PVP 20

Code: 20EE3303

II B.Tech - I Semester – Regular / Supplementary Examinations DECEMBER 2023

ELECTRICAL MACHINES - I
(ELCTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Find expression for magnetic force developed in a doubly-excited translational magnetic system.	L3	CO2	7 M
	b)	Define the key magnetic quantities used in magnetic circuit analysis and discuss their significance in understanding magnetic systems.	L2	CO1	7 M
OR					
2	a)	Derive expressions for field energy and co-energy in a singly-excited electromechanical unit.	L3	CO2	7 M
	b)	Describe the B-H curve of magnetic materials and its importance in characterizing magnetic behavior.	L3	CO2	7 M

UNIT-II					
3	a)	A long-shunt compound generator delivers a load of 50A at 500V and has armature, series field and shunt field resistances of 0.05Ω, 0.03Ω and 250Ω respectively. Calculate the generated voltage and the armature current. Allow 1V per brush for contact drop.	L3	CO2	7 M
	b)	Explain the armature reaction in detail for a DC machine.	L4	CO4	7 M
OR					
4	a)	Explain the process of commutation and list various methods of improving Commutation.	L3	CO2	7 M
	b)	An 8-pole generator has an output of 200A at 500V, the wave-connected armature has 1280 conductors and 160 commutator segments. If the brushes are advanced 4-segments from the no-load neutral axis, estimate the armature demagnetizing and cross-magnetizing ampere-turns per pole.	L4	CO4	7 M
UNIT-III					
5	a)	Explain the significance of back EMF of a DC motor. Derive the torque equation of a DC motor.	L4	CO4	7 M
	b)	A 220 V, D.C. shunt motor takes 4A at no-load when running at 700 r.p.m. The field resistance is 100Ω. The resistance of armature at standstill gives a drop of 6V across armature terminals when 10A were passed through it. Calculate (i) speed on load (ii) torque in N-m and (iii) efficiency. The normal input of the motor is 8kW.	L4	CO4	7 M

OR					
6	a)	Explain speed-current, torque-current and speed-torque characteristics of DC shunt motor.	L4	CO4	7 M
	b)	A 220V series motor running at a certain speed takes 25A. Its armature and series field resistances are 0.3 ohm and 0.1 ohm respectively. Find the resistance to be inserted in series with the armature to reduce the speed by 30%. Assume that the total torque varies as the cube of the speed and the flux is proportional to the current.	L4	CO4	7 M
UNIT-IV					
7	a)	Derive an expression for the emf induced in a transformer winding.	L3	CO3	7 M
	b)	A single-phase transformer with a ratio of 440/110V takes a no-load current of 5A at 0.2 power factor lagging. If the secondary supplies a current of 120A at a p.f. of 0.8 lagging, estimate the current taken by the primary.	L3	CO3	7 M
OR					
8	a)	A residential apartment arranged an 800 kVA transformer for feeding power to their residents. It has core loss of 1.42 kW and full load copper loss of 7.5 kW. Calculate the all-day efficiency if the transformer operates on the following duty cycle: (see table below)	L3	CO3	7 M

Time duration	Load details
6 hours	500 kW @ 0.8 pf lag
4 hours	700 kW @ 0.9 pf lag
4 hours	300 kW @ 0.95 pf lag
10 hours	No Load

	b)	Explain the operation of transformer operating on R-L load with the help of a phasor diagram.	L3	CO3	7 M
UNIT-V					
9	a)	Write a brief note on tap changing transformers.	L4	CO5	7 M
	b)	A 5 kVA, 110/110 V, single phase, 50 Hz transformer has a full load efficiency of 95% and an iron loss of 50W. The transformer is now connected as an auto transformer to a 220 V supply. If it delivers a 5kW load at unity power factor to a 110V circuit, calculate the efficiency of the operation and the current drawn by the high voltage side.	L3	CO3	7 M
OR					
10	a)	What are the various three-phase transformer connections? Explain the star-star and star-delta connections with neat diagrams.	L4	CO5	7 M
	b)	Explain about the auto transformer and compare it with two winding transformer.	L4	CO5	7 M