PART - A

Answer all questions from Part - A.

1. What are the different components of load torque? Explain.

2. Draw the circuit diagram and waveforms of a single phase half controlled rectifier fed dc motor drive.

3. Why stator voltage control is an inefficient method for speed control of an induction motor?

4. Compare between a CSI fed and VSI fed induction motor drives.

5. Write any four advantages and disadvantages of a stepper motor. (5x4=20 Marks)

PART - B

Answer any one full question from each Module:

Module – I

6. a) Explain the steady state stability criteria for a motor load combination.

   b) A motor drives two loads. One has rotational motion. It is coupled to the motor through a reduction gear with \( a = 0.2 \) and efficiency of 90\%. The load has a moment of inertia of 10 kg\( \cdot \)m\(^2\) and a torque of 15 N-m. Other load has translational motion and consists of 500 kg weight to be lifted up with a uniform speed of 1.5 m/s. Coupling between this load and motor has an efficiency of 85\%. Motor has an inertia of 0.7 kg\( \cdot \)m\(^2\) and run at a constant speed of 1500 rpm. Determine equivalent inertia referred to the motor shaft and power developed by the motor.

   OR

   P.T.O.
7. a) With the help of block diagrams, explain the operation of a closed loop speed control scheme for a dc motor drive for speed control above and below base speed.  

b) Explain the operation of a bridge type single phase to single phase step up cycloconverter.

Module – II

8. a) Draw the circuit diagram and explain the operation of a four quadrant chopper fed dc motor.  

b) Draw and explain the speed torque characteristics of a single phase fully controlled rectifier fed separately excited dc motor.  

OR

9. a) A 230 V, 1000 rpm 15 A separately excited motor has an armature resistance of 1.2 \( \Omega \). Motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. The braking resistance has a value of 30 \( \Omega \). (i) Calculate duty ratio of chopper for rated torque and the speed of 800 rpm. (ii) What will be the motor speed for duty ratio of 0.6 and motor torque equal to its rated torque?  

b) With the help of circuit diagram and waveforms, explain how the speed of a separately excited dc motor can be controlled using a single phase full controlled bridge converter, when it is operating under continuous conduction mode of operation. Also derive an expression for average armature voltage.

Module – III

10. a) Draw the circuit diagram and explain the slip power recovery scheme using static Scherbius drive.  

b) A 440 V, 3 phase, 50 Hz, 6 pole, 945 rpm delta connected induction motor has the following parameters referred to stator:  
\[ R_s = 2 \ \Omega \ , \ R'_s = 5 \ \Omega \ , \ X_s = 3 \ \Omega \ , \ X'_s = 5 \ \Omega \ , \ X_m = 60 \ \Omega \ , \]  
when driving a fan load at rated voltage and rated current. Motor speed is controlled by stator voltage control. Find motor terminal voltage, current and torque at 800 rpm.  

OR
11. a) Describe the current source inverter circuit used for speed control of an induction motor.
     b) Explain the static rotor resistance control for the speed control of induction motor.

Module – IV

12. a) Explain the unipolar and bipolar drive circuits for stepper motors.
     b) Explain the measures that could be taken to conserve energy in electrical drives.

OR

13. a) Discuss the operation of dc traction drive employing voltage source inverter fed induction motor drive.
     b) With the help of suitable diagrams, explain the operation and control requirements of a switched reluctance motor.