



# **UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

## **PEPERIKSAAN AKHIR SEMESTER II SESI 2008/09**

**NAMA MATA PELAJARAN : SISTEM KAWALAN FUZZY**

**KOD MATA PELAJARAN : BER 4233**

**KURSUS : 4 BEE**

**TARIKH PEPERIKSAAN : APRIL 2009**

**JANGKA MASA : 2 1/2 JAM**

**ARAHAN : JAWAB EMPAT (4) SOALAN  
SAHAJA DARIPADA LIMA (5)  
SOALAN.**

**KERTAS SOALAN INI MENGANDUNGI 5 MUKA SURAT**

- Q1. (a) List 4 advantages of fuzzy control system. (4 marks)
- (b) Draw the fuzzy control system block and tell each element definition. (11 marks)
- (c) Explain why input and output variables very important to know in designing fuzzy control system? (5 marks)
- (d) Describe what is neuro fuzzy system? (5 marks)

Q2. Fuzzy control system is applied for control the robot arm movement. Fuzzy control system type is MISO and each variable have five membership functions in triangular function. Each membership function names respectively are NB (negative big), N (negative), Z (zero), P (positive), and PB (positive big). Universe discourse related with each variable name as the following:

- Error:
  - NB: [-3, -2, -1]
  - N: [-2, -1, 0]
  - Z: [-2, 0, 2]
  - P: [0, 1, 2]
  - PB: [1, 2, 3]
- Change in error:
  - NB: [-6, -4, -2]
  - N: [-4, -2, 0]
  - Z: [-2, 0, 2]
  - P: [0, 2, 4]
  - PB: [2, 4, 6]
- Change in error:
  - NB: [-3, -2, -1]
  - N: [-2, -1, 0]
  - Z: [-1, 0, 1]
  - P: [0, 1, 2]
  - PB: [1, 2, 3]

Maximum value of all quantification is 1.

- (a) Create table of Rule (10 marks)
- (b) Draw the membership function related table in point (a) (12 marks)
- (c) Formulate all rules fire related with error is -1.5 and change in error is 2.5 (3 marks)

- Q3. (a) Describe what neural network is and explain how it works? (4 marks)
- (b) List 4 advantages of neural network (4 marks)
- (c) Calculate the error one iteration of three layers neural network with three input layer neurons and three hidden layer neurons and one output layer neuron. Where inputs, target and learning rate respectively are:  $x_1 = 1, x_2 = 0, x_3 = 1, t = 0, \eta = 0.45$ .  
Initial value for all hidden layer neurons are -0.01 and for output layer neuron is 0.02 and activation function for hidden and output layer is  $f(net) = \frac{1}{1 + e^{-net}}$  (17 marks)

- Q4. A fuzzy control system has triangular membership function and three membership functions below are firing:

IF error is zero AND change in error is positive big THEN output is positive  
 IF error is negative big AND change in error is positive big THEN output is negative big  
 IF error is negative AND change in error is positive big THEN output is zero

Evaluate implies fuzzy set using minimum criteria and the crisp output signal using centroid of gravity (COG) for change in error is 2.5 and error is -1.5 if universe discourse for zero error is [-2, 0, 2], negative error is [-3, -1.5, 0], negative big error is [-4, -2.5, -1], positive

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big change in error is [2.5, 4, 5.5], zero output is [-4, 0, 4], positive output is [2, 4, 6], and negative big output is [-8, -6.5, -5]

(25 marks)

Q5. A multilayer neural network is represented in Figure Q5. The network is trained using Backpropagation learning algorithm with initial condition as below:

$$x_1 = 1, x_2 = 1, x_3 = 1, t = 1, \eta = 0.5$$

$$w_1 = 0.01, w_2 = -0.01, w_3 = 0.11, w_4 = -0.21, w_5 = -0.11, w_6 = -0.2, w_7 = -0.15,$$

$$w_8 = 0.31$$

Activation function for hidden and output layer is  $f(net) = \frac{1}{1 + e^{-net}}$

(a) Determine the value of each weight after one iteration

(21.6 marks)

(b) Calculate and draw MSE graph

(3.4 marks)

PEPERIKSAAN AKHIR

SEMESTER SESI : 2 2008/09  
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KURSUS : 4 BER  
KOD : BER 4233  
MATAPELAJARAN

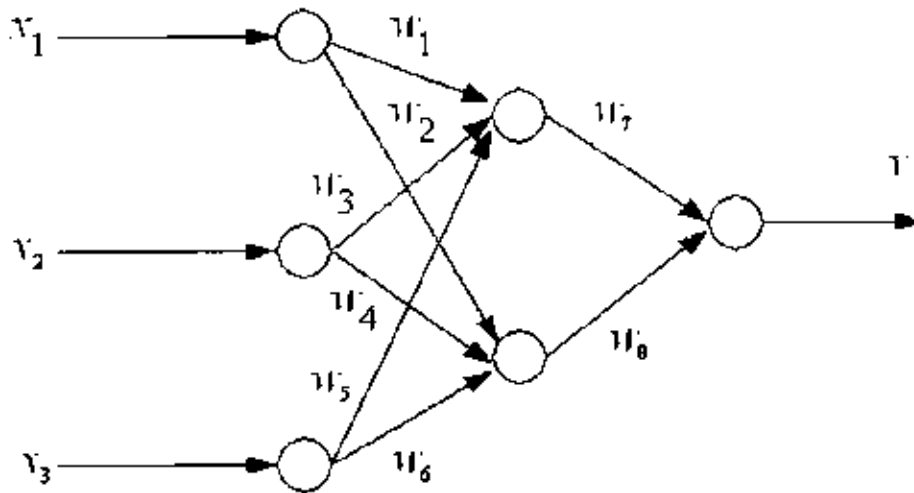


Figure Q5

TABLE OF SPECIFICATION  
FOR FINAL EXAMINATION QUESTION AND MAPPING OF SLO TO QUESTIONS

Programme	: Bachelor Of Electrical Engineering		
Code	: BER 4233	Course	: 4 BER
Semester	: 2	Session	: 2008/2009

SLO/ PLO	SLO Assessed (Fill in With % Marks for Cognitive Level Assessed)																								PLO Assessed (tick / where needed)									
	1						2						3						4						5						1	2	4	5
Cognitive Level	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	4	5
Q1	(a)	4																																
	(b)				11																													
	(c)		5																															
	(d)		5																															
Q2	(a)																																	
	(b)																																	
	(c)																																	
Q3	(a)																																	
	(b)																																	
	(c)																																	
Q4																																		
Q5	(a)																																	
	(b)																																	
Cognitive Level For Each SLO																																		

**INSTRUCTIONS**

1. Get the softcopy of this template 'Table Of Specification' from Puan Norida Kasim, through email.
2. Adjust the template accordingly suitable for the number of question and no. of SLO assessed.
3. Only consider PLO1, PLO2, PLO4 and PLO5, which is PLO concerns with Technical Competency.
4. To simplify the overall assessment, each question assesses one PLO. But each PLO may be assessed by two Questions
5. Fill in the box within the SLO assessed, giving percentage marks for the related cognitive level
6. Calculate the total % marks for each cognitive level for each SLO.
7. Tabulate the grand total of each cognitive level.

Cognitive Level		Total Marks For Each Cognitive Level
1	8	8
2	18	18
3		
4	64	64
5	38	38
6		
		100 %