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BIEEE-003

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00083 **December, 2016**

BIEEE-003 : SPECIAL ELECTRICAL MACHINES

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is allowed.*

1. Explain how the desirable features of high starting torque and low operating slip are achieved in double cage polyphase induction motors. Also discuss the relative merits and demerits of single cage and double cage induction motors. *14*

2. With the help of relevant diagrams, discuss the starting methods of the following single-phase induction motors :

   (a) Split phase induction motor

   (b) Capacitor start and capacitor run motor

   Also mention the types of capacitors used for continuous duty and short duty rating. *14*

3. (a) Explain the principle of operation of a two-phase AC servomotor.

   (b) Draw the torque-speed characteristics for various control voltages for AC servomotor.

(c) How can the direction of rotation of an AC servomotor be reversed ?

(d) Mention the applications of an AC servomotor. $4 \times 3\frac{1}{2} = 14$

4. Describe the construction of a hybrid stepper motor. Discuss the operating principle and characteristics. Mention its advantages and disadvantages. $5+5+4=14$

5. For the single-phase reluctance motor shown in the Figure 1

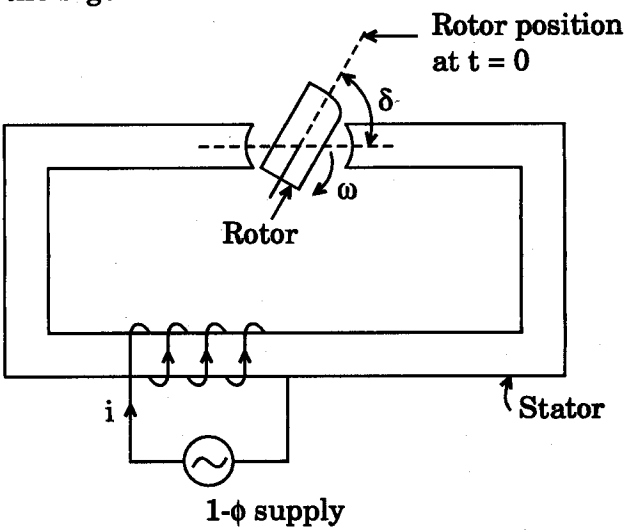

Figure 1

(a) Find the expression of the instantaneous current i in terms of reluctance, maximum flux ϕ_{max}, t and δ.

(b) If the winding resistance is neglected, develop an expression for the average electromagnetic torque in terms of reluctance and maximum flux. $2 \times 7 = 14$

6. Describe a three-phase three pulses brushless DC motor. Discuss how torque is developed in this motor. Also show that the output torque is independent of rotor angular position assuming that phase currents vary sinusoidally. *5+5+4=14*

7. (a) With relevant diagrams, explain the operation of a DC series motor when connected to an AC source. 7

   (b) A universal series motor has a resistance of 30 Ω and an inductance of 0·5 H. When connected to a 250 V DC supply and loaded to take 0·8 A, it runs at 2000 rpm. Determine the speed and the power factor when connected to a 250 V, 50 Hz AC supply and loaded to take the same current. 7

8. (a) Explain the constant torque drive scheme. Give the power distribution between the main induction motor and auxiliary equipments. 7

   (b) Describe the construction of a permanent magnet DC motor. State its advantages and disadvantages. *4+3=7*