Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	MODELLING AND SIMULATION
COURSE CODE	:	BDC 40703
PROGRAMME	:	4BDD
EXAMINATION DATE	:	JUNE 2014
DURATION	:	2 HOURS
INSTRUCTIONS	:	ANSWER ANY **THREE (3)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PRINTED PAGES

Q1 System identification needs to do both Structure and Parameter Identifications repeatedly until satisfactory model is found.

a) Elaborate the differences between the terms ***Structure Identification*** and ***Parameter Identification***.

(5 marks)

b) Construct a flow diagram that details the sequence of processes which involve both identification stages to find a mathematical model of a water level system.

(20 marks)

Q2 a) Consider the closed-loop control system shown in **FIGURE Q2**. In the system, $\frac{1}{S^2+2S+4}$ and $\frac{S+10}{S}$ are the controller and plant representations. There are infinitely many state-space representations can be created from any given system. Provide **TWO** possible state-space representations for the system in **FIGURE Q2**.

(5 marks)

b) Obtain the **TWO** state-space equations for the system based on the state-space representations obtained from **Q2** (a).

(20 marks)

Q3 As a design engineer, you are asked to model and simulate a car auto-cruise system.

a) Determine whether deterministic or stochastic mathematical model is more appropriate for the system. Explain your selection.

(5 marks)

b) Elaborate **FOUR (4)** objectives of your car auto-cruise simulation.

(4 marks)

c) Assume that the car auto-cruise system is using PID controller with values $K_p = 1$, $K_i = 0$ and $K_d = 0$. Illustrate the time-response of the car if the initial velocity is set at 100km/h and the car suddenly collides with a bumper at time, t = 10 second. The impact reduces the car velocity to 50km/h before the velocity oscillates and settles at 95km/h at time, t = 13.5 second.

(8 marks)

d) Explain how the PID controller can be optimised in order to improve the response so that zero error is achieved with minimum overshoot and settling time.

(8 marks)

Q4 a) If an unknown system is selected for a length measurement, explain how system linearization and system identification can be conducted on the unknown system.

(10 marks)

b) A system is found to be non-linear in nature. The system however can be simplified as a linear system in the region defined by $5 \leq x \leq 7$, $3 \leq y \leq 5$. Please linearise the system in the indicated region if the nonlinear equation is given as follows,

$$z=3x^2+5xy+7y^2$$

(15 marks)

- END OF QUESTION -

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014 PROGRAMME : BDD
COURSE NAME: MODELLING AND SIMULATION COURSE CODE : BDC 40703

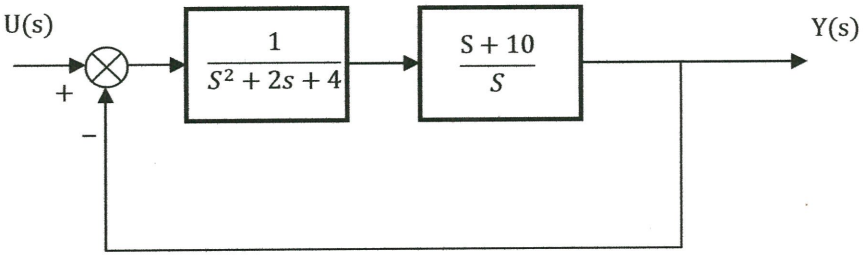

FIGURE Q2