****

**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2019/2020 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: STA 114**

**COURSE TITLE: VECTOR ANALYSIS**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 18/12/2020 TIME: 03.00-05.00 AM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of TWO (2) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

**Q1. (a)**  If  and  find:

 (i) the scalar triple product **(2 marks)**

 (ii) the vector triple product **(3 marks)**

 **(b)** If , ****and **,** find the value of for

whichthe three vectors are coplanar **. (4 marks)**

 **(c)** A particle moves along a curve whose parametric equations are:, 

 and , where  is the time. Determine:

 (i) the velocity and acceleration at time  **(3 marks)**

 (ii) the magnitude of the velocity and acceleration at  **(2 marks)**

 **(d)** (i) Find the unit tangent vector on the curve:

  ,  **(4 marks)**

 (ii) Determinethe unit tangent at a point  **(2 marks)**

 **(e)** Evaluate  where  **** and is the surface bounded by

  using divergence theorem. **(5 marks)**

 **(f)** Evaluate, given that  where is the region bounded

 by the surfaces  **(5 marks)**

**QUESTION TWO (20 MARKS)**

**Q2. (a)** A particle moves so that its position vector is given by  where

  is a constant. Show that

 **(i)** The velocity of the particle is perpendicular to. **(4 marks)**

 **(ii)** The acceleration is directed towards the origin and has magnitude proportional to

 the distance from the origin. **(4 marks)**

 **(iii)** x is a constant vector **(4 marks)**

 **(b)** Prove that: ** (8 marks)**

**QUESTION THREE (20 MARKS)**

 **Q3. (a) (i)** Show that is a conservative force field. **(3 marks)**

 **(ii)** Find the scalar potential **(6 marks)**

 **(iii)** Find the work done in moving an object in this field from  to .

 **(5 marks)**

 **(b)** If **,** prove that , where  is a constant vector. **(6 marks)**

 **QUESTION FOUR (20 MARKS)**

**Q4. (a)** Verify Green’s theorem in the plane for , where c is the closed

 curve of the region bounded by  and . **(14 marks)**

 **(b)** Find the constants: and such that

  is irrotational. **(6 marks)**

**QUESTION FIVE (20 MARKS)**

**Q5. (a)** Prove that , where is a scalar differentiable **(6 marks)**

 **(b)** A surface consists of that part of the cylinder  between  and 

  and the two semicircles of radius 3 in the and  If 

 Evaluate  over the surface using Stokes theorem, **(14 marks)**