PAPER ID-411523

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

BTECH
(SEM IV) THEORY EXAMINATION 2023-24
ELECTRICAL MACHINES-I

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

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a.	Explain principle of electro-mechanical energy conversion with the help of block diagram.
b.	Define energy and co-energy in a linear magnetic system.
c.	Describe working of commutator in a DC machine as mechanical rectifier.
d.	Write the emf equation of DC Motor. Explain each term.
e.	Discuss the need for starters in the operation of DC motors.
f.	Draw phasor diagram of ideal transformer at no load condition.
g.	List the conditions for parallel operation of transformers.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a.	Show that the field energy in a linear magnetic system is given by: $W_f = \frac{1}{2}Li^2 = \frac{1}{2}\psi i = \frac{1}{2L}\psi^2$
b.	With the help of neat sketch, explain armature reaction in DC machine.
c.	Explain in detail the speed control of DC motor by (i) Armature Control Method and (ii) Field Control Method.
d.	The maximum efficiency of a 100 kVA, 1100/440 V, 50 Hz transformer is 96%. This occurs at 75% of full load at 0.8 power factor lagging. Calculate the efficiency of transformer at half load and at 0.6 power factor lagging.
e.	Discuss various types of connections employed in 3-phase transformers.

SECTION C

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

(a)	Derive an expression for Reluctance torque in rotating electrical machines.
(b)	For a doubly excited linear magnetic system, derive an expression for the electromagnetic torque.

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

(a)	Explain the construction and working of DC machine with well-labelled diagram.
(b)	Draw the internal and external characteristics of the DC shunt generator. Also, explain (i) why the external characteristics turn backwards (ii) concept of voltage build-up and critical field resistance in DC shunt generator.

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

(a)	Explain Swinburne's test to calculate no-load losses in a DC machine. State its limitations over Hopkinson's test.
(b)	With the help of neat diagram, explain the working of 3-point starter. What are its limitations? How are these limitations overcome by 4-point starter?

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

(a)	A 200 kVA, 2000/440 V, 50 Hz, single phase transformer gave the following test results: O.C Test (hv) : 2 kV, 1.75 kW, 1.8 A S.C Test (lv) : 13 V, 1 kW, 300 A (i) Calculate the parameters of equivalent circuit as referred to H.V side (ii) Determine voltage regulation and efficiency at full-load, 0.8 power factor lagging.

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(b)	Draw and explain the complete equivalent circuit model of a practical transformer. Also, draw phasor diagram of practical transformer on-load condition at lagging power factor.

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

(a)	Describe the 3-phase to 2-phase conversion in transformers with suitable diagram. Also, derive the expression for positioning of neural point.
(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.