Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET-A

SCHOOL OF ENGINEERING
END TERM EXAMINATION – MAY/JUNE 2024

Semester : Semester VIII - 2020
Course Code: EEE3007
Course Name : Modern power electronics and AC drives
Program : B.Tech.

Date: May 29, 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. State how is the management of power losses typically handled when controlling rotor resistance in an induction motor?
(CO1) [Knowledge]
2. Describe the concept of open-loop Volts/Hz control in induction motor drives.
(CO2) [Knowledge]
3. Outline the key characteristics of a synchronous motor and control strategies used to optimize its performance.
(CO4) [Knowledge]
4. State the different methods of excitation used in synchronous motors and their applications.
(CO4) [Knowledge]
5. Describe typical applications where current-controlled brushless DC motor servo drives are used.
(CO5) [Knowledge]
6. List the key drive characteristics and applications of a variable reluctance motor.
(CO5) [Knowledge]
7. State the working principle of vector control in induction motor drives using the block diagram.
(CO3) [Knowledge]

Part - B

Answer any 4 questions **4 x 10M = 40M**

8. State the approach which is employed to mitigate power losses associated with controlling rotor resistance in an induction motor? Explain the selected method with necessary diagrams and equations.
(CO1) [Comprehension]

9. Indirect vector control is frequently employed in electric vehicle propulsion systems to manage motor speed and torque, offering effective and responsive control during vehicle operation. Elaborate on the concept of indirect vector control in induction motor drives.

(CO3) [Comprehension]

10. Choose how does DTC of synchronous motor differ from other control schemes, and what are its key features for achieving fast torque response and robust operation?

(CO3) [Comprehension]

11. Explain the principles and characteristics of Field-Oriented Control (FOC) used in Permanent Magnet Synchronous Motors (PMSM) drives.

(CO3) [Comprehension]

12. Describe the importance of feedback control in variable reluctance motor drives. What types of feedback (e.g., position feedback, speed feedback) are essential for closed-loop control? Interpret how does feedback influence stability and performance in variable reluctance motor systems?

(CO4) [Comprehension]

13. Describe the different control methods block diagrams used to achieve variable voltage and variable frequency operations for an induction motor.

(CO1) [Comprehension]

Part - C

Answer any 2 questions **2 x 20M = 40M**

14. a. A 400 V, 50 Hz, 1000 rpm, 6 pole star connected 3 phase wound rotor connected Induction motor has the following parameters refer to the stator. Stator resistance is 0.2 ohm, rotor resistance is 0.06 ohm, stator reactance is 0.4 ohm, rotor reactance is 0.5 ohm. The stator to rotor turns ratio is 7. The motor speed is controlled by static scherbius drive is designed for a speed range of 25% below the synchronous speed. Maximum value of firing angle is 165 degrees. If the motor operates at 800 rpm and firing angle is 135 degrees. (i) List the associated parameters can be computed for the above data. (ii) Compute the listed parameters.

b. In industrial settings, a speed control technique utilizes a pair of thyristors to recover slip power from induction motors, which is then fed back to the power source. Identify the suitable method for this application and provide a detailed explanation of the method.

(CO2) [Application]

15. 3-phase, 460 V 60 Hz system

Load 1: 6-pole, 60 Hz, 400 hp synchronousmotor operating at 75% rated output, Efficiency = 90%, power factor = 82% Lagging. •

Load 2: 75 kW delta-connected resistance heater

Load 3: 300 hp 60 Hz 4-pole Y-connected cylindrical rotor synchronous motor operating at 50% rated torque angle of -16.4 degrees Efficiency = 95% Xs = 0.667 ohms/phase.

i. Identify the parameters that are can be computed by all the three loads

ii. Compute the identifed parameters.

(CO4) [Application]

16. Mr. Rishabh has been assigned by his professor to explain the principle, working mechanism, and features of a motor that is suitable for a variety of applications.The data which is provided by his professor in order to select the motor are:

a. The electric motor induces a non-permanent magnetic poles on the ferromagnetic rotor.

b. The torque is generated through the phenomenon of magnetic reluctance.

Put yourself in place of Mr. Rishabh and select a motor with the above information and explain the operation with the suitable reasons.

(CO5) [Application]