Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 41030

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Third Semester

Electrical and Electronics Engineering

EE 3303 — ELECTRICAL MACHINES – I

(Regulations 2021)

(Also Common to PTEE 3303 – for Regulations 2023)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Recall statically induced EMF.

2. Define Magnetic reluctance.

3. List the conditions for making a self excited DC shunt generator to build up the voltage.

4. Define armature reaction in DC generator and recall its effects on the field flux.

5. State the working principle of DC motor and identify the corresponding Fleming's rule.

6. Why a series motor should never start with out a load?

7. List the different types of transformer with its applications.

8. Name the parts of a transformer.

9. Show the difference of a two winding transformer and an auto transformer with a circuit.

10. List the applications of auto transformer.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Compare Magnetic and electric circuits. (7)

(ii) Define hysteresis effect in a Ferro magnetic substance. Label the hysteresis loop and mark retentively, coercivity and saturation regions. (6)

Or

(b) (i) Explain a single excited system and derive the expression for energy stored in the magnetic field. (7)

(ii) Define rotating magnetic field. Also explain the conditions exist for the production of a rotating magnetic field in three phase windings of AC rotating machines with corresponding expression for total magnetic field. (6)

12. (a) Explain the construction and working of a DC generator with a cross sectional view diagram and recall the induced emf equation. (13)

Or

(b) Explain the parallel operation of DC shunt generators with a neat sketches. (13)

13. (a) (i) List the different types of DC shunt motor speed control method and explain the Ward Leonard DC Motor Speed control system with a diagram. (7)

(ii) Illustrate the working principles of a three point starter with neat sketches. (6)

Or

(b) (i) A six pole, 500 V, wave connected shunt motor has 1200 armature conductors and useful flux /pole of 20mWb. Armature and field resistance are 0.5 ohms and 250 ohms. What will be the speed ad torque of then it draws 20amp current from supply? Neglect armature reaction. Also determine the useful torque and efficiency at this load if magnetic and mechanical losses are 900 watts. (7)

(ii) Summarize the experimental setup of dynamometer type brake test on DC shunt motor with neat sketches and also derive the expression for efficiency for a load current. (6)

14. (a) (i) Explain the principle of operation of a single phase transformer with as neat sketches. (7)

(ii) Derive the expression of the RMS value of the induce emf per turn for a transformer. (6)

Or

(b) (i) Define All day efficiency of a distribution transformer. Also derive the condition to get maximum efficiency from a transformer. (7)

(ii) A single phase 50 Hz transformer has 100 turns on the primary and 400 turns on the secondary winding. The net cross-sectional area of core is 250 cm^2. If the primary winding is connected to a 230 V, 50 Hz supply, determine,

(1) The e.m.f. induced in the secondary winding (3)

(2) The maximum value of flux density in the core. (3)

15. (a) (i) Prove that the amount of copper saving in auto transformer is (1-K) W_{TW} as compared to two winding transformer. (7)

(ii) Explain the working principle of auto transformer in detail. (6)

Or

(b) (i) Illustrate a delta-delta connected winding transformer and explain the phasor diagram with a circuit diagram. (6)

(ii) Two similar 200 kVA, single phase transformers gave the following results in Sumpner's test: Mains wattmeter W_1 = 4 kW. Series wattmeter W_2 = 62 kW at full load current. Find out individual transformer efficiencies at

(1) Full load at unity p.f. and (4)

(2) Half load at 0.8 p.f. lead. (3)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Estimate the e.m.f. generated by a 6 pole DC Generator having 480 conductors and driven at a speed of 1200 RPM. The flux per pole is 0.0 12 webers. (1) When the machine is lap wound (2) When the machine is wave wound, (2+3)

(ii) Analyse structure of the different types of DC generator armature winding connection and compare each other. (10)

Or

(b) (i) A 2000/200 V single phase transformer gives 0.5 A and 40 W as ammeter and wattmeter readings when supply is given to the low voltage winding and high voltage winding is kept open. Find:

(1) The magnetizing component, (1)

(2) The iron component and (1)

(3) The power factor of no-load current (3)

(ii) A 2300/230 V, 50 Hz single phase transformer has the transformer parameters: R_1 = 0.3 Ω; R_{2e}=0.295 Ω; X_1 = 0.375 Ω ; X_{2e} = 0.685 Ω; R_{c1} = 4 kΩ ; X_{m1}= 1000 Ω. The secondary load impedance Z_L = (0.4 + j0.3) Ω. Find the voltage regulation, losses of the transformer using approximate equivalent circuit. (10)

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