UPES

Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program/course:BTECH ICE | **Semester – VII**
Subject: Industrial Drives | **Marks: 100**
Code :PSEG-424 | **Duration: 3 Hrs**
No. of page/s:2

SECTION – A

Note: All questions are compulsory **(5 x 4M = 20 M)**

Q1) [CO1]Explain the importance of energy conservation in electrical drives?
Q2)[CO1]Explain the advantages of improvement of power factor with respect to drives.
Q3)[CO2]Justify, why stator voltage control is an inefficient method of induction motor speed control?
Q4) [CO3]Chopper control drive have more advantages over phase controlled drive. Justify.
Q5) [CO1]State and explain the various functions of converter in an electrical drive system.

SECTION – B

Note: Attempt all the following questions **(4 x 10M = 40 M)**

Q6) [CO2]Explain how brushless dc motor (BLDC)operated when employed from a Voltage Source Inverter(VSI) and draw the variation of Induced voltages , Phase currents and torque waveforms of a BLDC motor

Q7)[CO2]Explain how below mentioned breaking techniques are employed for an separately exited dc motor with the help of slip-torque characteristics.

i. Regenerative braking
ii. Dynamic braking

Q8)[C03]In the case of fully regenerative electric variable speed drives (VSDs) offer a rapid dynamic motoring and regenerative braking in both forward and reverse directions. Explain how dynamic motoring and braking can be achieved in the case of dc motor drive with the help of multi-quadrant operation?
Q9) [CO4] Explain in detail about the different classes of motor duty as per IS: 4722 -1968 standards?

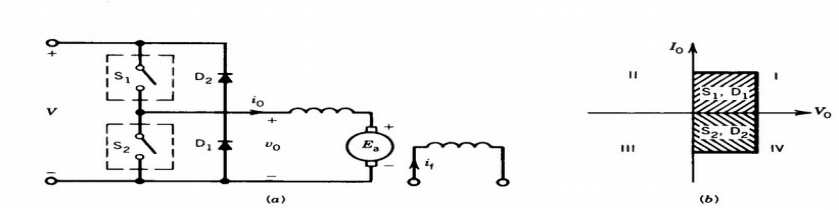
SECTION – C

Note: Attempt both questions **(2 x 20M = 40 M)**

Q10)[CO5]Draw and explain the closed loop control of variable voltage variable frequency method for 3-phase squirrel cage induction motor . What is the significance of (V/F) ratio control?

[OR]

Q11)[CO3]The two-quadrant chopper shown in Fig. below is used to control the speed of the dc motor and also for regenerative braking of the motor. The motor constant is $K\phi = 0.1$ V/rpm ($E_a = K\phi n$). The chopping frequency is f = 250 Hz and the motor armature resistance is Ra = 0.2 Ω The inductance La is sufficiently large and the motor current i_o can be assumed to be ripple-free. The supply voltage is 120 V.



(a) Chopper S1 and diode D1 are operated to control the speed of the motor. At n = 400 rpm and i_0=100 A (ripple-free),(i) Draw waveforms of V_0,i o, and is.(ii) Determine the turn-on time (ton) of the chopper.

(iii) Determine the power developed by the motor, power absorbed by Ra, and power from the source.

(b) In the two-quadrant chopper S_2 and diode D_2 are operated for regenerative braking of the motor. At

n = 350 rpm and i_0 = -100 A (ripple-free),(i) Draw waveforms of V_0, i_0, and i_s.(ii) Determine the turn-on time (ton) of the chopper.(iii) Determine the power developed (and delivered) by the motor, power absorbed by Ra, and power to the source.

Q12)[C04]A 400 V 3 Ph 50 Hz 6 pole 945 rpm , delta connected squirrel-cage induction motor had a following parameters referred to stator : Rs=2Ω, R_r'= 2Ω , Xs=Xr'= 4 Ω , Xm=80 Ω.

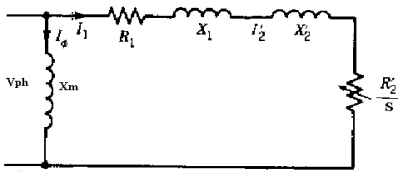
Motor speed is controlled form a stator voltage control . when driving a load torque is proportional to speed square ($T_L=K*N_r^2$) at rated speed at rated voltage .Value of K= 57.7

The motor speed is controlled by stator voltage control

Calculate (i) motor terminal voltage , current ,and torque at 800rpm

(ii)Motor speed , current and torque for terminal voltage of 280V

Note :consider below circuit for the analysis



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SECTION – A

Note: All questions are compulsory **(5 x 4M = 20 M)**

Q1) [CO1] list the measures that could be taken place to conserve energy in electrical drives.
Q2) [CO1]list the advantages of regenerative breaking over the conventional breaking systems ?
Q3)[CO2] Justify,why stator voltage control is suitable for speed control of induction motor in fan and pumps?
Q4)[C02]Explain the importance of "load equalization " and why it is required?
Q5)[C02]Write the advantages of inverter fed ac drive system over the stator voltage control drive?

SECTION – B

Note: Attempt all the following questions **(4 x 10M = 40 M)**

Q6)[C02] Explain how below mentioned breaking techniques are employed for an separately exited dc motor with the help of slip-torque characteristics.

i. Plugging
ii. Dynamic braking

Q7)[C03]Explain how brushless dc motor operated when employed from a Voltage Source Inverter and draw the variation of Induced voltages , Phase currents and torque waveforms.

Q8)[CO4]A separately Excited DC motor Drives is controlled form a Armature voltage control is inherently a closed loop control system in dc motor drives. Development of the mathematical model to relate the voltage applied to the armature to the velocity of the separately exited DC

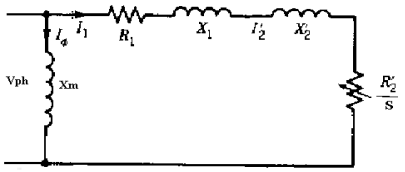
motor. Write balance equations can be developed by considering the electrical and mechanical characteristics of the system.

Q9) [C04]Explain the closed loop control scheme for a converter fed sep- excited dc motor for speed below and above rated speed.

SECTION – C

Note: Attempt both questions **(2 x 20M = 40 M)**

Q10)[CO3] A 400 V 3-Ph 50 Hz 6 pole 945 rpm , delta connected squirrel-cage induction motor had a following parameters referred to stator : Rs=2Ω, R_r'= 2Ω , Xs=Xr'= 4 Ω , Xm=80 Ω.
Motor speed is controlled form a stator voltage control . when driving a load varies linearly with speed .The motor speed is controlled by stator voltage control
Calculate (i) motor terminal voltage , current ,and torque at 800rpm
(ii)Motor speed , current and torque for terminal voltage of 280V
Note :consider below circuit for the analysis



OR

Q11) [C04]Draw and explain the closed loop control of variable voltage method for 3-phase squirrel cage induction motor and draw the speed torque characteristics for different voltage levels .

Q12)[C05] Explain the type of chopper circuit used to achieve forward motoring and regenerative breaking can be achieved for a separately excited DC-motor driving a hoist load. With the help of the circuit diagram and output wave forms.