Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) / S4 (WP) (R) /ʹS2 (PT) (S, FE) Examination May 2024 (2019 Scheme)

Course Code: EET 202

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	Derive the electromagnetic torque equation of a DC machine.	3
2	A 4-pole simplex progressive lap wound armature contains 20 slots and has two coil sides per slot. Find (i) Back Pitch (ii) Front Pitch (iii) commutator Pitch.	3
3	Give any two reasons for parallel operation of DC generators and what are the conditions to be met while connecting shunt generators in parallel.	3
4	Why is the field winding resistance of a DC shunt generator kept below the critical field resistance?	3
5	Describe the principle of operation of a 3-point starter.	3
6	Explain electrical characteristics of a DC series motor with suitable figure.	3
7	What is the condition for maximum efficiency in a single-phase transformer? Explain.	3
8	A single-phase transformer takes a current of 0.9 A and absorbs 60 W when primary is connected to normal supply of 230 V, 50 Hz and the secondary being on open circuit. Find the magnetising and iron loss currents.	3
9	Compare dry and oil type transformers.	3
10	What are the functions of tertiary winding in a three-winding transformer.	3

PART B

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

Module -1

11	a)	Prepare the winding table and draw the developed winding diagram of a 9 slot, 4-pole simplex progressive armature winding of a DC machine with 2 conductors per slot and 2 parallel paths. Mark the brush positions.	10
	b)	Compare full pitched coil and fractional pitched coil with diagram.	4

12   a) What are the principal components of a DC machine? Explain its functions with the help of neat diagram.   10

      b) The armature of a 6-pole 800 r.p.m.lap wound generator has 75 slots. If each coil has 4 turns, calculate the flux per pole required to generate an EMF of 250 Volts.   4

Module -2

13   a) Explain armature reaction in DC generator. How its effects can be minimized.   10

      b) A 4-pole DC generator has a wave wound armature with 820 conductors and it delivers 50A on full load. If the brush lead is $8°$, calculate the demagnetising and cross-magnetising Ampere-turns per pole.   4

14   a) The following data were obtained from on Open Circuit test on a DC shunt generator driven at 1500 r.p.m.   10

Field current(A)	0.5	1	1.5	2	2.5	3
OC Voltage(V)	100	120	125	130	135	140

If the field resistance is 40 Ω, find graphically (i) the terminal voltage on open circuit when the speed is 1500 r.p.m. (ii) the terminal voltage on open circuit when the speed is 1000 r.p.m. (iii) the additional field resistance required so that the machine build up to 83 V when the speed is 1000 r.p.m.

      b) What is commutation? Describe any two methods to improve commutation.   4

Module -3

15   a) Explain any three methods of electric breaking in DC shunt motor.   9

      b) A 250 V 5 hp DC shunt motor has a full load efficiency of 80 %. with the same shunt field and armature current, it is desired to reduce the speed by 20% by inserting a resistance in the armature circuit. The field and armature resistances are 200Ω and 0.2Ω respectively, find the value of inserted resistance.   5

16   a) With diagram explain how no-load test is conducted on a DC shunt machine and to find the efficiency when the machine is running as a motor.   8

      b) A 50 KW ,220 V, DC shunt generator was run as a motor no-load at its rated   6

voltage and speed. The total current taken was 8 A including shunt current of 2 A. The armature resistance is 0.15 Ω. Calculate the efficiency at full load.

Module -4

17   a)   Draw and explain the phasor diagram of a practical transformer supplying inductive load,   7

     b)   The primary and secondary winding of a 50 KVA ,6000/230 V single phase transformer have resistance of 12Ω and 0.03 Ω respectively. The leakage reactance of the transformer referred to primary is 30Ω. Calculate the percentage voltage regulation of the transformer when supplying full load current at a power factor of 0.8 lag.   7

18   a)   Explain with circuit diagram how efficiency of a transformer can be predetermined by conducting Back-to-Back test.   10

     b)   A 30 KVA transformer has iron loss of 400 W and full load copper loss of 900 W. If the power factor of the load is 0.8 lagging, calculate (i) Full load efficiency (ii) KVA load at which maximum efficiency occurs.   4

Module -5

19   a)   Explain Open-Delta connection. What are the applications of it.   7

     b)   For the same output and transformation ratio an autotransformer requires less amount of copper than an ordinary two winding transformer. Justify.   7

20   a)   Explain the principle of operation of no-load tap changing with diagram.   7

     b)   What is vector grouping? Explain any five vector groups used in three phase transformers.   7

***