BOWEN UNIVERSITY, IWO, OSUN
COLLEGE OF AGRICULTURE, ENGINEERING & SCIENCES (COAES)
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

2022/2023 SECOND SEMESTER EXAMINATIONS

COURSE CODE:	EEE 202	**COURSE TITLE:**	ENGINEERING MATHEMATICS II
COURSE UNIT:	3	**TIME:**	3 HOURS
INSTRUCTION(S):	ANSWER **FIVE** QUESTIONS IN ALL WITH **AT LEAST TWO** QUESTIONS FROM EACH SECTION		

SECTION A

QUESTION ONE:

a. Find the solutions to the following differential equations:

i. $\frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 25y = 0$ (4 marks)

ii. $2\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$ (4 marks)

iii. $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 9y = 0$ (4 marks)

b. The following are solutions to certain differential equations. Formulate the corresponding differential equations.

i. $y = Ae^{-2x} + Be^{3x}$ (4 marks)

ii. $y = e^{-2x}(A + Bx)$ (4 marks)

QUESTION TWO:

Find the solution to the following second order differential equation when the boundary conditions are $x = 0,\ y = \frac{3}{4}$ and $x = 0,\ \frac{dy}{dx} = \frac{5}{2}$

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 2\sin 4x$$ (20 marks)

QUESTION THREE:

a. Evaluate $\oint_C y\,dx$ when C is the circle $x^2 + y^2 = 4$ (12 marks)

b. Find the area enclosed by a triangle with vertices (0,0), (5,3) and (2,6). Take all dimensions in meter. (8 marks)

QUESTION FOUR:

a. Find the area of the plane figure bounded by the curves $y_1 = (x-1)^2$ and $y_2 = 4 - (x-3)^2$. Take all dimensions in meter. (12 marks)

b. Determine $V = \int_1^4 \int_2^5 \int_0^{x+y} dz\, dy\, dx$ (8 marks)

SECTION B

QUESTION FIVE

a. (i) What is an analytical function? 2 Marks

(ii) Determine if the function $f(z) = \frac{(z+1)}{(z-1)}$ is analytical? 5 Marks

b. If $|z^2 - 1| = |z|^2 + 1$, show that z is completely imaginary? 5 Marks

c. What are the conditions for *f(z)* to be differentiable? 3 Marks

d. Find the first derivative of the function f(z) = $x^2 - y^2 + i2xy$ 5 Marks

QUESTION SIX

a. In each of the following cases, write $f(z)$ in the form $u(x, y)$ *where* $z = x + iy$ *and* u, v are real-valued functions.

i. $f(z) = z^2$ 4 Marks

ii. $f(z) = \frac{1}{z}$ $(z \neq 0)$ 4 Marks

b Show that u *and* v satisfy the Cauchy-Riemann equations everywhere for (i) and for all $z \neq 0$ in (ii) above 4 Marks

c. Write the function *f(z)* = |z| in the form $u(x, y) + iv(x, y)$. Using Cauchy-Riemann equations, decide whether there are any points in C which is differentiable. 8 Marks

QUESTION SEVEN

a. i. Express z = (-√3 – i1) in polar form and sketch on z-plane 4 Marks

ii. Explain four properties of complex numbers with an aid of an example each. 4 Marks

b. i. Find and sketch the image of $|z - 2| < 1$ under the mapping of $w = \frac{2}{z-1}$. 4 Marks

ii. Find the modulus and conjugate of the following functions.

i. $z = 11 + 27i$ 2 Marks

ii. $z = -6 - 12i$ 2 Marks

c. Given that $z_1 = 2 - i6$ and $z_2 = 5 + i8$ Determine the

I. Additive property 2 Marks

II. Multiplicative property 2 Marks