NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL ENGINEERING

MASTERS IN MANUFACTURING SYSTEMS AND OPERATIONS MANAGEMENT

Automation & Robotics – TIE 6220

SUPPLEMENTARY EXAMINATIONS OCTOBER 2009

Time allowed: 3 hours
Answer any four questions, at least one from each section A,B,C and D

SECTION A

Qu.1 a)   What is an industrial robot?   [5]
      b)   Describe one type of robots according to their configuration with
           illustrations to support.   [10]
      c)   Discuss two tangible and three intangible benefits for introducing robots.
           [10]

Qu.2 a)   Describe one type of a mechanical gripper.   [10]
      b)   Discuss one aspect that needs to be considered in gripper design. [10]

      c)   Explain two sources of hazards associated with robots.   [5]

SECTION B

Qu.3 a)   Briefly explain lead through programming method.   [4]

      b)   What do you understand by forward and reverse transformation in robot
           motion control.   [6]

      c)   Given that the end effect of the robot is currently at position
           X=435 y=510; $\theta = 60°$, $\theta_2 = 335°$

           Find the change in joint that needs to be computed by the system to get
           to position x=252 y=161   [10]

      d)   Discuss control resolution in robot systems.   [5]

Qu. 4 a) Discuss mechanical inaccuracies.   [10]

       b) Describe a open loop control system in and briefly
           explain the components in the control system.   [15]

SECTION C
Robot Sensing

Qu. 5 a) Discuss Inductive sensors. [10]

b) Briefly discuss Tactile Sensors [15]

Qu.6 a) Explain why in robot sensing/computer vision, illumination is so important. [5]

b) Discuss the design, operation, advantages and disadvantages of solid state CCD array camera. [20]

SECTION D
Automation

Qu. 7 a) Write a program in Matlab that will control the traffic lights corner Cecil and Gwanda Road. Assuming the first two positions stand for red and the next two stand for yellow and the next two stand for green and the last two stand for fail safe which is flashing if the is a fault. [8]

b) Briefly explain what PLCs are. [2]

c) Discuss briefly the following terms Counters and Timers [4]

d) A PLC is to be used to control the operation of an automatic door. A camera is used to defect a person's approach. When the person is within 50mm of the door, the door is to be opened automatically. An infrared beam in the doorway is to be used to detect the actual entrance of the person. Ten seconds after the person enters the door is to be closed unless there is someone within 50mm of the door. If the person does not enter 30s after the door has opened, it is closed again. Develop your own I/O assignments and construct a ladder logic diagram for this task. What suggestions could you make to improve on this logic? [11]

End of Exam