Register No: ………………….

B.E. DEGREE EXAMINATIONS: NOV/DEC 2012

Third Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

EEE103: Electrical Machines-I

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions

PART A (10 x 1 = 10 Marks)

1. A dc generator works on the principle of

   a) Fleming's right hand rule   b) Fleming's left hand rule

   c) Faradays laws of electromagnetic induction   d) Right hand thumb rule

2. A dc shunt generator has a speed of 800 rpm when delivering 20 A to the load at the terminal

   voltage of 220V. If the same machine is run as a motor it takes a line current of 20A from

   220V supply. The speed of the machine as a motor will be

   a) 800 rpm.   b) more than 800 rpm.

   c) less than 800 rpm.   d) both higher or lower than 800 rpm.

3. In a dc series motor the electromagnetic torque developed is proportional to

   a) I_a b) I_a^2 c) $1/I_a$ d) $1/I_a^2$

4. In a dc shunt motor the terminal voltage is halved while the torque is kept constant.

   The resulting approximate variation in speed 'N' and armature current ' I_a ' will be

   a) Both N and I_a are doubled.   b) N is constant and I_a is doubled.

   c) N is doubled while I_a is halved.   D) N is constant but I_a is halved.

5. Hopkinson's test is conducted when the motor is

   a) No loaded   b) Half loaded   c) Full loaded   d) ¾ th loaded

6. The following motor has maximum self loading property

   a) DC shunt motor   b) DC series motor

   c) DC cumulatively compounded motor   d) DC differentially compound motor

7. The two windings of a transformer is

   a) conductively linked.   b) inductively linked.

   c) not linked at all.   d) electrically linked.

8. A 1:5 step-up transformer has 120V across the primary and 600 ohms resistance across the

   secondary. Assuming 100% efficiency, the primary current equals

a) 0.2 A.   b) 5 A.   c) 10 A.   d) 20 A.

9. In a transformer the voltage regulation will be zero when it operates at

   a) unity p.f.   b) leading p.f.   c) lagging p.f.   d) zero p.f. leading

10. The efficiency of a transformer does not depend on

   a) Ampere rating   b) Volt rating   c) KW rating   d) KVA rating

PART B (10 x 2 = 20 Marks)

11. What are the conditions to be fulfilled for a dc shunt generator to build up voltage?

12. Why is a dc series generator called as rising characteristic machine?

13. What is the significance of back emf in dc motors?

14. What is the advantage of 4 point starter over 3 point starter?

15. Which test is used for determining the stray losses in a dc motor?

16. Why Swinburne's test cannot be performed on the dc series motor?

17. Why is the rating of transformer in KVA?

18. Does the transformer draw any current when its secondary is kept open? Why?

19. What are the constant losses that occur in transformers?

20. Mention some applications of auto transformers.

PART C (5 X 14 = 70 Marks)

21. a) (i) Derive the emf equation of a dc generator.   (7)

    (ii) Explain the load characteristics of dc shunt and series generators.   (7)

(OR)

   b) Two shunt generators are operating in parallel. The emf induced in one machine is 260 V
      and that induced in the other machine is 270 V. They supply together a load current of
      1800 A. If each machine has an armature resistance of 0.04 ohm and field resistance of
      50 ohm, calculate:

      (i) Terminal voltage

      (ii) Output of each machine

22. a) (i) Derive the torque equation of a dc motor.   (7)

    (ii) Explain the electrical characteristics of dc series motor and mention some applications
        of dc series motors.   (7)

(OR)

   b) (i) Explain the process of commutation in dc motors.   (7)

(ii) Explain the working of a 2 point starter used in dc motors. (7)

23. a) Describe the test conducted on two identical dc shunt machines and derive an expression for its efficiency.

(OR)

b) The no load test of a 44.76 kw, 220V,dc shunt motor gave the following datas:

Input current=13.25 A; field current = 2.55A; resistance of armature at 75 C =0.032 ohm and brush drop=2V. Estimate the full load current and efficiency.

24. a) (i) Derive the emf equation of a transformer. (7)

(ii) With necessary phasor diagrams explain the concept of transformer on load when the load is inductive and non-inductive. (7)

(OR)

b) Derive an expression to calculate the saving of copper in an auto transformer. Mention the advantages of an auto transformer.

25. a) The parameters of the equivalent circuit of a 150-kVA, 2400/240V transformer are: R_1=0.2ohm, R_2=2 x 10^{-3} ohm, X_1=0.45 ohm, X_2= 4.5 x 10^{-3} ohm, R_i =10 kohm, X_m = 1.6 kohm as seen from 2400 volts side. Calculate:

(i) Open circuit current, power and PF when LV side is excited at rated voltage.

(ii) The voltage at which the HV side should be excited to conduct a short-circuit test (LV side) with full-load current flowing. What is the input power and its power factor?

(OR)

b) Find the all day efficiency of a transformer having maximum efficiency of 98% at 15KVA at unity power factor and loaded as follows:

12 hours-2KW at 0.5pf lag

6 hours-12 KW at 0.8 pf lag

6 hours-at no load.

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