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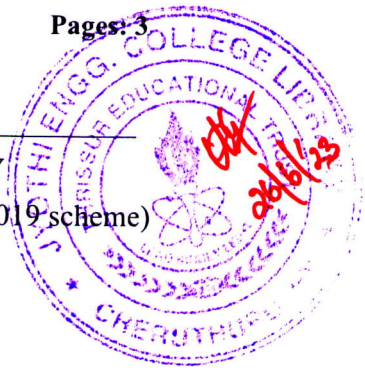

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree Supplementary Examination June 2023 (2019 scheme)

Course Code: EET202

Course Name: DC MACHINES AND TRANSFORMERS

Max. Marks: 100 Duration: 3 Hours

PART A

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

1	Point out the necessity of equalizer rings in a lap wound DC machine. Why this is not applicable in wave wound machines?	(3)
2	Explain why commutator and brush arrangement is necessary for the operation of DC machines.	(3)
3	A 4 pole DC generator running at 1500 rpm has an armature with 90 slots having 6 conductors per slot. The flux per pole is 60 mWb. Determine (i) the induced emf if the coils are lap connected and (ii) the electrical power developed if the current per conductor is 100 A.	(3)
4	Explain critical resistance and critical speed and bring out their roles in the process of self-excitation in DC generators.	(3)
5	Compare electrical characteristics and mechanical characteristics of a DC shunt motor with those of a DC series motor. Based on this, point out the applications of these motors.	(3)
6	A 230 V DC series motor is drawing 50 A from the supply lines. Resistance of the armature and series field windings are 0.2 Ω and 0.1 Ω respectively. Calculate the back emf and the mechanical power developed.	(3)
7	Explain the principle of operation and derive the emf equation of a single phase transformer.	(3)
8	What is all-day efficiency of a transformer? How does it differ from ordinary efficiency?	(3)
9	What is vector grouping? Name the vector groups commonly used in three phase transformers.	(3)
10	Derive an expression for the saving of copper in an auto-transformer as compared with a an equivalent two winding transformer.	(3)

PART B

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

Module -1

11 a) Explain the need of dummy coils in DC machines (4)

b) Draw the developed diagram of a simplex two-layer progressive lap winding for a 4 pole generator with 16 coils. Indicate the position of brushes. (10)

12 a) Define pole pitch, front pitch, back pitch, resultant pitch, average pitch and commutator pitch of DC armature windings. Illustrate them with the help of neat sketches. (6)

b) Explain the construction of a DC machine with the help of a neat diagram. (8)

Module -2

13 a) Explain armature reaction in DC machines. How demagnetizing and cross-magnetising ampere-turns per pole are calculated in a DC machine? (10)

b) Why compensating windings are used in DC machines? Explain how they are connected? (4)

14 a) What are the necessary conditions for voltage build up in a DC shunt generator. (4)

b) A 4 pole, 1200 rpm, short shunt compound generator has armature, shunt field and series field resistances of 0.4Ω, 200Ω and 0.6Ω respectively. The machine supplies a load of 4.4kW at 220V. Calculate (i) the emf generated in the armature and (ii) the flux per pole if the wave connected armature winding has 780 conductors. (10)

Module -3

15 a) Explain the working of a three point starter with a neat diagram. (6)

b) Explain the Swinburne's test to determine the constant losses of a DC machine. What are the limitations of this test? (8)

16 a) Explain any four speed control methods of DC motors. (8)

b) A 250V, 4 pole DC shunt motor has a two circuit armature winding with 500 conductors. The armature circuit resistance is 0.25Ω, field resistance is 125Ω and the flux per pole is 0.02Wb. Compute (i) the speed and (ii) the internal torque developed, if the motor draws 14A from the mains. (6)

Module -4

17 a) Calculate the efficiency, voltage at the secondary terminals and primary input current when supplying full load secondary current at unity power factor for a (8)

4 kVA, 200/400 V single phase transformer. The following are the test results:
Open circuit test: 200 V, 0.8 A, 70W (low voltage side) and
Short circuit test: 20 V, 10 A, 60 W (high voltage side).

b) Explain the different losses in a transformer. Derive the condition for maximum efficiency of a transformer. (6)

18 a) Draw the circuit diagram and explain the experimental procedure to conduct Sumpner's test on single phase transformers. (8)

b) Draw and explain the phasor diagram of a single phase transformer supplying (i) a lagging load (ii) a leading load and (iii) a upf load. (6)

Module -5

19 a) State the essential and desirable conditions to be satisfied for operating two 3-phase transformers in parallel. (4)

b) Explain with connection diagrams, the Y-Y, Δ-Δ, Y-Δ and Δ-Y connections of 3-phase transformers. Compare the merits and demerits. (10)

20 a) Explain Yy0, Dd0, Yd1 and Yd11 grouping of transformers with neat circuit and phasor diagrams. (8)

b) Explain with sketches, the principle of on load tap changing transformer. (6)

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