

OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2017 /2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE & APPLIED STATISTICS AND COMPUTING

COURSE CODE: MAT 111

**COURSE TITLE: GEOMETRY AND ELEMENTARY
APPLIED MATHEMATICS**

DATE: 18TH APRIL, 2018

TIME: 9AM – 12.00 NOON

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

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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 (16 marks)**

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

Question two (15 marks)

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

SECTION B: [39marks] ANSWER ANY THREE QUESTIONS**Question three (13 marks)**

- a) Obtain the direction of the line from the origin to the point (6,-2,3) (4mks)
- b) For a line through the points (0,1,-2) and (1,5,6), obtain its
 - i. Direction numbers (3mks)

- ii. Direction cosines (3mks)
- c) Obtain the distance from the point $(2, -3, -1)$ to the plane $2x - 3y + 6z + 7 = 0$ (3mks)


Question four (13 marks)

- a) Obtain the equations of a line through the points $(1, 2, -1), (2, 2, 0)$ (4mks)
- b) Find the Cartesian equation for the plane through $P_0(-3, 0, 7)$ and perpendicular to the vector $\vec{N} = 5i + 2j - k$ (5mks)
- c) 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)

Question five (13 marks)

- a) Three masses $8\text{kg}, 5\text{kg}$ and 2kg are located on the x axis at distances of $2\text{m}, 3\text{m}$ and 6m respectively. How far from the origin is the center of mass of the system (4mks)
- b) 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)
- 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 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) 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)
- b) Express $\left(2, \frac{\pi}{6}\right)$ in rectangular coordinates (5mks)
- c) State the applications of gradients (3mks)

