



**ELIZADE UNIVERSITY, ILARA-MOKIN,  
ONDO STATE, NIGERIA  
DEPARTMENT OF AUTOMOTIVE ENGINEERING**


**FIRST SEMESTER EXAMINATIONS 2018/2019 ACADEMIC SESSION**

**COURSE:** GNE 415 Engineering Analysis (3 Units)

**CLASS:** 400 Level General Engineering

**TIME ALLOWED:** 3hrs

**INSTRUCTIONS:** Answer Five (5) questions.

  
**HOD'S SIGNATURE**

**Date:** March, 2019

**Question 1**

- 1a. Show that the real and imaginary parts of the function  $w = \log Z$  satisfy the Cauchy – Riemann equation when  $Z$  is not zero. **5 marks**
- b. Find the image and draw a rough sketch of the mapping of the region  $1 \leq x \leq 2$  and  $2 \leq y \leq 3$  under the mapping  $W = e^z$  **7 marks**

**Question 2**

- 2a. Find from first principle the Laplace transform of  $f(t) = \begin{cases} \cos\left(t - \frac{2\pi}{3}\right), & t > \frac{2\pi}{3} \\ 0, & 0 < t < \frac{2\pi}{3} \end{cases}$  **3 marks**
- b. Find the Laplace of  $t \sinh at$  **3 marks**
- c. Solve the following differential equation using Laplace Transform  
 $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y = 6te^{-t}$  given that  $y = 0$  and  $\frac{dy}{dt} = 0$  at  $t=0$  **6 marks**

**Question 3**

- 3a. A periodic function  $f(t)$  of period  $2a$  is defined by  $f(t) = \begin{cases} a & \text{for } 0 \leq t < a \\ -a & \text{for } a \leq t \leq 2a \end{cases}$  show that  
 $\mathcal{L}\{f(t)\} = \frac{a}{s} \tanh\left(\frac{as}{2}\right)$ . Recall that for a periodic function  $f(t)$  of period  $\alpha > 0$   
 $\mathcal{L}\{f(t)\} = \frac{1}{1 - e^{-s\alpha}} \int_0^\alpha e^{-st} f(t) dt$  **6 marks**
- b. Find the inverse Laplace transform of  $\frac{3s-1}{(s-3)(s^2+4)}$  **6 marks**

#### Question 4

4. Find the Fourier transform of the following: (a)  $f(t) = \begin{cases} 0, & t < -2 \\ 1, & -2 < t < 2 \\ 0, & 2 < t \end{cases}$  **4 marks**
- b.  $f(t) = 3\Pi_4(t) + 5\Lambda_4$  **8 marks**

#### Question 5

5. The masses of 50 ingots in kg are measured correct to the nearest 0.1 kg and the results are as shown below. Produce a frequency distribution having about 7 classes for these data and then present the grouped data as;

8.0	8.6	8.2	7.5	8.0	9.1	8.5	7.6	8.2	7.8
8.3	7.1	8.1	8.3	8.7	7.8	8.7	8.5	8.4	8.5
7.7	8.4	7.9	8.8	7.2	8.1	7.8	8.2	7.7	7.5
8.1	7.4	8.8	8.0	8.4	8.5	8.1	7.3	9.0	8.6
7.4	8.2	8.4	7.7	8.3	8.2	7.9	8.5	7.9	8.0

- a. develop the cumulative frequency distribution table **5 marks**
- b. draw a frequency polygon for the data **3½ marks**
- c. draw the ogive curve for the data. **3½ marks**

#### Question 6

6. The frequency distribution for the value of resistance in ohms of 48 resistors is as shown.

20.5-21.5	3,	22.0-23.5	10,	24.5-25.5	11,
26.0-27.5	13,	28.5-29.5	9,	30.0-31.5	2.

- a. Draw a histogram depicting this data and hence determine the mean, median and modal values of the distribution. **8 marks**
- b. Calculate the standard deviation from the mean of the resistors, correct to 3 significant figures. **4 marks**

#### Question 7

7. A box contains 74 brass washers, 86 steel washers and 40 aluminium washers. Three washers are drawn at random from the box without replacement.
- a. determine the probability that all three are steel washers **2 marks**
- b. determine the probability that there are no aluminium washers drawn. **4 marks**
- c. find the probability that there are two brass washers and either a steel or aluminium washer

**6 marks**