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**MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**P.O. Box 972-60200 – Meru-Kenya**

**Tel: 020-2069349, 061-2309217. 064-30320 Cell phone: +254 712524293, +254 789151411**

**Fax: 064-30321**

**Website:** [**www.must.ac.ke**](http://www.must.ac.ke) **Email:** **info@must.ac.ke**

**University Examinations 2015/2016**

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE , BACHELOR OF SCIENCE STATISTICS AND BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE

**SMA 2305: COMPLEX ANALYSIS I**

**DATE: November, 2015 TIME:** $2$**HOURS**

**INSTRUCTIONS:** *Answer questions* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE - (30 MARKS)**

1. Use Demoivres theorem to express $(1 +i)^{5}$ in the form a+ib where a,b are real.

 (4 Marks)

1. Find the real and imaginary part of z given that z = $\frac{3-2i}{\left(1-i\right) (2-2i)}$ (3 Marks)
2. Evaluate the limit  (5 Marks)
3. Identify the singularities and calculate the corresponding residues for f(z) = $\frac{z^{2}}{\left(z-1\right)\left(z+2\right)^{2}}$

(5 Marks)

1. Show that the function u =$e^{-y}Sin x$ is harmonic hence find its harmonic conjugate v(x,y) (6 Marks)
2. Calculate the radius and disk of convergence for the series  (5 Marks)
3. Evaluate the integral  along the straight line joining z = i and z = 2-i

(5 Marks)

**QUESTION TWO – (20 MARKS)**

1. Given that $z\_{1}=\frac{\sqrt{3}}{2}$ + ½ i and z = $2e^{^{πi}/\_{4}}$. Compute the following giving your answer in the form a+bi
2. $z\_{1}+z\_{2}$ (3 Marks)
3. $\left(\overbar{z}\_{1}\right)^{5}$ (4 Marks)
4. Verify that f(z)= $\frac{4z+3}{z}$ is analytic for all z$\ne 0$ using the cauchy -Riemann equations. (7 Marks)
5. Identify the singularities and hence compute the residues of f(z)=$\frac{1}{z^{2}(z-3)^{2}}$ (6 Marks)

**QUESTION THREE – (20 MARKS)**

1. Evaluate the integral  along the straight line from

$z\_{1}=1+3i $ $to $ $z\_{2}=4+5i $ (8 Marks)

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1. State the Cauchy –Goursat theorem. (2 Marks)
2. Use residue theorem (or otherwise) to evaluate the integral; (10 Marks)



**QUESTION FOUR – (20 MARKS)**

1. Use series expansion for f(z) to identify the residue and evaluate the integral

$∮\_{}^{}f\left(z\right)dz $ for f(z)= $z^{4}Sin (\frac{1}{z})$ and c is the positively oriented unit circle $\left|z\right|=1$ (5 Marks)

1. Find the four fourth roots of z = -2$\sqrt{3}$ - 2i (9 Marks)
2. Find the Laurent series expansion of $\frac{1}{z(z-3)}$ about the singular point z = 3 (6 Marks)