

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examination

Semester: 8**Subject Code: 03106480****Subject Name: Industrial Electrical Drives - II****Date: 06/05/2019****Time: 10.30 am to 1.00 pm****Total Marks: 60****Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (All are compulsory) (Each of one mark) (15)

1. The advantage of a synchronous motor in addition to its constant speed is
 - (A) High power factor
 - (B) better efficiency
 - (C) Lower cost
 - (D) all of the above.
2. An induction motor when loaded from no load to full load, its slip also varies from $s=1$ to $s=0$. Then the torques in the low slip region and in high slip region is
 - (A) Both are directly proportional to the slip
 - (B) Both are inversely proportional to the slip
 - (C) Directly proportional to the slip, inversely proportional to the slip
 - (D) Independent of slip, proportional to the slip
3. The concept of V/f control of inverters driving induction motors results in
 - (A) constant torque operation
 - (B) speed reversal
 - (C) reduced magnetic loss
 - (D) harmonic elimination
4. If a 3-phase 350V, 50Hz squirrel-cage induction motor is run at 55 Hz supply, then
 1. Starting torque will increase
 2. Maximum torque will increase
 3. Maximum torque will remain same
 4. Starting torque will decrease
 5. Operating speed will rise
 - (A) 3, 4, 5
 - (B) 1, 3, 5
 - (C) 1, 2
 - (D) 5
5. To control the speed of an induction motor, the supply frequency is reduced by 10%. For the same magnetizing current to remain constant, the supply voltage must be
 - (A) reduced by 20%
 - (B) reduced by 10%
 - (C) increased by 10%
 - (D) increased by 20%
6. A 4 pole, 50 Hz, wound rotor inductor is supplied at rated voltage and frequency with slip ring open circuited. If the rotor is driven by an external means at 1500 rpm opposite to the direction of stator field, the frequency of voltage across slip rings will be_____.
7. A 4 pole, 3 phase, 50 Hz star connected induction motor has a full load slip of 5%. Then full load speed of the motor is/are _____ RPM.
8. When applied rated voltage per phase is reduce to one half, the starting torque of three phase squirrel cage induction motor becomes_____ of the initial value.
9. In pulse width modulated inverters, the output voltage is controlled by controlling the _____.
10. For a synchronous motor, the breakdown torque will be proportional to_____.
11. The value of slip for motoring, generating and braking region respectively are?
12. "By adding external resistance to rotor till it becomes equal to rotor reactance, the maximum torque can be achieved at start". This statement holds for Slip ring induction motor. (True/False).
13. Are Variable Frequency Drives Phase Sensitive?
14. Which Switching techniques used in the phase – current control loop of vector control of Inverter fed induction motor drives?
 Ans. PWM, Hysteresis, Space-Vector Modulation.
15. A change of variables is often used to reduce the complexity of the differential equations (voltage equations) that describe the behavior of electric machines. All known real transformations are obtained from the general transformation by simply assigning the speed of the rotation are known as a? (Reference Frames/FOC/Vector Control).

- Q.2 Answer the following questions. (Attempt any three) (15)**
- A) Draw and explain all three region of 3 – phase induction motor Torque – Speed characteristics with different parameters (load torque direction, motor torque direction, speed direction, sleep etc.)
- A) Discuss the operation of induction motor on unbalanced source voltage & single phasing.
- A) Sketch and describe the mechanical characteristics of a three phase induction motor with V/f method
- B) A 1 kW, 415 V, 50 Hz, 4 pole, star connected squirrel cage induction motor is connected with mechanical load. Then find
- (i) Stator flux speed and rotor speed at 0.90 slip.
- (ii) If supply voltage is 380 V at remain same supply frequency then find the Torque at motor parameters referred to stator are $R_s = 1 \Omega$, $X_s = 3 \Omega$, $R_r = 3 \Omega$ and $X'_r = 3 \Omega$, also discuss about rotor speed.
- Q.3 A) Draw the circuit diagram and explain operation of static scherbius drive. (07)**
- B) Discuss the suitability of different reference frames for the induction motor in vector control studies with using vector diagram of induction motor. (08)
- OR**
- B) A 2.5 kW, 400 V, 50 Hz, 4 pole, 1440 rpm, Star connected squirrel cage motor is operating in regenerative braking operation of inverter fed induction motor drive. The parameters of induction motor referred to stator are
- $$R_s = 2 \Omega, X_s = 5 \Omega, R'_r = 5 \Omega \text{ and } X'_r = 5 \Omega$$
- Calculate (i) Speed for the frequency of 30 Hz and 60 % of full load torque.
- (ii) Frequency or a speed of 1000 rpm and full load torque.
- (iii) Torque for a frequency 40 Hz and speed of 1240 rpm.
- Q.4 A) Discuss different control strategies of synchronous motor with reference to its characteristics. (07)**
- OR**
- A) A 2.5 kW, 400 V, 50 Hz, 4 pole, 1440 rpm. Star connected squirrel cage induction motor has following parameters referred to stator as:
- $$R_s = 2 \Omega, X_s = 5 \Omega, R'_r = 5 \Omega \text{ and } X'_r = 5 \Omega$$
- The motor is controlled by a voltage source inverter at constant (V/f) ratio. Inverter allows frequency variation from 10 to 50 Hz.
- (i) Obtain a plot between the break down torque and frequency.
- (ii) Calculate starting torque and current of this drive as a ratio of their values when motor is started at rated voltage and frequency.
- B) With closed loop block diagram explain direct vector control scheme. (08)