UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
SEPTEMBER 2016 SEMESTER

COURSE CODE	:	LEB 40403
COURSE NAME	:	DIGITAL SIGNAL PROCESSING
PROGRAMME NAME	:	BACHELOR OF ENGINEERING TECHNOLOGY (HONS) IN MARINE ELECTRICAL AND ELECTRONIC
DATE	:	25 JANUARY 2017
TIME	:	9.00 AM – 12.00 PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.

2. This question paper has information printed on both sides of the paper.

3. Answer FOUR (4) questions only.

4. Please write your answers on the answer booklet provided.

5. Answer all questions in English / Bahasa Melayu language ONLY.

THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

INSTRUCTION: Answer any FOUR (4) questions.
Please use the answer booklet provided.

Question 1

a)   Analogue and digital signal is the most popular signal used in real world as sinusoidal, tangential and cos signal. Differentiate **SIX (6)** between analogue and digital signal. **(CLO 1, C4)**

(12 marks)

b)   An ultrasound wave used by fisherman to measure depth sea water and locate fish. Digital signal used on panel for user interface, converting from digital to analogue (DAC) signal. Given sample number is 30 and complete sinusoidal wave used for ultrasound application. Summarize by calculate distance between classes per half degree used by fisherman. **(CLO 1, C5)**

(13 marks)

Question 2

a)   The block diagram is simplifications represent several output transfer function. The general output transfer function is final process over input function. Given output equation $y(x) = 2z(x^2 + 2x + 3) * (2x^2 + 3x + 4) + (5x^2 + 6x + 7)$, interpret the full diagram based on the equation. **(CLO 2, C5)**

(4 marks)

b)   A discrete signal or discrete-time signal is a time series consisting of a sequence of quantities. In other words, it is a time series that is a function over a domain of integers. Distinguish **two (2)** types of discrete time signal. **(CLO 2, C4)**

(4 marks)

c)   An arbitrary sequence can be represented in time domain as weighted sum of basic sequence and it's delayed. Based on figure 1.0, solve the output equation. **(CLO 2, C6)**
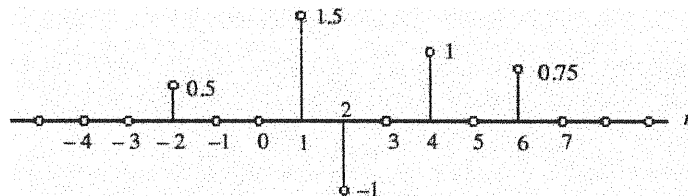

Figure 1.0: Arbitrary sequence

(7 marks)

d)   A complete cycle wave represents (n), used by military for sampling high frequency at different amplitude. Evaluate the discrete time signal $v(n)$ obtained by uniform sampling at a sampling rate of 100 Hz the continuous time signal. **(CLO 2, C5)**

$$v(t) = 6\cos(60\pi t) + 3\sin(300\pi t) + 2\cos(340\pi t) + 4\cos(500\pi t) + 10\sin(660\pi t)$$

(10 marks)

Question 3

a)   In engineering, a transfer function (also known as system function or network function and, when plotted as a graph, transfer curve) is a mathematical representation for or to describe inputs and outputs. Interpret the transfer function $H(z)$, given number of sample n is 6. **(CLO 3, C5)**

(15 marks)

b)   A parallel transfer function given by $y_1(x_1) = x^2 + 2x$, $y_2(x_2) = 2x^2 + 3x$ and $y_3(x_3) = 3x^2 + 4x$, both function undergo convolution kernel process of $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$. Distinguish output transfer function. **(CLO 3, C4)**

(10 marks)

Question 4

a) Company AAA used to operate in ultrasound spot device. The ultrasound measure complete sinusoidal wave travel to allocate fish spot used by boat. You was assigned as an engineer to Company AAA, and required to justify the best ultrasonic device between A and B for sampling process in radiance/second. **(CLO 4, C5)**

(13 marks)

Device A	Device B
Signal Type: Analog	Signal Type: Analog
Travel Distance: 800m	Travel Distance: 850m
Sampling time: 10 sec	Sampling time: 5 sec

b) Digital electronics or digital (electronic) circuits are electronics that handle digital signals (discrete bands of analog levels) rather than by continuous ranges as used in analog electronics. Digital signal also used to by computer and generated from analog signal called digital to analog converter. Solve the resolution even number between bit numbers 6 to 14. **(CLO 4, C4)**

(12 marks)

Question 5

a)   Filter system is widely used in digital signal processing, it is functioning by remove unwanted signal (noise). Sketch **four (4)** types of filtering system, which represent $h1$ transfer function as low frequency and $h2$ transfer function as high frequency. **(CLO 5, C4)**

(8 marks)

b)   A set of input transfer function represent $z(a) = \frac{1}{x^2+2x+3}$ operated at 30Hz and $z(b) = 2x^2 + 3x + 4$ capable frequency at 150Hz. **(CLO 5)**

   i)   Produce output frequency for bandpass and bandstop filter. **(C4)**

(2 marks)

   ii)   Design bandpass and bandstop output transfer function. **(C6)**

(11 marks)

c)   Infinite Impulse Response (IIR) filters have traditional analog counterparts (Butterworth, Chebyshev, Elliptic, and Bessel) and can be analyzed and synthesized using more familiar traditional filter design techniques. Distinguish **four (4)** characteristic of spectral transformation of Infinite Impulse Response (IIR) filter. **(CLO 5, C5)**

(4 marks)

END OF EXAMINATION PAPER