Register Number: ……

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

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 Direction of induced EMF is given by

a) Fleming's Left hand rule b) Fleming's Right hand rule

c) Right hand cork screw rule d) Right hand grip rule

2 The foremost condition to be satisfied for self excitation to take place in a DC generator is

a) Field circuit should be connected properly

b) Field circuit resistance should be less than critical value

c) Speed of operation should be more than critical value

d) Presence of residual flux

3 A DC motor operating on 230 V DC supply has armature resistance of 0.5 Ω and back EMF of 220 V. Its armature current is

a) 5 A b) 10 A c) 20 A d) 225 A

4 The speed control method generally used for DC series motors used in traction application is

a) Field diverter control b) Tapped field control

c) Armature resistance control d) Series – parallel control

5 In a DC shunt machine, if W_i is iron loss, W_m is mechanical loss, W_{sh} is shunt field copper loss and W_{ac} is armature copper loss, then the constant loss, W_c is

a) $W_c = W_i + W_m$ b) $W_c = W_i + W_m + W_{ac}$

c) $W_c = W_i + W_m + W_{sh}$ d) $W_c = W_{sh} + W_m + W_{ac}$

6 The most economical method of estimating the efficiency of a large capacity DC machine is

a) Hopkinson's test b) Field's test c) Swinburne's test d) Retardation test

7 The primary and secondary windings of a two winding transformer always have

a) Different number of turns b) Same size of copper wire

c) Different voltage ratings d) Same VA rating

8 In a Scott connected transformer, the number of turns in the main and Teaser transformer respectively are

a) 2T, $\frac{\sqrt{3}T}{2}$ b) $(\frac{T}{2}+\frac{T}{2})$, $\frac{\sqrt{3}T}{2}$ c) $(\frac{T}{2}+\frac{T}{2})$, $\frac{2T}{\sqrt{3}}$ d) $\frac{T}{2}$, $\frac{\sqrt{3}T}{2}$

9 The all day efficiency of a distribution transformer mainly depends on

a) Iron loss b) Full load copper loss

c) Active power developed d) The load and its duration

10 The following is the Sumpner's test readings on the series connected HV side: 40 V, 12 A, 200 W. Its total resistance is

a) 0.4167 Ω b) 0.6 Ω c) 0.6944 Ω d) 1.667 Ω

PART B (10 x 2 = 20 Marks)

11. Name any two materials with which brushes are made.
12. Name the different types of DC generators.
13. Write the significance of Back EMF in DC motor?
14. DC series motors should never be started on No load why?
15. What are the advantages of Hopkinson's test over Swinburne's test and what are its limitations?
16. What are the reasons for the iron loss to occur in DC machines?
17. Draw the phasor diagram of a single phase transformer on No load.
18. What is meant by turns ratio in transformer?
19. Define voltage regulation of a Transformer.
20. Draw circuit diagram to conduct Sumpner's test.

PART C (5 x14= 70 Marks)

21. a) (i) Develop the expression for EMF induced in a DC generator. (10)

(ii) In a 120 V compound generator, the resistance of the armature, shunt and series windings are 0.06 Ω, 25 Ω and 0.04 Ω respectively. The load current is 100 A at 120 V. Find the induced EMF and the armature current when the machine is connected as long shunt and as short shunt. (4)

(OR)

b) (i) Explain the armature reaction in a DC generator on No load and on Load. Briefly explain the methods to overcome the adverse effects of the armature reaction. (10)

(ii) Two DC generators, each having linear external characteristics, are operating in parallel and supply a total load current of 160 A. The terminal potential difference of one machine falls from 240 V on no load to 220 V when its current output is 100 A. The terminal potential difference of the other machine falls from 240 V to 216 V when its armature current is 80 A. Determine the current supplied by each machine. (4)

22. a) (i) How the torque is developed in a DC motor and derive the expression for the same. (10)

(ii) Explain with neat diagram and the working of a three point starter. (4)

(OR)

b) (i) A DC series motor drives a load, the torque of which varies square of the speed. The motor takes the current of 20 A when the speed is 800 rpm. Calculate the speed and current when the motor field winding is shunted by a diverter of the same resistance as that of the field winding. Neglect all motor losses and assume that the magnetic circuit is unsaturated. (10)

(ii) Explain all the characteristics of a DC shunt motor. (4)

23. a) (i) A 500 V shunt motor takes 8 A on No load. The armature and field resistances are 0.2 Ω and 250 Ω respectively, when measured at room temperature. Neglect the increase in resistance due to temperature rise. Find the efficiency of the machine : (a) When run as a motor taking a line current of 90 A at 500 V, (b) When run as a generator delivering a current of 90 A at 500 V. Assume the stray losses to be 1.2 percentage of the output. (10)

(ii) Draw the power stages of a DC motor. (4)

(OR)

b) (i) Hopkinson's test on two identical shunt machines gave the following readings: Supply voltage = 250 V, Field currents = 7 A an 6 A, Line current = 40 A, Armature current of a motor = 250 A, Armature resistance of each machine = 0.016 Ω, Voltage drop / brush = 1 V. Find the efficiency of each machine. (10)

(ii) List the draw backs of the brake test. (4)

24. a) (i) Derive the EMF equation of a single phase transformer. (10)

(ii) Construct the phasor diagram of a single phase transformer with inductive load. (4)

(OR)

b) (i) Explain the working of auto transformer and prove that when transformation ratio approaches unity, the amount of copper used approaches smaller value. (10)

(ii) Draw the circuit arrangement for three phase star – delta connected transformer and open delta arrangement of the transformer. (4)

25. a) (i) Step by step, develop exact and approximate equivalent circuit of a single phase transformer. (10)

(ii) Two similar 100 kVA, single phase transformer gave the following test readings when tested by Sumpner's test. Supply power = 2.4 kW. Power supplied to secondary circuit in passing full load current through it = 3.2 kW. Find the efficiency and regulation of each transformer at unity power factor. (4)

(OR)

b) (i) Obtain the approximate equivalent circuit of a given 200 / 2000 V single phase, 30 kVA transformer having the following test results : (10)

OC test : 200 V, 6.2 A, 360 W on LV side

SC test : 75 V, 18 A, 600 W on HV side

(ii) Write a technical note on the parallel operation of the transformers. (4)

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