Q. Code: 650364

Reg. No. | | | | | | | | | | | | | |

B.E./ B.TECH. DEGREE EXAMINATIONS, MAY 2024

Third Semester

EE22301 – ELECTRICAL MACHINES I

(Electrical and Electronics Engineering)

(Regulation 2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Analyze magnetic circuits and determine the performance parameters.	**4**
CO 2	Compute the performance parameters of single phase and three phase transformers.	**3**
CO 3	Derive torque of rotating machines and analyze the machine performance.	**3**
CO 4	Estimate the electro-mechanical performance of DC Generators.	**4**
CO 5	Apply different methods of starting & speed control and determine the performance of DC Motors.	**4**

PART- A(20x2=40Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Give the analogy between magnetic and electric circuit.	**1**	**2**
2.	State Ampere's circuital law.	**1**	**2**
3.	How will you minimize the magnetic losses in electro mechanical conversion device?	**1**	**2**
4.	A conductor 80 cm long moves at right angle to its length at a constant speed of 30 m/s in a uniform magnetic field of flux density 1.2T. Find the emf induced when the conductor motion is normal to the field flux.	**1**	**3**
5.	A 500 V, 50 HZ single phase transformer has 400 primary and 1000 secondary turns. The net cross-sectional area of the core is 60cm^2.Calculate the value of flux developed in the core.	**2**	**3**
6.	Specify the method to represent the transformer primary and secondary impedance of same value and also summarize its advantages.	**2**	**3**
7.	Why all-day efficiency is lower than commercial efficiency?	**2**	**2**
8.	Give the conditions to be satisfied for the parallel operation of transformer.	**2**	**2**
9.	Based on the principle of conservation of energy, write the energy balance equation for a motor.	**3**	**2**
10.	Why all practical energy conversion devices make use of the magnetic fields as a coupling medium rather than electric fields?	**3**	**2**
11.	A 3Φ induction motor is wound for 4 poles and supplied from 50Hz system. Find its synchronous speed.	**3**	**3**

12.	Compare lap and wave winding of a DC machine armature.	**3**	**3**
13.	Calculate the flux per pole required for a 4 pole, lap connected generator with 360 conductors generating 250 V at 1500 rpm.	**4**	**3**
14.	State the conditions under which a DC shunt generator fails to excite.	**4**	**2**
15.	Specify the role of interpole in DC machine.	**4**	**2**
16.	Define the term critical resistance and critical speed.	**4**	**2**
17.	Brief-up the method of speed control of a constant speed motor by armature voltage.	**5**	**2**
18.	Identify the type of DC motor suited for traction application and justify your reason.	**5**	**3**
19.	State the advantages of no-load test on DC shunt machine to predetermine its efficiency.	**5**	**3**
20.	In a brake test the effective load on the branch pulley was 48.1 kg, the effective diameter of the pulley 53.5 cm. Calculate the shaft torque in Nm.	**5**	**3**

PART- B (5x 10=50Marks)

			Marks	CO	RBT LEVEL
21. (a)		Two coils having 30 and 600 turns respectively are wound side by side on a closed iron circuit of area of cross section 100 cm^2 and mean length 200 cm. Estimate the mutual inductance between the coils if the relative permeability of iron is 2000.If a current of zero ampere grows to 20A in a time of 0.02 second in the first coil, find the emf induced in the second coil.	**(10)**	**1**	**4**
		(OR)			
(b)	**(i)**	The total core loss of a specimen of silicon steel is found to be 2000 W at 50 Hz. Keeping the flux density constant the loss becomes 3200 W when the frequency is raised to 75 Hz. Calculate separately the hysteresis and eddy current loss at each of those frequencies.	**(6)**	**1**	**4**
	(ii)	Derive the expression for a factor which relates the self and mutual inductances in a magnetic circuit.	**(4)**	**1**	**4**
22. (a)		Explain the operation of transformer on loaded condition with phasor diagram for different load conditions.	**(10)**	**2**	**3**
		(OR)			
(b)		Calculate the efficiency at half, full load of a 100 KVA transformer for PF of unity and 0.8. The copper loss is 1000W at full load and iron loss is 1000W.	**(10)**	**2**	**3**
23. (a)		Derive the expression for magnetic torque developed in a multiply excited	**(10)**	**3**	**3**

magnetic system.

(OR)

(b)	Derive the expression for the RMS value of EMF induced in the AC machine having full-pitched distributed winding. Define the terms involved in it.	**(10)**	**3**	**3**

24. (a)	In a 'n' pole generator, the M.N.A lies at an angle 'θ' to the G.N.A. what is its effect? Briefly explain.	**(10)**	**4**	**3**

(OR)

(b)	Draw and explain the characteristics of a DC generator whose field winding is excited by separate DC source.	**(10)**	**4**	**3**

25. (a)	**(i)**	A 220 V, DC. shunt motor at no load takes a current of 2.5 A. The resistances of the armature and shunt field are 0.8 Ω and 200 Ω respectively. Predetermine the efficiency of the motor when the input current is 20 A. State precisely the assumptions made.	**(7)**	**5**	**3**
	(ii)	Discuss the nature of mechanical characteristics of a medium starting torque motor.	**(3)**	**5**	**3**

(OR)

(b)	Illustrate the necessity of starter? Elaborate the working of starter used for a motor has both shunt and series field winding with neat sketch.	**(10)**	**5**	**3**

PART- C (1x 10=10Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Obtain the equivalent circuit of a 200/400V, 50 Hz, 1-phase transformer from the following test data: O.C test: 200 V,0.7 A,70 W – on L.V side S.C test: 15 V,10 A,85 W – on H.V side Evaluate the secondary voltage, when delivering 6 KW at 0.8 p.f leading, the primary voltage being 200 V.	**(10)**	**2**	**5**

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