



LANDMARK UNIVERSITY, OMU-ARAN

COLLEGE OF ENGINEERING

ALL DEPARTMENTS IN ENGINEERING

B. Eng. (HONS)

2021/2022 ALPHA SEMESTER EXAMINATIONS

COURSE CODE: GEC 210

COURSE TITLE: Engineering Mathematics I

COURSE UNIT: 2

TIME: 2 HOURS

INSTRUCTION(S): ANSWER QUESTION ONE IN SECTION A AND ANY TWO (2) QUESTIONS FROM SECTION B

SECTION A

Question One

- (a) i. Three numbers are in arithmetic progression, their sum is 15 and their product is 80 determine the three numbers (6 marks)
ii. Find the Taylor Series for the Function $x^4 + x - 2$ centered at $C=1$ (6 marks)

- (b) i. Solve for x and y in the complex equation

$$\frac{2+j}{1-j} = j(x + jy) \quad (4 \text{ marks})$$

- ii. Find the two roots of $(3 + j4)^{1/2}$ (3 marks)
iii. Find the four roots of $(-2 + j)^{1/4}$ (6 marks)

- (c) Graph (by Sketching) the inverse trigonometric function
$$Y = -3 \operatorname{Sec}(3x - \pi) + 6 \quad (10 \text{ marks})$$

[TOTAL: 35 marks]

SECTION B

Question Two

- (a) i. Find the sum of the series $\sum_{r=1}^4 (2r + r^3)$ (4 marks)
ii. Using Integral test determine if the series $\int_{x=1}^{\infty} \frac{3n^2+2n+1}{x^3+x^2+x-1} dx$ is convergent or divergent (3½ marks)

- (b) Find the radius and interval of convergence for the following series using ratio test:

i. $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}(x-1)^n}{n} \quad (5 \text{ marks})$

ii. $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}x^n}{n^3} \quad (5 \text{ marks})$

[TOTAL: 17½ marks]

Question Three

- (a) Three vectors represented by $\vec{p} \ 2 < 30^\circ$, $\vec{q} \ 3 < 90^\circ$, and $\vec{r} \ 4 < -60^\circ$ determine in polar form the vectors represented by:
i. $\vec{p} + \vec{q} + \vec{r}$ (5 marks)
ii. $\vec{p} - \vec{q} - \vec{r}$ (3 marks)

- (b) i. A delta-connected impedance Z_A is given by

$$Z_A = \frac{Z_1 Z_2 + Z_2 Z_3 + Z_3 Z_1}{Z_2}$$

Determine Z_A in both Cartesian and Polar form given:

$$Z_1 = 10 + j0, Z_2 = 0 - j10, \text{ and } Z_3 = 10 + j10,$$

(4 marks)

- ii. Determine the value of $(-7 + j5)^4$ expressing the result in polar and rectangular form
(5½ marks)

[TOTAL: 17½ marks]

Question Four

- (a) Find the vector product and the length of that $\vec{a} = [2 \ 0 \ 3] \ \vec{b} = [0 \ 4 \ 1]$ as well as the angle between these vectors
(7½ marks)

(b) If $\vec{a} = 6i + 4j + 5k$

$$\vec{b} = 2j - 3k \quad \text{and}$$

$$\vec{c} = i + 3j + 3k$$

Solve

i. $(\vec{c} \cdot \vec{b})$

(2 marks)

ii. $(\vec{a} \times \vec{b})$

(3 marks)

iii. $(\vec{a} \cdot \vec{b} \cdot \vec{c})$

(3 marks)

iv. $(\vec{a} + \vec{c})$

(2 marks)

[TOTAL: 17½ marks]

Question Five

- (a) The 6th term of a GP is 486 and the 9th term is 13122.

Find:

- i. The series

(5½ marks)

- ii. The 20th term of the series

(6 marks)

- iii. The sum of the First 10th term.

- (b) Express the roots of $(-14 + j3)^{-2/5}$ in polar form

- (c) Solve the following hyperbolic functions:

i. $\cosh^{-1} 2.356$

(3 marks)

ii. $\sinh^{-1} 1.475$

(3 marks)

[TOTAL: 17½ marks]