



**ELIZADE UNIVERSITY, ILARA-MOKIN,
ONDO STATE, NIGERIA**

DEPARTMENT OF
MECHANICAL, AUTOMOTIVE AND PRODUCTION ENGINEERING

FIRST SEMESTER EXAMINATIONS

2017/2018 ACADEMIC SESSION

COURSE: GNE 415 – Engineering Analysis (3 Units)
CLASS: 400 Level General Engineering
TIME ALLOWED: 3 Hours
INSTRUCTIONS: Answer any **FOUR** questions

HOD'S SIGNATURE

Date: March, 2018

Question 1

a). Find the inverse Laplace of the following;

i. $\frac{s+2}{s^2+8s+25}$ (5 marks)

ii. $\frac{2s-3}{s^2-2s+5}$ (5 marks)

b). If $f(t) = \begin{cases} 1 & 0 < t < 2 \\ t & 2 < t < 4 \\ t^2 & t > 4 \end{cases}$ find $\mathcal{L}\{f(t)\}$ (5 marks)

Question 2

a). Find the Fourier series for the function

$f(x) = \pi - |x|$ ($-\pi \leq x \leq \pi$) given that f is an even function (8 marks)

b). Find the cosine Fourier series representing the function $f(x) = 2x$ in the interval $0 < x < 1$ (7 marks)

Question 3

a). Show that the continuous function $f(z) = |z|^2$ is not differentiable everywhere. (3 marks)

b). Show that the function $e^x(\cos y + i \sin y)$ is analytic and determine its derivative (5 marks)

c). Show that $u(x, y) = x^3 - 3xy^2$ is a harmonic function. Find the harmonic conjugate function $v(x, y)$ and the analytic function $f(z)$. (7 marks)

Question 4

a). The following data set gives the yearly food stamp expenditure in thousands of dollars for 25 households in Lagos State:

2.3	1.9	1.1	3.2	2.7	1.5	0.7	2.5	2.5	3.1	2.5
2.0	2.7	1.9	2.2	1.2	1.3	1.7	2.9	3.0	3.2	1.7
2.2	2.7	2.0								

Construct a frequency distribution consisting of six classes for this data set. Use 0.5 as the lower limit for the first class and use a class width of 0.5 (4 marks)

b). Table Q4 gives the annual returns for 30 randomly selected mutual funds.

Table Q4.

10.5	12.5	14.5	22.0	12.5
-2.5	20.2	3.5	7.5	14.5
14.0	17.5	14.0	12.0	17.0
20.3	27.5	22.5	10.5	40.0
5.5	12.7	35.5	38.0	10.5
4.0	-5.5	19.0	14.5	10.5

- i. Find the mean, median and mode for the annual return. (6½ marks)
- ii. Find the range (1½ marks)
- iii. variance and standard deviation for the annual returns (3 marks)

Question 5

a). Three items are selected from a production process and each is classified as defective or non-defective. Give the outcomes in the following events and check each pair to see if the pair is mutually exclusive. Event A is the event that the first item is defective; B is the event that there is exactly one defective in the three, and C is the event that all three items are defective. (5 marks)

b). Table Q5 gives the number of defective and non-defective items in samples from two different machines. Is the event of a defective item being produce by the machine dependent upon which machine produced it?

Table Q5

	Number defective	Number nondefective
Machine 1	5	195
Machine 2	15	585

(6 marks)

c). The probability that a machine does not produce a defective item during a particular shift is 0.90. What is the complement of the event that a machine does not produce a defective item during that particular shift and what is the probability of that complementary event? (4 marks)

Question 6

Solve the following differential equation;

- a). $\frac{du}{dt} = u^2, u(t_0) = u_0$ (5 marks)
- b). $\frac{du}{dt} = (1 - 2t)u, u(0) = 1$. Plot the graph of u in this case (10 marks)