LNCT University
Diploma EX, IV Semester Syllabus

ELECTRICAL MACHINES - I (DEX-401)

COURSE OUTCOMES:

After Completing the course student should be able to:

CO-1	Understand the fundamentals of magnetic circuits and materials including laws.
CO-2	Analyse the construction, working and performance of single and three-phase transformers, including equivalent circuit, efficiency, voltage regulation, testing methods and specialized connections.
CO-3	Explain the principles of electromechanical energy conversion and magnetic field interactions in rotating machines, including energy conversion equations, magnetic field distribution and the behaviour of rotating magnetic fields.
CO-4	Describe the construction and operation of DC generators, develop EMF equations and analyse the effects of armature reaction, excitation methods and commutation and performance characteristics.
CO-5	Examine the working principles and characteristics of DC motors, evaluate starting methods, speed control techniques, braking methods, testing procedures and explore applications of PMDC motors.

UNIT I: MAGNETIC CIRCUITS AND MAGNETIC MATERIALS
Magnetic circuits - Laws governing magnetic circuits - Flux linkage, Inductance and energy - Statically and dynamically induced EMF - Torque - Properties of magnetic materials, Hysteresis and Eddy Current losses, ac excitation, and introduction to permanent magnets transformer as a magnetically coupled circuit.

UNIT II: TRANSFORMERS
Construction, principle of operation, types, equivalent circuit diagram and parameters, phasor diagrams, losses, testing, efficiency and voltage regulation. All day efficiency, scott connection.

UNIT III: ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES
Energy in magnetic system, Field energy and co energy-force and torque equations -singly and multiply excited magnetic field systems-mmf of distributed windings, winding inductances, magnetic fields in rotating machines, rotating mmf waves, magnetic saturation and leakage fluxes.

UNIT IV: DC GENERATORS
Construction and components of DC Machine, Principle of operation, lap and wave windings, EMF equations, armature reaction, methods of excitation, commutation, interpoles compensating winding, characteristics of DC generators.

UNIT V: DC MOTORS
Principle and operation, types of DC motors, speed torque characteristics of DC Motors, starting and speed control of DC motors, plugging, dynamic and regenerative braking, testing

and efficiency, retardation test, Swinburne’s test and Hopkinson’s test, permanent magnet DC (PMDC) motors. Applications of DC motor.

Reference Books: -

1. Electrical Machines, D.P. Kothari and I.J. Nagrath.
2. Electrical Machinery, P.S. Bimbhra.
3. Theory of Machines, A.E. Fitzgerald, Charles Kingsley Jr., and Stephen D. Umans.

List of suggestive core experiments: -

1. Open Circuit Characteristics of a DC Shunt Generator.
2. Load Test on DC Shunt Generator
3. Load Test on DC Series Generator
4. Load Test on DC Compound Generator.
5. Brake Test on DC Shunt Motor
6. Speed Control of DC Shunt Motor
7. Hopkinson’s Test (Back-to-Back Test) on DC Machines
8. Polarity Test and Voltage Ratio Test on Single Phase Transformer
9. Open Circuit and Short Circuit Test on Single Phase Transformer
10. Sumner’s Test (Back-to-Back Test) on Transformers
11. Load Test on Single Phase Transformer