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**NPTEL** (<https://swayam.gov.in/explorer?ncCode=NPTEL>) » **Robotics and Control: Theory and Practice (course)**

 Announcements (announcements)    **About the Course** ([https://swayam.gov.in/nd1\\_noc20\\_me03/preview](https://swayam.gov.in/nd1_noc20_me03/preview))

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## Unit 2 - Week 1

### Course outline

#### How does an NPTEL online course work?

#### Week 1

- Introduction (unit? unit=49&lesson=50)
- Coordinate Frames and Homogeneous Transformations-I (unit? unit=49&lesson=51)
- Coordinate Frames and Homogeneous Frames-II (unit? unit=49&lesson=52)
- Differential Transformations (unit? unit=49&lesson=53)

## Assignment 1

 The due date for submitting this assignment has passed. **Due on 2020-02-12, 23:59 IST.**
**Assignment submitted on 2020-02-08, 14:19 IST**

1) Degree of Freedom for a rigid body in space is:

**1 point**

- ☐ Three  
☐ One  
☒ Six  
☐ Four

Yes, the answer is correct.

Score: 1

Accepted Answers:

*Six*

2) Which of the following quantities not taken into account for Kinematics of a rigid body?

**1 point**

- ☐ Position  
☐ Velocity  
☐ Acceleration  
☒ Torque

Yes, the answer is correct.

Score: 1

Accepted Answers:

*Torque*

Transforming Differential Changes between Coordinate Frames (unit? unit=49&lesson=54)

Quiz : Assignment 1 (assessment? name=81)

Solution For Assignment 1 (unit? unit=49&lesson=90)

Week 2

Week 3

Week 4

Week 5

Week 6

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3) Two vectors are orthonormal if:

1 point

- ☒ Their cross product is zero.
- ☐ Their dot product is zero.
- ☐ Their cross product is one.
- ☐ Their dot product is one.

No, the answer is incorrect.

Score: 0

Accepted Answers:

*Their dot product is zero.*

4) Select True or False:

1 point

Statement: While performing successive translations and rotation , we can change the sequence of Homogeneous transformations.

- ☒ True
- ☐ False

No, the answer is incorrect.

Score: 0

Accepted Answers:

*False*

5) Consider following differential coordinate transformation Matrix represented by vectors  $n$ ,  $o$ ,  $a$  and  $p$ . Which of the following is not true?

1 point

$$T = \begin{bmatrix} n_x & o_x & a_x & p_x \\ n_y & o_y & a_y & p_y \\ n_z & o_z & a_z & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- ☐
- ☐  $n \times o = a$
- ☐
- ☐  $a \times n = o$
- ☐
- ☐  $o \times a = n$
- ☒
- ☐  $a \times o = n$

Yes, the answer is correct.

Score: 1

Accepted Answers:

$a \times o = n$

6) In case of Inverse Kinematics:

1 point

- ☐ Base frame position and orientation known; find end-effector position and orientation
- ☐ Joint Variables values known; find end-effector position and orientation.
- ☒ End -Effector position and orientation known; find values of joint variables.
- ☐ End-Effector position and orientation known; find base frame position and orientation.

Yes, the answer is correct.

Score: 1

Accepted Answers:

*End -Effector position and orientation known; find values of joint variables.*

7) A triangle with coordinates A(0,0), B(4,0) and C(2,2) rotated about z-axis by  $90^\circ$  anticlockwise, now triangle will be described by:

**1 point**

- ☐ A(0,0),B(2,-2),C(0,4)
- ☐ A(0,0),B(-2,2),C(0,4)
- ☒ A(0,0),B(0,4),C(-2,2)
- ☐ A(0,0),B(0,-4),C(2,-2)

Yes, the answer is correct.

Score: 1

Accepted Answers:

*A(0,0),B(0,4),C(-2,2)*

8) Let F be the coordinate frame with  $\vec{i}, \vec{j}, \vec{k}$  as the coordinate axes and M be the coordinate frame with  $\vec{k}, \vec{j}, -\vec{i}$  as its coordinate axes. Suppose the coordinates of point p with respect to frame M are  ${}^M[p] = [2, 1, 3]^T$ . What are the coordinates of p with respect to fixed frame F.

**1 point**

- ☒  $[-3, 1, 2]^T$
- ☐  $[3, 1, 2]^T$
- ☐  $[2, 1, 3]^T$
- ☐  $[-2, 1, 3]^T$

Yes, the answer is correct.

Score: 1

Accepted Answers:

*$[-3, 1, 2]^T$*

9) If the work space of a 3 dof manipulator is a cylinder, then its configuration is given by:

**1 point**

- ☐ PPP
- ☐ RRP
- ☒ RPP
- ☐ RRR

Yes, the answer is correct.

Score: 1

Accepted Answers:

*RPP*

10) If the matrix for a general rotation about a unit vector angle  $\theta$  is given by

**0 points**

$$\begin{bmatrix} \frac{1}{\sqrt{3}} & -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{6}} \\ \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{6}} \\ \frac{1}{\sqrt{3}} & 0 & -\frac{2}{\sqrt{6}} \end{bmatrix}$$

Then approximate value of  $\cos\theta$  will be:

- ☐ 0.467
- ☒ 0.934
- ☐ 0
- ☐ 0.783

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
0.467