

## Unit 7 - Week 5

Course outline
How does an NPTEL online course work?
Pre Requisite
Week 1
Week 2
Week 3
Week 4
Week 5
<input type="radio"/> Overview of Electric Actuators and Operational Needs
<input type="radio"/> Principles of DC Motor Operation
<input type="radio"/> DC Motor Equations and Principles of Control
<input type="radio"/> Lecture Materials
<input type="radio"/> Quiz : Assignment 5
<input type="radio"/> Introduction to robotics :Week 5 Feedback Form
Week 6
Week 7
Week 8
Week 9
Week 10
Week 11
Week 12
Download Videos
Text Transcripts

## Assignment 5

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

**Due on 2020-10-21, 23:59 IST.**

1) Among the variants of actuators - electric, hydraulic and pneumatic, for a given power rating, 1 point

- electric actuators are the smallest in size.  
 hydraulic actuators are the smallest in size  
 pneumatic actuators are the smallest in size  
 the size of actuators will remain more or less the same.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*hydraulic actuators are the smallest in size*

2) In robotic applications, electric actuators are widely preferred because 1 point

- they are available in wide ranges of ratings  
 they are smallest in size for a given operational power requirement  
 they are easier to control  
 other actuators are incapable of generating a steady torque

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*they are easier to control*

3) An electric motor is used for actuating a robotic arm used in a pick and place application. It is observed that the torque output from the motor has a ripple superimposed over the steady value. For a given magnitude of peak to peak ripple 1 point

- if the frequency of ripple is higher, the impact of oscillations felt on the mechanical system is likely to be higher  
 if the frequency of ripple is higher, the impact of oscillations felt on the mechanical system is likely to be lower  
 the impact of oscillations felt on the mechanical system is independent of the frequency of the ripple and depends only on its amplitude.  
 the movement of the arm always becomes unstable at any frequency of ripple

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*if the frequency of ripple is higher, the impact of oscillations felt on the mechanical system is likely to be lower*

4) The use of gears in robotic arms is preferred in many cases because 1 point

- gears improve the overall efficiency of the drive.  
 the operating speed required for the arm is likely to be much lesser than the rotational speed of the actuating motor  
 the operating torque required for the arm is likely to be much larger than the torque generated by the actuating motor  
 gear can amplify the power generated by the motor and feed the load arm

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*the operating speed required for the arm is likely to be much lesser than the rotational speed of the actuating motor*  
*the operating torque required for the arm is likely to be much larger than the torque generated by the actuating motor*

5) Consider a statement(S) made about electric actuators for robotic applications and a reason (R) assigned to it. 1 point

- S: A power electronic converter is generally used for energizing the motor in the closed loop drive of the actuating system.  
R: The power converter is used to feed adjustable input supply to the motor as decided by the controller. Of these

- Both (S) and (R) are true and (R) is the correct reason for (S)  
 Both (S) and (R) are true and (R) is not the correct reason for (S)  
 (S) is true and (R) is false  
 Both (S) and (R) are not true

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*Both (S) and (R) are true and (R) is the correct reason for (S)*

6) A rectangular coil having length 10 cm and a width of 5 cm is placed in a uniform magnetic field of flux density 1 T , such that the plane of the coil is at an angle of 30 degrees to the direction of field. If the coil has 10 turns and carries a current of 5 A, the torque experienced by the coil, correct to 3 decimal places, is \_\_\_\_\_Nm

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*(Type: Range) 0.124,0.126*

1 point

7) A rectangular coil having length 10 cm and a width of 5 cm and 10 turns is placed in a uniform magnetic field of flux density 1 T , such that the coil sides are perpendicular to the direction of field. If the coil is manually rotated at a speed of 1000 rpm such that the axis of rotation is perpendicular to the direction of field, the peak value of emf developed across the coil, correct to 3 decimal places, is \_\_\_\_\_V

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*(Type: Range) 5.23,5.24*

1 point

8) In a PMDC motor, when the armature is rotated at 100 rpm, an emf of 2 V is developed across its terminals. For this motor, the armature current flow required to generate a torque of 0.4 Nm is 1 point

- 40 A  
 4 A  
 2 A  
 8 A

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*2 A*

9) For a PMDC motor, a peak to peak ripple of 1A in the current results in a torque ripple (peak to peak) of 0.25 Nm. The average current drawn from the supply is measured to be 10 A. If this motor is operated at a speed of 500 rpm, determine the average input voltage applied across the armature terminals, correct to 1 decimal place. Assume that the armature resistance is 0.5 Ω.(Answer is in volts)

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*(Type: Range) 17.5,18.5*

1 point

10) Pick out the correct statements from the following regarding the commutator-brush assembly 1 point

- The commutator and brushes rotate together at the same speed as that of the rotor  
 The commutator segments are insulated from each other  
 The brushes and commutators are generally made of the same conducting material  
 The external supply voltage in the case of motoring operation is applied across the brushes

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*The commutator segments are insulated from each other*  
*The external supply voltage in the case of motoring operation is applied across the brushes*

11) Consider a statement (S) made about DC motors and a reason (R) assigned to it. 1 point

- S: While a DC motor operates, the magnetic field generated by the permanent magnet remains unaltered by the armature current.  
R: The amount of magnetic field generated by the flow of armature current is lesser than the main field by an order of magnitude and hence its impact on the main field is trivial. Of these,

- Both (S) and (R) are true and (R) is the correct reason for (S)  
 Both (S) and (R) are true and (R) is not the correct reason for (S)  
 (S) is true and (R) is false  
 Both (S) and (R) are not true

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*(S) is true and (R) is false*

12) A PMDC motor has an armature resistance of 0.5 Ω. When supplying its rated load of 0.5 Nm, the motor draws an armature current of 2.5 A from a fixed input DC source of 48 V. The stall torque of the motor, correct to 1 decimal place, is \_\_\_\_\_Nm

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*(Type: Range) 18.8,19.4*

1 point

13) Adjusting the field is not possible for speed control in the case of PMDC motor based actuators because 1 point

- any change in magnetic field does not affect the operating speed significantly  
 the field is established in a PMDC motor by means of magnets whose flux density levels are generally fixed, and is practically difficult to alter  
 the field arrangement is placed in the stator  
 any variation in field results in an increased torque ripple for the same current

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*the field is established in a PMDC motor by means of magnets whose flux density levels are generally fixed, and is practically difficult to alter*

14) A dc motor rated for 48 V has its armature resistance of 0.4 Ω. The speed-emf constant of the motor is 0.3 V/(rad./s). The motor drives a constant load (independent of speed) of 1.2 Nm. Determine the additional resistance (in Ω) that needs to be placed in the armature circuit in order to operate the motor at a speed of 1000 rpm when it is driven by a 48 V supply. Do the calculations correct to 3 decimal places

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*(Type: Range) 3.735,3.75*

1 point

15) A dc motor rated for 48 V has its armature resistance of 0.4 Ω. The speed-emf constant of the motor is 0.3 V/(rad./s). The motor drives a constant load (independent of speed) of 1.2 Nm. Determine the armature voltage (in V) that needs to be applied in order to operate the motor at a speed of 1000 rpm. Do the calculations correct to 1 decimal place

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
*(Type: Range) 32.5,33.5*

1 point