02000EET202052107

Reg No .:____

Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) (FT/WP) / (S2 PT) Exam April 2025 (2019 Scheme)

Course Code: EET202

Course Name: DC MACHINES AND TRANSFORMERS

Max. Marks: 100

Duration: 3 Hours

Pages: 3

PART A

	(Answer all questions; each question carries 3 marks)	Marks
1	What is the function of commutator in i) DC generators and ii) DC motors?	(3)
2	For a 4-pole, 11 slots, 2 coil sides per slot simplex progressive wave winding,	(3)
	select the values of front pitch Y_f , back pitch Y_b and winding pitch Y.	
3	List any 3 methods for reduction of effects of armature reaction.	(3)
4	For a 200V, 5kW separately excited DC generator, maximum efficiency occurs	(3)
	at full-load. If armature resistance is 0.4Ω , find the maximum efficiency.	
5	What is the necessity of starters in DC motors?	(3)
6	Name 3 methods for controlling the speed of DC series motors.	(3)
7	List any 3 characteristics of ideal transformer.	(3)
8	Comment on the voltage regulation of a 1-phase transformer when the load is i)	(3)
	at unity power factor ii) zero power factor lag and iii) zero power factor lead.	
9	List any three advantages of auto-transformers over two-winding transformers.	(3)
10	Draw the HV and LV side phasor diagrams for i) Yy0 ii) Yd1 and iii) Yd11	(3)
	connections of 3-phase transformer.	

PART B

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

Module -1

11 a) Explain the need of equalizer rings and dummy coils in DC machines. (7)

Page 1 of 3

- b) An 8-pole, 12kW, 240V DC machine is wave connected. If this machine is now (7) lap-connected, all other things remaining the same, calculate its voltage, current and power ratings.
- 12 a) List any seven comparisons between simplex-lap and simplex-wave windings of (7) a DC machine.
 - b) A progressive simplex lap winding is to be designed for a 4-pole, 8-slot, 2 coil- (7) sides per slot DC armature. Obtain the winding table.

Module -2

- 13 a) Describe the process of commutation in DC machines through the reversal of (8) current in the commutating coil, with neat sketches.
 - b) An 8-pole lap wound DC generator delivers an output current of 200A at 500V. (6) The armature has 1280 conductors and 160 commutator segments. If the brushes are advanced 4 segments from geometric neutral axis, find the demagnetising and cross-magnetising ampere-turns per pole.
- 14 a) What are the conditions to be satisfied while connecting DC generators in (7) parallel? Explain the parallel operation of DC shunt generators.
 - b) A separately excited DC shunt generator has armature circuit resistance of 0.1Ω (7) and a total drop at brushes is 2V. When running at 1000rpm, it delivers a current of 100A at 250V to a load of constant resistance. If the generator speed drops to 700rpm, with field current unaltered, find the current delivered to the load.

Module -3

- 15 a) Derive the torque equation of a DC motor from basics.
 - b) A 230V, DC series motor runs at 800rpm when drawing 155A from the supply (8) lines. The armature circuit resistance of the motor is 0.1 Ω. Calculate the speed of the motor at half the torque assuming unsaturated magnetic field.

(6)

16 a) Explain the speed Vs armature current, torque Vs armature current and speed Vs (6) torque characteristics of a DC series motor.

b) Describe with the aid of a circuit diagram, the Hopkinson's test for a pair of DC (8) shunt machines and explain the method of calculating the efficiency.

Module -4

- 17 a) Derive the emf equation of a single-phase transformer. (7)
 - b) The primary of a single-phase transformer is rated at 10A and 1000V. Open (7) circuit readings are 1000V, 0.42A and 100W. Short circuit readings are 126V, 10A, 400W. Determine the approximate equivalent circuit.
- 18 a) Derive the condition for maximum efficiency of a single-phase transformer. (7)
 - b) With a neat circuit diagram, explain Sumpner's test on two identical single-phase (7) transformers.

Module -5

- 19 a) Differentiate between power transformers and distribution transformers. (6)
 - b) The primary and secondary voltages of an auto-transformer are 400V and 300V (8) respectively. The current delivered to the load is 120A. Calculate i) transformation ratio ii) primary current iii) volt-ampere transferred inductively iv) volt-ampere transferred conductively v) saving in copper compared to similar 2-winding transformer. Neglect magnetising current and losses.
- 20 a) List the necessary and essential conditions for satisfactory operation of 3-phase (6) transformers in parallel.
 - b) What are the four common ways of connecting 3-phase transformers? Also write (8) the voltage relations in each case.

Page 3 of 3