



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MEDICAL ENGINEERING

AMA2150: ENGINEERING MATHEMATICS I

END OF SEMESTER EXAMINATION

**SERIES: DECEMBER 2016**

**TIME: 2 HOURS**

**DATE: 9 Dec 2016**

## Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

## Question ONE

a) Calculate the diameter of a solid cylinder which has a height of 82.0 cm and a total area of  $2.0 \text{ m}^2$   
(10 marks)

b) Proof the following

i) 
$$\sqrt{\frac{1-\sin x}{1+\sin x}} = \sec x - \tan x$$

ii) 
$$\frac{\tan x + \sec x}{\sec x \left(1 + \frac{\tan x}{\sec x}\right)} = 1$$
 (10 marks)

c) i) Transpose the formula  $p = \frac{a^2x + a^2y}{r}$  to make  $a$  the subject

ii) Determine  $y$  in terms of  $x$   $5 \log_a y - 2 \log_a (x + 4) = 2 \log_a y + \log_a x$  (10 marks)

## Question TWO

- a) i) Expand  $(2a + 3b)^5$  using Pascal triangle  
ii) Calculate the number of permutations for 10 distinct objects taken six at a time. (10 marks)
- b) The radius of a cylinder is reduced by 4% and its height increased by 2%. Determine the appropriate percentage in its volume and curved surface area neglecting products of small quantities. (10 marks)

## Question THREE

- a) The law connecting friction  $F$  and load  $L$  for an experiment is given by  $F = aL + b$  where  $a$  and  $b$  are constants. Given that  $F=5.6$  and  $L=8.0$  when  $F=4.4$  and  $L=2.0$ , determine the  
i) values of  $a$  and  $b$   
ii) value of  $F$  when  $L=6.5$  (10 marks)
- b) A cylinder with a varying circular section is 6 m long and has its cross-sectional areas measured from one end at interval of 1.0 m recorded as 49,62,79,102,152,191,240 cm<sup>2</sup>. Determine the volume of the cylinder using  
i) Trapezoidal  
ii) Simpson and  
iii) Mid-ordinate rule (10 marks)

## Question FOUR

- a) Express  $\frac{\sqrt{1+2x}}{\sqrt[3]{1-3x}}$  as a power series as far as the term in  $x^2$  hence state the range of values of  $x$  for which the series is convergent (10 marks)
- b) i) Solve for  $x$   $2\log_a x - \log_a(x - 1) = \log_a(x - 2)$   
ii) Make  $G$  the subject of the formula  $T = 2\pi\sqrt{\frac{GJ}{IL}}$  (10 marks)

## Question FIVE

- a) Solve the following simultaneous equations graphically  
 $2x + y = 3$   
 $x = -2y$   
 $3y = 4x + 11$  (15 marks)
- b) Solve  $2x = 1 - 8x^2$  using completing the square method (5 marks)