Bachelor of Electrical Engineering 2nd Year 1st Semester Supplementary Examination, 2023

SUBJECT: ELECTRICAL MACHINES - I

Time: Three Hours   Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part.

Question No.	PART - I	Marks

Answer question no. 6 and any two from the rest.

6.   Justify the following (any six) :   **6x3**

i)   In a DC machine armature mmf waveform is a space varying triangular waveform.

ii)   Swinburne test cannot be performed for DC shunt generator.

iii)   Lap connected DC machine requires the equalizer connections whereas wave connected DC machine doesn't require it.

iv)   The role of commutator remains the same irrespective of operation of a DC machine (as a motor or generator).

v)   Shunt DC generator is preferred for traction application. .

vi)   Inductive kick method is used to check the proper position of the brushes

vii)   DC separately excited motor should not be operated under low load condition.

viii)   A DC motor itself solely cannot decide the speed of operation

7. i)   Explain the delayed commutation.   **5+4+3+4**

ii)   What is interface film? How commutation process continues in spite of this interface film.

iii)   Interpole helps in linear commutation- explain

[Turn over

iii)   In a 4-pole DC machine each coil having 8 turns contributes 20 volts. Find the maximum possible voltage rating of the machine if it has 320 conductors.

8. i)   Derive the expression of electro-magnetic torque in a DC machine.   4+4+8

ii)   Draw a 4-point starter.

iii)   A 100 kW belt-driven shunt generator running at 300 rpm and 220V bus-bars continues to run as a motor when the belt breaks, then taking 10kW. What will be its speed? Armature resistance, r_a = 0.025 Ω.; field resistance, r_f = 60 Ω. Contact drop under each brush is 1V. Ignore armature reaction

9. i)   What are the adverse effects of armature reaction in a DC machine? Show that brush shift is not a good solution for these.   8 + 8

ii)   A DC shunt machine connected to 250V mains has an armature resistance (including brushes) of 0.12 Ω and the resistance of the field circuit is 100 Ω. Find the ratio of the speed as generator to the speed as a motor, the line current in each case being 80A.

10.   Write short notes on the following :   8x2

i)   Open circuit characteristics of different types of DC generators

ii)   Hopkinson's method of testing of DC machine

PART - II

6. (a) Draw the equivalent circuit of a single-phase transformer. How the equivalent   10
   circuit parameters are determined in the laboratory?
   Or,

   (b) What are the advantages of an auto transformer over a two winding transformer?
   Develop equivalent circuit of an auto-transformer.

7. Write short notes on any two of the following: 10
   a) Conservator and breather
   b) Transformer oil
   c) Buchol's Relay

8. a) Derive an expression for maximum efficiency of a transformer. Why power and   10
   distribution transformers have maximum efficiency at different values of p.u.
   load?
   Or,

   b) Derive the expression for exact voltage regulation of a two winding transformer.

9. (a) A 20 kVA , 2300 V/ 230 V, two winding transformer is to be used as a step-up
   auto-transformer, with constant source voltage of 2300 V. If the efficiency of the   10
   two-winding transformer at 0.8 p.f. is 96%, find the auto-transformer efficiency
   at the same p.f.
   Or,

   (b) A 10 kVA, single-phase transformer has a core loss of 70 W and full load copper
   loss of 200 W. The daily variation of the load on the transformer is as follows:

   7 A.M. to 1 P.M. : 6 kW at 0.7 p.f.

   1 P.M. to 6 P.M. : 4 kW at 0.85 p.f.

   6 P.M. to 1 A.M. : 10 kW at 0.9 p.f.

   1 A.M. to 7 A.M. : no-load

   Determine the all-day efficiency of the transformer.

10   Write short notes on any two of the following: 10
   a)   Inrush current of a transformer
   b)   No-load current of a transformer
   c)   All-day efficiency of a transformer

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