



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES
UNIVERSITY EXAMINATION FOR DEGREE OF MASTER OF SCIENCE
IN PURE MATHEMATICS
1ST YEAR 1ST SEMESTER 2023/2024 ACADEMIC YEAR
MAIN CAMPUS

COURSE CODE: SMA 807

COURSE TITLE: COMPLEX ANALYSIS I

EXAM VENUE: STREAM: (MSc. PURE MATHEMATICS)

DATE: EXAM SESSION: 2.00 – 5.00 PM

TIME: 3.00 HOURS

Instructions:

- 1. Answer ANY 3 questions**
- 2. Candidates are advised to write on the text editor provided, or to write on a foolscap, scan and upload alongside the question.**
- 3. Candidates must ensure that they submit their work by clicking ‘FINISH AND SUBMIT ATTEMPT’ button at the end.**

QUESTION 1 [20MARKS]

(a). Evaluate $\int_0^{1+i} (x - y - ix^2) dz$ along the :

(i). Straight line from $z = 0$ to $z = 1 + i$. (5 marks)

(ii). Real axis from $z = 0$ to $z = 1$ then along the line parallel to imaginary axis from $z = 1$ to $z = 1 + i$. (5 marks)

(iii). The imaginary axis from $z = 0$ to $z = i$ and then along a line parallel to axis $z = i$ to $z = 1 + i$. (5 marks)

(b). Prove that $\oint \frac{dz}{z-a} = 2\pi i$. (5 marks)

QUESTION 2 [20MARKS]

(a). State and prove Cauchy's integral theorem. (10 marks)

(b). Evaluate $\oint_c \frac{3z^2+z}{z^2-1} dz$, where c is the circle $|z-1|=1$. (10 marks)

QUESTION 3 [20MARKS]

(a). Determine the poles of the function $f(z) = \frac{z^2}{(z-1)^2(z+2)}$. (10 marks)

(b). Evaluate $\int_0^{2\pi} \frac{d\theta}{1-2a\sin\theta+a^2}$. (10 marks)

QUESTION 4 [20MARKS]

Expand the function $f(z) = \frac{1}{z^2-3z+2}$ in the regions: (i). $|z| < 1$ (ii). $1 < |z| < 2$ (iii). $|z| < 2$ (iv). $0 < |z-1| < 1$

in the Laurent's series.

QUESTION 5 [20MARKS]

(a). Prove that if $f(z)$ is analytic at all points inside and on a simple closed curve C , except at a finite number of isolated singular points within C , then $\oint_C f(z)dz = 2\pi i$ [sum of residues at singular points within C]. **(10 marks)**

(b). Evaluate $\int_{-\infty}^{\infty} \frac{x^2}{(x^2-a^2)(x^2+b^2)} dx, (a > 0, b > 0)$. **(10 marks)**