


**SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR**

Siddharth Nagar, Narayanavanam Road – 517583

**QUESTION BANK (DESCRIPTIVE)**
**Subject with Code :**

DIGITAL CONTROL OF POWER ELECTRONIC AND DRIVE SYSTEMS (20EE2113)

**Course & Branch:** M.Tech - PE

**Year & Sem:** I M.Tech & II-Sem

**Regulation:** R20

**UNIT –I**
**Introduction to Induction motor Drives**

1. Explain the construction and principle of operation of induction machine. Discuss on production of torque in a 3 $\Phi$  Induction motor? [L2][CO1][12M]
2. Derive the steady state performance equations and Explain Torque – Speed characteristics of IM Drive? [L2][CO1][12M]
  - (i) Find the efficiency of an induction motor operating at full load. The machine details are given in the following, [L3][CO1][12M]  
 2000 hp, 2300V, 3 phase, star connected, 4 pole, 60Hz, Full load slip = 0.03746  
 $R_s = 0.02\Omega$ ;  $R_r = 0.12\Omega$ ;  $R_c = 451.2\Omega$ ;  $X_m = 50 \Omega$ ;  $X_{ls} = X_{lr} = 0.32 \Omega$ .
  - (ii) The line power factor needs to be improved to unity by installing capacitors at the input terminals of the induction motor. Calculate the per-phase capacitance required to obtain a line power factor of unity.
3. Explain the induction motor characteristics in constant torque and field weakening region? [L2][CO1][12M]
4. Explain any one control strategy to control the speed of inverter- driven induction motor? [L2][CO1][12M]
5. Explain induction motor characteristics in field weakening regions? [L2][CO1][12M]
6. Explain Speed, Torque characteristics of an induction motor with variable voltage operation? [L2][CO1][12M]
7. Explain Speed, Torque characteristics of an induction motor with variable frequency operation? [L2][CO1][12M]
8. Explain torque production in an induction motor ? [L2][CO1][12M]
9. Explain induction motor characteristics in constant torque regions? [L2][CO1][12M]
10. Explain the variable stator current operation of induction motor [L2][CO1][12M]

**UNIT –II****Scalar control of Induction motor drives**

1. Discuss the operation of voltage source inverter fed induction machine with relevant wave forms and circuit diagram? [L2][CO2][12M]
2. Derive the relationship between voltage and frequency in case of constant V/f controlled IM? [L3][CO2][12M]
3. Explain how speed and flux controlled in CSI fed IM Drive operating under V/f control? [L2][CO2][12M]
4. An Induction Motor has the following ratings and parameters: [L3][CO2][12M]  
 40hp,460v,3 phase, star connected, 4 pole, 60Hz,  
 $R_s = 0.22\Omega$ ;  $R_r = 0.209\Omega$ ;  $L_m = 50$  H;  $L_s = 0.0425$  H;  $L_r = 0.043$ H,  $B=0$   
 Load torque =  $T_1 = 0$ ,  $J = 0.124\text{kg-m}^2$ ,  $a = 2$   
 The statically stable slip region is required to be doubled. That can be achieved by connecting external resistance in the rotor phases. Calculate approximately the value of external rotor resistance/phase to be added?
5. Find the relation between the dc link voltage and the stator frequency for the closed loop implementation of a volts/Hz inverter-fed induction motor drive. The motor parameters are as follows: [L3][CO2][12M]  
 5 HP, 200 V, 60 Hz, 9 phase, star connected 4 pole, 0.86 pf and 0.82 efficiency.  
 $R_s = 0.277 \Omega$ ,  $R_r = 0.183 \Omega$ ,  $X_m = 20.30 \Omega$ ,  $X_{ls} = 0.554 \Omega$ ,  $X_{lr} = 0.841 \Omega$ .
6. Explain the efficiency optimization control by flux program? [L2][CO2][12M]
7. Explain Volts/Hz control of Current-fed inverter drive for induction motor? [L2][CO2][12M]
8. Explain in detail Speed and flux control in Current-Fed inverter drive for Induction motor drive? [L2][CO2][12M]
9. Differentiate between current fed inverter control and voltage fed inverter control? [L2][CO2][12M]
10. Draw the functional block diagram for current fed inverter control and explain in detail? [L1][CO2][12M]

**UNIT –III****Slip power recovery Induction motor drives**

1. Explain with relevant circuit diagram for different modes the operation of static scherbius drive?  
[L2][CO3][12M]
2. A static Kramer drive is used for speed control of a 4-pole SRIM fed from 3-phase, 415V, and 50Hz supply. The inverter is connected directly to the supply. If the motor is required to operate at 1200rpm, find the firing advance angle of inverter. Voltage across the open-circuited slip rings at stand still is 700V. Allow a voltage drop of 0.7V and 1.5V across each of the diodes and thyristors respectively. Inductor drop is neglected?  
[L3][CO3][12M]
3. Describe the static Kramer drive for speed control of 3-phase Slipring IM. Draw and explain the speed-torque characteristics of static Kramer drive?  
[L2][CO3][12M]
4. Describe a static Kramer drive and show that the slip  $s$  at which it operates is given by  
$$S = - (a_T/a) \cos \alpha$$
  
[L2][CO3][12M]
5. With the help of steady-state equivalent circuit, explain the principle of slip-energy recovery scheme in case of induction motor operating at above and below synchronous speed. Also derive a relation between slip and firing angle?  
[L2][CO3][12M]
6. Explain with relevant circuit diagram for different modes the operation of static Kramer drive?  
[L2][CO3][12M]
7. Differentiate between sinusoidal PM machines and trapezoidal PM machines?  
[L2][CO4][12M]
8. Draw the equivalent circuit of wound field induction machine and derive the expression for developed torque?  
[L1][CO4][12M]
9. Draw and explain the characteristics of salient pole Synchronous Motor?  
[L1][CO4][12M]
10. Explain of principle of operation of the sinusoidal and trapezoidal PM synchronous drives?  
[L2][CO4][12M]

**UNIT –IV****Control of Wound-field Synchronous motor and SRM drives**

1. Explain the brush and brushless DC excitation of the wound-field synchronous motor? [L2][CO5][12M]
2. Explain the vector control of cyclo-converter fed SRM drive? [L2][CO5][12M]
3. Derive the fast torque response of the SRM drives? [L3][CO5][12M]
4. Explain the different control techniques of the SRM drives briefly? [L2][CO5][12M]
5. Explain torque Production in the variable reluctance motor? [L2][CO5][12M]
6. Explain the brush and brushless DC excitation of the wound-field synchronous motor? [L2][CO5][12M]
7. Explain scalar control of cycloconverter drives? [L2][CO5][12M]
8. Explain current vector control of synchronous reluctance drives? [L2][CO5][12M]
9. Derive the expression for maximum torque/ampere control for SRM drive? [L3][CO5][12M]
10. Explain maximum power factor control for SRM drive? [L2][CO5][12M]

**UNIT –V****Control of PM Synchronous motor and BLDC drives**

1. Explain Flux weakening operation of permanent magnet synchronous motor? [L2][CO6][12M]
2. Explain the control strategies of PMSM at Zero direct axis current control? [L2][CO6][12M]
3. Explain the direct flux weakening algorithm to obtain the maximum speed for the synchronous motor drive? [L2][CO6][12M]
4. Explain Flux Weakening controller of permanent magnet synchronous motor? [L2][CO6][12M]
5. Derive the voltage and current modelling equations of PM Brushless DC Motor? [L3][CO6][12M]
6. Explain the half wave operator of PM brushless DC Motor with the split-supply controller? [L2][CO6][12M]
7. Explain the merits and demerits of the PM Brushless DC Motor? [L2][CO6][12M]
8. The parameters of a star-connected, 1.5-kw, 9.2-A, 1500-rpm, 9.55-N-m/(rad/sec), 3-phase PMSM drive are as follows [L3][CO6][12M]  
 $R_s = 1.4\Omega$ ;  $L_d = 0.0056\text{H}$ ;  $L_q = 0.009\text{H}$ ;  $\lambda_{af} = 0.1546\text{Wb-Turn}$ ;  $B_t = 0.01\text{N.m/rad/sec}$ ,  
 $J = 0.006\text{kg-m}^2$ ,  $P = 6$ ,  $f_c = 2\text{ kHz}$ ;  $V_{cm} = 10\text{V}$ ;  $H_w = 0.05\text{V/V}$ ;  $H_c = 0.8\text{V/A}$ ,  $V_{dc} = 285\text{V}$ .
9. Determine the maximum speed of the PMSM drive system? [L3][CO6][12M]
10. Explain the Vector control of permanent magnet synchronous Motor? [L2][CO6][12M]

Prepared by Dr.K.Divakar

