

S.No. : 143

BEE 3401

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Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 33314

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B. Tech Examination 2021-22

(Even Semester)

**ELECTRO-MECHANICAL ENERGY
CONVERSION-I**

Time : Three Hours]

[Maximum Marks : 60

Note :— (i) Attempt all questions.

SECTION – A

1. Attempt all parts of the following : $8 \times 1 = 8$

- (a) Define energy and co-energy.
- (b) Differentiate between mechanical angle and electrical angle.
- (c) Which part of dc machine is laminated? Why?
- (d) What do you mean by pole pitch?
- (e) Write the expression of torque for singly excited system.

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- (f) A 6-pole dc machine has an armature with 90 slots and 8 conductors per slot and runs at 1000 rpm. The flux per pole is 0.05 wb. Determine the induced emf for wave wound armature.
- (g) What parameters can be calculated by indirect loading tests on transformer?
- (h) Draw the circuit diagram for conversion of a two winding transformer into an additive polarity autotransformer.

SECTION – B

2. Attempt any two parts of the following : $2 \times 6 = 12$

- (a) What is the significance of co-energy? 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) Explain the methods to overcome the adverse effects of the armature reaction.

- (c) What is difference between starter and controller? Explain the function of no-volt release in a three point starter. What would happen if the external resistance for starting the dc motor is left in the armature circuit?
- (d) What is all dat efficiency of a transformer? How to calculate it? Explain with example?

SECTION – C

Note:- Attempt all questions. Attempt any two parts from each questions. $5 \times 8 = 40$

3. (a) Explain the concept of electromechanical energy conversion with neat diagram.
- (b) Show that torque developed in doubly excited machine is equal to the rate of increase of field energy with respect to displacement at constant currents.
- (c) Explain flow of energy in electronmechanical devices for both generating and motoring action.
4. (a) Explain the construction of a 2 pole dc machine.
- (b) Distinguish between simplex lap and simplex lap and simplex wave winding with suitable diagram

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- and explain the terms back pitch, front pitch, winding pitch, commutator pitch.
- (c) Discuss in details the process of commutation in dc machines.
5. (a) Explain Ward-lenonard method of speed control of dc motors. Why a dc series motor cannot be started on no load?
- (b) Derive an expression for the torque developed in a dc motor.
- (c) Enumerate the various losses in a dc machine. which of these losses are constant? Derive expression for the efficiency of a dc generator and dc motor.
6. (a) Derive an expression for the emf induced in a transformer winding. Show that emf per turn in primary is equal to e. m. f. per turn in secondary.
- (b) Develop the phasor diagram of a single phase transformer under lagging-power load.
- (c) In Sumpner's test, the reading of the wattmeter recording the core lesser, remains unaffected when low voltage is injected in the secondary series circuit. Explain.
