

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
ONLINE END SEMESTER EXAMINATION, JUNE 2021

Course: Electrical Actuators and Drives

Semester: II

Program: M TECH AUTOMATION AND ROBOTICS ENGG.

Time 03 hrs.

Course Code: EPEC 7009

Max. Marks: 100

SECTION A

1. Each Question will carry 5 Marks

2. Instruction: Complete the statement / Select the correct answer(s)

S. No.		CO
Q1	List the components of load torque and classify the load torque	CO1
Q2	Define breaking and plugging with respect to the operation of DC motors.	CO2
Q3	Write the principle of closed-loop control of dc drives.	CO3
Q4	Differentiate the types of induction motor based on construction and write their application.	CO4
Q5	List two applications of solenoid and stepper motor.	CO5
Q6	Name the methods of speed control of induction motor with their advantages and disadvantages.	CO4

SECTION B

1. Each question will carry 10 marks

2. Instruction: Write short / brief notes

Q7	Explain the four-quadrant operation of separately excited DC motors.	CO1
Q8	(i) Discuss any one method used to control the speed of separately excited DC motors (ii) A DC series motor, running a fan at 1000 rpm, takes 50A from 250V mains. The armature plus field resistance is 0.6Ω . If an additional resistance of 4.4Ω is inserted in series with armature circuit, find the motor speed in case the field flux is proportional to the armature current.	CO2
Q9	Derive the closed loop transfer function of field control DC motor.	CO3
Q10	A 3-Phase, 50 Hz, 4-Pole Induction motor has rated output of 10kW at 1425 rpm and maximum torque is developed at 1200 rpm. Calculate the starting torque. Neglect the stator resistance and rotational losses.	CO4
Q11	Describe the working of servomotor and list some of its industrial application with its advantages and disadvantages.	CO5

Section C

1. Each Question carries 20 Marks.

2. Instruction: Write long answer.

3. Attempt any one question

<p>Q12</p>	<p>i. Explain the dynamic braking of induction motor and show the impact of dynamic braking on the torque slip characteristics of induction motor. (10 marks)</p> <p>ii. A 3-Phase, star connected, 6 Pole, 60 Hz, induction motor has the following constants $V_t = 231 \text{ V}$, $R_t = R_r' = 1\Omega$, , $X_t = X_t' = 2\Omega$,</p> <p>a. If the motor is used for regenerative braking determine the range of active load torque it can hold and the corresponding range of speed. (5 marks)</p> <p>b. If the motor is used for plugging, determine the braking torque and current at a synchronous speed. (5 marks)</p> <p style="text-align: center;">OR</p> <p>i. Explain the variable frequency speed control of induction motor in detail and plot the torque speed characteristics at various frequency control. (10 marks)</p> <p>ii. A 400V, 50 Hz, 6 Pole, 960 rpm, star connected induction motor has the following parameters per phase referred to the stator $R_s = 0.4\Omega$, $R_r' = 0.2\Omega$, $X_s = X_r' = 1.5\Omega$, $X_m = 30\Omega$</p> <p>The motor is controlled by variable frequency control at a constant flux of rated value,</p> <p>a. Calculate the motor speed and the stator current at half the rated torque and 25 Hz. (5 marks)</p> <p>b. Calculate the frequency, the stator current and voltage at rated breaking torque and 800 rpm. (5 marks)</p>	<p>CO4</p>
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