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**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**  
**(AUTONOMOUS)**  
**I Year M.Tech II Semester (R16) Regular Examinations May/June 2017**  
**POWER ELECTRONIC CONTROL OF AC DRIVES**  
 (Power Electronics)  
 (For Students admitted in 2016 only)

Time: 3 hours

Max. Marks: 60

(Answer all Five Units 5 X 12 =60 Marks)

**UNIT-I**

- Q.1** a. Derive the steady state performance equations and Explain Torque – Speed characteristics of IM Drive? 6M
- b. 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  $R_s = 0.02\Omega$ ;  $R_r = 0.12\Omega$ ;  $R_c = 451.2\Omega$ ;  $X_m = 50 \Omega$ ;  $X_{ls} = X_{lr} = 0.32 \Omega$ . 6M

**OR**

- Q.2** a. Explain Speed, Torque characteristics of an induction motor with variable frequency operation? 6M
- b. Explain torque production in an induction motor? 6M

**UNIT-II**

- Q.3** a. Discuss the operation of voltage source inverter fed induction machine with relevant circuit diagram 6M
- b. Derive the relationship between voltage and frequency in case of constant V/f controlled IM. 6M

**OR**

- Q.4** 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 phases, star connected 4 pole, 0.86 pf and 0.82 efficiency.  $R_S = 0.277 \Omega$ ,  $R_r = 0.183 \Omega$ ,  $X_m = 20.30 \Omega$ ,  $X_{ls} = 0.554 \Omega$ ,  $X_{lr} = 0.841 \Omega$ . 12M

**UNIT-III**

- Q.5** a. Explain the operation of wound field synchronous motor with neat diagram? 6M
- b. Draw the equivalent circuit of the wound field synchronous motor and deduce the expression for torque? 6M

**OR**

- Q.6** a. Explain flux and torque control in case of direct vector controlled induction motor drive with space vector modulation? 6M
- b. Explain the different control strategies for synchronous motor drives? 6M

**UNIT-IV**

- Q.7** a. Explain Flux weakening operation of permanent magnet synchronous motor? 6M  
b. Explain the control strategies of PMSM at Zero direct axis current control? 6M

**OR**

- Q.8** a. Draw the simplified speed controller block diagram? 6M  
b. Explain Flux Weakening controller of permanent magnet synchronous motor? 6M

**UNIT-V**

- Q.9** a. Explain the merits and demerits of the PM Brushless DC Motor? 4M  
b. 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  $R_s = 1.4\Omega$ ;  $L_d = 0.0056H$ ;  $L_q = 0.009H$ ;  $\lambda_{af} = 0.1546Wb\text{-Turn}$ ;  $B_t = 0.01N.m/rad/sec$ ,  $J = 0.006kg\text{-m}^2$ ,  $P = 6$ ,  $f_c = 2\text{ kHz}$ ;  $V_{cm} = 10V$ ;  $H_w = 0.05V/V$ ;  $H_c = 0.8V/A$ ,  $V_{dc} = 285V$  8M

**OR**

- Q.10** a. Explain the brush and brushless DC excitation of the wound-field synchronous motor? 6M  
a. Explain the scalar and vector control of cyclo-converter fed SRM drive? 6M

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