QP Code:EE2T02-2 **(Pages: 3)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Third Semester B.Tech. Degree (SAY) Examination, February, 2026

Course Code: B24EE2T02

Course Name: ELECTRICAL MACHINES I

Max. Marks: 100 Duration: 3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. Distinguish between duplex and triplex winding.
2. Differentiate between long-shunt and short-shunt DC compound generators.
3. Explain the two main effects of armature reaction in a DC machine
4. Classify the different losses in a DC generator.
5. List three methods for controlling the speed of DC series motors.
6. Derive the condition for maximum power developed by DC motor.
7. Derive the emf equation of a single-phase transformer.
8. Explain how the efficiency of a transformer at different loads may be estimated from Sumpner's test with circuit diagram.
9. Enumerate three differences between power and distribution transformers.
10. Draw the HV and LV side phasor diagrams for i) Yy0 ii) Yd1 connections of 3-phase transformer.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

11. With neat sketches, explain the types of armature windings and their applications.

OR

12. a. Derive the EMF equation of a DC generator. (6 marks)

    b. A 6-pole lap-wound DC generator has 600 conductors on its armature. The flux per pole is 0.02 Wb. Calculate (i) the speed at which the (8 marks)

generator must run to generate 300 V (ii) what would be the speed if the generator were wave-wound?

Module 2

13. The open circuit characteristics of a shunt DC generator at 800 rpm give:

Field Current (A)	0	0.5	1	2	3	4	5
E.M.F (V)	10	50	100	175	220	245	262

i) Find graphically the terminal voltage at 800 rpm. ii) the critical resistance of the shunt field circuit. iii) If the circuit resistance is changed to 75 Ω, What will be the critical speed for the machine to build up.

OR

14. A long shunt compound generator running at 1000 rpm supplies 22 kW at a terminal voltage of 220V. The resistance of the armature, shunt field and the series field are 0.05 Ω, 110 Ω and 0.06 Ω, respectively. The overall efficiency at the above load is 88%. Find (i) copper loss, (ii) iron and friction losses and (iii) torque exerted by the prime mover.

Module 3

15. Explain the working of a three-point starter with the help of a neat diagram.

OR

16. Describe with the aid of a circuit diagram, the Swinburne's test for estimating the efficiency of a DC shunt machine.

Module 4

17. a. Draw and explain the vector diagram of a single phase practical transformer supplying (i) lagging power factor load and (ii) leading power factor load. (8 Marks)

b. A 230/2300 V transformer takes no load current of 5 A at 0.25 power factor lagging. Find (i) the core loss and (ii) magnetising current. (6 Marks)

OR

18. a. Explain different losses in a transformer. (7 Marks)

b. In a 50 kVA transformer, the iron loss is 500 W and full-load copper loss is 800 W. Find the efficiency at full-load and half full-load at 0.8 p.f. lagging. (7 Marks)

Module 5

19. a. For the same output and transformation ratio an autotransformer requires less amount of copper than an ordinary two winding transformer. Justify. (6 Marks)

b. An autotransformer is used to step down the voltage level from 230V to 200V. Find the current in different sections of the winding when the load is 20 kW at upf. Neglect losses and magnetising current. (8 Marks)

OR

20. A 3 φ step down transformer is connected to 6.6 kV supply mains and takes 20A. Calculate its secondary line voltage and line current for the following connections if the ratio of turns per phase is 16 (i) Y-Y (ii) Y- Δ (iii) Δ – Y (iv) Δ – Δ.

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