



COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical & Control Engineering

Lecturer : Dr Ahmed El-Shenawy

Course : Robotics

Course Code : EE 514

Date : 17 / 1 / 2016

Marks : 40

Time : 2 hour

Final Exam

Answer all the following questions

Question (1) : (10 marks) (A1)(A4)

For the robot shown below find the following

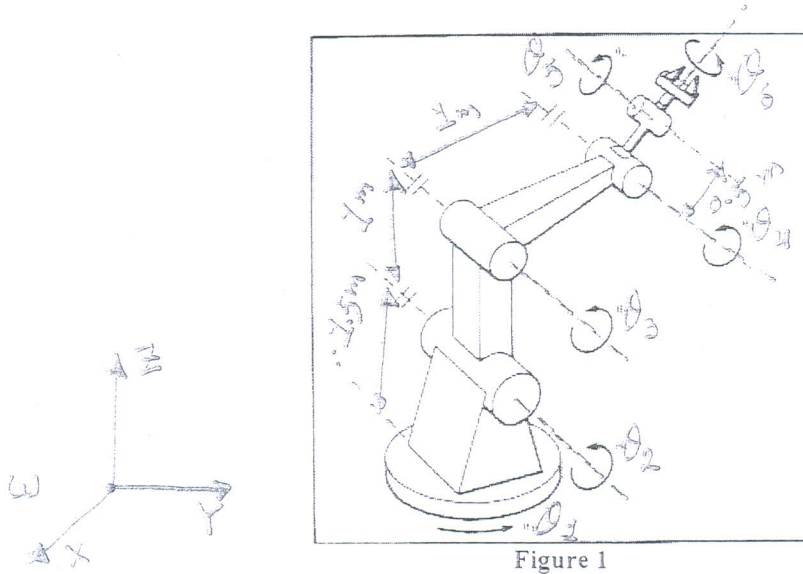


Figure 1

- Locate the frame coordinates for each joint
- Obtain the D-H table
- The forward Kinematics using D-H table

Question (2) : (12 marks)

- What are the main components of a robotics system? (2 marks)
- Explain the servo mechanism using example and its properties. (4 marks)
- Define with short description four classes of sensors. (2 marks)
- Explain the theory of operation of rotator Encoders. (4 marks)

Members of course Examination Committee:	Signature:	Date:
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Course Coordinator : Dr Ahmed El-Shenawy		6/1/2016
Head of Department: Prof. Hamdy Ashour		6/1/2016

Question (3): (12 marks) (C1)(B3)

Design a Land Mine Sweeper which scans a land space of 25 m^2 . Assume that the land is divided into squares; each square is 1 m^2 as shown in Fig 2.

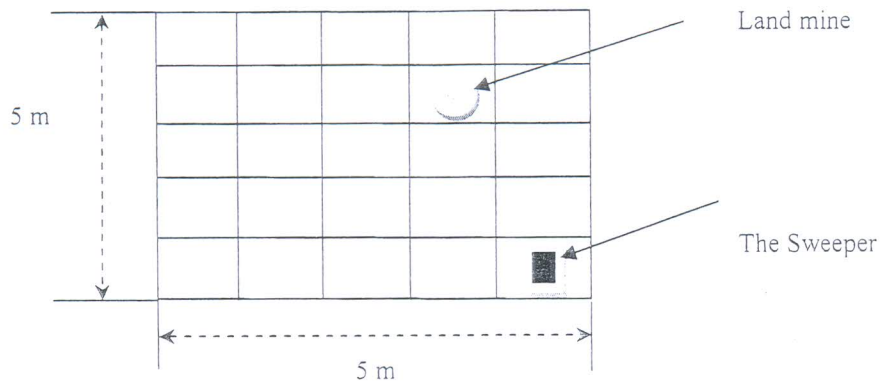


Figure 2

Mission:

The Sweeper will be designed as a Wheeled Mobile Robot with proper wheels for sand environment. The sweeper will detect the landmine and avoid its explosion by avoiding driving over it, and the land mine is constructed of metal.

Requirements:

- Define the robot configuration with allocation of coordinate systems (types of wheels, Manipulator arm may be added)
- Show that the robot drive properly on sand ground with robust sensing and actuation.
- Show each wheel Jacobean and define its actuated and sensed variables.
- Write the composite equation.
- State the kinds of sensors and actuators used in this robot
- Explain a theoretical method to avoid the landmines.

Question (4): (6 marks) (C1)(B3)

Figure 3 shows a PID control system for a Valve. The PID parameters are tuned to give best response. However in some cases the PID control Signal (c) is not enough to reach the set point as shown in Figure 4. The high steady state error (ess) and the highly increasing control signal (C) is quite noticeable in the figure. Please state the name of such phenomena and its reasons. Show in block diagram how may you solve such problem?

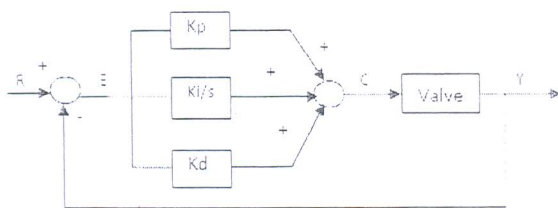


Figure 3

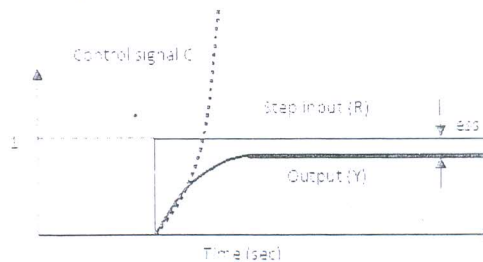


Figure 4

Best Regards

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