UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
JANUARY 2016 SESSION

SUBJECT CODE : LED10103
SUBJECT TITLE : SHIPBOARD ELECTRO-TECHNOLOGY
LEVEL : DIPLOMA
DATE : 19 May 2016
TIME : 9.00 AM – 12.00 PM
DURATION : 3 hours

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections; section A and section B.
6. Answer all questions in section A. For section B, answer TWO (2) questions ONLY.
7. Answer all questions in English.

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.
PART A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

a. There are various types of electrical and electronics system used on a board ship and a small craft including in navigation system. List down four(4) navigation system on a ship that use electrical and electronics part and explain the function of the system listed. (12 marks)

b. Resistor is one of many device that been used in electrical circuit. The resistance value can be determined by its colour code. Determine the value of $R_1$, $R_2$, and $R_3$ by its colour code and then determine the value of voltage $V_2$ in Figure 1 below.

![Figure 1](image)

i. $R_1 = \text{White, Grey, Brown}$ (1 marks)

ii. $R_2 = \text{Brown, Blue, Red}$ (1 marks)

iii. $R_3 = \text{Violet, Red, Brown}$ (1 marks)

iv. Voltage, $V_2$ (5 marks)
Question 2

a. Series and parallel electrical circuits are two basic ways of wiring components. The circuit can be connected as a combination of series and parallel circuit as shown in Figure 2 below.

![Figure 2](image)

Analyze and calculate:

i. The value of equivalent resistance, $R_T$  
   (6 marks)

ii. Current flow through $R_T$  
    (6 marks)

iii. Voltage at $R_3$  
    (2 marks)

iv. Power absorbed at $R_6$  
    (6 marks)

b. The period of time during which charge is being deposited is called the transient period. The circuit in Figure 3 composed of resistor and capacitor that have the transient period and can be determine by using the correct equations.

![Figure 3](image)

Determine the:

i. The time constant of the circuit  
   (1 mark)

ii. Voltage, $V_c$ when $t=2$, $t=5$  
    (4 marks)
Question 3

a. A 6μ capacitor, 12μ capacitor and 16μ capacitor are connected in parallel to a 120V source.
   i. Sketch a circuit as mention above. (2 marks)
   ii. Calculate the total capacitance. (4 marks)
   iii. Calculate the magnitude of charge stored by each capacitor. (6 marks)

b. A transformer in Figure 4 with a turn ratio of 0.667 is connected to a 220V voltage source and the resistive load of 10Ω is connected to the terminal of the secondary winding.

![Figure 4]

Calculate:
   i. Secondary voltage (4 marks)
   ii. Secondary current (2 marks)
   iii. Primary current (2 marks)
PART B

INSTRUCTION: Answer only TWO (2) questions.
Please use the answer booklet provided.

Question 4

a. The sine wave is important in electrical system because it retains its wave shape when added to another sine wave of the same frequency and arbitrary phase. Referring to the figure 4, an alternating voltages has the equation $v(t) = 220 \cos 150t V$
Determine the:

i. Frequency (2 marks)

ii. Period (2 marks)

iii. Peak value (2 marks)

iv. Root means square (Vrms) (2 marks)

v. Average value (2 marks)

\[ v(t) = 220 \cos 150t V \]

Figure 5
b. An electrical power on cargo ship is commonly generate a voltage of $100 \sin (200t + 60)$ and was connected to a load consists of resistor $8\Omega$, inductor reactance $15\Omega$ and capacitor reactance $2\Omega$. Calculate the:

i. The frequency of the circuit (2 marks)

ii. The value of inductor $L$ (2 marks)

iii. The value of capacitor $C$ (2 marks)

iv. The current (2 marks)

v. Power factor (2 marks)

Question 5

a. State FOUR (4) major types of dc generators on board ship and sketch their equivalent circuit each types including label such as voltage source, field winding, armature winding, armature resistance and etc. (12 marks)

b. The terminal voltage of a separately excited DC generator can be controlled by changing the internal generated voltage $E_A$ of the machine.

$$V_T = E_A - I_A R_A$$

A ship was equipped with a separately-excited. It develops a no-load e.m.f of 220V at an armature speed of 1200 rpm and a flux per pole of 0.10Wb. Determined the generated voltage when:

i. The speed increase to 1500 rpm and the pole flux remains unchanged (2 marks)

ii. The speed remains 1200 rpm and the pole flux is increase to 0.12Wb. (2 marks)

iii. The speed increase to 1440 rpm and the pole flux is decreased to 0.07Wb (2 marks)

iv. The speed increase to 1600 rpm and the pole flux is decreased to 0.05Wb (2 marks)
Question 6

a. Explain definition of electrical machine  
   (2 marks)

b. A 50 hp, 250 V, 1200 rpm DC shunt motor with compensating windings has an armature resistance (including the brushes, compensating windings, and interpoles) of 0.06 Ω. Its field circuit has a total resistance $R_{adj} + R_f$ of 50 Ω, which produces a no-load speed of 1200 rpm. The shunt field winding has 1200 turns per pole. Calculate:

i. Input current when the motor speed at 1167r/min.  
   (6 marks)

ii. Input current when the motor speed at 1138r/min.  
    (6 marks)

iii. Input current when the motor speed at 1115r/min.  
     (6 marks)

END OF QUESTION