



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of applied and Health Sciences

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

SMA 2480: COMPLEX ANALYSIS

END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME: 2 HOURS

DATE: 2016

PAPER B

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of 5 questions. Question one is compulsory. Answer any other two questions

Do not write on the question paper.

QUESTION ONE (COMPULSORY)

a) Evaluate $\lim_{\Delta z \rightarrow i} \frac{z^{10} + 1}{z^6 + 1}$ (6 marks)

b) Given that $z_1 = 2 + i$, $z_2 = 3 - 2i$, $z_3 = -\frac{1}{2} + \frac{\sqrt{3}}{2}i$ evaluate

- i) $|3z_1 - 4z_2|$ (2 marks)
- ii) $\left| \frac{2z_2 + z_1 - 5 - i}{2z_1 - z_2 + 3 - i} \right|^2$ (3 marks)
- c) Prove that if $\lim_{z \rightarrow z_0} f(z)$ exists, then the limit is unique (6 marks)
- d) Define an analytic function (2 marks)
- e) Determine the poles of the function $f(z) = \frac{z^2}{(z-1)^2(z+2)}$ and obtain the Residues at each point (5 marks)
- f) Show that if two images of two curves under a conformal mapping are orthogonal, then those curves must be orthogonal then those curves must be orthogonal (6 marks)

QUESTION TWO

- a) State and Prove the Cauchy's Integral Theorem (12 marks)
- b) Evaluate $\oint_c \frac{2z-1}{z(z+1)(z-3)} dz$ where c is the circle $|z|=2$ (8 marks)

QUESTION THREE

- a) State and prove the Cauchy Riemann Equations (10 marks)
- b) Obtain the Isolated singular points, $\text{Res}\{f(z), a\}$ of the function

$$f(z) = \frac{1}{(z-3)(z+1)}$$
 (6 marks)
- c) Show that $e^{iz} = \cos z + i \sin z$ (4 marks)

QUESTION FOUR

a) State and Prove the Residue Theorem (10 marks)

b) Given that $\lim_{z \rightarrow z_0} f(z) = A$ and $\lim_{z \rightarrow z_0} g(z) = B$. Prove that $\lim_{z \rightarrow z_0} |f(z) + g(z)| = A + B$
(10 marks)

QUESTION FIVE

a) Given that $F(t) = \cos at$ obtain $L\{\cos at\}$ (15 marks)

b) Evaluate $\lim_{z \rightarrow -2i} \frac{(2z+3)(z-1)}{z^2 - 2z + 4}$ (5 marks)