## NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

## FACULTY OF INDUSTRIAL TECHNOLOGY

## DEPARTMENT OF INDUSTRIAL ENGINEERING

## Computer Control of Manufacturing Systems – TIE 6120

SUPPLEMENTARY EXAMINATIONS OCTOBER 2009

*Time allowed: 3 hours Answer Four questions altogether All questions carry equal marks Semi-log graph paper is provided* 

$$G(s) = \frac{K(s+3)}{s(s+1)(s+2)}$$

Qu.2 a) Open loop transfer function given below. What are the positive values (if any) of the variable parameter to give closed loop stability [12]

$$g(s)h(s) = \frac{K}{(1+s)(1+0.5s)(1+3s)}$$

- b) Sketch the root locus diagram for the open loop transfer function and describe the closed loop behaviour in each case as the gain is increased progressively from a low to a high value. [13]
- Qu. 3 a) The proportional plus integral plus derivature (PID) control algorithm can be written as

$$PID = K_c \left[ \varepsilon(t) + \frac{1}{T_i} \int \varepsilon(t) dt + Td \frac{d\varepsilon(t)}{dt} \right]$$

- i) Define  $K_c$ ,  $T_i$  and  $T_d$
- b) Write a Matlab program for Figure 3.1 to sketch the root locus for the system shown that would find the following: [16]
  - i. The exact point and gain where the locus crosses the 0.45 damping ratio line.
  - ii. The exact point and gain where the locus crosses the jw –axis
  - iii. The break away point on the real axis.



Figure 3.1

Qu. 4 a) Briefly explain what PLCs are. [6]

b) Discuss briefly the following term Timers [6]

c) 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? [13]

Qu. 5 a) Briefly discuss the following terms with aid of examples where applicable.

i)	Stepper motors	[4]
ii)	Serial communication	[4]
iii)	LAN	[4]

b) Explain briefly the following terms in terms of Data communication between the computer and external devices.

i)	Hertz	[2]
ii)	Bandwidth	[2]

c) What do you understand by the term Token Ring? [5]

d)	What does the term MAP and TOP mea	an in relationship with	
comp	puter Control of manufacturing systems		[8]

Qu 6 a) Explain the following terms as related to network Communication

- i) Baud[2]ii) Communication Medium[2]iii) Network topologies and two examples[8]
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b) Write a Matlab program for displaying a root locus and pause [13]



End of Exam