



MACHAKOS UNIVERSITY

University Examinations 2019/2020

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN BUILDING AND CIVIL ENGINEERING (TVET)

ENGINEERING MATHEMATICS II

DATE: 24/3/2020

TIME: 8.30-11.30 AM

INSTRUCTIONS:

This paper consists of five questions, attempt ALL.

QUESTION ONE

- a) Define a complex number and express it in triangular form using a and b as the constants of a complex (3 marks)
- b) Solve the equation
 $5x^2 - 6x + 5 = 0$ (3 marks)
- c) Simplify the following
- i) j^9 (3 marks)
- ii) j^{20} (3 marks)
- d) Solve
 $\frac{7-4j}{4+3j}$ (4 marks)
- e) Express $5(\cos 60^\circ + j \sin 60^\circ)$ into the exponential form. (4 marks)

QUESTION TWO

- a) Determine the gradient of a straight-line PQ passing through the points $P(-4, 2)$ and $Q(-7, -10)$ (3 marks)

- b) Find the derivative of the $y = \sqrt{x}$ from the first principles (5 marks)
- c) Given that, $f(x) = 5x^2 - 3x + 1$ find $f(0)$ and $f(-4)$ (4 marks)
- d) Find the differential of, $y = \frac{x^3}{1-x^2}$ (3 marks)
- e) Find $\frac{dy}{dx}$, when $y = \sqrt{\frac{1-\sin x}{1+\sin x}}$ (5 marks)

QUESTION THREE

- a) Define $\cosh x$, $\sinh x$ and $\tanh x$ by the formula. (6 marks)
- b) Simplify $\cosh x + \sinh x$ and $\cosh x - \sinh x$ (4 marks)
- c) If $\sinh x = \frac{8}{15}$ calculate $\cosh x$ and $\tanh x$ (4 marks)
- d) Given that $y = \tanh \sqrt{1+t^2}$ determine $\frac{dy}{dt}$ (6 marks)

QUESTION FOUR

- a) Use Taylor's theorem to expand $\sin\left(\frac{\pi}{6} + h\right)$ in ascending powers of h as far as the term in h^4 . (13 marks)
- b) Use Maclaurin's theorem to expand $\ln(1+x)$ in ascending powers of x as far as the term in x^5 (7 marks)

QUESTION FIVE

- a) Find; (10 marks)
- i) $\int x\sqrt{3x-1}dx$
- ii) $\int \sin^5 x dx$
- b) Evaluate $\int_2^3 \frac{x}{\sqrt{x^2-3}} dx$ (6 marks)
- c) A propeller blade has profile $y = \sin 2x - \sqrt{3} \sin x$ between $x=0$ and $x = \frac{\pi}{6}$. Find the area of the cross-section. (4 marks)