

**TAMIL NADU PUBLIC SERVICE COMMISSION**  
**SYLLABUS**

**SUBJECT : ELECTRICAL ENGINEERING**

**Code No.169**

**(DEGREE STANDARD)**

**Unit –I Electrical Materials**

Conductors, Semi-conductors and Insulators – Insulators for electrical and electronic applications – Magnetic materials – Ferro and ferri magnetism – Properties and applications – Dielectric materials – Optical materials – Optical properties of metals, insulators and semiconductors – Photoconductivity – Special semi conductors – Super-conductivity

**Unit –II Electrical Circuits**

Circuit elements – Kirchoff's Laws – Mesh and nodal analysis – Network Theorems and applications – Natural and forced response – Resonant circuits – Transient and steady state response for arbitrary inputs – Transfer function – Two-port networks – Elements of two-element network synthesis– Properties of networks in terms of poles and zeros– Three phase circuits.

**Unit –III Electro Magnetic Theory**

Electric and Magnetic fields – Magnetic Circuits – Faraday's law of Electro Magnetic Induction – Gauss's Law and Amperes Law – Fields in dielectrics – Maxwell's equations – Time varying fields – Plane wave propagating in dielectric and conducting media – Pointing theorem – Transmission lines and Waveguides.

**Unit –IV 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 instruments – Digital Voltmeter and Frequency counter – Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level – Telemetry system – Data acquisition systems – A/D and D/A converters.

**Unit –V Control Systems**

Mathematical modeling 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 type of inputs and stability criteria for feedback systems – Stability analysis using Routh-Hurwitz array – Nyquist plot and Bode plot – Root locus and Nicols chart – Estimation of gain and phase margin – Basic concepts of compensator design – State variable matrix – System modeling and design – Sampled data system – Stability of sampled data system – Elements of non-linear control analysis – Control system components, electromechanical, hydraulic, pneumatic components – Programmable logic controllers – Distributed control systems.

## **Unit –VI Power Apparatus**

D.C. Machines – Construction, Excitation methods – Armature reaction and commutation – Characteristics and performance analysis – Generators and motors – Starting and speed control – Testing – Losses and efficiency.

Analysis and Design of Power transformers – Construction and testing – Equivalent circuits – Losses and efficiency – Regulation – Parallel operation – Three-phase transformers – Auto-transformer.

Induction Machines – Construction, Principle of operation – Rotating fields – Characteristics and Performance analysis – Circle diagram – Starting and speed control – Single-phase Induction motors – Linear Induction motors – Hysteresis motors – Reluctance motors – Stepper motors.

Synchronous Machines – Construction – Operating characteristics and Performance analysis – Efficiency and Voltage regulation – Parallel operation – V and inverted V curves of synchronous motors – Power factor improvement.

## **Unit –VII Power systems**

Types of Power Stations – Hydro, Thermal and Nuclear Stations – Pumped storage plants – Economic and operating factors – Power transmission lines – Modeling and performance characteristics – Voltage control – Load flow studies – Optimal power system operation – Load frequency control – Symmetrical short circuit analysis – ZBus 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.

## **Unit –VIII Analog and Digital Electronics**

Semiconductor devices – PN junctions – Transistors – FET – Zener, Tunnel, Schottky, Photo diodes and their applications – Rectifier circuits – Voltage regulators – Multipliers – switching behavior of Diodes, Transistors, UJT, SCR, IGBT.

Biasing circuits – Small signal amplifiers – frequency response – Multistage amplifiers – Coupling methods – Large signal amplifiers – Push-pull amplifiers – Feedback amplifiers – Oscillators – Operational amplifiers – Precision rectifiers – Wave shaping circuits.

Digital logic gate families – Universal gates – Combination circuits for arithmetic and logic operations – Flip-flops – Multivibrators and their applications – Sequential logic circuits – Counters – Registers – Memories.

Power Semiconductor devices – Thyristors – Power transistor – GTOs – Single and three phase AC to DC Converters – Single and three phase AC to AC converters – MOSFET and IGBT based DC to DC Converters and single and three phase inverters. Pulse width modulation – Sinusoidal modulation with uniform sampling – Switched mode power supplies – Speed control of DC and AC motors – Reactive power compensation – Power factor improvement.

## **Unit –IX Microprocessors and Microcontrollers**

Architecture of 8085, 8086, 8088, 8051 and 8097 – Instruction sets – Assembly language programming – Interfacing for memory and I/O – Applications.

## **Unit –X Communication Systems**

Types of modulation – AM, FM and PM – Demodulators – Noise and bandwidth considerations – Digital communication systems – Pulse code modulation and demodulation – Frequency division and time division multiplexing – Satellite Communication – Fibre optic communication – Cellular mobile communication (Block diagram treatment).

### **REFERENCE BOOKS:**

1. Dekker.A.J, “Electrical Engineering Materials”, Prentice Hall of India.
2. Sudhakar.A, Shyammohan.S.P, “Circuits, Network Analysis and Synthesis”, TMH.
3. William H. Hayt.Jr, “Engineering Electro Magnetics”, TMH.
4. Sawhney.A.K, “A Course in Electrical and Electronic Measurements and Instrumentation”, Wiley Eastern Limited.
5. Nagrath.J, Gopal.M, “Control System Engineering”, New Age International Publishers Limited.
6. Nagrath.I.J, Kothari.D.P, “Electrical Machines”, TMH.
7. Nagrath.I.J, Kothari.D.P, “Power System Engineering”, TMH.
8. Jacob Milmann, Arvin Gravel, “Micro Electronics”, McGrawHill.
9. RoyChoudhry, Shall Jain, “Linear Integrated Circuits”, Wiley Eastern Limited.
10. Rashid.M.H, “Power Electronics”, Prentice Hall of India.
11. Ramesh G. Gaonkar, “Micro processor Architecture, Programming and Applications”, Wiley Eastern Limited.
12. Kenneth.J.Ayala, “The 8051 Microcontroller Architecture, Programming and Applications”, Pentam International Publishers (India).
13. Simon Haykin, “Communication Systems”, JohnWiley.