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KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF ENGINEERING

BSc. (Mechanical Engineering) End of Second Semester Examination

EE 252 : ELECTRICAL ENGINEERING MACHINES

MARCH, 2018

Time allowed: **ONE HOUR**

INSTRUCTIONS FOR CANDIDATES:

1. Answer **ALL** questions.
2. Circle your answer on the question paper and on the Scannable sheet.
3. Indicate your **index number** on the question paper.

CAUTION: DO NOT TAKE AWAY ANY EXAMINATION MATERIAL PROVIDED TO YOU, UNLESS YOU ARE TOLD TO DO SO.

7.5 11.25 11.25
30 40 45
45 30 30
82.5 91.25 86.25

An eight –pole armature is wound with 480 conductors. The magnetic flux and speed are such that the average emf generated in each conductor is 2.2V and each conductor is capable of carrying a full load current of 100A.

Use the above information to answer questions 1 to 4

1. Find the terminal voltage on no load in volts if the armature is lap-connected.

a)162 b) 153 c)132 d)None of the above

2. Find the output current on full load in amperes if the armature winding is lap-connected.

a)800 b)750 c) 700 d) None of the above

3. Find the terminal voltage on no load in volts if the armature winding is wave-connected.

a)556 b)544 c)528 d)None of the above

4. Find the output current on full load in amperes if the armature is wave-connected.

a)200 b)180 c)140 d)None of the above

5. The volt-ampere equation for a long shunt compound generator is given by

a) $V_t = E_a + I_a r_a$ b) $V_t = E_a - I_a r_a$

c) $V_t = E_a - I_a(r_a + r_s)$ d) $V_t = E_a - I_a r_a - I_L r_s$

6. Armature winding is the one in which

a) flux is produced by field current b) e.m.f. is produced by the working flux

c)flux is produced by the working e.m.f. d) e.m.f. is produced by the leakage flux

The armature of a d.c machine has a resistance of 0.1 Ω and is connected to a 230 V supply.

Use the above information to answer questions 7 and 8.

7.Calculate the generated E.M.F when it is running as a generator giving 80A.

a) 218V b)265V c) 238V d)None of the above

8.Calculate the generated E.M.F when it is running as a motor taking 60A.

a)190V b)245V c)224V d)None of the above

A solenoid relay is operated from a 220-V, dc supply and the 1000-turn coil resistance is 5.5 kΩ. The core diameter of the relay is 20 mm and the gap length is 1.5 mm, the armature being

Index number .....Department.....

stationary. The gap faces may be taken as parallel and the permeability of the ferromagnetic parts as very high. Take $\mu_o=4\pi\times10^{-7}$. ***Use the above information to answer questions 9 to 13.***

9.Determine the current that will flow through the relay coil .

a)0.04A b)0.004A c)0.05A d)None of the above

10.Determine the mmf of the magnetic system

a)40.0 At b) 80.0 At c) 120.0 At d)None of the above

11.Determine the air gap flux density

a) 0.0107Wb/m^2 b) 0.00107Wb/m^2 c) 0.107Wb/m^2 d)None of the above

12.Determine the coil inductance

a)0.804 H b) 0.084H c) 0.656H d)None of the above

13. Determine the pull on the armature.

a)0.95N b) 0.88N c) 0.69N d)None of the above

14.A long shunt compound D.C. generator has a full-load magnetic flux of 0.0001Wb. If the current through its series field windings is caused to be zero, then its full-load flux

a) *becomes more than 0.0001Wb* b)remains 0.0001Wb

c)becomes less than 0.0001Wb d)becomes 0.0011Wb

15.In a d.c. series generator, the terminal voltage with increase in load

a)decreases b) remains unchanged

c)Increases d) varies with drooping characteristic

16. A four pole d.c motor is fed at 440V and takes an armature current of 50A .The resistance of the armature circuit is 0.28 Ω .The armature winding is wave –connected with 888 conductors and the useful flux per pole is 0.023Wb. Calculate the speed.

a)567rev/min b)626rev/min c)545 rev/min d)None of the above

17. A d.c. motor runs at 900rev/min off a 460 V supply. Calculate the approximate speed when the machine is connected across a 200V supply. Assume the new flux is to be 0.7 of the original flux

a)367rev/min b)648 rev/min c)559 rev/min d) None of the above

18. Which of the following explains why the armature current of a shunt motor decreases as the motor accelerates?

b) The high speed of the motor will cause the flux in the motor to decrease.
b) The supply voltage decreases because the back emf has increased.
d) The current decreases because the motor cannot take up any load.
e) The current decreases because the back emf has increased

19. A D.C shunt generator when driven without any excitation showed an open circuit voltage of 12 volts. When the field winding was excited, the voltage dropped to zero . It happened because

a) The field resistance was higher than the critical resistance

b) There was break in the armature circuit c) Field winding was wrongly connected

d) There was no residual magnetism in the field circuit

20. A D.C shunt motor runs at a rated speed if its field circuit gets open –circuited, then soon after this the motor speed would tend to

a) decrease b) remain ungagged c) increase d) fluctuate around its previous speed

A 250V compound generator has armature, series field and shunt -field resistances of 0.4 Ω, 0.2 Ω and 125 Ω respectively. The compound generator supplies 10kW at rated voltage. ***Use the above information to answer questions 21 to 27.***

21. Calculate the load current

a)40.0A b)50.54A c)42.00A d)None of the above

22. Calculate the shunt field current if the generator is connected a long shunt

a)2.04A b)3.54A c)2.00A d)None of the above

AJK

dex number .....Department.....

3. Calculate the armature current if the generator is connected a long shunt

a)32.04A b)43.54A c)42.00A d)None of the above

4. Calculate the shunt field current if the generator is connected short shunt 2.064A

a)1.852A b)1.936A c)1.978A d)None of the above

25. Calculate the armature current if the generator is connected short shunt 42.064A

a)45.67A b)42.00A c)47.20A d)None of the above

26. Calculate the generated emf if the generator is connected short shunt

a)275.34V b)274.8V c)267.34A d)None of the above

27. Calculate the generated emf if the generator is connected long shunt

a)270.45V b)265.9V c)275.20V d)None of the above

A four-pole armature is wound with 564 conductors and driven at 800rev/min, the flux per pole being 20mWb.The current in each conductor is 60A . ***Use the above information to answer questions 28 to30.***

28.Calculate the armature if the conductors are connected wave.

a)240A b)60A c)120A d)None of the above

29.Calculate the emf generated in the armature if the conductors are connected wave.

a)300.8V b) 358.0V c)420V d)None of the above

30.Calculate the power generated in the armature if the conductors are connected wave.

a)36,096W b) 21,480W c)100,800W d)None of the above