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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, RESEARCH AND STUDENTS' AFFAIRS

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 , $0^0 < \theta > 360^0$,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 $y=\dfrac{1}{x}$ (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 60^0. 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)