Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – MARCH 2026

Date: 10 – 03- 2026 **Time:** 02:00pm – 03:30pm

School: SOE	**Program:** B.TECH-EEE	
Course Code: EEE2502	**Course Name:** DC Machines and Special Electrical Machines	
Semester: IV	**Max Marks**:50	**Weightage**:25%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**8**	**20**	**22**	**-**	**-**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	List the conditions to be fulfilled for a DC shunt generator to build up emf.	**2 Marks**	**L1**	**CO1**
2	A 6-pole lap wound DC generator has 600 conductors on its armature. The flux per pole is 0.02 Web. Determine (i) the speed at which the generator must be run to generate 350V.	**2 Marks**	**L3**	**CO1**
3	A DC series generator delivers a load current of 100 A at 500 V. The resistance of armature and series field are 0.03 ohm and 0.06 ohm respectively. Calculate the generated emf.	**2 Marks**	**L2**	**CO1**
4	List out the variable and constant losses occurring in DC machines	**2 Marks**	**L1**	**CO1**
5	Determine the value of torque in kg-m developed by the armature of a 6-pole wave wound motor having 492 conductors, 35 mWb per pole when the total armature current is 40 amperes.	**2 Marks**	**L3**	**CO3**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	Explain how a DC generator converts the alternating current induced in its armature into direct current using a mechanical rectifier. Describe the conversion process clearly with the help of neat sketches.	**10 Marks**	**L2**	**CO2**
		Or			
7.	**a.**	Under what operating conditions does armature reaction occur in a DC generator? Explain in detail how the armature flux interacts with the main field flux, and summarize the effects produced by this interaction.	**10 Marks**	**L2**	**CO2**
8.	**a.**	In a small hydroelectric power station, a DC generator is used to supply power to nearby facilities. During testing, the generator produces an armature emf of 100 V when operating with a useful flux of 20 mWb per pole at a speed of 800 rpm. Due to variations in water flow and operating conditions, the generator is required to run at different speeds and flux levels. Based on these changes, determine the generated emf (i) when the generator operates at 1000 rpm with the same flux, and (ii) when the generator operates with a flux per pole of 25 mWb at a speed of 850 rpm.	**5 Marks**	**L3**	**CO2**
	b	In a power generation workshop, a 4-pole lap-wound DC generator is used to supply electrical power to industrial loads. The generator has 460 armature conductors and delivers a current of 150 A to the load. During operation, it is observed that the brushes are shifted, providing an actual brush lead of 10°. Due to this brush shift, armature reaction affects the magnetic field distribution in the machine. Based on this operating condition, determine the demagnetizing ampere-turns per pole and the cross-magnetizing ampere-turns per pole.	**5 Marks**	**L3**	**CO2**
		Or			
9.	**a.**	A 4-pole generator supplies a current of 145 A. It has 492 armature conductors (a) wave wound, (b) Lap wound. When delivering full-load, the brushes are given an actual lead of 100.Calculate the demagnetizing ampere-turns per pole. This field winding is shunt-connected and takes 10 A. Determine the number of extra shunt field turns to neutralize the demagnetization	**10 Marks**	**L3**	**CO2**
10.	**a.**	In a heavy-duty lifting application, a 220 V, 6-pole DC series motor is employed to drive a mechanical load. The motor has a wave-connected armature with 1000 conductors. During operation, the motor draws 47 A from the mains and delivers an	**6 Marks**	**L3**	**CO3**

		output power of 8.5 kW to the load. The flux produced per pole is 25 mWb, and the armature resistance of the motor is 0.6 Ω. Based on these operating conditions, determine the torque developed by the motor and the shaft torque.			
	b	Describe the mathematical relationship between the speed of a DC machine, its back electromotive force (EMF), and the magnetic flux.	**4 Marks**	**L3**	**CO3**
		Or			
11.	**a.**	In a workshop, a 250 V DC shunt motor is used to operate a machine tool. During initial testing under no-load condition, the motor runs at 1000 rpm and draws a current of 5 A from the supply. The total armature resistance of the motor is 0.2 Ω and the shunt field resistance is 250 Ω. When the motor is connected to the machine during normal operation, it draws a current of 50 A from the supply. Based on this operating condition, determine the speed of the motor under load.	**6 Marks**	**L3**	**CO3**
	b	Which motor is suitable for a traction application? Draw its electrical and mechanical characteristics curves.	**4 Marks**	**L3**	**CO3**

12.	**a.**	In a small manufacturing unit, a 220 V DC shunt motor is used to drive a production machine. During inspection, it is observed that the motor draws 3 A from the supply while running at rated voltage under no-load conditions. The armature resistance of the motor is 0.5 Ω and the field resistance is 220 Ω. When the machine is operating under working load, the motor draws a line current of 40 A from the supply. Based on this operating condition, determine the efficiency of the motor.	**10 Marks**	**L3**	**CO3**
		Or			
13.	**a.**	In a power plant maintenance workshop, a 100 kW, 400 V DC shunt generator is tested by running it as a motor at rated voltage and speed under no-load condition to determine its performance. During the test, the machine draws a total current of 10 A from the supply, which includes a shunt field current of 3 A. The resistance of the armature circuit at normal operating temperature is 0.10 Ω. Using the test data, determine the efficiency of the generator when it operates at full-load.	**10 Marks**	**L3**	**CO3**