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Question Paper Code : 91032

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Third Semester

Electrical and Electronics Engineering

EE 3303 – ELECTRICAL MACHINES – I

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

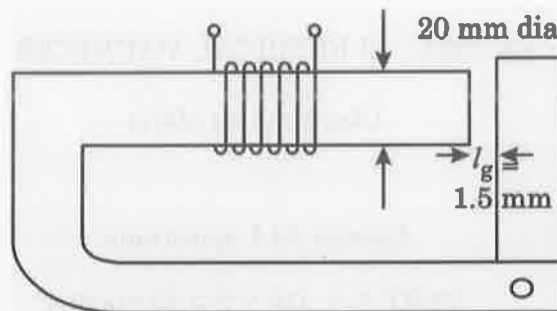
1. Why all practical energy conversion devices make use of the magnetic field as a coupling medium rather than an electric field.
2. Write the standards for kVA and voltage rating as per the Indian standards Institution standards: IS:1180-1966 for an Outdoor type distribution transformers.
3. Define critical and normal field resistances of a self-excited DC shunt generator.
4. Mention some methods used to reduce armature reaction in large DC Machines.
5. Mention the different speed control strategies of the DC Shunt motor.
6. List the merits and demerits of Swinburne's test.
7. The emf per turn for a single-phase 2200/220 V, 50 Hz transformer is 11 V. Calculate the number of primary and secondary turn.
8. Write the condition for maximum efficiency of a distribution transformer.
9. Give the various primary and secondary winding configurations for 3-phase power transformer and distribution transformer.
10. Compare an auto transformer with two winding transformer.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Explain the concept energy balance in electro mechanical energy conversion and illustrate with an armature relay coil which is excited by a voltage source.

Or

- (b) A solenoid relay shown below is operated from a 110 V DC supply and the 5000-turn coil resistance is $5.5 \text{ k}\Omega$. The core diameter of the relay is 20 mm and the gap length is 1.5 mm, the armature being stationary. The gap faces may be taken as parallel and the permeability of the ferromagnetic parts as very high.



Estimate :

- (i) the gap flux density ;
 - (ii) the coil inductance;
 - (iii) the pull on the armature.
12. (a) (i) Explain the internal and external characteristics of all DC generators with neat waveforms. (6)
- (ii) A 4 pole DC Shunt Generator with lap connected armature supplies 5 kW at 230 V. The armature and field copper losses are 360 W and 200 W respectively. Calculate the armature current and generated EMF. (7)

Or

- (b) Explain in detail about commutation and list out the various methods of improving commutation in detail with a neat sketch.
13. (a) (i) Derive the DC motor torque equation assuming the necessary variables. (6)
- (ii) Outline the mechanical characteristics of all DC motors and list the applications (7)

Or

- (b) Describe Plugging, dynamic and regenerative braking in DC Motor.

14. (a) (i) Calculate the all-day efficiency of a 500 kVA transformer with the following load cycle whose copper and iron losses at full load are 4.5 kW and 3 kW respectively. (6)

No. of Hours	6	6	8	4
Load in kW	450	300	150	0
Power factor	0.90	0.75	Unity	-

- (ii) Explain the Sumpner's test for two identical single phase transformers with the circuit and give the merits. (7)

Or

- (b) Explain open circuit and short circuit tests on a single phase transformer to obtain the

- (i) equivalent circuit parameters referred to primary/secondary. (4)
(ii) predetermination of efficiency. (4)
(iii) Predetermination of voltage regulation. (5)

15. (a) Illustrate in detail with a circuit about the autotransformer working. Explain with the expression for saving of copper and determination of kVA rating for any loading level.

Or

- (b) Describe the construction, working and parallel operation of core type three phase transformers.

PART C — (1 × 15 = 15 marks)

16. (a) A 200-V shunt motor has $R_a = 0.1 \Omega$, $R_f = 240 \Omega$ and rotational loss = 236 W. On full load the line current is 9.8 A. With the motor running at 1450 rpm. Determine

- (i) the mechanical power developed (4)
(ii) the power output (3)
(iii) the load torque and full load efficiency. (8)

Or

- (b) A 200/400 V, 20 kVA, and 50 Hz transformer is connected as an auto transformer to transform 600 V to 200 V

- (i) Determine the auto transformer ratio. (5)
(ii) Determine the kVA rating of the auto transformer. (5)
(iii) With a load of 20 kVA, 0.8 pf lagging connected to 200 V terminals, determine the currents in the load and the two transformer windings. (5)

