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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree Examination June 2022 (2019 scheme)

Course Code: EET202

Course Name: DC MACHINES AND TRANSFORMERS

Max. Marks: 100 Duration: 3 Hours

Use Graph sheets wherever required

PART A

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

1	Why equalizer rings are not used in wave windings?	(3)
2	Compare lap and wave windings in DC machines.	(3)
3	What are the necessary conditions for voltage build up in a DC shunt generator?	(3)
4	What are the advantages and disadvantages of separately exited DC machines?	(3)
5	Why the speed of a DC shunt motor is practically constant?	(3)
6	Explain different losses in a DC motor.	(3)
7	Derive the emf equation of a single-phase transformer.	(3)
8	Why are transformers rated in kVA?	(3)
9	Enumerate the purposes which dictate the use of tertiary winding in a three winding transformer.	(3)
10	Explain the vector groupings Yy0 and Dy1 in three phase transformers.	(3)

PART B

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

Module -1

11		Explain the constructional details of a DC machine with the help of neat diagrams. Mention the material used for each part and give reasons for the choice of the material	(14)
12	a)	Prepare the winding table for the simplex progressive armature winding for a 20 slot, 4 pole DC machine with two coil sides per slot. Number of parallel paths required is 4.	(8)
	b)	An 8-pole lap connected DC armature has 960 conductors and runs at 400 rpm. The flux per pole is 40mWb. Calculate the induced emf. If the same armature is wave connected, calculate the speed at which the generator must be run to generate 400V.	(6)

Module -2

13 a) Derive the condition for maximum efficiency of a DC generator. (4)

b) Explain any two types of DC generators with the help of neat sketches and relevant circuit equations. (10)

14 a) The O.C.C. of a DC generator driven at 400 rev/min is as follows: (10)

Field current (A)	2	3	4	5	6	7	8	9
Terminal voltage (V)	110	155	186	212	230	246	260	271

Find :

(a) the maximum voltage to which the machine will excite when run as a shunt generator at 400 rev/min with shunt field resistance equal to 34 Ω.

(b) the additional resistance to be inserted in the shunt field circuit to reduce the O.C. voltage to 220 V.

(c) the critical value of the shunt field circuit resistance.

(d) the critical speed when the field circuit resistance is 34 Ω.

b) Explain the process of commutation in DC machines? (4)

Module -3

15 a) A 4-pole, 11.19 kW, 240 V, wave connected DC shunt motor draws armature and field currents of 50 A and 1.0 A respectively while running at 1000 rpm. Its armature has 540 conductors and the armature resistance is 0.1 Ω. Assuming a drop of 1 volt per brush, find (a) the torque developed (b) the shaft torque (c) useful flux / pole (d) rotational losses and (e) efficiency. (10)

b) Explain any two speed control methods of DC motors. (4)

16 a) Derive the torque equation of a DC motor. (4)

b) What is the function of a starter in a DC motor? Explain the working of a three-point starter with the help of neat diagrams. (10)

Module -4

17 a) With the help of a neat diagram, explain Sumpner's test on the transformer. (10)

b) Explain different losses in a transformer. (4)

18 a) Develop the equivalent circuit of a single phase two winding transformer referred to secondary. (8)

b) Draw and explain the vector diagram of a single phase transformer supplying (i) lagging power factor load and (ii) leading power factor load. (6)

Module -5

19	a)	Draw the connection diagram of a V-V connected 3 phase transformer and discuss the operation. What is the total capacity of V-V connected transformer bank as compared with a Δ-Δ bank?	(9)
	b)	What are the essential and desirable conditions for parallel operation of three phase transformers?	(5)
20	a)	Derive an expression for the saving in copper effected by using an autotransformer in place of a two winding transformer.	(6)
	b)	A 3 φ step down transformer is connected to 3.3 kV supply mains and takes 30A. Calculate its secondary line voltage and line current for the following connections if the ratio of turns per phase is 14 (i) Y-Y (ii) Y- Δ (iii) Δ – Y (iv) Δ – Δ.	(8)

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