



**SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR**

Siddharth Nagar, Narayanavanam Road – 517583

**QUESTION BANK (DESCRIPTIVE)**

**Subject with Code : PEAC (16EE4307)**

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

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

**Regulation: R16**

**UNIT –I**

**Introduction to AC drives**

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

**UNIT –II****Control of Induction motor drives at stator side and rotor side**

1. Discuss the operation of voltage source inverter fed induction machine with relevant wave forms and circuit diagram? 10M
2. Derive the relationship between voltage and frequency in case of constant V/f controlled IM? 10M
3. Explain how speed and flux controlled in CSI fed IM Drive operating under V/f control? 10M
4. An Induction Motor has the following ratings and parameters:  
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? 10M
5. Explain with relevant circuit diagram for different modes the operation of static scherbius drive? 10M
6. 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? 10M
7. Describe the static Kramer drive for speed control of 3-phase Slipring IM. Draw and explain the speed-torque characteristics of static Kramer drive? 10M
8. Describe a static Kramer drive and show that the slip  $s$  at which it operates is given by  
$$S = - (a_r/a)\cos\alpha$$
 10M
9. 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? 10M
10. 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:  
5 HP, 200 V, 60 Hz, 9 phase, star connected 4 pole, 0.86 pf and 0.82 efficiency.  
 $R_s = 0.277 \Omega$ ,  $R_r = 0.183 \Omega$ ,  $X_m = 20.30 \Omega$ ,  $X_{ls} = 0.554 \Omega$ ,  $X_{lr} = 0.841 \Omega$  . 10M

**UNIT –III****Vector control of Induction motor Drives and Control of Synchronous motor Drives**

1. Explain the principle of operation of vector controlled induction machine drive? 10M
2. Describe the indirect vector control scheme with necessary block diagrams? 10M
3. Discuss in depth the following vector control methods of induction machine
  - a) Self tuning regulator. 5M
  - b) Model referencing control. 5M
4. Explain direct method of Vector control and Adaptive control principles? 10M
5. Explain the operation of wound field synchronous motor with neat diagram? 10M
6. Draw the equivalent circuit of the wound field synchronous motor and deduce the expression for torque? 10M
7. Draw and explain the characteristics of salient pole Synchronous Motor? 10M
8. Explain of principle of operation of the sinusoidal and trapezoidal PM synchronous drives? 10M
9. Explain flux and torque control in case of direct vector controlled induction motor drive with space vector modulation? 10M
10. Explain the different control strategies for synchronous motor drives? 10M

**UNIT -IV****Controllers**

1. Explain Flux weakening operation of permanent magnet synchronous motor? 10M
2. Explain the control strategies of PMSM at Zero direct axis current control? 10M
3. Design the speed controller for PMSM drive? 10M
4. Explain the direct flux weakening algorithm to obtain the maximum speed for the synchronous motor drive? 10M
5. Draw the simplified speed controller block diagram? 10M
6. Explain Flux Weakening controller of permanent magnet synchronous motor? 10M
7. Explain Indirect flux weakening of synchronous motor drive? 10M
8. Explain Constant torque mode controller of permanent magnet synchronous motor? 10M
9. Explain Speed control scheme of permanent magnet synchronous motor? 10M
10. Explain Implementation strategy of permanent magnet synchronous motor? 10M

**UNIT -V****Variable Reluctance motor Drive and Brushless DC motor Drives**

1. Derive the voltage and current modelling equations of PM Brushless DC Motor? 10M
2. Design the current and speed controllers for BLDC Drive? 10M
3. Explain the half wave operator of PM brushless DC Motor with the split-supply controller? 10M
4. Explain the merits and demerits of the PM Brushless DC Motor? 10M
5. 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  
 $R_s = 1.4\Omega$ ;  $L_d = 0.0056H$ ;  $L_q = 0.009H$ ;  $\lambda_{af} = 0.1546Wb\text{-Turn}$ ;  $B_t = 0.01N.m/rad/sec$ ,  
 $J = 0.006kg\text{-m}^2$ ,  $P = 6$ ,  $f_c = 2\text{ kHz}$ ;  $V_{cm} = 10V$ ;  $H_w = 0.05V/V$ ;  $H_c = 0.8V/A$ ,  $V_{dc} = 285V$ .  
 Determine the maximum speed of the PMSM drive system? 10M
6. Explain the brush and brushless DC excitation of the wound-field synchronous motor? 10M
7. Explain the scalar and vector control of cyclo-converter fed SRM drive? 10M
8. Derive the fast torque response of the SRM drives? 10M
9. Explain the different control techniques of the SRM drives briefly? 10M
10. Explain torque Production in the variable reluctance motor? 10M

Prepared by: **S.MUNISEKHAR**