

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**  
**Autonomous Institution – UGC, Govt. of India)**  
**UG Model Question paper-I**

**Electrical Drives**  
**IV YEAR I SEM**  
**EEE**

**Time: 3 hours**

**Max Marks: 70**

**Note:** This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

**SECTION-I**

**5\*14=70M**

- 1 a) State all essential parts of Electric drives? What are the functions of a power modulator?
- b) What are the advantages of electrical drives? The speed of a separately excited DC Motor is controlled by 3- $\phi$  full-converter. Input voltage 415V,  $R_a=0.9\Omega$ ,  $K_m=1.5V/\text{rad/s}$ ,  $I_a=10A$ . Find the motor developed torque?

**OR**

- 2 a) Draw and explain the speed-torque characteristics at different firing angles for a single phase fully converter feeding a d.c series motor. Draw the quadrant diagram also.
- b) A 200V, 875rpm, 150A separately excited dc motor has an armature resistance of 0.06ohm. It is fed from a single phase fully controlled rectifier with an ac source of 220V, 50Hz. Assuming continuous conduction, calculate (i) Firing angle for rated motor torque and 750rpm. (ii) Motor speed for  $\alpha=160^\circ$  and rated torque.

**SECTION-II**

- 3 a) Describe different braking methods employed for electrical motors.
- b) A 220v, 24A, 1000rpm separately excited dc motor having an armature resistance of  $2\Omega$  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.

**OR**

- 4 a) Describe relative merits and demerits of four quadrant dc drives employing non circulating and circulating dual converters
- b) A 230 V, 500 rpm, 90 A separately excited dc motor having an armature resistance and inductance of  $0.115\Omega$  and 11 mH respectively, is controlled by a class C two quadrant 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?

**SECTION-III**

- 5 a) Class-B chopper, operating in time-ratio control, is supplying the armature of the separately excited dc motor. Derive the motor speed-torque relation.

- b) A 230 V, 960 rpm and 200A separately excited dc motor has an armature resistance of  $0.02\Omega$ . The motor is fed from a chopper, which is capable of providing both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction: (i) Calculate the time ratio of chopper for the motoring action at rated torque and 350 rpm. (ii) Determine the maximum possible speed, if maximum value of time ratio is 0.95 and maximum permissible motor current is twice the rated value.

**OR**

- 6 a) Explain two-quadrant operation consisting of forward motoring and regenerative braking of chopper fed dc drive with speed-torque characteristics

- b) A 230 V, 960 rpm, and 200 A separately excited dc motor has an armature resistance of  $0.02\Omega$ . The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. assuming continuous conduction. Calculate duty ratios of chopper for motoring and braking operations at rated torque and 350 rpm.

**SECTION-IV**

- 7 a) Discuss speed control of induction motor from stator side with speed-torque curves.

- 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.  $R_1 = 0.4 \text{ Ohm}$ .  $R_2 = 0.20 \text{ Ohm}$ ,  $X_1 = X_2 = 1.5 \text{ Ohm}$ ,  $X_m = 30 \text{ Ohms}$ . 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.

**OR**

- 8 a) Explain in detail about the variable frequency control of induction motor by CurrentSource inverter.

- b) Explain the concept of slip power recovery with the help of control of Static Kramersdrive

## SECTION-V

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

**OR**

- 10 Describe separate controlled mode and self-controlled mode of operation of a synchronous motor drive in detail and compare them.

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**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**  
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**UG Model Question paper-II**  
**Electrical Drives**  
**IV YEAR I SEM**  
**EEE**

**Time: 3 hours**

**Max Marks: 70**

**Note:** This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

**SECTION-I**

**5\*14=70M**

- 1 a) Explain the operation of a DC series motor fed by a single-phase full converter. Discuss the continuous and discontinuous modes of operation with the help of their governing equations. 7M
- b) A separately excited DC motor running at 1200 rpm is operated from a single phase half controlled bridge with input voltage  $320 \sin 310t$ , emf 100V and armature resistance 5 ohms. SCRs are fired at  $\alpha = 45^\circ$  for every half cycle. Calculate i) The armature current  
ii) The motor torque. 7M

**OR**

- 2 a) Explain the operation of a three-phase full converter when feeding Separately excited DC motor. With neat waveforms 7M
- b) For three-phase full converter controlling a 450V DC motor, find the firing angle if the voltage drop of motor is 30V and the ac input supply is 3-phase, 50Hz, 420V. 7M

**SECTION-II**

- 3 a) Describe how a four-quadrant drive can be obtained from a chopper-fed separately excited dc motor. 7M
- b) Define braking. Describe electric braking in detail. 7M

**OR**

- 4 What is a dual converter? Explain the principle of operation of a dual converter in circulating current mode. How is the same used for speed control of dc drive? 14M

**SECTION-III**

- 5 a) Distinguish between class A & class B choppers with suitable examples of speed control of Motor. 7M
- b) Discuss with suitable diagrams the first quadrant and second quadrant chopper operation when feeding dc series motors 7M

**OR**

- 6 a) Explain the principle of speed control of a DC motor and show how it can be achieved by a chopper 7M
- b) Derive expression for average motor current, current  $I_{max}$  &  $I_{min}$  & average torque for chopper fed DC separately excited Motor. 7M

#### SECTION-IV

- 7 a) Explain the operation of voltage source inverter ( $180^\circ$  conduction mode) used for induction motor speed control. Draw neat waveforms of line voltages and hence show that the phase voltage is a six-step voltage waveform. 7M
- b) Draw a neat circuit diagram for speed control of 3-phase IM using AC voltage controller. 7M

**OR**

- 8 a) with a block schematic diagram, explain how the speed of the induction motor can be controlled automatically using closed loop scheme, with voltage source inverter. 7M
- b) A 3-phase, 50 kW, 1470 rpm, 400V, 50Hz, 4-pole star-connected induction motor has the following data:  $R_s=0.42$  ohms,  $R_r=0.23$  ohms,  $X_r = 0.85$  ohms and  $X_m= 28$  ohms, all quantities being referred to the stator side. The motor is operated with frequency control. If the slip for maximum torque at the given supply frequency is 0.12, determine i) The supply frequency, ii) The breakdown torque, iii) The speed at maximum torque. 7M

#### SECTION-V

- 9 a) Draw and Explain a closed-loop operation for a static Kramer controlled drive. 7M
- b) An 8-pole, 50Hz, 380 V, star-connected induction motor has a star-connected slip ring rotor. The stator rotor turns ratio is 1.25, and the speed of the motor is controlled by a converter cascade in the rotor circuit. Determine the firing angle of the inverter to get 600 rpm and 400 rpm at no load. The inverter is connected to a 380 V, 3-phase system. Assume no overlap in the rectifier as well as in the inverter. What is the minimum possible speed? 7M

**OR**

- 10 a) Describe the separate controlled and self-controlled modes of operation of a synchronous motor drive in detail and compare them. 7M
- b) A 5MW, 3-phase, 11kV, star-connected, 6-pole, 50Hz, 0.9 leading pf synchronous motor has  $X_s = 10$  ohms and  $R_s=0$  ohms. The rated field current is 50A. Assume that stator resistance is to be neglected. The machine is controlled by variable frequency control at constant v/f ratio up to base speed and constant V above base speed. Determine the torque and the field current for the rated armature current of 750rpm and 0.8 pf leading 7M

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**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

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**UG Model Question paper-III**

**Electrical Drives**

**IV YEAR I SEM**

**EEE**

**Time: 3 hours**

**Max Marks: 70**

**Note:** This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

**SECTION-I**

**5\*14=70M**

1. a) Explain the operation of a separately excited DC motor fed by a single-phase semi-converter. Discuss the continuous mode of operation with the help of their governing equations. 7M
- b) Separately excited DC motor has its armature circuit connected to a single-phase semi-converter having 230V, 50Hz,  $R_a=10$  Ohms, with its rated load torque 80N-m at 1000rpm,  $K_a\phi = 0.8V\text{-s/rad}$  for its armature and field currents, and with zero firing angle for field converter. Determine (i) rated current, (ii) firing angle at rated torque. 7M

**OR**

2. a) Explain the operation of a separately excited DC motor fed by a three phase full converter. 7M
- b) A 220V, 1440rpm, 120A separately excited DC motor with armature resistance of  $0.7 \Omega$  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. 7M

**SECTION-II**

- 3 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. 7M
- b) A 220V, 24A, 1000rpm separately excited DC motor having an armature resistance of  $2\Omega$  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 7M

**OR**

- 4 Explain how four-quadrant operation is achieved by dual converters, each of 3 phase full wave configuration, for separately excited dc motor. 14M

### SECTION-III

- 5 a) Explain with circuit and waveforms of two quadrant chopper fed separately excited DC motor. 7M
- b) A 230V, 960 rpm and 200A separately excited DC motor has  $R_a=0.02\text{ohm}$ . 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. 7M

### OR

- 6 a) Derive speed torque expression of class B chopper operation with time ratio control is supplying the armature of the separately excited motor, and draw speed torque characteristics. 7M
- b) Explain the operation of two-quadrant, type D chopper drive. 7M

### SECTION-IV

- 7 a) Discuss speed control of induction motor from stator side with speed-torque curves. 7M
- 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.  $R_1=0.4\text{ Ohm}$ .  $R_2=0.20\text{ Ohm}$ ,  $X_1=X_2=1.5\text{ Ohm}$ ,  $X_m=30\text{ Ohms}$ . 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. 7M

### OR

- 8 a) Explain with suitable block diagrams the various types of VSI-controlled induction motor drive. 7M
- b) A 2200V, 2600kW, 735 rpm, 50Hz, 8-pole, 3 Phase squirrel cage induction motor has following parameters referring to the stator side:  $R_s=0.075\text{ ohms}$ ,  $R_r=0.1\text{ ohms}$ ,  $X_s=0.45\text{ ohms}$ ,  $X_r=0.55\text{ ohms}$ . Stator winding is delta-connected and consists of two sections connected in parallel.
- I. Calculate starting torque and maximum torque as a ratio of rated torque. If the motor is started by star delta switching, what is the maximum value of line current during starting?

- II. What will be the value of maximum line current and torque during starting, if the past winding method of starting is employed? 7M

**SECTION-IV**

- 9 a) Draw the circuit diagram and explain the working of a slip power recovery system using static Scherbius system for a three phase induction motor. 7M
- b) Explain Static Kramer drive for a three phase induction motor. 7M

**OR**

- 10 a) Describe the operation of self-controlled Synchronous Motor drives in detail. 7M
- b) Describe the open-loop and closed loop methods of speed control of a synchronous motor using VSI. 7M

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