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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, 2007-08

ELECTRICAL MACHINES

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

Note : Attempt **all** questions.

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

(a) Describe the operation of a single-phase transformer, explaining clearly the functions of different parts.

(b) Explain how emf induced in a winding of transformer is related to the number of turns and the flux density in the core.

(c) Explain polarity test of single phase transformer with suitable circuit diagram.

(d) Derive an expression for saving in conductor material in an autotransformer over a two-winding transformer of same rating.

(e) What are distinguishing features of Y-Y and Y-Δ 3-phase connections ?

(f) Draw the Scott connection of transformers and mark the terminals. What are the applications of Scott connection ?

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

(a) Explain the principle of operation of dc machine. Derive the expression for the back emf in a dc motor. Briefly explain the role it plays in starting and running of the motor.

(b) A dc shunt generator running at 500 rpm delivers 50 kW at 250 V. It has armature resistance of **0.02** Ω and field winding resistance of **50** Ω. Calculate the speed of the machine running as a shunt motor and taking a power of 50 kW at 250 V.

(c) Why is it necessary to use a starter for starting a dc motor ? Draw the diagram of a three-point starter and explain the function of each component.

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

(a) Derive the equation for the torque developed by a three - phase induction motor. Draw a typical torque-slip curve and deduce the condition for maximum torque.

(b) A 4 pole, 3-phase, 50 Hz, 230 V induction motor has a delta connected stator and a star connected rotor. Each phase of rotor winding has one - fourth the number of turns of each stator. The full load speed is 1455 rpm. The rotor resistance is **0.3** Ω and rotor stand still reactance is **1.0** Ω per phase. The rotor and stator windings are similar. Stator losses are equal to 50 watts. Friction and windage losses are equal to 30 W.
Calculate :

(i) blocked rotor voltage per phase.
(ii) rotor current per phase under full load running condition.
(iii) total rotor power input at full load.
(iv) rotor gross loss at full load
(v) total mechanical power developed.

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(c) Explain why a starter is needed for starting an induction motor. With the help of a circuit diagram, explain how a star-delta starter is used for starting an induction motor.

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

(a) Explain the constructional details of a synchronous machine giving reasons for making two different types of rotors.

(b) A 3-phase, star connected alternator is rated at 1600 kVA, 13500 V. The armature effective resistance and synchronous reactance are **1.5** Ω and **30** Ω respectively per phase. Calculate the percentage regulation for a load of 1280 kW at power factor of (i) 0.8 lagging and (ii) 0.8 leading.

(c) Explain the effect of change of excitation of a synchronous motor on its :
(i) armature current and (ii) power factor and also draw phasor diagram.

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

(a) Explain the working principle of capacitor start single - phase induction motor. Why should be the auxiliary winding in a capacitor start motor be disconnected after the motor has picked up speed?

(b) Explain the operation of a stepper motor. What are its advantages and disadvantages ?

(c) What is two-phase servomotor ? Describe its construction and operation.
