KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.E.
Year : II
Course : EEEG 215
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date 03 DEC 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option.

1. The main purpose of using core in a transformer is to
   a. Decrease iron losses.
   b. Prevent eddy current loss.
   c. Eliminate magnetic hysteresis.
   d. Decrease reluctance of the common magnetic circuit.

2. In a single phase transformer with subscripts 1 and 2 for primary and secondary windings respectively,
   a. $E_1N_2 = E_2N_1$ and $I_1N_1 = I_2N_2$
   b. $E_1N_1 = E_2N_2$ and $I_1N_1 = I_2N_2$
   c. $E_1N_2 = E_2N_1$ and $I_1N_2 = I_2N_1$
   d. $E_1N_1 = E_2N_2$ and $I_1N_2 = I_2N_1$

3. A transformer having 1000 primary turns is connected to a 250V ac supply. For a secondary voltage of 400 V, the number of secondary turns should be
   a. 1600 b. 250 c. 400 d. 1250

4. In relation to a transformer, the ratio 20:1 indicates that
   a. There are 20 turns in primary and one turns in secondary.
   b. Secondary voltage is 1/20th of primary voltage.
   c. Primary current is 20 times greater than secondary current.
   d. For every 20 turns in primary, there is one turn on secondary.

5. The equivalent resistance of primary of a transformer having transformation ratio equal to 5 and primary resistance equal to 0.1 Ohm when referred to secondary becomes
   a. 0.5 Ohm b. 0.02 Ohm c. 0.004 Ohm d. 2.5 Ohm

6. The flux involved in the e.m.f equation of a transformer has
   a. r.m.s value b. Average value c. Total value d. Maximum value

7. When a 400 Hz transformer is operated at 50 Hz, its KVA rating is
   a. Reduced to 1/8th
   b. Increased to 8 times
   c. Unaffected
   d. Increased 64 times

8. A transformer can have zero voltage regulation at
   a. leading power factor loads
   b. lagging power factor loads
   c. unity power factor loads
   d. zero power factor loads

9. The no-load current drawn by a transformer is usually ..... of full load current.
   a. 0.2 to 0.5 % b. 2 to 5 % c. 12 to 15 % d. 20 to 30 %

10. As compared to Δ-Δ bank, the capacity of the V-V bank of transformer is
    a. 57.7 % b. 66.7 % c. 50 % d. 86.6 %

11. In a D.C motor, the polarity of interpoles is
    a. Same as that of main pole ahead
    b. Same as that of immediately preceding pole
    c. Opposite that of main pole ahead
    d. Neutral as these poles do not play part in generating emf

12. In a DC motor
    a. External characteristic = internal characteristic – armature reaction.
    b. Internal characteristic = magnetization characteristic-ohmic drop.
    c. External characteristic = magnetization characteristic-ohmic drop- armature reaction.
    d. External characteristic = magnetization characteristic.

13. The counter e.m.f of a dc motor
    a. Often exceeds the supply voltage
    b. Aids the applied voltage
    c. Helps in energy conversion
    d. Regulates its terminal voltage

14. Two d.c machines A and B have armature circuit resistances of 0.4Ω and 1.2Ω respectively. In these two machines
    a. A is bigger than B for the same current rating.
    b. A is bigger than B for same voltage rating.
    c. A is bigger than B for same voltage rating.
    d. Both the machines are of the same size for the same current rating.

15. The e.m.f induced in the armature of a shunt generator is 600V. The armature resistance is 0.1 Ω. If the armature current is 200A, the terminal voltage will be
    a. 640 V b. 620 V c. 600 V d. 580 V

16. A 220 V D.C motor if connected to 220 V A.C supply
    a. Armature winding of motor will burn.
    b. Motor will vibrate violently.
    c. Motor will not run.
    d. Motor will run with less efficiency and more sparking.

17. If residual magnetism of a shunt generator is destroyed accidently, it may be restored by connecting its shunt field
    a. To earth b. To an a.c source c. Reverse d. To a d.c source

18. The d.c generator with a poorest voltage regulation is
    a. Series generator.
    b. Shunt generator.
    c. Long shunt compound generator.
    d. Short shunt compound generator.

19. If brushes of a D.C generator are moved in order to bring these brushes in magnetic neutral axis, there will be
    a. demagnetization only.
    b. cross magnetization and magnetization.
    c. cross magnetization and demagnetization.
    d. cross magnetization only.

20. The volt ampere equation for a long shunt compound motor is given by
    a. $V_t = E_a + I_a * r_a$
    b. $V_t = E_a - I_a * r_a$
    c. $V_t = E_a + I_a * r_a + I_L * r_s$
    d. $V_t = E_a + I_a(r_a + r_s)$

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SECTION "B"
[4 Q × 10 = 40 marks]

Attempt *ANY FOUR* questions. Assume any suitable data if required.

1.

a. Derive the e.m.f equation of a d.c generator. [3]

b. A shunt generator supplies 97A at a terminal voltage of 210V. The armature and shunt field resistances are 0.1 ohm and 55 ohm respectively. The iron and frictional losses are 2000 W. Find,
   i. E.M.F generated.
   ii. Copper loss. [1.5+1.5=3]

c. A 25 kW, 240V dc shunt generator has armature and field resistance of 0.15 Ohm and 135 Ohm respectively. Calculate the total armature power when running
   i. As generator delivering 25 kW output.
   ii. As a motor taking 25 kW input. [2+2=4]

2.

a. Explain the process of ideal and practical commutation in a dc machine with suitable diagram. [4]

b. Explain the three point starting method of a dc machine. [3]

c. Explain graphically the speed torque characteristic curves of a dc shunt motor. [3]

3.

a. A 4 pole, 260 V, wave connected shunt motor gives 12 kW when running at 1000 rpm and drawing armature and field current of 61A and 1.5A respectively. It has 560 conductors. Its armature resistance is 0.25 Ohm. Assuming a brush drop of 1V per brush for total of two brushes, determine
   i. Total torque and useful torque.
   ii. Rotational losses and efficiency. [2+2=4]

b. Describe Swinburne's method of determining efficiency for a dc machine. [3]

c. A 4 pole wave wound dc machine running at 1500 rpm has a commutator of 30 cm diameter. If armature current is 150 A, thickness of brush 1.25cm and a self-inductance of each armature coil is 0.05 mH, calculate the average e.m.f induced in each coil during commutation. Assume linear commutation. [3]

4.

a. A single phase 3300/3800 V transformer has following winding resistances and reactances:

$$R_1 = 0.75\Omega, R_2 = 0.013\Omega, X_1 = 3.7\Omega, X_2 = 0.049\Omega$$

The secondary terminal is connected to a coil having resistance of 4.5Ω and inductive reactance of 3.2Ω. Calculate the secondary terminal voltage and power consumed by the coil. [1.5+1.5=3]

b. Describe the Delta-Delta (Δ-Δ) method of connection of the three phase transformer showing the case of Dd0 with electrical connection diagram and vector diagram [3]

c. Describe the open circuit test and short circuit test of a transformer. [4]

5.

a. Two single phase transformers share a load of 500 kVA at power factor of 0.85 lagging. Their equivalent resistances referred to secondary windings are (1+j2) Ω and (5+j4) Ω respectively. Calculate the load shared by each transformer. [3]

b. A 480/120V, 5kVA two winding transformer is to be used as an autotransformer to supply power at 480V from 600V source. Draw the connection diagram and determine the kVA capacity as an auto transformer. [3]

c. A 20 kVA, 50 Hz, 2000/200V distribution transformer has a leakage impedance of (0.42+j0.52) Ω in the HV winding and (0.004+j0.05) Ω in the LV winding. When seen from the LV side, the shunt branch admittance Y_0 is (0.002-j0.015) mho at rated voltage and frequency. Draw the equivalent circuit referred to,

i. HV side and

ii. LV side, indicating all impedances on the circuit. [2+2=4]