Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

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

Course Code: EET 202

Course Name: DC MACHINES AND TRANSFORMERS

Max. Marks: 100 Duration: 3 Hours

Use gragh paper wherever necessary

PART A

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

1	What are equalizer rings? Why it is generally used in lap windings instead of wave windings?	3
2	Derive the expression for electromagnetic torque in a DC machine.	3
3	Mention different rotational losses in a DC machine. How these rotational losses can be minimised?	3
4	While conducting an experiment to plot OCC of a shunt generator, the machine fails to buildup voltage even though there were no errors in connection. What may be the reasons for failure to build of voltage?	3
5	Explain most energy efficient braking method of a dc motor with help of diagram.	3
6	"Never run DC series motor when zero load is applied to shaft." Is this statement true? Justify with the help of speed-armature current characteristics.	3
7	Derive the condition for maximum efficiency in a transformer.	3
8	Compare core and shell type transformers.	3
9	Compare dry type transformer with conventional oil type transformer.	3
10	In order to meet the increased load demand on the grid the supplier intends to parallel a 3-phase transformer with existing one. Suggest various conditions to be satisfied to successfully parallel the two three-phase transformers.	3

PART B

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

Module -1

11	a)	Explain the constructional features of dc machine with a neat diagram and explain the functions of each part.	8
	b)	A 4-pole, double layer with 2 coil sides per slot, wave wound armature of a DC machine, have 25 slots. Calculate the number of commutator segments. Also	6

Calculate i) Back pitch, ii) Front Pitch iii) Commutator pitch expressed in terms of number of coil sides.

12 Draw the developed winding diagram for a progressive simplex lap wound, double layer with 2 coil sides per slot, 24 slot, 4 pole DC armature, showing position of poles, direction of motion, direction of induced emf and position of brushes. Also draw the sequence diagram. 14

Module -2

13 a) Explain commutation in a dc generator and what are the various methods to improve commutation? 8

b) A 6 pole, 400kW, 500 V lap connected DC generator has 1000 conductors and is delivering full load current. If the brushes are shifted by 12 degrees(electrical), calculate 6

i)Demagnetising ampere turns per pole.

ii) Cross magnetising ampere turns per pole.

14 a) Draw and explain internal and external characteristics of a dc shunt generator. 4

b) The magnetisation characteristics of a 4 pole, 110 V, 1000 rpm shunt generator is as follows. 10

Eg (V)	5	50	85	102	112	116	120
If (A)	0	0.5	1	1.5	2	2.5	3

Armature is lap connected with 144 conductors & Field resistance is 45 ohms

Calculate

i) The voltage the machine will build up at no load.

ii)The critical resistance.

iii) The speed at which the machine just fails to excite.

iv) The residual flux per pole.

Module -3

15 a) What is back emf in a dc motor? Discuss its significance. Also write down equation for back emf in a DC motor. 4

b) Why we require starter for a dc motor? With a neat diagram, explain the working of a three-point starter. What are its limitations? 10

16	a)	With supporting diagrams, show how the retardation test can be employed to find out the various losses occurring in a dc machine?	8
	b)	A 250V shunt motor has an armature current of 20A when running at 1000 rpm against full load torque. The armature resistance is 0.5Ω. What resistance must be added in series with armature to reduce the speed to 500 rpm at same torque and what will be the speed if load torque is halved with this resistance in circuit? Assume flux to remain constant throughout and neglect brush contact drop.	6

Module -4

17	a)	Draw and explain the phasor diagram of a transformer on (i) an inductive load and (ii) a capacitive load.	10
	b)	A 11000/230V, 125kVA, 50Hz single phase transformer has core loss of 800 W and copper loss of 1200 W at full load condition. Find the load in kVA at which maximum efficiency occurs?	4
18		The test results of 5kVA, 230/115V single-phase transformer are as follows: OC Test: 115V, 1.2A, 50W SC Test: 12V, 21.74A. 100W Find i. Efficiency at 50% full load, 0.8 pf ii. Regulation at 30% full load, 0.8 pf lag iii. Draw the equivalent circuit of transformer as referred to low voltage side iv. Draw the equivalent circuit of transformer as referred to high voltage side	14

Module -5

19	a)	Explain the operation of an autotransformer. Derive the expression for saving of copper in an autotransformer as compared to an ordinary two winding transformer?	8
	b)	Explain the functions of tertiary winding in a transformer.	6
20		With the aid of three phase transformer connections and phasor diagram, explain the vector groups Yy0, Yy6, Dy11 and Dy1.	14

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