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Question Paper Code : 11288

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Third Semester

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Electrical and Electronics Engineering

EE3303 — ELECTRICAL MACHINES – I

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw the typical normal magnetization curve of ferromagnetic material.
2. Define coercivity.
3. State the conditions to be fulfilled for a dc shunt generator to build up EMF.
4. Categorize the different types of dc machine.
5. Why are carbon brushes preferred for DC machines?
6. Name any four applications of DC series motor.
7. How the transformers are rated? Justify.
8. When will a Bucholz relay operate in a transformer?
9. What are the no load losses in a two winding transformer? Why the losses are unavoidable in transformer?
10. Define voltage regulation of transformer.

PART B — (5 × 13 = 65 marks)

11. (a) Derive the expressions for statically and dynamically induced EMF.

Or

(b) Deduce the expressions for singly excited magnetic field system mmf of distributed windings.

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12. (a) (i) Derive the expression for EMF induced in the generator. (7)

(ii) A 4-pole, lap-wound, d.c. shunt generator has a useful flux per pole of 0.07 Wb. The armature winding consists of 220 turns each of 0.004 Ω resistance. Calculate the terminal voltage when running at 900 r.p.m. if the armature current is 50 A. (6)

Or

(b) (i) Explain the process of commutation in a DC machine. (7)

(ii) A 10 kW, 250 V, d.c., 6-pole shunt generator runs at 1000 r.p.m. when delivering full-load. The armature has 534 lap-connected conductors. Full-load Cu loss is 0.64 kW. The total brush drop is 1 volt. Determine the flux per pole. Neglect shunt current. (6)

13. (a) Describe the working of 3 point starter for DC shunt motor with neat diagram.

Or

(b) List the different methods used for the speed control of D.C. shunt motor and explain.

14. (a) (i) Derive the emf equation of single phase transformer. (7)

(ii) The core of a three phase, 50 Hz, 11000/550 V delta/star, 300 kVA, core-type transformer operates with a flux of 0.05 Wb. Find

(1) number of H.V. and L.V. turns per phase.

(2) e.m.f. per turn. (6)

Or

(b) (i) Derive the condition for maximum efficiency in a transformer. (7)

(ii) A 25 kVA, single-phase transformer has 250 turns on the primary and 40 turns on the secondary winding. The primary is connected to 1500-volt, 50 Hz mains. Calculate (1) Primary current on full-load, (2) Secondary e.m.f. (6)

15. (a) Explain the working of auto transformer and prove that when transformation ratio approaches unity, the amount copper used approaches smaller value.

Or

(b) Provide detailed study on 3ϕ transformer connections.

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PART C — (1 × 15 = 15 marks)

16. (a) A d.c. series motor having a resistance of 1 ohm drives a fan for which the torque varies as the square of the speed. At 220 V, the set runs at 350 r.p.m. and takes 25 A. The speed is to be raised to 500 r.p.m. by increasing the voltage. Determine the necessary voltage assuming the field to be unsaturated.

Or

(b) A 30 kVA, 2400/120-V, 50-Hz transformer has a high voltage winding resistance of 0.12 and a leakage reactance of 0.22 ohm. The low voltage winding resistance is 0.035 ohm and the leakage reactance is 0.012 ohm. Find the equivalent winding resistance, reactance and impedance referred to the high voltage side.

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