Paper id: 252777

Subject Code: BEE402

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2024-25
ELECTRICAL MACHINES-I

TIME: 3 HRS **M.MARKS: 70**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **02 x 7 = 14**

Q no.	Question	CO	Level
a.	Define Co-energy and explain its physical significance.	1	K2
b.	Derive the relation between electrical and mechanical degree using the waveform of induced emf in an armature coil.	2	K2
c.	Explain the interpoles.	2	K2
d.	A series motor cannot be left unloaded, explain using speed-torque curve.	3	K4
e.	Explain the polarity test of single-phase transformer.	4	K2
f.	Explain Star/Delta connection in three phase transformers.	5	K2
g.	Give conditions for three parallel operation of three phase transformer.	5	K4

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

a.	Determine the force and torque equation from energy and co-energy.	1	K4
b.	Describe the process of commutation. Also explain its types and the methods to improve the commutation in DC machines.	2	K2
c.	A 250 V dc shunt motor has an armature resistance of 0.5Ω and a field resistance of 250 Ω. When driving a constant torque load at 600 rpm, the motor draws 21 A. What will be the new speed of the motor if an additional 250 Ω resistance is inserted in the field circuit?	3	K3
d.	The maximum efficiency of a 50 kVA, 1100/440 V, 50 Hz transformer is 96%. This occurs at 85% of full load at 0.8 p.f. lagging. Calculate the efficiency of transformer at half load and at 0.6 p.f. lagging.	4	K4
e.	What are the methods of speed control of DC motor. Explain Ward Leonard methods of speed control.	5	K3

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Derive the torque expression in cylindrical rotor machines.	1	K2
b.	Explain the principle of electromechanical energy conversion using suitable block diagram, energy balance equation and energy flow diagram.	1	K2

4. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Explain the armature reaction in DC generators using armature and field MMF waveforms. Describe the effects of armature reaction?	2	K2
b.	Draw the external characteristics of various types of dc generators in one figure on the assumption of same rated terminal voltage and the same rated load current. A 240V, 36kW, dc shunt generator has 500 field turns per pole. On no load, the generated voltage of 240 V is obtained with a field current of 2 A. For maintaining 240 V at full load and at the same speed, the field current required is 3.2 A. Calculate the number of series-field turns per pole required for level compounding.	3	K4

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5. Attempt any *one* part of the following: 07 x 1 = 07

a.	Justify the need of Starter in DC motors. Explain the construction and operation of 4-point starter.	2	K2
b.	A 230V DC series motor develops its rated output at 1500rpm while taking 20A. Armature and series field resistances are 0.3 Ω and 0.2 Ω respectively. Neglecting saturation, determine the resistance that must be added to obtain rated torque i) at starting and ii) at 1000 rpm.	3	K3

6. Attempt any *one* part of the following: 07 x 1 = 07

a.	In Open Circuit and Short Circuit Test the following reading were obtained on a 230/115Volt, 1kVA 1- phase transformer. Low voltage side : 100V, 0.26A, 8.3W; High Voltage side : 18.4V, 5A, 46W; Determine the equivalent circuit and parameters of transformer. Also determine the Efficiency and Voltage Regulation at ***Full load*** 0.8 pf Lagging.	4	K2
b.	What is V-V connection? Show that the open delta connection has a kVA rating of 57.7% of the rating of the normal delta-delta connection.	5	K3

7. Attempt any *one* part of the following: 07 x 1 = 07

a.	Explain Sumpner's test in transformer with neat diagram.	4	K3
b.	Enlist conditions of parallel operation of three phase transformers. Two 150 kVA, single-phase transformers are to be operated in parallel to share a load of 240 kW at pf 0.8 lagging. The equivalent leakage impedances are *1+j3.0Ω* for transformer A and *1.2+j3.2Ω* for transformer B. Calculate the load shared by each transformer and their operating power factors.	5	K2