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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S, FE) / S2 (PT) (S) Examination January 2024 (2019 Scheme)

Course Code: EET202

Course Name: DC MACHINES AND TRANSFORMERS

Max. Marks: 100 Duration: 3 Hours

Use graph sheets wherever necessary

PART A

(Answer all questions; each question carries 3 marks) Marks

1 A 4-pole DC generator running at 1500 rpm has an armature with 90 slots and 6 conductors/slot. The flux per pole is 10mWb. Determine the induced emf if the armature winding is a) lap connected b) wave connected (3)

2 Compare the lap and wave windings used for DC machine armature. (3)

3 An 8-pole, DC shunt generator has 1556 conductors, wave connected, in the armature and runs at 2000 rpm. The terminal voltage is 250V and the load is 10Ω. The armature resistance is 0.5Ω and the field resistance is 500Ω. Find the armature current and induced emf. (3)

4 What are the conditions to be fulfilled for self- excitation of a DC shunt generator? Explain. (3)

5 DC series motors should never be started on no-load, why? (3)

6 Explain the necessity of a starter in a DC motor. (3)

7 Explain the principle of operation of a single- phase transformer. (3)

8 What are the losses in a transformer? How they can be reduced? (3)

9 Explain the principle of operation of an auto- transformer. (3)

10 Explain the working of off load tap-changing transformers. (3)

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 Give the constructional features and working principle of a DC generator. Draw the cross- sectional view of a 4-pole machine and mark the parts. Explain the function of each part. (14)

12 Draw the winding diagram of a simplex double- layer wave winding for a 4-pole DC generator with 19 commutator segments. (14)

Module -2

13 a) Explain the different methods of excitation of a DC generator with suitable diagrams (4)

b) The OCC of a DC shunt generator driven at 600rpm is given by (10)

If(A)	0	2	4	6	8	10	12	14	16
Vo(V)	4	58	110	150	180	200	218	230	240

i) Determine the field circuit resistance in order to produce an open circuit voltage of 220V.

ii) What is the critical speed of the generator for this setting of field resistance?

iii) What is the critical field resistance at the original speed?

14 a) Discuss the precautions to be observed while two DC generators are to be operated in parallel and explain the load sharing between the two. (4)

b) A separately excited DC generator running at 1000rpm supplies 20A at 230V to a resistive load. If the load resistance remains constant, what will be the load current if the speed is reduced to 800rpm? The armature resistance is 0.5Ω. The field current is unaltered. Assume a voltage drop of 1V per brush. Ignore armature reaction effect. (10)

Module -3

15 a) A 500V DC shunt motor takes 4A on no-load. The armature resistance including that of brushes is 0.2Ω and the field current is 1.0A. Estimate the output at which its efficiency is the maximum. Also determine the value of maximum efficiency. (8)

b) Explain the retardation test conducted on a DC machine. Discuss the results obtained from this test. (6)

16 a) Explain the different speed control methods of DC motors. (6)

b) A 10 kW, 240 V DC shunt motor draws a line current of 5 A while running at the no-load speed of 1500 rpm from a 240 V DC supply. The machine has an armature resistance of 0.25Ω and a shunt field resistance of 240Ω. Estimate the efficiency of the motor when it delivers rated load. (8)

Module -4

17 a) Derive the approximate equivalent circuit referred to primary, of a single- phase transformer. (10)

b) Define all-day efficiency of a transformer. State how the all-day efficiency may be improved. (4)

18 A 250 / 500 V, single phase transformer has a primary resistance of 0.2Ω and leakage reactance of 0.5Ω. The corresponding values for the secondary are 0.82Ω and 2.1Ω respectively. Calculate the secondary terminal voltage and the voltage regulation when the primary draws a current of 40 A at 0.8 pf leading from the supply. (14)

Module -5

19 a) Explain the four common ways of connecting three-phase transformers. Discuss their merits and demerits. (8)

b) Derive an expression for the saving in copper effected by using an autotransformer instead of a 2- winding transformer. (6)

20 Explain Dy11 and Yd1 grouping of transformers with neat circuit and phasor diagrams. (14)

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