

TAMIL NADU PUBLIC SERVICE COMMISSION
SYLLABUS
ELECTRICAL ENGINEERING /
ELECTRICAL & ELECTRONICS ENGINEERING
(DIPLOMA STANDARD)

CODE : 446

UNIT – I: CIRCUIT THEORY AND DC MACHINES

Electrostatics - Basic Concepts of Electricity - Ohm's Law, Kirchhoff's Laws, Series, Parallel and Series-Parallel Circuits - Network Theorems (Mesh Analysis, Nodal Analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems) - Star-Delta transformation - Source Transformation (Simple problems in DC only) - Single Phase AC and 3 Phase AC Circuits - Resonant Circuits - Electromagnetism - DC Generator - Types - Construction - Working - EMF Equation - Characteristic Curves - Armature reaction - Applications - DC Motor - Types - construction - Working - Characteristics - Commutation - Applications - Speed Control - D.C Starters - Losses in DC Machines - Testing of DC Machines - Maintenance of DC Machines - Storage Batteries - Special DC Machines - PMDC - DC Servo Motor - Stepper Motor - Variable Reluctance Stepper Motor - Permanent Magnet Stepper Motor.

UNIT – II: AC MACHINES

Single Phase Transformer - Construction - Principle of Operation - EMF Equation - Vector Diagram - Regulation, Losses and Efficiency - OC & SC Test - Parallel Operation - Auto Transformer - All day Efficiency - Three Phase Transformer - Construction - Testing - Parallel operation - Grouping of Transformer - Maintenance - Alternator - Construction - EMF Equation - Parallel operation - Testing - Determination of voltage regulation - Synchronous Motor - Construction - Starting Methods - Characteristics - Applications - 3 Phase induction motor - Types - Construction and Working Principle - Characteristics - Phasor Diagram - Starters - Speed Control -

Maintenance - Single Phase Induction Motors - Working Principle - Types - Applications - Special AC Machines - Permanent Magnet Synchronous Motor, SRM, AC Servo Motor - Linear Induction Motor.

UNIT – III: MEASUREMENTS AND INSTRUMENTS

Classification and characteristics of instruments - Operating forces - Construction and Working of MI, MC and Dynamometer type instruments - Extension of Instrument Range - Instrument transformers - Direct measurement of current, Voltage and Resistance - Measurement of Power - Measurement of Energy - Single Phase and 3 Phase Energy meters - Measurement of power factor - Maximum demand indicator - Synchroscope - Measurement of frequency - AC Bridges - Anderson bridge - Schering bridge - Cathode ray Oscilloscope - Sensing elements - Transducers - Passive, active transducers.

UNIT – IV: ELECTRONIC DEVICES AND CIRCUITS

Semi conductor Diodes - Rectifiers - Half wave, full wave and Bridge rectifier - 3 Phase rectifiers - Filter - Types - Capacitor filter - Inductor filter - L Section filter - π Section filter - RC Filter - Bipolar Junction Transistors (BJT) - Biasing - configuration - Field effect Transistors (JFET & MOSFET) and Unit junction Transistor (UJT) - Transistor Oscillators - Special semiconductor devices - Gunn diode, varactor diode, Zener diode, Tunnel diode - Silicon controlled Rectifier - DIAC - TRIAC - IGBT - Opto electronic devices - LDR, LED, LCD, Opto coupler, IR transmitter and receiver, Laser diode, Solar cell, Photo diode, Photo transistor - Diode clipper - Diode clamper - Voltage Multiplier - Multi vibrators - Astable, Monostable, Bistable - Schmitt trigger - Seven Segment LED - Amplifier - RC Coupled amplifier - Emitter follower - Oscillator - Hartley Oscillator, Colpitts Oscillator - RC Phase Shift Oscillator.

UNIT – V: ANALOG AND DIGITAL ELECTRONICS

Operational amplifiers Specifications - characteristics - Applications - Number system - Boolean algebra - De-Morgan's theorems - Logic gates - Digital logic families - Combinational Logic Circuits - Sequential Logic Circuits - Flip-flops, Counters, shift registers - Memory devices - D/A and A/D converters - Special function ICs - IC555 timer - IC565 - IC566 - IC Voltage regulators - Karnagh map (Upto 4 Variables) - Half adder - Full adder - Half Subtractor - Full Subtractor - Parity Generator and Checker - Decimal to BCD Encoder - 3 to 8 Decoder - 4 to 1 Multiplexer - 1 to 4 Demultiplexer - Flipflops - JK - RS - Edge triggered FF - D-FF - T-FF - Counters - Up counter - Down counter - Decade counter - Mod N counter - Shift register - Memories - ROM - RAM.

UNIT-VI: GENERATION, TRANSMISSION AND SWITCH GEAR:

Generation of Electrical Energy - Conventional Methods, Co-generation Methods - Inter Connected System - Load Curve - Load duration curves - Demand factor - Capacity Factor - Load factor - Diversity factor - Base Load and Peak load plants - Renewable Energy Sources - Solar power generation on grid and off grid solar power - Different types of PV Panels - Wind - Tidal - Bio - Geo - Hybrid - AC Transmission - HV Transmission - Voltage Regulation - Transmission efficiency - Over Head lines - Constants of TL - Transposition of TL - Skin, Ferranti effect - Corona - HVDC Transmission - Facts Controllers (Statcom, UPFC) - Line Insulators - String Efficiency - Underground Cables - Types of Cables - Laying of Cables - Switch gear - Circuit Breaker [ELCB,SF6, Vacuum CB, Oil CB] - Fuses [HRC, HV, Cartridge, Liquid Type and Metal clad] - Over Voltage Protection - Lightning Arresters - Protective relays - Grounding - Renewable Energy.

UNIT – VII: DISTRIBUTION AND UTILISATION

AC and DC Distribution - Substations - Indoor SS - Outdoor SS - Feeder - Distributors - Fault Analysis - Protection System - Busbar system - Industrial Drives - Types of electric drives and choice of electric motor - Electric Traction - System of track electrification - Traction mechanics - Traction motors and control - Magnetic levitation - Illumination - Laws of illumination - Lighting systems - Construction and Characteristics of Arc, Incandescent, Sodium vapour - CFL and LED lamps - Electric heating - Electric furnaces - Electric welding - Electric welding equipments.

UNIT – VIII: MICRO CONTROLLER AND ITS APPLICATION

8051 micro controller - Architecture - Instruction set - Assembler directives - Addressing modes - Programs - I/O programming - Timer/Counter programming - Serial communication - Interrupts - IC 8255 - Interfacing techniques with 8051 - Applications - PIC Micro Controller - Arduino - Raspberry Pi - Introduction to IOT - Architecture of IOT Systems.

UNIT-IX: A. POWER ELECTRONICS AND DRIVES

Thyristor family - SCR Triggering Circuits [R, RC, UJT, Pulse Transformer triggering circuits - IC based Triggering Circuits] - Driver and Buffer Circuits - Commutation Circuits - Phase Controlled Rectifier - Thyristor Protection - Choppers - SMPS - Inverters - UPS - Control of DC Drives – Rectifier Based Control, Chopper Based Control - Closed Loop Control - Control of AC Drives [Stator Voltage Control, Variable Frequency Control, v/f Control Rotor resistance control] - Closed Loop Control - Micro Processor based PWM Control - Static Var Compensation - Cyclo Converters.

B. ELECTRICAL ESTIMATION & ENERGY AUDITING

Indian Electricity Rules - 1956-Standard symbols for various wiring items, accessories - Types of Internal Wiring - Service Connection (Over Head and

Under Ground) - Quantity of Material Required in Electrical Installation - Wire Size - Selection of fuses - Earthing - Testing of installations - Domestic, commercial and industrial installation estimate - Energy auditing - Need of Energy audit and management - Types of Energy audit - Audit Process - Electrical Measurement - Load and Power factor measuring equipment - Energy conservation - Selection of cable - Lighting systems - Pumping systems.

UNIT-X: CONTROL OF ELECTRICAL MACHINES:

Control Circuit Components [Switches, Relays, Timers, Contactors] - Simple Motor Control Circuits - DC Motor Control Circuits - Starters, Jogging, Dynamic braking, Plugging, Reversing Control - AC Motor Control Circuits -Starters - 2 Speed Motor Control - Reversing the Rotation of IM - Dynamic braking - Plugging - Industrial Control Circuits [Planner Machine - Skip Hoist - Water pump - Electric Oven - Air Compressor - Over Head Crane - Battery Operated Truck - Conveyor System - Elevator] - PLC - Components of PLC - Operation of PLC - Scan - PLC Memory - i/p and o/p Module - Programming, Programming Devices - Ladder Diagram (Relay, Timer, Counter) - DOL, λ/Δ Starter - EB to Gen - SCADA - DCS.

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