KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.E.
Year : II

Course : EEEG 215
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate option.

1. Air gap is usually inserted in magnetic circuits to
   a. Increase magneto motive force
   b. Increase the flux
   c. Prevent saturation
   d. Decrease the magneto motive force

2. If the area of the hysteresis loop of a material is large, the hysteresis loss in the material will be
   a. Zero
   b. Small
   c. Large
   d. No effect at all

3. 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 $I_1N_2 = I_2N_1$

4. 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

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

6. The no-load test on a transformer is carried out to determine
   a. Copper loss
   b. Magnetizing current
   c. Magnetizing current and loss
   d. Efficiency of the transformer

7. The efficiency of a transformer will be maximum when
   a. Copper loss = Hysteresis loss
   b. Hysteresis loss = Eddy current loss
   c. Eddy current loss = Copper loss
   d. Copper loss = Iron loss

8. The resistance between primary and secondary of a transformer is
   a. Zero
   b. 1 Ω
   c. 1000 Ω
   d. Infinite

9. The main advantage of an auto-transformer over a two-winding transformer is
   a. Hysteresis losses are reduced
   b. Saving in winding material
   c. Copper losses are negligible
   d. Eddy losses are totally eliminated

10. A transformer can have regulation closer to zero
   a. On full load
   b. On overload
   c. On leading power factor
   d. On zero power factor

11. In a lap winding for a DC generator, the number of brushes is always
    a. Double the number of poles
    b. Same as the number of poles
    c. Half the number of poles
    d. Two

12. The purpose of providing dummy coil in a generator is
    a. To enhance flux density
    b. To amplify voltage
    c. To provide mechanical balance for the rotor
    d. To reduce eddy currents

13. The demagnetizing component of armature reaction in dc generator
    a. Reduces generator emf
    b. Increases armature speed
    c. Reduces interpoles flux density
    d. Results in sparking trouble

14. In a DC generator the magnetic neutral axis coincides with the geometrical neutral axis when
    a. There is no load on the generator
    b. The generator runs on full load
    c. The generator runs on overload
    d. The generator runs on designed speed

15. If the field of a DC shunt motor gets opened while motor is running
    a. The speed of the motor will be reduced
    b. The armature current will reduce
    c. The motor will attain dangerously large speed
    d. The motor will continue to run at constant speed

16. The condition for maximum power in case of a DC motor is
    a. Back emf = 2 × supply voltage
    b. Back emf = half × supply voltage
    c. Supply voltage = half × back emf
    d. Supply voltage = back emf

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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Level : B.E.
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Time : 2 hrs. 30 mins.

Course : EEEG 215
Semester : II
F.M. : 40

SECTION "B"
[4 Q. × 10 = 40 marks]

Attempt *ANY FOUR* questions.
Symbols have their usual meanings. *Assume appropriate data if required.*

1. a. Explain the operation of a single phase transformer operating on lagging power factor load with a phasor diagram considering the resistance and leakage reactance. How does the transformer maintain the constant flux for the lagging power factor load? [2.5+2.5]

   b. Obtain the approximate equivalent circuit of a given 200/2200 V single phase 30 kVA transformer having the following test results: [3+2]

   Open circuit test: 200V, 6.2A, 360W on low voltage side
   Short circuit test: 75V, 18A, 600W on high voltage side

   Determine the load voltage across a load impedance, $Z_L = (10+j20)\ \Omega$, if connected on the low voltage side of the transformer.

2. a. 600 kVA, 1-phase transformer has an efficiency of 92% both at full load and half load at unity power factor. Determine its efficiency at 60% of full load at 0.8 power factor lagging. [3]

   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. A 100 kVA, single phase transformer has a no load core loss of 270 Watts and a full load ohmic loss of 1200 Watts. The daily variation of load on the transformer is as shown in Table 1. Determine the all-day efficiency of the transformer, provided copper loss is directly proportional to (kVA of load)^2. [4]

Time	**Load**	**Reactive power**
8 A.M TO 1 P.M	65 kW	35 kVAR
1 P.M TO 6 P.M	80 kW	50 kVAR
6 P.M TO 1 A.M	30 kW	30 kVAR
1 A.M TO 7 A.M	No load	

Table 1. Load variation on daily basis for 100kVA transformer

3. a. Explain the armature reaction in a dc generator on no load and on load. Illustrate with a diagram the effects of armature reaction on the flux distribution. [4]

b. How are demagnetizing and cross-magnetizing ampere-turns/pole in a DC machine calculated? [3]

c. Explain with the aid of neat sketches the phenomenon of commutation in a DC machine. [3]

4. a. The open circuit characteristic curve of a shunt DC generator running at 375 r.p.m is shown in Table 2: [2+1.5+1.5]

Field current (A)	0	2	3	4	5	6	7
Armature voltage (V)	9.4	115	165	202.5	228.8	248.8	265

Table 2. O.C.C curve at 375 r.p.m

i. Plot the O.C.C curve and determine the voltage to which the machine will excite if the field resistance is 40 Ω.

ii. What additional resistance would have to insert in the field circuit to reduce the voltage to 200 V at 375 r.p.m?

iii. Without the additional resistance, determine the load current supplied by the generator when its terminal voltage is 200 V. Take an armature current of 0.3 Ω. Assume speed to be constant and armature reaction may be ignored.

b. A long shunt compound generator has an armature, series field and shunt field resistance of 0.04 Ω, 0.03 Ω and 200 Ω respectively. It supplies a load current of 180 A at 400 V. Calculate the generated e.m.f. Assume contact brush/drop = 1 V. [3]

c. Derive the expression for a torque developed in a d.c motor. [2]

5. a. A 440 V, 4 pole, lap connected shunt motor has a no load input current of 15 A and shunt field current of 10 A. At full load it takes a current of 150 A. If armature resistance = 0.1 ohm, flux per pole on no load = 0.05 Weber, number of armature conductors = 750 and contact drop per brush = 1 V, calculate [1.5+1.5]

i. No load speed and full load speed

ii. Speed regulation

b. Explain the armature resistance, field flux, armature voltage and Ward Leonard's methods of speed control of a dc motor. [4]

c. A 4 pole, 250 V, wave connected shunt motor gives 10 kW when running at 1000 r.p.m and drawing armature and field currents of 60 A and 1 A respectively. It has 560 conductors. Its armature resistance is 0.2 ohm. Assuming a drop of 1 volt per brush, determine [1.5+1.5]

i. Total torque and useful torque

ii. Efficiency