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ELECTRICAL ENGINEERING (for both objective and conventional type papers)
PAPER I

1. KM Theory
Electric and magnetic fields. Gauss's Law and Awpcris Law, Fields in dielectrics, conductors and magnetic materials. Maxwell's equations. Time varying fields. Plane-Wave propagation in dielectric and conducting media. Transmission lines.

2. Electrical Materials
Band Theory. Conductors, Semi-conductors and Insulators. Super-Conductivity. Insulators for electrical and electronic applications. Magnetic materials. Ferro and feri-magnetism. Ceramics, properties and applications Hall effect and its applications. Special semiconductors.

3. Electrical Circuits
Circuit elements. Kirchoffs Laws Mesh and nodal analysis. Network theorems and applications. Natural response and forced response. Transient response and steady-stat response for arbitrary inputs. Properties of networks in terms of poles and zeros. Transfer function. Resonant circuits. Three-phase circuits Two-port network. Elements of two-element network systhesis.

4. Measurements and Instrumentation
Units and Standards, Error analysis. Measurement of current. Voltage Power, Power-factor and energy. Indicating instruments. Measurement of resistance inductance. Capacitance and frequency. Bridge Measurements. Electronic measuring instrument, digital voltmeter and frequency counters. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc. Data acquisition systems. A/D and D/A Converters.

5. Control Systems
Mathematical modelling of physical systems. Block diagrams and signal flow graphs and their reduction. Time domain and frequency domain analysis of linear dynamical system. Errors for different types of inputs and stability criteria for feedback systems. Stability analysis using Routh-Hurwitz array, Nyquist plot and Bode plot. Root locus and Nicols chart and the estimation of gain and phase margin. Basic concepts of compensator design. State variable matrix and its use in system modelling and design Sampled data system and performance of such a system with the samples in the error channel. Stability of sampled data system. Elements of nonlinear control analysis. Control system component, electromechanical hydraulic pneumatic components.

PAPER II

1. Electrical Machines and power transformers

Magnetic Circuits.— Analysis and Design of Power transformers. Construction and testing. Equivalent circuits, losses and efficiency Regulation. Auto-transformer. 3-phase transformer. Parallel operation.

Basic concepts in rotating machines. EMF, torque, basic machine types. Construction and operation, leakage, losses and efficiency.

D. C. Machines Construction.—Excitation methods, Circuit models. Armature reaction and communication. Characteristics and performance analysis. Generators and motors. Starting and speed control. Testing Losses and efficiency.

Synchronous Machines.—Construction Circuit model. Operating characteristics and performance analysis. Synchronous reactance. Efficiency. Voltage regulation. Salient pole machine. Parallel operation. Hunting. Short circuit transients.

Induction Machines Construction.—Principle of operation. Rotating fields. Characteristics and performance analysis. Determination of circuit model. Circle diagram. Starting and speed control.

Fractional KW motors. — Single-phase synchronous and induction motors.

2. Power Systems
Types of Power Station Hydro, Thermal and Nuclear Stations. Pumped storage plants. Economics and operating factors.

Power transmission lines.— Modelling and performance characteristics. Voltage control. Load flow studies. Optimal power

system operation. Load frequency control. Symmetrical short circuit analysis. Z-Bus formulation Symmetrical Components. Per unit representation. Fault analysis. Transient and steady-state stability of power systems. Equal area criterion.
Power system Transients. Power system Protection Circuit breakers Relays. HVDC transmission.

3. Analog and Digital Electronics and Circuits

Semi-conductor device physics, PN junctions and transistors, circuits Models and parameters, FET Zener tunnel, Schottky, photo diodes and their applications, rectifier circuits voltage regulators and multipliers, switching behaviour diodes and transistors. Small signal amplifiers biasing circuits, frequency response and improvement, multistage amplifiers and feed-back amplifiers, D.C. amplifiers. Oscillators, Large signal amplifiers, coupling methods, push pull amplifiers, operational amplifiers, wave, shaping circuits. Multivibrators and flip-flops and their applications. Digital logic gate families, universal-gates-combinational circuits for arithmetic and logic operation sequential logic circuits. Counters Registers. RAM and ROMs.

4. Microprocessors

Microprocessor architecture.—Instruction set and
simple assembly language programming. Interfacing for memory and I/O. Applications of Microprocessors in power system.

5. Communication Systems

Types of modulation; AM, FM and PM. Demodulators. Noise and bandwidth consideration. Digital communication systems. Pulse code modulation and demodulation. Elements of sound and vision broadcasting Carrier communication. Frequency division and time division multiplexing. Telemetry system in power engineering.

6. Power Electronics

Power Semi-conductor devices, Thyristor, Power transistor, GTOs and MOSFETs. Characteristics and operation. AC to DC Converters. 1-phase and 3-phase DC to DC Converters.

AC regulators.—Thyristor controlled reactors, switched capacity networks.

Inverters : Single-phase and 3-phase Pulse width modulation. Sinusoidal modulation with uniform sampling. Switched mode power supply.