



Paper id: 252777

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Subject Code: BEE402

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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 250Ω . 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 250Ω 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 0.3Ω and 0.2Ω 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 $1+j3.0\Omega$ for transformer A and $1.2+j3.2\Omega$ for transformer B. Calculate the load shared by each transformer and their operating power factors.	5	K2