Registration No:

Total Number of Pages:02

M.Tech.
P1IPBC03

1st Semester Regular Examination 2017-18
POWER CONVERSION DEVICES AND DRIVES
BRANCH: INDUS. POWER CONTROL AND DRIVES
Time: 3 Hours
Max Marks: 100
Q.CODE: B940
Answer Question No.1 which is compulsory and any FOUR from the rest.
The figures in the right hand margin indicate marks.

Q1   **Answer the following questions:** *Short answer type*   **(2 x 10)**
a) What is the need of reference frame with regard to machine modeling?
b) Draw a schematic diagram for Kron's Primitive machine.
c) Variable frequency control of induction motor yields high torque to current ratio during starting. Why?
d) Give the stability criteria of drive.
e) Find the average output voltage of a single phase full converter feeding a resistive load of R= 10 Ω and for a firing angle of 60°. The supply voltage is single phase 200V,50 Hz.
f) What is line commutated inverter?
g) How is the reactive power of a 1-Ph fully controlled rectifier affected by the firing angle?
h) What is four quadrant dc-dc converter? Give its circuit diagram
i) What is soft starting of induction motor?
j) What is the impact of non sinusoidal excitation on induction motor?

Q2 a) Derive the dynamic modeling of 3-phase synchronous machine under three phase fault and discuss the transient torque characteristics.   **(10)**
b) Derive and represent the modeling of PM Synchronous motor with relevant block diagram and equations.   **(10)**

Q3 a) Draw the steady state equivalent circuit of 3-phase induction motor in the d_e-q_e reference frame and represent the relevant equations.   **(10)**
b) Give the dynamic modeling of induction machine explaining the relevant differential equations. What are its shortcomings from the view point of losses?   **(10)**

Q4 a) A single phase half wave controlled rectifier supplies a R-L load with R=20Ω and L=64 mH. Supply voltage is 1-Phase AC 230 V, 50 Hz. The firing angle of the thyristor is 45°. Compute the following
i. Average value of output voltage and load current.
ii. RMS value of output voltage and load current
iii. Power delivered to load   **(10)**
b) Draw the output voltage of a three phase semi converter for a firing angle of 30° assuming R-L load with continuous ripple free load current having amplitude of 20 A. The three phase AC supply voltage is 400V, 50 Hz. Also find out the RMS value of source current and thyristor current.   **(10)**

Q5 a) Explain the circulating current mode dual converter operation with relevant circuit diagram and waveforms. Give its advantages over non circulating current mode dual converter operation.   **(10)**
b) A single phase 220V, 1 kW electric room heater is connected across 220V, 50 Hz ac supply through a triac. For a firing delay angle of 90°, calculate the power dissipated by the heater element.   **(10)**

Q6 a) Explain the speed control of 3-phase induction motor by stator voltage control method with relevant circuit diagram and waveforms. What are its limitations? **(10)**

b) A 440V , 50 Hz, 4 pole,1420 rpm, delta connected squirrel cage induction motor has the following parameters **(10)**

R_s =0.35 Ω, $R_r^{'}$ =0.4 Ω , X_s =0.7Ω, $X_r^{'}$ =0.8 Ω

The motor is fed from a voltage source inverter. The drive is operated with a constant (V/f) control up to 50 Hz and at rated voltage above 50 Hz. Calculate the breakdown torques for a frequency of 75 Hz both for motoring and braking operations.

Q7 a) With relevant block diagram explain the working principle of variable frequency PWM- Voltage Source Inverter induction motor drive, **(10)**

b) With neat circuit diagram explain the working of static Cramer drive. Enumerate its advantages and disadvantages. **(10)**