Reg. No. :

Question Paper Code : 52952

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY, 2019.

Fourth Semester

Electrical and Electronics Engineering

EE 6401 — ELECTRICAL MACHINES — I

(Regulation 2013)

(Common to PTEE 6401 — Electrical Machines — I for B.E. (Part-Time) — Third Semester — Electrical and Electronics Engineering — Regulation 2014)

Time : Three hours　　　　Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define coefficient of coupling.

2. State ohms law for magnetic circuits.

3. Full load copper loss in a transformer is 1600 watts. What will be the loss at half load?

4. Does the transformer draw any current when secondary is open ? Why?

5. What does "speed voltage" mean?

6. Why do all practical energy conversion devices make use of the magnetic field as a coupling medium rather than electric field?

7. Why is the emf not zero when the field current is reduced to zero in a dc generator?

8. Under what circumstances does a dc shunt generator fail to generate?

9. How does a d.c motor differ from d.c generator in construction?

10. What is the function of a no-voltage release coil provided in a dc motor starter?

PART B — (5 × 13 = 65 marks)

11. (a) A ring composed of three sections. The cross-sectional area is 0.001 m^2 for each section. The mean arc length are I_a = 0.3m, I_b = 0.2m, I_c = 0.1m. An air-gap length of 0.1 mm is cut in the ring. μ_r for sections a, b, c are 5000, 1000 and 10,000 respectively. Flux in the air gap is 7.5×10^{-4} Wb. Find
(i) mmf (ii) exciting current if the coil has 100 turns, (iii) reluctances of the sections.

Or

(b) (i) Determine the amp-turns required to produce a flux of 0.38 mWb in an iron ring of mean diameter 58 cm and cross-sectional area of 3 cm^2. Use the following data for the ring :

B : Wb/m^2 :	0.5	1.0	1.2	1.4
μ_r :	2500	2000	1500	1000

(ii) If a saw-cut of 1 mm width is made in the ring, calculate the flux density in the ring, with the mmf remaining same as in case (i) above.

12. (a) With neat sketch explain the working of transformer under no load and lagging power factor load.

Or

(b) The O.C and S.C test data are given below for a single phase, 5 kVA, 200V/400V, 50Hz transformer.
O.C test from LV side : 200V 1.25A 150W
S.C test from HV side : 20V 12.5A 175W
Draw the equivalent circuit of the transformer (i) referred to LV side and (ii) referred to HV side inserting all the parameter values.

13. (a) Calculate the torque produced by the Faraday's disc if a dc current I_{dc} flows from the positive terminal to the negative terminal as shown Fig. 13 (a).

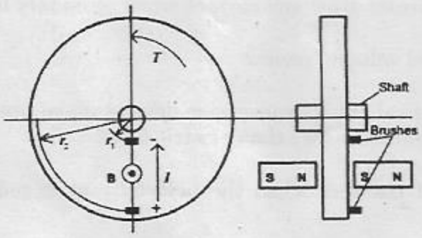

Fig. 13 (a).

Or

(b) Derive Force and Torque from Energy and Co-energy for Doubly Excited Rotating Actuator.

14. (a) A 4 pole, lap wound, dc generator has 42 coils with 8 turns per coils. It is driven at 1120 rpm. If useful flux per pole is 21 mWb, calculate the generated emf. Find the speed at which it is to be driven to generate the same emf as calculated above with wave wound armature.

Or

(b) Explain in detail about characteristics of a dc separately excited generator.

15. (a) A 220 V d.c series motor has armature and field resistances of 0.15 Ω and 0.10 Ω respectively. It takes a current of 30 A from the supply while running at 1000 rpm. If an external resistance of 1 Ω is inserted in series with the motor, calculate the new steady state armature current and the speed. Assume the load torque is proportional to the square of the speed i.e., $T_L \alpha\, n^2$.

Or

(b) A 220 V shunt motor has armature and field resistance of 0.2 Ω and 220 Ω respectively. The motor is driving a constant load torque and running at 1000 rpm drawing 10 A current from the supply. Calculate the new speed and armature current if an external armature resistance of value 5 Ω is inserted in the armature circuit. Neglect armature reaction and saturation.

PART C — (1 × 15 = 15 marks)

16. (a) Initially a d.c shunt motor having Ra = 0.5 Ω and Rf = 220 Ω is running at 1000 rpm drawing 20 A from 220 V supply. If the field resistance is increased by 5%, calculate the new steady state armature current and speed of the motor. Assume the load torque to be constant.

Or

(b) A 5 kVA, 200 V/100 V, 50 Hz, single phase ideal two winding transformer is to used to step up a voltage of 200 V to 300 V by connecting it like an auto transformer. Show the connection diagram to achieve this. Calculate the maximum kVA that can be handled by the autotransformer (without over loading any of the HV and LV coil). How much of this kVA is transferred magnetically and how much is transferred by electrical conduction.
