DEPARTMENT OF ELECTRICAL ELECTRONICS

QUESTION BANK(2018-19)

POWER ELECTRONIC CONTROLLERS DRIVES

REGULATION: R16

COURSE : B.TECH **BRANCH: EEE** **YEAR / SEMESTER : III/ II**

UNIT –I

1 a) Explain the different components of basic electrical drive system. [5M]
b) Describe different braking methods employed for electrical motors. [5M]

2 a) What are the main factors which decide the choice of electrical drive for a given application? [5M]
b) Explain in detail about components of load torques. [5M]

3 a) Explain the four quadrant operation of a motor drive in general. [5M]
b) Describe different braking methods employed for D.C. motors. [5M]

4 a) What are advantages of electrical drive? [5M]
b) Explain about fundamental torque equation. [5M]

5 a) What do you mean by regenerative braking of motor? Explain. [5M]
b) Explain about nature and classification of different load torques. [5M]

6 a) Explain the different components of basic electrical drive system. [5M]
b) Explain the four quadrant operation of a motor drive in general. [5M]

UNIT – 2

1 a) Describe the flux control method of series motor. [5M]
b) Explain the first quadrant chopper controlled separately excited dc motor. [5M]

2 a) Explain the operation of a separately excited dc motor supplied from 3-phase fully controlled rectifier with necessary diagrams. Assume Continuous conduction.[5M]

b) A 220V, 1440rpm, 120A separately excited DC motor with armature resistance of 0.7 ohms is fed from 3-phase fully controlled converter with an ac source line voltage 440V, 50 Hz supply. A star connected transformer is used to feed the armature so that motor terminal voltage equals rated voltage when converter firing angle is zero. Calculate the value of firing angle when motor is running at 1200 rpm at rated torque.[5M]

3 a) Briefly explain different speed control techniques for D.C. motor. [5M]
b) Discuss the drawbacks of rectifier control of dc series motor. [5M]

4 a) Explain the operation of 3-phase six pulse converter feeding DC series motor with neat diagram and relevant waveforms. [5M]

b) A 200V, 875rpm, 150A separately excited dc motor has an armature resistance of 0.06ohm. It is fed from a three phase fully controlled rectifier with an ac source of220V, 50Hz. Assuming continuous conduction, calculate (i) Firing angle for rated motor torque and 750rpm.
(ii) Motor speed for a =1600 and rated torque. [5M]

5 a) Explain the operation of dual converter controlling the separately excited dc motor. [5M]

b) A 220 V, 1500 rpm, 11.6 A separately excited motor is controlled by a 3-phase fully controlled rectifier with an ac source voltage of 230 V, 50 Hz. Enough filter inductance is added to ensure continuous conduction for any torque greater than 25 percent of rated torque, Ra = 2 ohms.
(i) What should be the value of the firing angle to get the rated torque at 1000 rpm?
(ii) Ca1culate the firing angle for the rated braking torque and 1500 rpm.
(iii) Ca1culate the motor speed at the rated torque and alpha = 160 degrees for the regenerative braking in the second quadrant.

6 a) Explain the operation of a separately excited dc motor supplied from 3-phase semi controlled rectifier.[5M]

b) A 12.2 kW, 230 V, 850 rpm, 56 A dc separately exited motor is controlled by a 3-phase fully-controlled rectifier fed from 460 V, 60 Hz ac supply through transformer. It has an armature resistance of 0.284 ohms and sufficient inductance to assure continuous conduction for all operating points with torques greater than 20 percent of the rated. The transformer and the source impedance can be neglected.
(i) A rated dc voltage across the motor at full load is desired. Choose a suitable transformer from the following three available:
(a) 460/460 V (b) 460/230 V (c) 460/ 180 V Having chosen the transformer find the following:
(i) The rectifier firing angle for the rated torque and speed. [5M]

(ii) The rectifier firing angle for the rated braking torque and the speed of 600 rpm in the reverse direction. [5M]

UNIT- 3

1a) Explain the first quadrant chopper controlled separately excited dc motor. [5M]

b) Describe the first quadrant chopper control of dc series motor. [5M]

2 a) Explain the operation of a four quadrant chopper fed to the D.C series motor and also draw the current and voltage wave forms for continuous current operation.[5M]

b) A 220v, 24A, 1000rpm separately excited dc motor having an armature resistance of 2 ohms is controlled by a chopper. The chopping frequency is 500Hz and the input voltage is 230V. Calculate the duty ratio for a motor torque of 1.2 times rated torque at 500rpm. [5M]

3 a) Explain with circuit and waveforms of four quadrant chopper fed separately excited DC motor.[5M]

b) A 230V, 960rpm and 200A separately excited dc motor has an armature resistance of 0.02ohms. The motor is fed from a chopper, which is capable of providing both motoring and braking operations. The source has a voltage of 230V. Assuming continuous conduction: When motor is operated in Dynamic braking, with Braking resistance of 2 ohm

(i) calculate Duty ratio of chopper for a motor speed of 600 rpm and braking torque of twice the rated value.

(ii) What will be the motor speed for a duty ratio of 0.6 and motor torque equal to twice its rated value? [5M]

4a) List the advantages offered by dc chopper drives over line-commutated converter controlled dc drives. [5M]

b) Draw the block diagram of closed loop operation of chopper controlled dc motor. [5M]

5 a) Explain with circuit and waveforms of two quadrant chopper fed separately excited DC motor.[5M]

b) A 230V, 960 rpm and 200A separately excited dc motor has Ra=0.02ohm. The motor is fed from a chopper which provides both motoring and braking operations. Assume continuous conduction. Calculate duty ratio of chopper for motoring and braking operations at rated torque and 350 rpm[5M]

6 a) With circuit and waveforms explain the operation of four quadrant chopper fed separately excited DC motor. [5M]

b) A 230 V, 500 rpm, 90 A separately excited dc motor having an armature resistance and inductance 0.115 ohms and 11 mH respectively, is controlled by a c1ass C twoquadran chopper operating with a source voltage of 230 V and a frequency of 400 Hz.

(i) Calculate the motor speed for a motoring operation at delta = 0.5 and half of rated torque.

(ii) What will be the motor speed when regenerating at delta = 0.5 and rated torque? [5M]

UNIT- 4

1a) Draw the block diagram of closed loop operation of induction motor drives. [5M]

b) Why V/f ratio must be constant for a frequency controlled induction motor drive?Explain. [5M]

2 a) Discuss speed control of induction motor from stator side with speed-torque curves. [5M]

b) The parameters of a three phase 400 Volts, 50 Hz, 6 pole, 960 rpm, and star connected induction motor has the following parameters per phase referred to the stator. R1= 0.4 Ohm. R2 = 0.20 Ohm,X1 = X2 =1.5 Ohm, Xm = 30 Ohms. If the motor is controlled by variable frequency control at a constant flux of rated value, determine the motor speed and the stator current at half the rated torque and 25Hz. [5M]

3 a) Explain why stator voltage control is suitable for speed control of Induction motors in fan and pump drives. Draw and explain speed control of 3 phase Induction motor using AC Voltage Controller

b) The rotor resistance and stand still reactance referred to stator of a 3 phase, 4 pole, 50 Hz Squirrel cage Induction motor is 0.2 ohm and 0.8 ohm per phase respectively. The full load slip of the motor is 4 percent. Neglect stator resistance and leakage reactance. Determine how much stator voltage should be reduced in order to get a speed of 1200 rpm if the load torque remains constant. [5M]

4 a) Draw the speed-torque characteristics of induction motor with variable frequency control. [5M]

b) Explain the significance of (V/f) speed control method of an induction motor. [5M]

5 a) Show that variable frequency control of induction motor is more efficient than stator voltage control.

b) A 440V, 3 phase, 50 Hz, 6 pole, 945 rpm, delta connected Induction Motor has the following parameters referred to the stator. Rs = 2ohms, Rr = 2ohms, Xs = 3ohms, Xr = 4ohms. When driving a fan load at rated voltage it runs at rated speed. The motor speed is controlled by stator voltage control.Determine motor terminal voltage, current and torque at 800 RPM. [5M]

6 a) Explain speed control of induction motor by AC Voltage Controllers. [5M]

b) A 3 phase, 4 pole, 50 Hz squirrel cage Induction motor has the following circuit parameters:

r1 = 0.05ohm, r2 = 0.09ohm, X1 + X2 = 0.55ohm The motor is star connected and rated voltage is 400V. It drives a load whose torque is proportional to the speed and is given as Tl = 0.05w N-m. Determine the speed and torque of the motor for a firing angle of 45 degree of the AC Voltage Controller on a 400V, 50 Hz supply[5M]

UNIT – 5

1a) Define Slip power and its significance. [5M]

b) Draw and explain the equivalent circuit of a wound rotor induction motor when voltage is injected in the rotor circuit. [5M]

2 a) Draw the circuit diagram and explain the operation of rotor- resistance control of Induction motor. Mention the advantages and disadvantages of the above method of control.[5M]

b) Explain Static Kramer drive for a three phase induction motor.[5M]

3a) Why rotor resistance control is preferred in low power crane drives? [5M]
b) Draw the circuit diagram for static Scherbius drive [5M]

4 a) Explain static Scherbius drive control for speed control of induction motor. Draw speed -torque characteristics. [5M]
b) Explain with circuit waveforms for speed control of induction motor by Static rotor resistance.

5 a) Draw the circuit diagram and explain the working of a slip power recovery system using Static Kramer drive for a three phase induction motor.[5M]

b) Explain with circuit and waveforms for speed control of induction motor by Static rotor resistance method.[5M]

6 a) Draw and explain the equivalent circuit of a wound rotor induction motor when voltage is injected in the rotor circuit. [5M]

b) Draw the circuit diagram and explain the working of a slip power recovery system using Static Kramer drive for a three phase induction motor.[5M]

UNIT – 6

1a) When operating in true synchronous mode, why the frequency must be changed in small steps? [5M]
b) Compare self-controlled and load-commutated inverter controlled synchronous motor drives. [5M]

2 a) Describe self-controlled and load-commutated inverter controlled synchronous motor drives in detail.[5M]
b) Draw the block diagram of a closed loop synchronous motor drive fed from VSI. [5M]

3 a) Explain the operation of Load commutated CSI fed Synchronous motor drive. [5M]
b) In variable frequency control of a synchronous motor why (V/f) ratio is maintained constant up to base speed and V constant above the base speed. Explain briefly with necessary waveforms. [5M]

4 a) What is the basic difference between true synchronous mode and self control mode for variable frequency control of Synchronous motor? [5M]
b) Compare self-controlled and load-commutated inverter controlled synchronous motor drives.

5 a) Describe the operation of self-controlled Synchronous Motor drives in detail. [5M]
b) Describe the open-loop and closed loop methods of speed control of a synchronous motor using VSI. [5M]

6 a) How is the output voltage of a VSI improved by PWM techniques? Explain how you will use this Converter for speed control of a synchronous motor. [5M]

b) Discuss in detail with suitable circuit diagram the principle of operation of self controlled Synchronous motor drive employing load commutated thyristor inverter. [5M]