

R18

Code No: 153AQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, February - 2024

**ELECTRICAL MACHINES - I
(Electrical and Electronics Engineering)**

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) Define the following terms with reference to armature windings of d.c. Machines.
(i) Pole pitch (ii) Back pitch. [2]
- b) Why the external characteristic of a D.C. Shunt generator is more drooping than that of separately excited generator? [3]
- c) Draw the speed torque characteristics of a D.C. Series motor. [2]
- d) Why is the starting current very high in a D.C. Motor? [3]
- e) What are constant losses of a d.c machine? [2]
- f) State the advantages and dis- advantages of an indirect testing on a d.c machine. [3]
- g) What are the types of transformers? [2]
- h) Explain the effect of variations of frequency and supply voltage on iron losses of a transformer. [3]
- i) What are the advantages of Sumpner's test? [2]
- j) What are the advantages of 3-phase transformer? [3]

PART – B

(50 Marks)

- 2.a) What is commutation in a d.c generator? Explain the disadvantages of it. State the methods to improve the commutation process.
- b) A 6-pole, 74 A D.C. shunt generator has 240 conductors and is a wave-wound. Its field current is 2 A. Find the demagnetizing and cross-magnetizing ampere turns per pole at full load if (i) Brushes are on GNA (ii) Brushes are shifted from GNA by 4° electrical, and (iii) Brushes are shifted from GNA by 4° mechanical. [6+4]

OR

- 3.a) Explain the process of building up of voltage in a d.c. shunt generator and give the conditions to be satisfied for voltage build up.
- b) The open circuit characteristics of a D.C. shunt generator at 700 r.p.m are given by following data:

| | | | | | | | | |
|-----------------------------|-----------|------------|-------------|-------------|-------------|-------------|-------------|------------|
| I_f(amp) | 0 | 0.2 | 0.40 | 0.65 | 1.02 | 1.75 | 3.15 | 5 |
| E_a(Volts) | 10 | 40 | 80 | 120 | 160 | 200 | 240 | 260 |

Determine the critical field resistance at (i) 700 r.p.m and (ii) 800 r.p.m. [5+5]

- 4.a) Explain the principle of torque production in a d.c. Motor. Derive torque expression of it.
- b) The armature of 4-pole, D.C. shunt motor has a lap winding accommodated in 50 slots, each containing 15 conductors. If the useful flux per pole is 20 mWb, calculate the total torque developed when the armature current is 40 A. [6+4]

OR

- 5.a) Explain (i) armature voltage control and (ii) field control of speed of d.c motor.
- b) Explain the various applications of d.c motors. [6+4]
- 6.a) Explain the procedure of conducting Brake test on a d.c motor.
- b) A full-load brake test on a small dc shunt motor, gave the following data:
- | | |
|-------------------------|----------------|
| Spring balance readings | 25 kg and 9 kg |
| Outside pulley diameter | 19.5 cm |
| Belt thickness | 0.50 cm |
| Motor speed | 1500 rpm |
| Applied voltage | 230 V |
| Line current | 12.5 A |
- Calculate the shaft torque, shaft power and the motor efficiency at rated load. [5+5]

OR

- 7.a) Explain the procedure of separation of stray losses in a d.c. motor test.
- b) A 500 V, 25 HP (=18.65 kW), dc shunt motor takes a current of 2.4 A while running light. The field and armature resistances are 650 ohms and 0.57 ohms, respectively. Calculate the full-load efficiency, assuming a brush drop of 2 V. [5+5]
- 8.a) Draw the phasor diagram of the practical transformer at u.p.f. Load.
- b) Derive an expression for induced emf in a transformer. [5+5]

OR

- 9.a) Derive the condition for maximum voltage regulation of a transformer.
- b) A 25 kVA, 2000/200 V, 50 Hz transformer has maximum efficiency at 80 % of full load. Its per unit resistance and reactance is 0.012 and 0.05 respectively. Determine its efficiency and voltage regulation at the full load and at 0.8 p.f lagging. [5+5]
- 10.a) How do you conduct the O.C. test and S.C. test on a single-phase transformer? Explain.
- b) The following readings were obtained from O.C. and S.C. tests on 8KVA 400/120V, 50 Hz, single phase transformer.
- | | |
|-----------|-------------------|
| O.C. test | : 120V, 4A, 75W |
| S.C. test | : 9.5V, 20A, 110W |
- Calculate (i) Voltage regulation and efficiency for 0.8 lagging p.f. load
(ii) The efficiency at half full load and 0.8 p.f. load. [5+5]

OR

- 11.a) Discuss the conditions necessary for the successful parallel operation of single phase transformer. How can you check these conditions?
- b) Explain the following three phase transformer connections: (i) Y- Δ and (ii) Δ -Y. [5+5]

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