KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Marks Scored:

Level : B.E
Year : II

Course : EEEG 215
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 05 FEB 2024

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate answers from the given choices.

1. The iron loss for a transformer with a copper loss of 500 Watt under maximum efficiency is .....
   a. 400 Watt b. 700 Watt c. 1000 Watt d. 500 Watt

2. The short circuit test of a transformer requires..... side to be short circuited.
   a. Low voltage side b. High voltage side
   c. Primary side d. Secondary side

3. A step up transformer converts ..... into a .....
   a. Low voltage at low current, high voltage at high current
   b. High voltage at low current, low voltage at high current
   c. High voltage at high current, low voltage at low current
   d. Low voltage at high current, high voltage at low current

4. Voltage regulation of a transformer is given by..... %, where, V_O= No load voltage, V_T= Full load terminal voltage
   a. $(V_O-V_T)/V_O$ b. $(V_O-V_T)/V$ c. $(V_T-V_O)/V_O$ d. $(V_T-V_O)/V$

5. For a given transformer, when a V-V system is converted into a Δ-Δ system, the capacity of the system is .....
   a. Increased by 86.6% b. Decreased by 86.6%
   c. Increased by 73.2% d. Decreased by 50%

6. Two transformers operating in parallel will share the load depending upon their .....
   a. Efficiency b. Ratings c. Impedance d. Leakage reactance

7. If there is no same voltage ratio while conducting parallel operation of transformers, then it produces .....
   a. Circulating current b. Leakage flux
   c. Leakage flux and hysteresis loss d. Magnetic hysteresis

8. The shape of the main field flux distribution for a dc machine is .....
   a. Peaky in nature b. Trapezoidal c. Triangular d. Sinusoidal

9. The pole pitch for a dc generator with 4 poles and 24 number of slots is .....
   a. 6 slots b. 4 slots c. 12 slots d. 8 slots

10. The generator with poorest voltage regulation at loaded conditions is .....
    a. Cumulative compounded b. Series
    c. Differential compounded d. Shunt

11. For a 4 pole, 20 kW, 200 Volts wave wound DC shunt generator, the current in each parallel path will be .....
a. 100 Amperes b. 25 Amperes c. 10 Amperes d. 50 Amperes

12. A 220 Volts dc machine supplies 20 Amperes at 200 Volts operating as a generator. The armature resistance is 0.2 Ohm. If the machine is now operated as a motor at a same terminal voltage and current but with increased flux of 10%, the ratio of motor speed to generator speed is .....
a. 0.87 b. 0.95 c. 0.96 d. 1.06

13. The carbon brushes used in DC machine primarily.....
a. Transfer current to the commutator
b. Prevent short circuit sparking when current is flowing through the commutator
c. Strengthen the field winding
d. Strengthen the armature winding

14. The speed of a dc motor can be controlled above the rated speed by .....
I. Applied voltage.
II. Resistance of armature circuit.
III. Flux per pole.
a. III b. II c. I and II d. I, II and III

15. A dc motor takes a large value of current at the time of starting due to .....
a. Low armature resistance b. Weak field
c. Armature reaction d. Absence of back e.m.f.

16. In speed control of dc motors, armature voltage control and field current control are used to obtain speeds.....base speed and .....base speed respectively.
a. Below; above b. Below; below c. Above; above d. Above; below

17. 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. $V_t = E_a + I_a(r_a + r_s)$

18. If T_a be the torque and I_a the armature current for a DC motor, then the condition before saturation is
a. Torque is directly proportion to armature current
b. Torque is inversely proportional to armature current
c. Torque is directly proportion to square of armature current
d. Torque is directly proportion to square root of armature current

19. If a rated 220V DC series motor is connected to 220V AC supply, ...
a. The armature winding of the motor will burn
b. The motor will vibrate violently
c. The motor will run with less efficiency and more sparking
d. The motor will not run

20. In case the back emf and the speed of a DC motor are doubled, the torque developed by the motor will be .....
a. Remain unchanged b. Reduced to one-fourth value
c. Increase four times d. Be doubled

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SECTION "B"
[4Q. × 10 = 40 marks]

Attempt *ANY FOUR* questions. Assume suitable data, if necessary. Symbol has their usual meaning.

1.

a. The resistances and leakage reactances of a 10 kVA, 50 Hz, 2200/220 V distribution transformer are as follows:

r_1=4 Ω, r_2=0.04Ω x_1=5Ω x_2=0.05Ω

Each quantity is referred to its own side of transformer. (Suffix '1' stands for HV and '2' or LV) [1+1+1=3]

i. Find the total leakage impedance referred to the HV side and LV side.
ii. Consider the transformer to give its rated kVA at a p.f of 0.8 lagging to a load at rated voltage. Find the HV terminal voltage and % voltage regulation.
iii. Consider the core loss to be 80 Watt. Find the efficiency under the conditions of part (ii).

b. The approximate equivalent circuit of a 4 kVA, 200/400 V single phase transformer, referred to the LV side is shown in figure 1. [2+2=4]

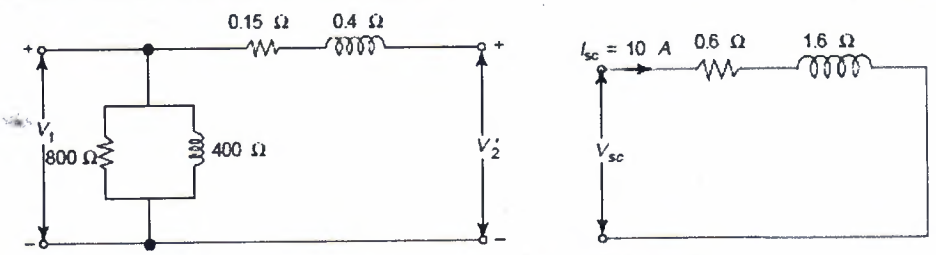

Figure 1. Approximate equivalent circuit for question 1 (b)

i. An open circuit test is conducted by applying 200V to the LV side, keeping the HV side open. Calculate the power input, power factor and current drawn by the transformer.
ii. A short circuit test is conducted by passing full load current from the HV side keeping the LV side short circuited. Calculate the voltage to be applied to the transformer and the power input and power factor.

c. Derive the expression for maximum efficiency conditions for a single phase transformer. [3]

2.

a. A transformer has its maximum efficiency of 0.98 at 20 kVA at unity power factor. During the day it is loaded as follows: [4]

12 hours: 2 kW at 0.6 p.f
6 hours: 10 kW at 0.8 p.f
6 hours: 20 kW at 0.9 p.f

Find the all day efficiency of the transformer.

b. Describe the method of parallel operation of two single phase transformers considering equal voltage ratios. Obtain the equations for load shard by the two transformers. [3]

c. Explain the advantages of autotransformer over two winding transformer. [3]

3.

a. A 4 pole generator has a wave wound armature with 722 conductors, and it delivers 100A on full load. If the brush lead is 8^0, calculate the armature demagnetizing and cross magnetizing ampere turns per pole. [3]

b. Explain with the aid of neat sketches the phenomenon of commutation in a dc machine. [4]

c. Two shunt generators each with an armature resistance of 0.01Ω and field resistance of 20Ω run in parallel and supply a total load of 4000 A. the e.m.f's are respectively 210V and 220V. Calculate the busbar voltage, 'V' and output power of each machine. [3]

4.

a. The open circuit characteristic curve of a shunt DC generator running at 1500 r.p.m is shown in Table 1. For the generator find [3]

Field current (A)	0	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.0
Emf (V)	6	60	120	172.5	202.5	221	231	237	240

Table 1. O.C.C curve for question 4(a)

i. No load emf for a total shunt field resistance of 100Ω.
ii. The critical field resistance at 1500 r.p.m.

b. A 220V compound generator is supplying a load of 100A at 200V. The resistances of its armature, shunt, and series windings are 0.1Ω, 50Ωand 0.06Ω respectively. Find the induced e.m.f and the armature current when the machine is connected [3]

i. Short shunt.
ii. Long shunt.

c. Explain the construction and operating principle of a dc generator. [4]

5.

a. A 4 pole, 240V wave connected shunt motor gives 1119 kW when running t 1000 r.p.m and drawing armature and field currents of 50 A and 1 A respectively. It has 540 conductors. Its resistance is 0.1Ω. Assuming a drop of 1V er brush, find [4]
   i. Total torque, and useful torque
   ii. Useful flux per pole
   iii. Rotational loss
   iv. Efficiency

b. A 220V dc series motor is running at a speed of 800 r.p.m and draws 100A. Calculate at what speed the motor will run when delivering half torque. Total resistance of the armature and field is 0.1Ω. Assume that the magnetic circuit is unsaturated. [3]

c. Explain the Hopkinson or Regenerative test method of a dc machine. [3]