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

PAPER ID : 2050 Roll No.

B. Tech.

(SEM. IV) EXAMINATION, 2007-08

ENERGY CONVERSION

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

Note : *Attempt **all** questions.*

1 Attempt any **four** parts of the following : **5×4=20**

(a) Explain why is field winding placed on the rotor, while armature winding on the stator in a large synchronous machine?

(b) Explain how distributed winding eliminates the harmonics in the output voltage waveforms of synchronous generator.

(c) Explain with suitable diagram how electromagnetic torque is developed in a d.c. machine.

(d) Explain rotating magnetic field, produced in a 3-phase induction motor and why this field rotates at synchronous speed.

(e) A 6-pole, 50Hz wound-rotor induction motor; when supplied at rated voltage and frequency with slip rings open circuited, developed a voltage of 100V between any two rings. Under the same

conditions its rotor is now driven by external means at 1000 rpm opposite to the direction of rotation of stator field. Find the voltage available between slip-rings and its frequency.

(f) Discuss different types of mechanical loads. How these loads match to the machine characteristics ?

2 Attempt any **four** parts of the following : **5×4=20**

(a) Classify d.c. motors on the basis of methods of excitation and also discuss them.

(b) Describe with schematic diagrams the circuit model of a d.c. shunt and series machines under generating and motoring modes.

(c) A 230 V d.c. shunt motor takes 32A at full load. Find the back e.m.f. on full load if the resistance of armature and field windings are $0.2\,\Omega$ and $115\,\Omega$ respectively.

(d) Explain commutation process in a d.c. machine. How interpoles improve the delayed commutation?

(e) Explain the necessity of starter for d.c. machines. Discuss the requirement of overload release and no-volt coil in a three point starter.

(f) The armature and shunt field resistances of a 230V shunt motor are $0.1\,\Omega$ and $230\,\Omega$ respectively. It takes a current of 61A at 1000 rpm. If the current taken remains unaltered find the resistance to be included in series with the armature circuit to reduce the speed to 750 rpm.

3 Attempt any **two** parts of the following : **10×2=20**

(a) Draw V-curve and explain with suitable phasor diagram. How synchronous motor operates at different power factors for a given load.

(b) Discuss with suitable derivations torque/speed characteristics of three phase induction motor for variable rotor resistances. Also find the condition for maximum torque.

(c) In a 6 pole, 3-phase, 50Hz induction motor with star connected rotor, the rotor resistance per phase is **0.3** Ω the reactance at standstill is1.5 Ω per phase and an e.m.f. between the slip-rings on open circuit is 175V.

Find:

(i) Slip at a speed of 950 r.p.m.

(ii) Rotor e.m.f. per phase

(iii) Rotor frequency and reactance at a speed of 950 t.p.m.

4 Attempt any **two** parts of the following : **10×2=20**

(a) (i) Discuss the working of a thyristor. How is it turned on by suitable gate current? Also explain latching and holding current.

(ii) Explain with suitable diagram the working behaviour of a power transistor as a switch.

(b) A single phase semi converter delivers power to R-L-Eb load with R=5 Ω, L=10mH, Eb=80V. The a.c. source voltage is 230V, 50 Hz. For a continuous conduction, find the average value of

output current for a firing angle delay of 50°. If one of the two main SCRs is damaged and open circuited, find the new value of average output current on the assumption of continuous conduction.

(c) Explain operation of a single phase full converter and draw output voltage and current waveforms assuming continuous current conduction. Derive expression for output voltage.

5 Attempt any **two** parts of the following : **10×2=20**

(a) A d.c. chopper feeds power to an R-L-Eb load with R=2Ω, L=10mH and Eb=6V. If this chopper is operating at a chopping frequency of 1 kHz and with duty cycle of 10% from 220V d.c. source, compute the maximum and minimum currents taken by the load.

(b) Describe with neat sketches the speed-control scheme of a three phase induction motor using three phase ac voltage controller.

(c) Discuss with neat diagram and relevant waveform the operation of a single phase bridge inverter for different types of load. Also discuss one scheme to eleminate the harmonics in the output voltage waveform of the inverter.