MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SUPPLEMENTARY EXAMINATION FOR DIPLOMA IN EDUCATION

SMA 0201 VECTOR ANALYSIS

DATE: **TIME:**

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

a) (i) Define a vector (1 mark)

(ii) Define a scalar (1 mark)

(iii) List three laws of algebra (3 marks)

(iv) Define a unit vector (1 mark)

(v) Define a vector field (1 mark)

b) If **A=** 2i+3j-2k and **B =**4i -2j+4k. Find;

(i) **A .B** (2 marks)

(ii) **B.A** +2**B** (3 marks)

(iii) The angle between the vectors **A**=3i +2j-6k and **B** =4i-3j +k (3 marks)

(c) If **A** + **B =**3i + j -3k, **A**-**B**= i- 7j +k , then find the value of (**A** +**B**) $\times$ (**A** –**B**)

(3 marks)

d) Find the projection of a vector **A =** i- 2j+k on vector **B** = 4i -4j +7k (3 marks)

f) If the vector **A** $=5t^2i + tj - t^3k$ and **B** $=$ sin ti – cos tj, find:

(i) d/dt **A. B** (2 marks)

(ii) d/dt **A×B** (2 marks)

(iii) d/dt **A. A** (2marks)

QUESTION TWO (20 MARKS)

a) If **A** $= (2x^2y - x^4)\ I + (e^{xy} - y \sin X)\ j + (x^2 \cos y)k$. Find

(i) $\partial A/\partial x$ (1 mark)

(ii) $\partial \mathbf{A}/\partial y$ (1 mark)

b) If **A** $= \cos xyi + (3\ xy - 2\ x^2)j - (3x + 2y)\ k$ find

(i) d**A**/dx (1 mark)

(ii) d**A**/ dy (1 mark)

(iii) $d^2\mathbf{A}/dx^2$ (1 mark)

(iv) d2**A/dy2** (1 mark)

(v) $d^2\mathbf{A}/\ dydx$ (2 marks)

(vi) $d^2\mathbf{A}/dxdy$ (2 marks)

QUESTION THREE (20 MARKS)

(a) if a particle moves along a curve whose parametric equations are
$x = e^{-t}$, $y = 2\cos t$, $z = 2 \sin 3\ t$

(i) Determine the velocity and acceleration at any time (2 marks)

(ii) Find the magnitude of the vector and acceleration at t=0 (2 marks)

(b) Determine $\Delta\Theta$ if $\Theta = z^2 \cos (xy - \prod/4)$ and find its value at the point $(1/\prod/2,1)$ (3 marks)

(c) Find the directional derivative of $\Theta = x^2yz + 4xz^3 + xyz$ at (1,2,3) in the direction

Of 2i +j-k (3 marks)

QUESTION FOUR (20 MARKS)

(a) If **A** $=(3x^2 + 6y)\ I - 14yzj + 20xz^2k$,
Evaluate $\int$**A.** d**r** from (0,0,0) to (1,1,1) along the following parts

(i) $X=t$, $y= t^{2,}$ $z= t^3$ (2 marks)

(ii) The straight line joining (0,0,0) amd (1,1,1). (2 marks)

(iii)

(b) Evaluate $\int \mathbf{A}.d\mathbf{r}$ where C is the curve $y=x^3$ in the xy- p. plane from the point (I,1) to (2,8) if $\mathbf{A}=(5xy-6x^2)z + (2y-4x)j$ (3 marks)

(c) Evaluate the integral from
$^{3}{}_{1}\int {}^{4x}{}_{1/2x}\int 2xydydx$ (3 marks)

QUESTION FIVE (20 MARKS)

(a) Evaluate
$^{1}{}_{0}\int \; ^{2x}{}_{0}\int \, ^{x+y}{}_{x-y}\int \; 30xy\, z\, d\, z\, dydx$ (4 marks)

(b) State the Green's Theorem (2 marks)

(c) State the stoke's Theorem (2 marks)

(d) State the Gauss-Divergence Theorem (2 marks)