Total number of printed pages:02 **Programme D/4th /DEE401**

2023

ELECTRICAL MACHINES

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.		Briefly write about the following- (i) Faraday's laws of electromagnetic induction (ii) Lenz's law (iii) Fleming's left hand and right hand rule (iv) Maxwell's right hand thumb rule (v) Self and mutual induction	5×4=20
2.	a)	What are the main parts of a DC generator?	5
	b)	How DC generators are classified?	5
	c)	Draw the symbolic diagrams for different types of DC generators.	10
3.	a)	Derive the emf equation of DC generator	5
	b)	Write about the losses of DC generator.	5
	c)	A 6-pole, lap wound DC generator has 600 conductors in its armature. The flux/pole is 0.02Wb. Calculate (i) the speed at which the generator must be run to generate 300V, (ii) What would be the speed if the generator is wave connected?	2.5+2.5=5
	d)	Write the SI units of the following- Electric current, Voltage, Electric power, Energy, Torque	1×5=5
4.	a)	On which principle a DC generator and a DC motor works?	2.5+2.5=5
	b)	What do you mean by back emf of DC motor?	5
	c)	Derive the following speed relation for DC motor – $N=E_b/Ø$ Where, N= speed in RPM, E_b= back emf in Volt , Ø=flux per pole in Wb	5
	d)	Draw the symbolic diagrams of the following- Shunt motor, series motor, long shunt and short shunt compound motors,	5

		separately excited motor.	
5.	a)	Show the power stages of a DC motor	5
	b)	A 230V motor has an armature circuit resistance of 0.6Ω. If the full load armature current is 30A and no-load armature current is 4A, find the change in back emf from no-load to full load.	5
	c)	A 20kW, 250V, DC shunt generator has armature and field resistances of 0.1Ω and 125Ω respectively. Calculate the total armature power developed when running (i) as a generator delivering 20kW output to the load (ii) as a motor taking 20kW input from supply.	5+5=10
6.	a)	Draw a neat diagram of single phase transformer showing the following- The core, primary and secondary windings, primary side-- source, applied voltage, induced voltage and current, secondary side-- induced voltage, terminal voltage, current and load	5
	b)	What do you mean by step up and step down transformers? What is voltage transformation ratio ?	5
	c)	What is an ideal transformer? How does it differ from practical transformer?	5
	d)	Derive the emf equation of a transformer.	5
7.	a)	A 2000/200V, 20kVA transformer has 66 turns in the secondary. Calculate, (i) primary turns, (ii) primary and secondary full-load currents.	6
	b)	Write about the losses of transformer. Why open and short circuit tests are performed in a transformer ?	4+2=6
	c)	A transformer takes a current of 0.6A and absorbs 64W when primary is connected to its normal supply of 200V, 50Hz ; the secondary being on open circuit. Find the magnetising and iron loss currents.	8