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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. II Year (E.E.E.) II-Semester (Supplementary) Examinations, December-2016

Electrical Machinery-I

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE from Part-B***

Part-A (10 × 2 = 20 Marks)

1. State advantages of field energy concept to analyse energy conversion devices.
2. Write the expression for magnetic field density 'W_{fld}' in terms of flux density 'B' and magnetic potential 'H'.
3. Define commutation process in DC machines.
4. Write about the position of brushes in DC machines, what material is used for brushes and why?
5. Mention the importance of commutator in a DC motor.
6. Draw the mechanical characteristics of shunt, series and cumulative compound motors.
7. State saving of copper in autotransformer compared to two winding transformer.
8. Draw the vector diagram of transformer when connected to resistive load.
9. Write the factors affecting the choice of connection in three phase transformer.
10. What are to be the precautions during on-load tap changing?

Part-B (5 × 10 = 50 Marks)
(All bits carry equal marks)

11. a) Show that in a singly-excited system the mechanical work done is equal to the area enclosed between two Ψi characteristics in initial and final positions.

    b) For a doubly excited system the inductances are as given below
    $L_1 = 11+3 \cos(2\theta)$ H; $L_2 = 7+2 \cos(2\theta)$ H: $M = 11 \cos(\theta)$ H
    These coils are energized as $I_1 = 0.7$ A and $I_2 = 0.8$ A
    Find the torque and energy stored as a function of θ and when $\theta = -50^0$.

12. a) Derive EMF equation of DC generator.

    b) A 2 pole DC shunt generator supplies a load of 10ohm at 230V has an armature resistance and field winding resistances of 0.5 ohm and 230ohm respectively. Find the generated e.m.f and the armature current. Assume voltage drop per bush is 1V.

13. a) How back EMF causes the development of mechanical power in a DC motor?

    b) Swinburne's test on DC shunt machine having the rating of line voltage = 220V, line current = 20A, armature resistance = 0.5ohm and shunt field resistance = 220ohm gives the following data: Line voltage = 220V, No-load current = 1A. Find the efficiency of DC machine as i) a generator ii) a motor at half full load and full load.

14. a) Explain the procedure to conduct the Sumpner's test and obtain the equivalent circuit parameters of the transformer from the test results

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b) A 2300/230V, 500 kVA, 50 Hz distribution transformer has core losses of 1600 W at rated voltage and copper losses of 7.5 kW at full load. During the day it is loaded as follows:

No	Load	for 2 hours
20%	Load	for 4 hours at 0.7 lag pf
50%	Load	for 4 hours at 0.8 lag pf
80%	Load	for 5 hours at 0.9 lag pf
100%	Load	for 7 hours at upf
125%	Load	for 2 hours at 0.85 lag pf

Determine the all day efficiency of the Transformer.

15. a) Derive the relation between input and output currents of a Scott connected transformers with vector and circuit diagrams.

b) A 500 kVA load at 0.8 power factor lagging is supplied by three single phase transformers connected in delta-delta. Each transformer rating is 110 kVA, 2000/200 V. If one of the transformer is defective calculate kVA load carried by v-v connection also calculate percentage increase in load on each transformer.

16. a) Draw and explain fully the general block diagram representation of an electro-mechanical energy conversion device.

b) A 220 V DC shunt generator has an armature, shunt field, resistances of 0.25Ω, 100Ω, 0.8Ω respectively. Calculate the generated voltage while delivering 20A to external circuit for long shunt and short shunt connections.

17. Write short notes on **two** of the following:

a) Derive the expressions for the torque of a D.C motor.

b) Explain the concept of an ideal transformer stating the assumptions made along with vector diagram.

c) Explain no-load tap changer with detailed schematic.

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