

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. IST Semester–Remedial Examination – July- 2011****Subject code: 710709N****Subject Name: Electrical Drives****Date: 12/07/2011****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.

- Q.1** (a) Draw the speed torque characteristics of an Induction motor. Show the portion of the characteristic which is usually considered as unstable. Discuss the operation on this portion (generally referred as unstable) with following loads (i) constant load torque and (ii) fan type load. **07**
- (b) Discuss the variation of speed-torque characteristics of an Induction motor when fed by VVVF source. Show how the operation is similar to that of armature voltage control (below the base speed) and field control (above the base speed) for a DC motor. **07**
- Q.2** (a) Derive an expression for the critical speed ω_{mc} of a separately excited DC motor fed from a single-phase half-controlled rectifier.. **07**
- (b) A separately excited DC machine is fed from a 1-phase fully controlled rectifier bridge. Draw the waveforms representing the output voltage and current of the converter (inputs to machine) when the machine is operating in motoring mode. Discuss these modes in brief. **07**
- OR**
- (b) Draw and explain any one continuous and any one discontinuous modes of operation of a 3-Phase fully controlled rectifier fed dc motor. **07**
- Q.3** (a) Explain the non-simultaneous control mode operation of a dual converter. Hence, discuss the four quadrant closed-loop control of a DC separately excited motor employing the dual converter. **07**
- (b) Draw and explain the speed-torque curves of a 3-phase fully-controlled rectifier drive. Also find the expression for no-load speed. List the assumptions if any. **07**
- OR**
- Q.3** (a) Write a brief note on the various current control schemes used with DC motor. **07**
- (b) A 230V, 500 rpm, 90A separately excited dc motor has an armature resistance of 0.115 ohm and an inductance of 11mH. The motor is controlled by a chopper circuit with a frequency of 400 Hz. If the motor is operating in regenerating mode, find the motor speed and the regenerated power at the rated current and a duty ratio of 0.5. **07**
- Q.4** (a) Derive the following equation for a current fed induction motor: **07**

$$T = \frac{3}{\omega_{ms}} \left[\frac{I_s^2 X_m^2 R'_r / s}{\left(\frac{R'_r}{s} \right)^2 + (X'_r + X_m)^2} \right]$$

where the notations have usual meanings.

- (b) Discuss the method of speed control of a slip ring induction motor by injecting a voltage in the rotor circuit. **07**

OR

- Q.4** (a) With neat diagram explain any one closed-loop control scheme for controlling the speed of a VSI fed induction motor. **07**
- (b) Draw the speed torque characteristics of an Induction motor under following cases: (i) when fed by voltage source and (ii) when fed by current source. On which portions of the characteristics the motor should be operated under these two cases? Why? **07**

- Q.5** (a) Write a brief note on modified Kramer drive. **07**
- (b) A 3-phase 6000-V, 6 pole, 50 Hz, 1000 kW Y-connected wound field synchronous motor has the following parameters **07**
 $X_m = 30\Omega$, $X_{sl} = 5\Omega$, $R_s = 1\Omega$, $n = 2$
When operating at rated power and unity power factor, calculate (i) the field current at full load (ii) torque angle at full load and (ii) the pull out torque. Neglect friction, windage and core loss.

OR

- Q.5** (a) Write a brief note on static Static Scherbius drive. **07**
- (b) What does one mean by coefficient of adhesion in context to traction? Discuss the factors that affect the coefficient of adhesion. **07**
