DAR ES SALAAM INSTITUTE OF TECHNOLOGY

DEPARTMENT OF GENERAL STUDIES

ASSIGNMENT 1

GSU 07202: ADVANCED CALCULUS

BENG 20 (ALL) AND B.TECH 20

DATE: 18^{th} **June, 2021**

INSTRUCTIONS

1. Read the instruction carefully
2. In a group of five students answer All Questions
3. All answers should be clearly and neatly presented.
4. Copied works will be penalized and roughly presented works will lead to poor marks.
5. Good and unique works from one group to another is expected.
6. Your works will be submitted on Friday 2^{nd} July 2021 at 1200hrs by class representatives. Individual submission is highly discouraged.

1. (a) Let f be a scalar field and $F(x, y, z)$ and $G(x, y, z)$ be vector fields. What if anything is wrong with each of the following expressions? (2 marks)
   i. $\nabla f = x^3 - 4y$
   ii. $\nabla . F = i - x^2 yj - zk$
   iii. $\nabla \times G = \nabla F$

2. (a) Sketch the region D and hence evaluate $\int\int_D x^5 \sin(y^4) dA$ where D is the region in the second quadrant bounded by the curves $y = -3x^2$, $y = -12$ and the y axis.(2 marks)

3. A string is stretched and fastened to two points at a distance $'l'$ apart. Motion is started by displacing the string in the form $y = k \sin \frac{\pi x}{l}$ from which it is released at time $t = 0$. Show that the displacement of any point on the string at a distance x from one end at time t is given by $k \sin \frac{\pi x}{l} \cos \frac{\pi a x}{l}$ (3 marks)

4. The ends A and B of a rod $20cm$ long have the temperature at 30 degree centigrade and 80 degree centigrade respectively until steady state prevails. The temperatures of the ends are changed to 40 degree centigrade to 60 degree centigrade respectively. Find the temperature distribution in the rod at time t.(3 marks)