Pokhara University

Faculty of Science and Technology

Central Entrance Examination Curriculum

Master of Science Electrical Engineering in Power System

Total marks: 150 Qualifying marks: 75 (Paying)/53(Scholarship)

Time: 3 hrs

Entrance curriculum mainly covers common topics of all streams covering Fundamental of Mathematics and Electrical Engineering of Bachelor's level.

Section	Course	Weightage (%)
A	Fundamentals of Mathematics	30
B	Circuit Theory , Fields , Basic Electronics and Instrumentation	20
C	Electrical Machine Theory, Power System , Protection and High Voltage	30
D	Power Electronics , Energy Utilization and Conservation and Control System	20
	Total	**100**

Section A: Fundamental of Mathematics

1. **Basic of Set, Continuity, Derivative, Vector and Scalar:** Set and functions, limit, continuity and differentiability of functions, Integration by using different integration techniques, standard integrals, definite integrals parts, vectors and scalars, resolution of vectors, scalar and vector product of two and more vectors, gradient, divergence, curl and directional derivative of vectors.
2. **Linear Algebra:** Definition and basic properties of matrices and determinants Rank of matrix, system of linear equations, inverse of a matrix, Eigen values and Eigen vectors.
3. **Infinite series:** Definitions of sequence and infinite series, the necessary conditions for convergence of an infinite series, test of convergence, alternating series test.
4. **Fourier series:** Periodic functions, Fourier series on the functions of period 2π, Euler's formula, Fourier series of a function having arbitrary period, even and odd functions and their Fourier series, half range functions
5. **Laplace transformation:** Laplace transform, Application of Laplace transform, Inverse Laplace transform, Convolution theorem on Laplace transform and application, Differential ewuation (ODE and PDE).
6. **Z-transform:** Definitions, one-sided and two-sided z-transform, linear time invariant system, Unit impulse function, properties of z-transform, region of convergence, inverse z-transform by residue and partial fraction, Parseval theorem, convolution.
7. **Nonlinear Equations:** Review of calculus and Taylor's theorem, errors in numerical calculations, trial and error method, Bisection method, Newton's method, Secant method
8. **Introduction of Descriptive Statistics:** Presentation and classification data frequency distribution, histogram, measures of central tendency -mean, median, mode, quartiles and percentiles, measures of dispersion (variability).

Section B: Circuit Theory, Fields, Basic Electronics and Instrumentation

1. **Electric Circuits :**
   Network graph, KCL, KVL, Node and Mesh analysis, DC/AC circuit analysis, Resonance, Passive filters, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Three phase circuits, Power and power factor in ac circuits. Transient response: Transient response analysis for R-L, R-C & R-L-C circuits. Pole zero plots, Two port Networks: Z - parameters, Y-parameters & ABCD-parameters.
2. **Field:** Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.
3. **Basic Electronics** :
   Characteristics of diodes, BJT, MOSFET; Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: Biasing, Equivalent circuit and Frequency response; Oscillators and Feedback amplifiers; Operational amplifiers: Characteristics and applications; Simple active filters, VCOs and Timers, Combinational and Sequential logic circuits, Multiplexer, De-multiplexer, Schmitt trigger, Sample and hold circuits, A/D and D/A converters, 8085Microprocessor: Architecture, Programming and Interfacing.
4. **Instrumentation:** Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Section C: Electrical Machine Theory, Power System, Protection and High Voltage Engineering

1. **Electrical Machines:**
   Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase transformers: connections, parallel operation; Auto-transformer, Electromechanical energy conversion principles, DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Operating principle of single phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines
2. **Power System :**
   Power generation concepts, ac and dc transmission concepts, Models and performance of transmission lines and cables, Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss-Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault

analysis, operation System stability concepts, swing equation ; Equal area criterion , stability enhancements ,Power control: Load -frequency control, VAR-Volt control

3. **Protection:**
   Concept of switchyard components ,Relays and its types, circuit breaker , theory of ARC quenching , DC and AC circuit breaking, transient recovery voltage, Recovery voltage, Rate of rise of TRV and RV, Re-striking Voltage, frequency of oscillation , Principles of over-current, differential and distance protection; transformer protection , alternator protection , feeder and line protection , solid state relays and digital protection; and , Safety Engineering: Electric shocks, Equipment Earthing
4. **High Voltage Engineering** :
   Generation , Testing ; Switching and lightening overvoltage ,Protection against overvoltage , Dielectric breakdown- Gaseous breakdown – Vacuum breakdown, Corona discharges and Insulation coordination

Section D: Power Electronics, Energy Utilization and Conservation and Control Theory

1. **Power Electronics:**
   Characteristics of semiconductor power devices: Diode, Thyristor, Triac, GTO, MOSFET, IGBT; DC to DC conversion: Buck and Boost, Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation.
2. **Energy Utilization and conservation:**
   Fundamentals of Electric drives – choice and applications; traction motors – characteristic features – electric braking, train movement and energy consumption; Design of illumination systems and various lighting schemes; Electric heating – methods of electric heating and its types – Electric welding - Principles of the conversion of solar radiation into heat; Solar Collectors-flat-plate collectors – concentrating collector – cylindrical parabolic; Wind energy conversion system: basic principles, site selection, basic components , Classification of WECS, Types of wind machines , Hydro-generation: Power output equation , components, site selection , turbine and generator selection.
3. **Control Theory:**
   Mathematical modeling and representation of systems, Feedback principle, transfer k diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Stability analysis, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, State transition matrix.