

MAT 111



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OFFICE OF THE DEPUTY PRINCIPAL
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UNIVERSITY EXAMINATIONS

2018 /2019 ACADEMIC YEAR

FISRT YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE
(ASC/CS)

COURSE CODE: MAT 111

COURSE TITLE: GEOMETRY AND ELEMENTARY
APPLIED MATHEMATICS

DATE: 15TH APRIL, 2019

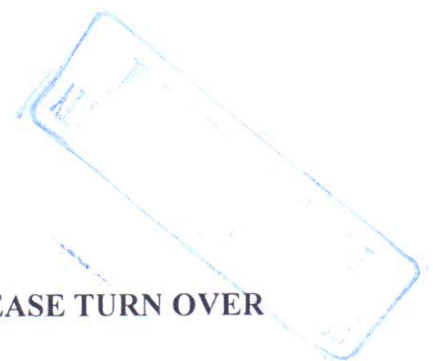
TIME: 9.00 AM – 12.00 PM

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

PLEASE TURN OVER



REGULAR –MAIN EXAM**MAT 111: GEOMETRY AND ELEMENTARY APPLIED MATHEMATICS****STREAM: BSc (CS/ASC)****DURATION: 3 Hours****INSTRUCTION TO CANDIDATES**

- i. Answer *ALL* questions from *section A* and any *THREE* from *section B*
- ii. Do not write on the question paper.

SECTION A [31 Marks] ANSWER ALL QUESTIONS**Question One (15 marks)**

- a) Find the unit tangent and normal vector to the curve $4x^2 + 6 = y$ at the point (1,1) (5mks)
- b) Obtain the distance between the points (2,-2,1) and (3,0,-1) (4mks)
- c) By drawing up a table of r and θ values, $0^\circ < \theta < 360^\circ$, plot the graph of $r = 1 + \cos\theta$ (3mks)
- d) Find the Cartesian equation of the polar equation $r \cos(\theta - \alpha) = p$ (3mks)

Question Two (16 marks)

- a) Show that the points $A(-1,-2), B(4,-1), C(5,4), D(0,3)$ are vertices of a rhombus (5mks)
- b) Find all points of intersection between $r = \cos 2\theta, r = \sin \theta$ (4mks)
- c) Find the distance between the points $P_1(1,4), P_2(-3,2)$ (3mks)
- d) Obtain the asymptote of $y = \frac{1}{x}$ (4mks)

SECTION B: Answer any *THREE* QUESTIONS

**Question Three (13 marks)**

- a) Find the equation of a plane through the point $(4,3,6)$ and perpendicular to the line joining that point to the point $(2,3,1)$ (5mks)
- b) Three masses 8kg, 5kg and 2kg are located on the x axis at distances of 2m, 3m and 6m respectively. How far from the origin is the center of mass of the system (4mks)
- c) A particle is projected vertically upwards at a velocity of 4.9m/s. Calculate the time taken to return to its point of projection and distance it travels. (4mks)

Question Four (13 marks)

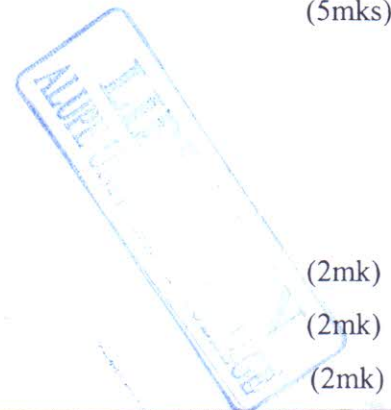
- a) A projectile is fired over a horizontal line at an initial speed of 500m/s at an angle of elevation of 60° . Where will the projectile be after 10s. (4mks)
- b) Obtain the equations of a line through the points $(1,2,-1), (2,2,0)$ (4mks)
- c) Find the Cartesian equation for the plane through $P_0(-3,0,7)$ and perpendicular to the vector $\vec{N} = 5i + 2j - k$ (5mks)

Question Five (13 marks)

- a) State the applications of gradients (3mks)
- b) Find two sets of directional cosines and indicate the direction along the line joining the points $A_1(3,1,2), A_2(5,2,-4)$ (5mks)
- c) Express $\left(2, \frac{\pi}{6}\right)$ in rectangular coordinates (5mks)

Question Six (13 marks)

- a) Define
- i. Relative motion (2mk)
 - ii. Friction (2mk)
 - iii. Moments (2mk)



iv. Couples (2mk)

- b) Find the velocity of the plane relative to the ground if its velocity relative to the wind is 200m/h due east and the velocity of the wind relative to the ground at 40m/h due North. Find by what angle the plane will change course. (5mks)

Question Seven (13 marks)

- a) For a line through the points $(0,1,-2)$ and $(1,5,6)$, obtain its
- i. Direction numbers (3mks)
 - ii. Direction cosines (3mks)
- b) Obtain the direction of the line from the origin to the point $(6,-2,3)$ (4mks)
- c) Obtain the distance from the point $(2,-3,-1)$ to the plane $2x - 3y + 6z + 7 = 0$ (3mks)