



COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical & Control Engineering

Lecturer : Dr Ahmed El-Shenawy

Course : Robotics

Course Code : EE 514

Marks : 40

Date : 2 / 6 / 2013

Time : 2 hour

Final Exam

Answer all the following questions

Question (1) : (12 marks) (A1)(A4)

- a) Consider the manipulator robotics system shown in Figure. 1 and 2. Find an expression for the forward Kinematics relation.

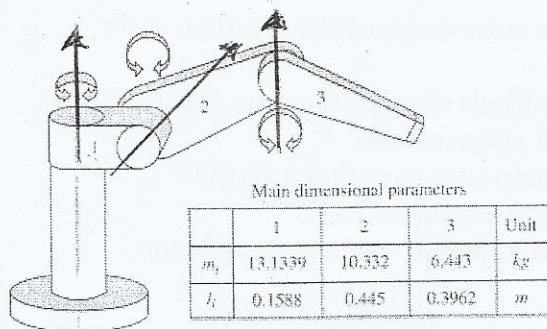


Figure (1)

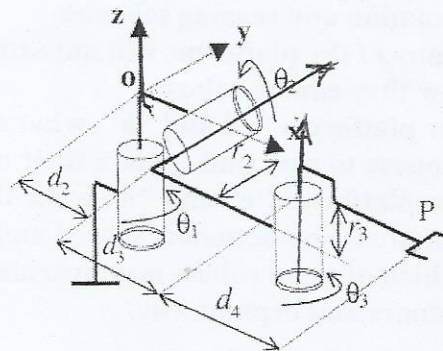


Figure (2)

Question (2) : (8 marks)

- a) Explain the servo mechanism using example. (3 marks)
 b) What are the properties of servo mechanism (2 marks)
 c) Find the Euler angles that produce the following matrix. (3 marks)

$$Q = \begin{bmatrix} 0.36 & 0.48 & -0.8 \\ -0.8 & 0.60 & 0 \\ 0.48 & 0.64 & 0.60 \end{bmatrix}$$

Members of course Examination Committee:	Signature:	Date:
Lecturer: Dr Ahmed El-Shenawy		29/5/2013
Course Coordinator : Dr. Mostafa Abdel-Gelil		29/5/2013
Head of Department: Prof. Hamdy Ashour		29/5/2013

Question (3): (10 marks) (C1)(B3)

For the wheeled mobile robots shown in Figure 3, please do the following (assuming that each robot's coordinate system is in the middle of the platform). Hint platform "d" has an omni directional wheel.

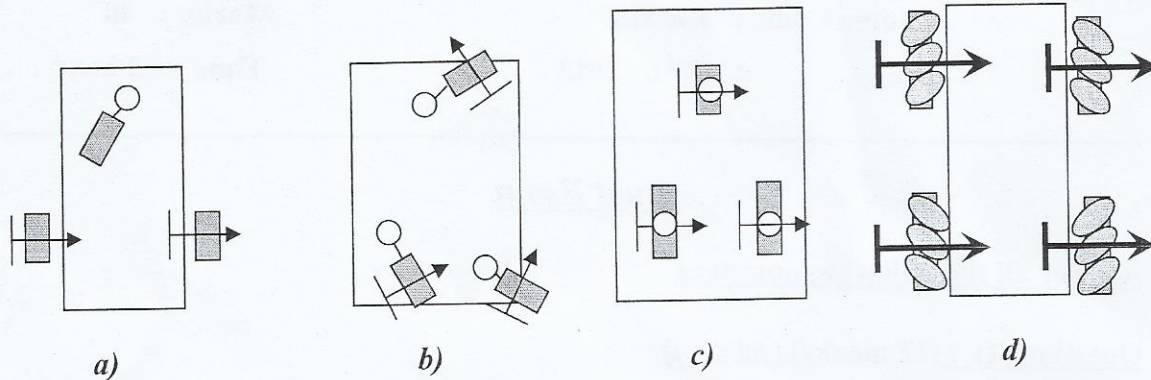


Figure (3)

- 1) Compare between the four configurations with respect to the mobility, actuation and sensing schemes.
- 2) If any of the platforms will not satisfy the robustness of the (1), then show how they can be robust.
- 3) For platforms "a" and "b", what are the kinds of actuators and sensors you propose to use? and explain their method of operation.
- 4) For platforms "c" and "d" write their composite equation and their actuated, non-actuated, sensed and non-sensed variables.
- 5) Which of these robots may operate out doors and which may operate indoors and explain why.

Question (4) : (10 marks)

- a) Explain the operation of incremental encoder and state two of its applications. (3 marks)
- b) Explain the method of collision avoidance using repulsive forces. (4 marks)
- c) What are the classifications of sensory? (3 marks)

Best Regards

Members of course Examination Committee:	Signature:	Date:
Lecturer: Dr Ahmed El-Shenawy	<i>[Signature]</i>	29/5/2013
Course Coordinator : Dr. Mostafa Abdel-Gelil	<i>[Signature]</i>	29/5/2013
Head of Department: Prof. Hamdy Ashour	<i>[Signature]</i>	29/5/2013