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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2049 Roll No.

B. Tech.

(SEM. IV) EXAMINATION, 2008-09

ELECTRICAL MACHINES

Time : 3 Hours] *[Total Marks : 100*

Note : (1) Attempt **all** questions

(2) All questions carry **equal** marks.

1 Answer any **two** parts of the following :

(a) A 100 kVA transformer has its maximum efficiency of 0.98 at full load at unity power factor. During the day it is loaded as follows: **10**

12 hrs - 20 kW at power factor 0.5

6 hrs - 45 kW at power factor 0.9

6 hrs - 80 kW at power factor 0.8

Calculate all-day efficiency of the transformer.

(b) What is necessity of a starter for a d.c. motor? Explain with a neat sketch the working of a 3-point d.c shunt motor starter bringing out the protective features incorporated in it. **10**

(c) Explain the effects of armature reaction on the main field flux by using developed view of armature current sheet and poles of a d.c. machine. Hence outline the bad effects of armature reaction. **10**

2 Answer any **two** parts of the following:

(a) Calculate the overall efficiency of a 250 V, 100 kW, d.c. shunt generator at full load if the resistance of the armature and shunt field are 0.006 Ω and 25 Ω respectively. The core, friction and windage losses together are 3.2 kW.

(b) Why is it advantageous to use double revolving field theory for determining the running performance of a single-phase induction motor?

Draw torque-speed characteristics of a $1-\phi$ induction motor based on double-revolving field theory and discuss about the magnitude of torque at zero speed and synchronous speed.

(c) A 4-pole $3-\phi$ induction motor delivers 37 H.P. at the shaft at a speed of 1425 rpm on 500 V, 50 Hz supply. The mechanical losses total 3 HP and power factor is 0.9. Calculate for this load :

(i) The slip
(ii) The rotor copper losses
(iii) The total power input if the startor losses are 2500 W.
(iv) The efficiency
(v) The line current.

3 Answer any **four** parts of the following :

(a) Explain the terms : 5

(i) air-gap power
(ii) internal mechanical power developed and
(iii) shaft power.

How are these terms related with each other?

(b) Explain working principle of a synchronous motor. 5

(c) What is an auto transformer? State its merits and demerits over the 2-Wdg. transformers. 5

(d) A 11000 / 2200 V, single phase transformer is rated at 1000 kVA, if the two windings are connected in series to form an auto transformer determine its rated voltage and power. 5

(e) What is meant by three phase transformer groups? What are the possible connections for a $3-\phi$ transformer bank? 5

4 Answer any **four** parts of the following :

(a) Why rotating field system is preferred over the stationary field system in synchronous generator? A 4 pole alternator rotates at 1500 rpm. What is the frequency of the generated voltage? 5

(b) Draw the phasor diagram of a loaded alternator for the following conditions : 5

(i) lagging p.f.

(ii) leading p.f

(iii) unity p.f.

(c) What do you mean by synchronization? Describe any one method of synchronizing alternators. 5

(d) A $3-\phi$ 6 pole star connected alternator revolves at 1000 rpm. the stator has 90 slots and 8 conductors/slot The flux/pole is 0.05 Wb (sinusoidally distributed).Calculate the voltage generated / phase by the machine if winding factor is 0.96. 5

(e) Explain the effect of excitation on the line current with regard to synchronous motor. 5

5 Answer any **four** parts of the following:

(a) What is a two phase servo motor? Draw its torque speed characteristics for various control voltages. 5

(b) Describe the construction and working of a capacitor-start single-phase induction motor. 5

(c) Explain the operation of a stepper motor. What are the merits and demerits of stepper motors? 5

(d) Describe Sumpner's (back to back) test used for transformers. Indicate its advantages? 5

(e) Explain concept of braking in dc and ac motors. 5

(f) Discuss industrial applications of dc series motors. 5
