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- N.B. : (1) Question No. 1 is compulsory.
 (2) Attempt any four questions from remaining six questions.
 (3) Assume suitable data if necessary.

MASOBI
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B. E. (E) VIII Sem Drives & Control

1. (a) Explain the four quadrant operation of a D.C. separately excited motor using 3-phase dual converter. 10
 (b) Explain the block diagram of an electrical drive. What are the functions of power modulator ? Explain. 10

2. (a) Explain the following methods of speed control of three-phase induction motors with neat sketches and characteristics : 10
 (i) Slip power control method (ii) V/F control method.
 (b) A 480 volt, 2-pole, 60 Hz, Star connected induction motor has an inductive reactance of 4 ohm and stator resistance of 0.2 ohm. The rotor resistance referred to stator is 0.3 ohm. The motor is driving a constant torque load of 60 N-m, at a speed of 3500 rpm. Assume that the torque includes the rotational components.
 Compute : (i) The motor speed at a slip = 0.025
 (ii) The starting current at 60 Hz and at 50 Hz. 10

3. (a) What are the different methods for improvement of power factor related to (A.C. to D.C.) converters ? Explain the extinction angle control and symmetrical angle control method using circuit diagrams and related waveforms. 10
 (b) The temperature rise of motor when operating for 25 min on full load is 25°C and becomes 40°C when the motor operates for another 25 min on the same load. Determine heating time constant and steady state temperature rise. 10

4. (a) A drive has following equations for motor and load torques $T = (1 + 2 W_m)$ and $T_e = \sqrt[3]{W_m}$ obtain the equilibrium points and determine their steady state stability. 10
 (b) Explain in detail the working of brushless D.C. motor. 10

5. (a) What do you mean by "Scalar-Control" of I. M. and "Vector-Control" of I.M. ? Explain the indirect vector-control with the help of suitable block diagram and phasor diagram. 12
 (b) A 3-phase, star connected, 60 Hz, 4-pole I.M. has the following parameters : 8
 $R_s = R_r = 0.024$; $X_s = X_r = 0.12$ ohm. Motor is controlled by variable frequency control with a constant (V/F) ratio. For an operating frequency of 12 Hz.
 Calculate :
 (i) The breakdown torque as a ratio of its value at the rated frequency for both motoring and braking mode.
 (ii) Starting torque and rotor current in terms of their values at the rated frequency.

6. Write detail notes on (any two) :- 20
 (a) Thermal model of motor for heating and cooling.
 (b) Load equalization
 (c) Variable reluctance stepper motor.

7. Write short notes on (any two) :- 20
 (a) Energy efficient motors
 (b) PLL control of D.C. drives
 (c) Synchronous motor variable speed drives.