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

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

B.Tech.

FOURTH SEMESTER EXAMINATION, 2005-2006

ENERGY CONVERSION

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt ALL questions.*
(ii) All questions carry equal marks.
(iii) In case of numerical problems assume data wherever not provided.
(iv) Be precise in your answer.

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1. Attempt *any two* parts of the following : **(10x2=20)**

(a) From the construction point of view, enumerate the common essential features of rotating electrical machines. Give the constructional features of d.c. machines, and with a suitable diagram describe the constructional details of commutator also.

(b) Derive an expression for the e.m.f. generated in the armature winding of a synchronous machine. Also explain how harmonics in the e.m.f. wave are eliminated by short-pitched winding.

(c) (i) Describe basic principle of operation of a three phase induction motor.

(ii) Calculate the fundamental, third and fifth harmonic distribution factor for a stator with 36 slots wound for 3-phase 4 poles.

2. Attempt *any four* parts of the following : (5x4=20)

(a) Derive an expression for electromagnetic torque of a d.c. motor. Also show when power developed will be maximum.

(b) What is armature reaction ? Explain how compensating winding improves the effect of armature reaction.

(c) Draw the speed torque characteristic of d.c. shunt, series and compound motor, in one figure and compare them.

(d) A 230 V, d.c. shunt motor, takes an armature current of 3.33 A at rated voltage and at no load speed of 1000 rpm. The resistance of armature and field windings are 0.3 Ω and 160 Ω respectively. The line current at full load and at rated voltage is 40 A. Calculate the full load speed if armature reaction weakens no load flux by 4%.

(e) Explain with neat diagram three point starter for d.c. motor and explain the function of over load and no load release coil.

(f) What is meant by speed control ? Explain with circuit diagram a speed control scheme of a d.c. shunt motor by varying field flux.

3. Attempt *any four* parts of the following : (5x4=20)

(a) Explain why synchronous motor is not self - starting. How it can be started at light loads ?

(b) Discuss with suitable phasor diagram how synchronous motor operates at different power factor for a constant load.

(c) A 3-phase, 400 V, 50 Hz star connected induction motor has the following constants in ohms per phase referred to stator : $r_1 = 0.15$, $r_2 = .45$, $x_1 = 0.12$, $x_2 = 0.45$, $X_\phi = 28.5$. Fixed losses (core, friction and windage losses) = 400 W, calculate stator current and output torque at a slip of .04.

(d) Draw the torque slip characteristic of three phase induction motor and show with suitable derivations that maximum torque is independent of rotor resistances.

(e) The rotor of a 3-phase induction motor has 0.04 Ω resistance per phase and 0.2 Ω per phase standstill reactance. What external resistance is required in the rotor circuit in order to get half maximum starting torque ? Neglect stator impedance.

(f) Discuss the method of starting of slipring induction motor by inserting resistances in the rotor circuit.

4. Attempt *any two* parts of the following : (10x2=20)

(a) (i) Describe different modes of operation of a thyristor with the help of static V-I characteristics. Also define latching and holding current.

(ii) How does GTO differs from a conventional thyristor ? Give its circuit symbol and static V-I characteristic.

(b) A single phase fully controlled thyristor converter is connected to a load comprising 2 Ω resistance and 0.3 H inductance. The supply voltage is 230 V at 50 Hz. Estimate the average load voltage, average load current and input power factor for triggering angle of 30°. Assume continuous and ripple free load current.

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(c) With neat diagram, explain the method of speed control scheme of d.c. series motor using single phase semi - converter.

5. Attempt *any two* parts of the following : **(10x2=20)**

(a) Discuss with neat diagram and wave forms a step-down PWM d.c. chopper fed with R-L-Eb. load and also derive expression for minimum and maximum currents.

(b) Describe static kramar slip power recovery scheme for speed control of slip ring induction motor. Why this scheme is not applicable to squirrel cage induction motor ?

(c) Explain operation of a three phase bridge inverter under 180 mode of operation and draw wave forms of phase and line voltages of output voltage taking star connected load.

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