TECHNICAL ASSISTANT (ELECTRICAL) - SYLLABUS FOR WRITTEN TEST

Engineering Physics: Units & Dimensions – Work, Power & Energy – Statics & Dynamics – Friction – Simple Harmonic Motion – Electricity & Magnetism – Properties of matter – Photo Electric Effect

Engineering Chemistry: Structure of atom – Chemical bonding – Oxidation – Reduction – Solutions – Acids & Bases – Polymers – Fuels – Electrochemistry – Corrosion – Principles of metallurgy

Engineering Mathematics: Matrices & Determinants – Co-ordinate geometry – Algebra – Vector algebra – Trigonometry – Logarithm – Differential calculus – Applications of differentiation

Electrical Engineering materials: Conducting materials – Semi-conducting materials – Insulating materials – Dielectric materials – Magnetic materials – Special purpose materials

Basic Electrical Engineering: Basic Principles of electricity – DC Circuits & Network theorems – Work, Power & Energy – Electrical Units – Heating effects of electric current – Single phase AC circuits – Poly phase AC circuits – Magnetic effect of electric current – Electromagnetic induction – Electrostatics & capacitance

DC Machines: Fundamentals of DC Generators – Construction, Principle of operation, losses, power stages, Efficiency – Armature Reaction & Commutation – Types & Characteristics of DC Generators, Applications – Fundamentals of DC Motors – Principle of operation, Back EMF, Types & characteristics, losses, power stages, Efficiency, Speed Control & Braking, Starters for DC Motors – Testing of DC Machines – Applications

Single phase Transformers: Principle of operation &constructional details – Phasor diagram & Equivalent circuit – Transformer tests, losses, Voltage regulation, efficiency, All day efficiency, Auto transformers, Parallel operation, Applications

Three phase transformers: Construction and type of connections – Parallel operation & Load sharing – Methods of cooling – Transformer accessories – Transformer oil testing – Earthing – Applications – Maintenance

Alternators: Working principle and constructional details – Types – EMF equation – Load characteristics, performance & testing – Cooling of alternators – Parallel operation & synchronisation – Armature reaction – Voltage regulation – Application – Maintenance

Three phase Induction motor: Principle of operation, construction and characteristics – Types of motors – Slip and slip frequency – torque – characteristics – phasor diagram – equivalent circuit – no load test and blocked rotor test – circle diagram – losses – efficiency – speed control – starters – types of starters – circuits – applications

Single phase Induction motor: Principle of operation and characteristics – Starting methods – Types of Induction motors and their construction, operation, characteristics & applications

Synchronous motors: Principle of operation – methods of starting – construction – characteristics – effects of excitation – hunting – damper winding – applications

Special AC/DC machines: Construction & working, Permanent magnet motors – AC and DC Servo motors – Stepper motors – types, construction & principle of working – Characteristics – comparisons – applications – AC series motor, universal motor, repulsion motor, reluctance motor, hysteresis motor

Measurement and Instrumentation: Methods of measurements, Classification of instruments, characteristics of Instruments Operating torques, Working and construction, damping systems, Range extension, Instruments for measurement of current, voltage, R, L, C, Power, Energy, Power factor, Frequency, Phase difference, waveform – Instruments types – operation – principles – construction – working – Rectifier type instruments – Instruments transformers – Testing, Errors and characteristics of CT and PT – Megger – Earth tester – Multimeters – Synchroscope – CRO – CRT – Digital storage oscilloscope – Transducers and sensors

Electric power Generation: Conventional methods of power generation – Hydel, Thermal, Nuclear power plants – Principles and types of co generation – Diesel , Gas, Pumped storage schemes – Renewable Energy Sources – Solar PV system – Wind power Generation – Hybrid Solar PV system– Grid or Interconnected system – Load curves – Connected load – Average load – Maximum demand – Diversity factor – Tariff – Load sharing

Transmission: Elements of transmission Line – Overhead line – Types of Insulators – properties – string efficiency – Types of conductors – Spacing – Span – Sag – Calculation of Sag – Constants of a Transmission line – Transposition of Transmission lines – Skin Effect – Ferranti effect – Corona – capacitance – grading – Voltage regulation and efficiency – HV DC Transmission – Underground cables – classification, construction details, laying, cable faults

Distribution: Substation – classification of substations – substation equipments – Bus bar – Types of bus bar arrangement – Distribution system – classification of Distribution Systems – types connection – schemes of Distribution System – AC Distribution calculations

Switch Gears: Basic principle of circuit breaker – Arc phenomenon – Methods of Arc extinction– Circuit breaker ratings – Classification, Construction and Working principle of various Circuit Breakers, MCBs, ELCB, RCCB, SF6, Vacuum Circuit Breaker – Fuses – Fuse Element materials – HRC, cartridge fuse, Voltage surge – causes of over voltage – Lightning – Lightning arrester

Protective relays: Importance – classification of relays – Principle, Operation, Construction, Characteristics, application of various protective relaying

Grounding: Equipment grounding – System grounding – ungrounded neutral system – Methods of grounding

System of wiring: List of symbols – Rules – Elements – Circuits – Types of internal wiring – Protection of electrical installation – electric shock – Soil resistivity – Safety signs – Domestic and Industrial wiring – Estimate and costing

Earthing: Requirement of earthing – Methods of earthing

Electric drives & braking: Types of Electric drives – Concept of electric drives – Factors governing the selection of motors – Standard ratings of motor – Classes of load duty cycles – Braking – Type of Braking – Electric braking – Plugging, Dynamic and Regenerative braking

Electric Traction: Traction systems – Methods of supplying power – Over Head equipments – Different systems of Track Electrification – Booster transformer – Neutral sectioning Traction Mechanics – Traction motors and control – Regenerative Braking

Illumination: Definition and units of different terms used in illumination – Sources of light – Arc lamp, Incandescent lamp, Halogen Lamp, Sodium vapour lamp, High pressure mercury vapour lamp, Fluorescent tube – Induction lamp – LED lamps, Requirements of Good Lighting System – Laws of Illumination – Types of Lighting Scheme – Design of lighting scheme – Energy efficient lamps &lighting controls

Electric heating: Modes of heat transfer – Types of electric heating – Electric furnaces – Electric welding

Storage Batteries: Classification of cells – construction – chemical action – electrical specifications – efficiencies – defects and their remedies – capacity – methods of charging – series and parallel connections of batteries – maintenance – applications

Power electronics devices and circuits: Semiconductor and Diodes – Classification, working, characteristics and applications – intrinsic and extrinsic, N type and P type – PN junction diode – Zener diodes – Rectifiers – filters – Transistor – transistor biasing – classification of amplifiers – negative feedback – oscillators and multivibrators – FET, UJT, SCR, DIAC, TRIAC, MOSFET, Classifications of optoelectronic devices – symbols, characteristics and working of LDR, LED, 7-segment LED and LCD – opto coupler – photo transistor – Clipper, clamper circuits – Solar cell – Applications of power electronics –SMPS, Inverters, UPS, Converters

Digital electronics: Number System – Conversion from one to another – binary codes – Boolean Algebra

Logic gates: Basic logic gates – Universal gates – Special gates – Boolean techniques – Boolean expression – TTL, CMOS Logics – Tristate logic – Combinational Circuits – Arithmetic circuits – Binary Addition& subtraction – Parallel and serial adders – Encoder and decoder – Multiplexer – Demultiplexer – Parity checker and generator

Sequential circuits: Flipflops – SR, JK, T, D Flipflops, JK Master slave Flipflop – Triggering of Flipflop – edge and level triggering – Counters – Registers – Memory devices

Basic computer: Computer hardware – CPU – RAM – ROM – I/O devices – Software – Internet and Web Technologies – Elementary concepts in Operating System – Windows – Introduction to MS Office – Auto CAD

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