Printed Pages—3   **TEE—405**

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

PAPER ID : 2049 **Roll No.**

B.Tech.

FOURTH SEMESTER EXAMINATION, 2005-2006

ELECTRICAL MACHINES

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) In non-ideal transformer, we assume that the windings have non-zero resistance. A 220/110-V, 10k VA non ideal transformer has a primary winding resistance of 0.25 Ω and a secondary winding resistance of 0.06 Ω. Determine

(i) the primary and the secondary currents at rated load ;

(ii) the total equivalent resistance referred to primary and referred to secondary.

(b) Write technical notes on polarity test and Sumpner's test on transformers. Make suitable illustrations and mathematical derivations.

(c)   A 10 k VA, 440/110-V two winding transformer is connected as a step down 550/440V auto-transformer. Compare the volt - ampere rating of the auto transformer with that of the original two-winding transformer, and calculate inductively and conductively supplied powers.

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

(a)   Explain Ward-Leonard system for controlling the speed of dc motor.

(b)   What are the main causes of the voltage drop in generators ? Explain in detail voltage build up in self excited generators ·and their load characteristics.

(c)   A 50 k-W, 250-V, dc-shunt generator has the following data Ra = 0.06 Ω and Rf = 125 Ω. Calculate the induced armature emf at rated load and terminal voltage. Take 2V as the total brush contact drop.

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

(a)   With the help of rotor equivalent circuit of an induction motor, show that the power transferred magnetically from stator to rotor is given by $I_2^2 \dfrac{r}{s}$ per phase. (various notations used are standard and carry usual meaning)

(b)   Describe the development of electromagnetic torque in squirrel cage induction motor through the inter action of flux and mmf waves, when the rotor is running at a speed less than the synchronous speed.

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(c) A 3 phase squirrel cage induction motor applied voltage of 50% gives a blocked rotor current of 200% and internal starting torque of 20% of their corresponding rated values. If an auto transformer limits the starting line current to 150% of the motor full load current, compute the percentage starting torque.

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

(a) A star connected alternator is synchronised with an infinite bus of 11 kV; its steam input is then increased till its output power is 15MW. Now when its excitation emf is increased to 150%. The synchronous machine starts operating at a pf of 0.8 lagging. While neglecting armature resistance compute the sychronous reactance of the machine.

(b) Explain V-curves, their origin and significance with regard to synchronous motor.

(c) List various methods of synchronisation of three phase synchronisation of machine. Explain any two of them in detail.

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

(a) Explain principle of operation of stepper motor. What are their applications ?

(b) Explain the various possible causes of d.c. shunt generator voltage not building up.

(c) Explain two quadrant and four quadrant operations of three phase induction motors.

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