



Roll No

**PRESIDENCY UNIVERSITY  
BENGALURU**

**SET-A**

**SCHOOL OF ENGINEERING  
END TERM EXAMINATION – MAY/JUNE 2024**

**Semester :** Semester VI - 2021

**Course Code :** EEE3001

**Course Name :** - Electrical Drives

**Program :** B. Tech.

**Date :** June 6, 2024

**Time :** 1:00 PM - 4:00 PM

**Max Marks :** 100

**Weightage :** 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**Part - A**

**Answer any 5 questions**

**5 x 4M= 20M**

1. In olden days DC Series motors were used as a traction motor by Indian Railways and in recent years A WAP5 locomotives are for traction by Indian Railways for passenger trains. Identify the parts of Electrical Drive in locomotive and mention the details.  
(CO1) [Knowledge]
2. An electrical drive is used in various applications in modern domestic and industrial applications. List out few advantages of Electrical Drives.  
(CO2) [Knowledge]
3. A 415 V, 50 Hz, 4 pole, 1440 rpm slip connected induction motor has following parameters referred to stator side:  $R_s=0.5 \Omega$ ,  $R_r'=0.4 \Omega$ ,  $X_s=X_r'=1.2 \Omega$ ,  $X_m=50 \Omega$ . Stator to rotor turns is 3.5. It is controlled by static rotor resistance controlled method, the duty cycle of transistor is 0.25. Compute the value of rotor resistance included in the circuit and comment on effect of maximum torque by varying rotor resistance.  
(CO3) [Knowledge]
4. Compute the %slip of 3.2kW, 1440 rpm, 4 poles and 50 Hz three phase induction motor and comment on effect of slip with variation of speed.  
(CO3) [Knowledge]
5. List out the different sections of cement industry?  
(CO4) [Knowledge]
6. List out the different types of motors used in cement industry?  
(CO4) [Knowledge]

7. A three phase, 50 Hz, 4 pole induction motor is controlled from a stator voltage regulator. The motor is running at a speed of 1000 rpm. Neglecting the core loss and stator impedance, compute the % efficiency of the motor when controlled by stator voltage control method and comment on % efficiency at low value of slips.

(CO3) [Knowledge]

### Part - B

Answer any 4 questions

4 x 10M = 40M

8. A 3-phase, 400 V, 6-pole, 50 Hz, star-connected, slip-ring induction motor is used in cement industry for crushing application. The details are as follows the stator resistance of  $0.5 \Omega$ , rotor resistance  $0.4 \Omega$  and stator leakage reactance & rotor leakage of  $1.2 \Omega$  per phase referred to stator magnetising reactance of  $50 \Omega$ . Stator to rotor turns ratio is 3.5. The motor is controlled by using static rotor resistance control method, The external rotor resistance that can be included is  $0.3347 \Omega$  per phase, at the time of running, it is observed that the transistor which is connected across the resistance is not working, What would be the value of resistance that can be inserted during the operation?.

(CO3) [Comprehension]

9. In present day textile industries, electric motors are used in various sections such as
- Ginning
  - Spinning
  - Weaving
  - Finishing
- a) Identify the suitable electric motors at different sections in the process of manufacturing the garment. (6M)
- b) Identify the section where speed control is not essential. (4M)

(CO4) [Comprehension]

10. A Baldor make CDP 3440 model, 90V, 7.6 A, 1750rpm DC shunt motor is used in lathe machine applications. While shaping the job piece, It is required to rotate at a speed of 750 rpm in both directions at half rated torque. The available power converters in the workshop are single phase semi converter and single phase fully controlled rectifier, both are fed with 1-phase 230V, 50Hz supply. (Assume armature resistance as  $0.05 \Omega$ )

- Suggest the suitable power converter and value of firing angle to rotate the spindle at 750 rpm (6M)
- Comment on the variation of firing angle, if operating torque increases. (4M)

(CO2) [Comprehension]

11. A 440V, 50 Hz, 970rpm, 6 Pole Star connected Slip Ring Induction Motor has following parameters referred to stator  $R_s = 0.1 \Omega$ ,  $R_r' = 0.08 \Omega$ ,  $X_s = 0.3 \Omega$ ,  $X_r' = 0.4 \Omega$ . Stator to Rotor Turns ratio is 2. Transformer Turns ratio is 8. The motor is controlled by Static Rotor resistance control method, It is observed that it is unable to send the power to the supply due to problem in the value of firing angle of the inverter. Identify the problem and compute the maximum value of slip of the drive.

(CO3) [Comprehension]

12. The MITSUBISHI ELECTRIC Company uses Permanent magnet motor drive for Elevator applications. The shaft of the motor is connected to the elevator which is capable enough to lift the weight of 1000kg at uniform speed of 1.5m/s. coupling between the load and the motor has an efficiency of 85%. Assume the motor inertias in the range of 0.15 to 0.3 kg-m<sup>2</sup> and the elevator has to run at an angular velocity of 148.7 rad/sec.

1. If it is required to operate the elevator with good dynamic response in acceleration and deceleration, suggest the value of moment of inertia?(3M)
2. Chose the different values of moment of inertia of your interest within the range and compute the equivalent torque seen by the motor? (4M)

Comment on the equivalent torque seen by the motor for the above results. (3M)

(CO1) [Comprehension]

13. A 440V, 50 Hz, 970rpm, 6 Pole Star connected Slip Ring Induction Motor has following parameters referred to stator  $R_s = 0.1$  ohms,  $R_r' = 0.08\Omega$ ,  $X_s = 0.3\Omega$   $X_r' = 0.4\Omega$ . Stator to Rotor Turns ratio is 2. The motor is controlled by Static Rotor resistance control method, It is observed that it is unable to send the power to the supply due to problem in the design of transformer. Identify the problem and compute the maximum value of slip of the drive, if Transformer Turns ratio is 8.

(CO3) [Comprehension]

### Part - C

Answer any 2 questions

2 x 20M = 40M

14. A 3-phase, 400 V, 6-pole, 50 Hz, star-connected, slip-ring induction motor has stator resistance of 0.5  $\Omega$ , rotor resistance 0.4  $\Omega$  and stator leakage reactance & rotor leakage of 1.2  $\Omega$  per phase referred to stator magnetising reactance of 50  $\Omega$ . Stator to rotor turns ratio is 3.5. Motor is controlled by static rotor resistance control. External resistance is chosen such that the breakdown torque is produced at standstill for a duty cycle of zero.

1. Compute the value of external resistance to be inserted in the circuit.
2. Comment on starting torque and maximum torque of the motor

(CO3) [Application]

15. A 500 kW, 3-phase, 3.3 kV, 50 Hz, 0.85(lagging) power factor, 4 pole, star connected synchronous motor which is used as a blower in paper mills is as shown in below Fig. The motor is having the following parameters:  $X_s=15 \Omega$ ,  $R_s=0 \Omega$ . The rated field current is 10A. For drying the material, it is required to blow out the hot air at maximum pullout torque. I
1. Suggest the load the load angle during the motor operation to exhibit the maximum pullout torque. (5M)
  2. Compute the current drawn and Power factor at half rated torque and field current. (15M)



Fig. : Blower driven by Synchronous motor drive in paper mill application.

(CO4) [Application]

16. A 2.8kW, 400V, 50Hz, 4pole, 1370rpm delta connected squirrel cage induction motor has following parameters referred to stator  $R_s=2\Omega$ ,  $R_r'=5\Omega$ .  $X_s=X_r'=5\Omega$ .  $R_r=5\Omega$ .  $X_s=X_r'=5\Omega$ .  $X_m=80\Omega$ .  $X_m=80\Omega$ . Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed at rated voltage.  
Compute  
Motor terminal voltage, current and torque at 1200rpm

(CO3) [Application]