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Printed Pages : 4 **TEE – 406**

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

PAPER ID : 2050 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. IV) EXAMINATION, 2006-07

ENERGY CONVERSION

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

Note : *Attempt **all** the **five** questions. All questions carry **equal** marks.*

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

(a) Explain the constructional features and principle of working of a dc machine.

(b) Explain how a rotating magnetic field is produced by applying **3** phase supply to **3** phase windings.

(c) Derive the expression of emf generated in a ac machine. Discuss and explain why a synchronous motor develops a unidirectional torque only at the synchronous speed whereas an induction motor develops a unidirectional torque at all speeds other than the synchronous speed.

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

(a) Starting from the first principles, derive an expression for the electromagnetic torque of a dc motor.

(b) Explain the speed torque characteristic of a **dc** shunt motor.

(c) Explain commutation in **DC** generator.

(d) Explain the field flux control method for speed control of a **dc** shunt motor.

(e) A **4** pole dc shunt motor working on **250V** takes a current of **2A** when running at no load at **1000 rpm**. How much back emf is generated? What will be its back emf, speed and percentage speed drop if the motor takes **51A** at a certain load? Armature resistance and shunt field resistance are **0.2** Ω and **250** Ω respectively.

(f) A **6** pole, lap connected with **864** conductors dc motor takes an armature current of **110A** at **480V.** The armature circuit has a resistance of **0.2** Ω. The flux per pole is **0.05 wb.** Calculate :

(i) The speed and

(ii) The gross torque developed by the armature.

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

(a) Explain the principle of working of three phase induction motor.

(b) Discuss the constructional differences between a squirrel cage and wound rotor induction motor.

(c) Draw the power flow diagram of a three phase induction motor.

(d) Explain the effect of change of excitation of a synchronous motor on its armature current and its power factor.

(e) Draw and explain the phasor diagram of synchronous motor operating at lagging power factor.

(f) A **37.3 kW**, **4** pole **50 Hz** induction motor has friction and windage losses of **3.32 kW**. The stator losses equal the rotor losses. If the motor is delivering full load power output at a speed of **1440 rpm**, calculate synchronous speed, slip, mechanical power developed by the motor and rotor copper loss.

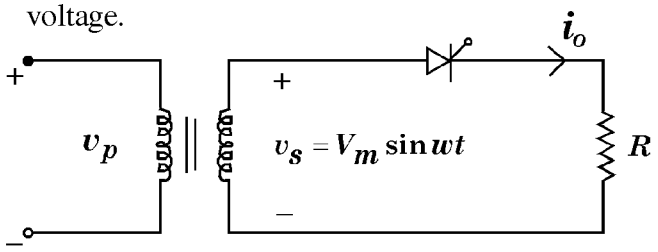
4 Attempt any **four** parts of the following : **5×4=20**

(a) The reverse recovery time of a diode is $\mathbf{t_{rr} = 3\ \mu s}$ and the rate of fall of the diode current is **di/dt = 30 A/μ s.** Determine :

(i) the storage charge $\mathbf{Q_{RR}}$ and

(ii) the peak reverse current $\mathbf{J_{RR}}$.

(b) For the single phase thyristor converter shown in **Fig 1**, derive the expression for rms output voltage.



(c) For a single phase semiconverter, sketch waveforms for load voltage and load current for :

(i) RL load

(ii) RL load with free wheeling diode across RL. Indicate clearly the conduction period of the devices.

(d) A single phase full converter feeds power to **RLE** load with **R = 6 Ω, L = 6 mH** and **E=60 V.** The **ac** source voltage is **230V, 50 H_e**. For continuous conduction, find the average value of load current for a firing angle delay of **50^o**.

If one of the four thyristors gets open circuited, find the new value of average load current taking the output current as continuous.

(e) Discuss the advantages and disadvantages of circulating current in a single phase dual converter.

(f) Draw the circuit diagram and output voltage waveforms of a single phase cycloconverter.

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

(a) What is duty cycle in chopper control circuit? Explain the operation of a step-up chopper circuit.

(b) Describe the operation of a three phase **180^o** mode voltage source inverter and draw its voltage waveforms.

(c) What are the different techniques for the control of voltage of an inverter? Explain the sinusoidal pulse width modulation technique.
