

**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja.**

**FACULTY OF SCIENCES**

**DEPARTMENT OF MATHEMATICS**

**JULY EXAMINATION 2017\_1**

**Course Code: MTH303**

**Course Title: VECTORS AND TENSORS**

**Credit Unit: 3**

**Time Allowed: 3 HOURS**

**Total Marks: 70%**

**Instruction: ATTEMPT QUESTIONS NUMBER ONE (1) AND ANY OTHER FOUR (4) QUESTIONS**

1. (a) Given a vector  and 

Find (i)  and (ii)  x  at the point (1,-1,1) (6 Marks)

1. Find the directional derivatives of  at the point (1,1,-1) in the direction toward the point (-3,5,6). (6 Marks)
2. Find the values of the constants a, b, c so that the directional derivative of  at (1,2,-1) has a maximum of magnitude 64 in a direction parallel to the z-axis. (5 Marks)
3. Evaluate divergence of  at the point (1,1,1) . (5 Marks)
4. (a) Determine the constant b such that is solenoidal. (4 Marks)

(b) If f and g are solutions of the Laplace equation show that  (4 Marks)

1. Find the curl of  at the point (1,2,3) (4 Marks)
2. (a) Given that  , find a scalar function f(x, y, z) such

that . (3 Marks)

1. Find the work done in moving a particle in the force field  along
2. Straight line from (0,0,0) to B(2,1,3) (3 Marks)
3. Space curve  y=t,  from t=0 to t =1 (3 Marks)
4. Curve c: defined by ,  from x=0, x = 2. (3 Marks)
5. (a) If  evaluate  around the curve c consisting of

 and  (4 Marks)

1. Evaluate (i) x F) . ndS and (4 Marks)

(ii)  if   and S is the surface of the plane  bounded by the coordinate planes x=0, y=0 and z=0 (4 Marks)

1. (a) Find the surface area of the plane  cut of by x =0, y=0 and 

(4 Marks)

1. (i) If V is the region in the first octant bounded by  and the plane x = 2 and  . Evaluate  (4 Marks)

(ii) Find the volume enclosed between two surfaces  and 

(4 Marks)

1. (a) Using Green’s theorem, find the area of the region in the first quadrant bounded by the

curves y = x, y = 1/x, y = x/4 (4 Marks)

(b) (i) Show that is a vector perpendicular to the surface where c is a constant

(4 Marks)

(ii) Find a unit normal to the surface  at the point (2,-2,3) (4 Marks)