

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME Semester –III Examination Dec. - 2011**

**Subject code: 730704**

**Date: 08/12/2011**

**Subject Name: Advanced Electrical Drives**

**Time: 10.30 am – 01.00 pm**

**Total Marks: 70**

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Support your answers with proper diagrams.

- Q.1** (a) Explain the basics construction of Brushless DC motor. Also explain how BLDC motor rotates. **07**
- (b) Obtain the expression of torque in terms of Flux Linkages and d-q currents for Synchronous Rotating reference frame. **07**

- Q.2** (a) Describe difference between scalar and vector control method of electrical drive. Also explain the vector control principal for AC motor drive. **07**
- (b) Explain the Inverter Control strategy to run BLDC motor. **07**  
Only prepare lookup table to run BLDC motor in clockwise and anticlockwise direction.

**OR**

- (b) Develop the mathematical model of Induction Motor in arbitrary reference frame. **07**

- Q.3** (a) Explain the indirect vector control of Induction motor with open loop flux control. Explain the each block in detail. **07**
- (b) Explain the Optical Encoder to sense the rotor position of Permanent Magnet Synchronous Motor. **07**

**OR**

- Q.3** (a) Enlist methods of flux vector estimation in direct vector control and discuss the current model in detail. **07**
- (b) Draw the block diagram of sensorless vector control of PMSM. And explain the operation of this in detail. **07**

- Q.4** (a) The transformation  $K_s$  is used to transform the variables  $f_{abc}$  to  $F_{dq0}$  in arbitrary reference frame. **07**  
Prove that  $(K_s)^T = (K_s)^{-1}$ . The transformation matrix  $K_s$  is given as below.

$$\sqrt{\frac{2}{3}} \begin{bmatrix} \cos \theta & \cos \left( \theta - \frac{2\pi}{3} \right) & \cos \left( \theta + \frac{2\pi}{3} \right) \\ \sin \theta & \sin \left( \theta - \frac{2\pi}{3} \right) & \sin \left( \theta + \frac{2\pi}{3} \right) \\ 1/\sqrt{2} & 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}$$

- (b) Draw the inductance profile of Switched Reluctance Motor. Explain the each step of this profile in detail. 07

**OR**

- Q.4** (a) Explain the space vector theory for AC machine. 07  
(b) Show different Converters for Switched Reluctance Motor Drives and explain freewheeling and regeneration capability converter in detail. 07

- Q.5** (a) Derive winding inductance and voltage equations for three phase symmetrical induction motor. 07  
(b) Write a short not on Linear Induction Motor. 07

**OR**

- Q.5** (a) Discuss the vector control strategies for Synchronous Motor. 07  
(b) Write a short note on Hysteresis Motor. 07

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