetic materials, Properties & applications of ferrites.

Unit-V

Conductivity of Metals: Ohm's Law, Relaxation time, collision time and mean free path, resistivity of conductors, temperature dependence of resistivity, super conductivity.
Semiconductor Materials: classifying materials as semiconductors, chemical bond in Si and Ge & its consequences, density of carriers in intrinsic semiconductors, the energy gap, the conductivity of intrinsic semiconductors, Carrier densities in n-type semiconductors & p-type semi-conductors, Hall Effect and Carrier Density.

Text Books:

1. **Dekker,** Electrical Engineering Materials.
2. **Allison,** Materials & Electronics Engineering & Devices.

Reference Books:

1. **Raghvan,** Electrical Engineering Materials.
2. **S.P. Seth & P. V. Gupta,** Electrical Engineering Materials.

Note for Paper Setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit .The student has to attempt five questions at least one from each unit

Course Title: Power System -I **Max Marks: 100**
Course Code: ERE-424 **University Exam:60**
Duration of Exam: 3 hours **Internal Assessment: 40**

Objective: The objective of this course is to develop an understanding of the diverse concepts of power system generation, transmission and distribution. It also involves the study of various power transfer methods and phenomenon associated with power system.

Unit-I

Introduction: Introduction to Power Systems generation, transmission & distribution. Element of AC distribution. Single fed, double fed and ring main distributor.

Unit-II

Insulators: overhead line insulator types; pin, suspension, strain, schackle, guy etc. String efficiency & methods of equalizing potential drop over string of suspension insulators.

Unit-III

Transmission Lines: Transmission line parameters and their evaluations, types of overhead conductors with calculations of inductance and capacitance. Models of short, medium and long transmission lines. Skin, proximity and Ferranti effect. Power transfer capability of a transmission line. Mechanical Design of transmission line. Electric Power Transmission Towers.

Unit-IV

Cables: Classification of cables, Cable conductors, insulating materials, insulation resistance, electrostatic stress, grading of cables, capacitance calculation, losses and current carrying capacity. Location of faults. Location of faults, methods of laying of underground cables.

Unit-V

Mechanical Design and Corona: Corona, Visual & critical voltages, corona loss, effect of corona on line design practical considerations

Text Books:

1. **Kothari** & **Nagrath** Modern Power System Analysis.
2. **J.J. Grainger** and **W.D Stevenson** Elements of Power System Analysis.

Reference books:

1. **B.W. Weedy** and **B.J. Cory,** Electric Power Systems.
2. **C.L. Wadhwa,** Electric Power Systems.
3. **H.Cotton,** Transmission and Distribution of Electrical Energy.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Semester IV

Course Title: Electrical Machines-II **Max Marks: 100**
Course Code: ERE-425 **University Exam:60**
Duration of Exam: 3 hours **Internal Assessment: 40**

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications of AC Machines. Emphasis is given to latest technologies.

Unit I

Three Phase Induction Motors: Introduction of rotating magnetic field**.** Construction and principle of operation, torque-slip characteristics, phasor diagram at standstill and on load, equivalent circuit, No load and blocked rotor tests, methods of starting & speed control, applications

Unit II

Alternators
Basic Principle of operation, construction, emf equationfactors effecting alternator size, Alternator on load, synchronous reactance, determination of voltage regulation, parallel operation of alternators.

Unit III

Synchronous Motors
Principle of operation, types , methods of starting, synchronous motor with differential excitations, salient pole synchronous motor, V and inverted V curves, hunting, synchronous motor applications.

Unit IV

Single Phase Induction Motors
Construction and principle of operation, Types of single phase induction motors, equivalent circuit based on double revolving field theory, Universal motors, fractional horse power motors.

Unit V

Special Machines
Universal motors-application and speed control, reluctance motors, Hysteresis motors, Stepper motors and its types, Permanent magnet DC motors, Ac & DC servomotors.

Text books:

1. **Nagrath I.J** and **Kothari D P,** McGraw Hill "Electric Machines", TMH.
2. **Chapman S.J**, "Electric Machinery Fundamentals", McGraw Hill (2005).

Reference books:

1. **Puchstein A F, Lloyds T C** and **Conard A C**, "Alternating Current Machines", Asia Publishing House (1968).
2. **Bimbhra P S**, **Khanna Publishers** "Electrical Machinery, Delhi, 6th Ed. (4003)
3. **Gupta B R** and **Singhal V** "Fundamentals of Electric Machines", 2nd Ed., New Age International Pub. (4000).

Note for Paper Setter: The Question Paper shall comprise of 10 question. Two questions will be set from each unit. The student has to attempt 5 questions at least one from each unit.

Semester IV

Course Title: Electrical Measurement -1 **Max Marks:100**
Course Code: ERE-426 **University Exam: 60**
Duration of Exam: 3hours **Internal Assessment: 40**

Objective: The objective of this course is to expose the students to a broad knowledge of experimental methods and measurement techniques.

Unit-I

Measurement System & Characteristics of Instruments:

Introduction, significance of measurements, methods of measurements, Instruments & measurement system, Classification of instruments – mechanical, electrical & electronic instruments, deflection & null type instruments, Comparison of Analog & digital modes of operation. Application of measurement systems, errors in measurements, types of errors. Accuracy, Precision, Resolution, loading effects. Units-Absolute, Fundamental & derived.

Unit-II

Bridge Circuits:

Wheatstone Bridge- galvanometer sensitivity, current through galvanometer & limitations, Kelvin Double Bridge, Maxwell Inductance Bridge, Maxwell inductance – capacitance bridge, Anderson's bridge, Schering Bridge, Hay Bridge & Wien's Bridge. Measurement of effective resistance, inductance & capacitance at high frequency Meter.

Unit-III

Eectromechanical Indicating Instruments:

D Arsonval Galvanometer- construction & theory, Torque equation, Dynamic behaviour & Galvanometer constants. Ballistic galvanometer- construction & theory. Introduction to PMMC Instruments and Moving Iron Instruments.

Unit-IV

Ammeters, Voltmeters:

DC Ammeter, Multirange Ammeter, , RF Ammeter. DC Voltmeter, Multirange Voltmeter, Extending ammeter & Voltmeter Ranges- Multipliers & shunts, The Aryton Shunt or Universal Shunt, Requirements of a Shunt, Introduction to Instrument Transformers & their application to extension of Instrument range.

Unit-V

Measurement of Energy & Power:

Measurement of power in three phase AC circuits using single phase & three phase wattmeter, Measurement of reactive power (single phase & three phase), Measurement of energy using Induction type meter, Energy meter testing, Power factor meter.

TEXT BOOKS

1. Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.
2. Ernest o Doebelin and dhanesh N manik, "Measurement systems" ,5th edition ,McGraw-Hill, 2007.

REFERENCES

1. John P. Bentley, "Principles of Measurement Systems", Fourth edition, Pearson Education Limited, 2005.
2. A. K. Sawhney, "Course In Electrical And Electronic Measurement And Instrumentation", Dhanpat Rai Publisher, 2000.
3. Bouwens,A.J, "Digital Instrumentation", Tata Mc-Graw Hill, 1986.
4. David A.Bell, "Electronic Instrumentation and Measurements", Second edition, Prentice Hall of India, 2007.

Note for Paper Setter: -The Question paper shall comprise of 10 questions. Two questions will be set from each unit .The student has to attempt five questions selecting one from each unit

Semester IV

Course Title: Network Analysis & Synthesis Lab **Max Marks: 50**
Course Code: ERE-431 **University Exam: 25**
Duration of Exam: 3 hours **Internal Assessment: 25**

1. Verification of Thevenin's theorem, Norton's theorem.
2. Verification of Maximum power transfer theorem, Superposition theorem.
3. Verification of Reciprocity theorem.
4. Design and implementation of T and Π passive filters.
5. Determination of h-parameters of a network.
6. Study of sinusoidal steady state response of a network.
7. Study of transient response of a network.
8. Study of passive integrator and differentiator.
9. Syntheses of RC-network for a given network function.
10. Verification of equivalence of star and delta transformation.

Note: Experimentation to be supported by computer simulations.

Semester IV

Course Title: Electrical Machines-II Lab **Max Marks: 50**
Course Code: ERE-432 **University Exam: 25**
Duration of Exam: 3 hours **Internal Assessment: 25**

1. To perform no-load and blocked-rotor test on a single phase induction motor and hence determine its equivalent circuit parameters
2. To perform no-load test and blocked rotor test on a three-phase induction motor and hence determine its equivalent circuit parameters
3. To study torque-speed characteristics of a 3 phase induction motor.
4. To obtain OCC & SCC of a synchronous machine by synchronous impedance method.
5. To perform open circuit and short-circuit test on a three phase alternator and hence determine its voltage regulation by synchronous impedance method
6. To synchronize an alternator with bus bar with bright/dark lamp method.
7. To obtain V-curves & inverted V Curves of a three phase synchronous motor at no load.
8. Parallel operation of alternator by synchronization using light/dark lamp method.
9. Power measurement by two wattmeter method.
10. To perform Scott connection of three phase transformer.

Note: These are only the suggested list of practicals. Instructor may add or change some practicals relevant to the course contents

Semester IV

Course Title: Electrical Measurements -I Lab **Max Marks: 50**
Course Code: ERE-433 **University Exam: 25**
Duration of Exam: 3 hours **Internal Assessment: 25**

1. To measure frequency and phase of a signal from a Lissajous Pattern using CRO.
2. Measurement of Inductance by Maxwell's Bridge.
3. Measurement of small resistance by Kelvin's Bridge.
4. Measurement of Capacitance by Schering Bridge.
5. Measurement of medium resistance by Wheat Stone's Bridge.
6. To measure a Strain using a Strain Gauge Transducer.
7. To measure a Displacement using LVDT Transducer.
8. To measure a Temperature using Thermocouple Transducer.
9. To measure a Temperature using Thermistor Transducer.

Note: These are only the suggested list of practicals. Instructor may add or change some practicals relevant to the course contents.