NPTEL Online Course

# Wheeled mobile robots: Week 4 by Dr.Asokan Thondiyath

Assignment 4

1. Question 1:

Which of the below system is constrained to perform tasks having least complexity, given the robotic systems have least sensing and perception capabilities?

* 1. Remotely operated mobile robot
  2. Tele-operated surgical robot
  3. An autonomous underwater robot
  4. Hybrid robots

Solution: **Ans**(*c*)

An autonomous underwater robot

1. Question 2:

“The process by which people translate sensory impressions into a coherent and unified view of the world around them.”

Choose the process for which the above statement suits the best.

* 1. Localization
  2. Cognition
  3. Motion control
  4. Perception

Solution: **Ans**(*d*)

Perception

1. Question 3:

Select the sensor systems which cannot be classified as both exteroceptive and active sensor systems.

* 1. Contact switches
  2. Non-contact proximity sensors
  3. Optimal Barrier
  4. Gyroscope
  5. Doppler radar
  6. Optical encoder

Solution: **Ans**(*a,d and f*)

Contact switches

Gyroscope

Optical encoder

1. Question 4:

Consider a robotic system having a mechanical gyroscope, which reads the following spinning and precession speed as 600rpm and 40rpm respectively. For the given gyroscope the mass of the spinning disc is 4kg with radius of gyration of 30mm. Find out the reactive torque in Newton-meter. (up to two decimal places)

Solution range: **0.93 to 0.95 Nm**

I = mk2 = 4×(0.03)2 =0.0036 kg.m2

𝜔 = 2×600/60 =62.83rad/s

Ω = 2×40/60 =4.19rad/s

T = I 𝜔 Ω = 0.94 Nm

1. Question 5:

Select the wrong statement:

The accelerometers are used in a robotic system for the measurement of

* 1. Displacement if the acceleration is known
  2. Linear Acceleration if the linear displacement is known
  3. Jerks on the system
  4. Force acting on the system if the mass is known.

Solution: **Ans**(*a*)

Displacement if the acceleration is known.

1. Question 6:

Which of the following sensors are not incorporated in an Inertial measurement unit for estimating the 6-DOF position and orientation of the system.

1. Optical encoder
2. MEMS gyroscope
3. Vision sensor
4. Accelerometer

Solution: **Ans**(*a and c*)

Optical encoder

Vision sensor

1. Question 7:

The minimum number of satellites required in a global positioning system are \_\_\_\_\_.

* 1. 2
  2. 3
  3. 24
  4. 4

Solution: **Ans**(*d*)

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1. Question 8:

A floor cleaning robot is placed at position ‘a’ and it detects an obstacle at a position ‘b’ with the help of an ultrasonic sensor. The sensor values are as follows, speed of wave propagation = 340m/s and time of flight = 0.04 seconds. Find the distance between ‘a’ and ‘b’ in meters. (up to two decimal places)

Solution range: **6.70 to 6.90 meters**

D = c×t = 340×0.04/2 = 6.80 m

1. Question 9:

Select the principles which are used in a proximity sensor.

* 1. Inductance
  2. Capacitance
  3. Ohm’s principle of resistivity
  4. Light intensity modulation
  5. Ultrasonic wave propagation

Solution: **Ans**(a, b, *d and e*)

Inductance

Capacitance

Light intensity modulation

Ultrasonic wave propagation

1. Question 10:

According to the error propagation law the output covariance is given by the relation, where

Solution: **Ans**(*b*)