NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JUNE/JULY EXAMINATION

COURSE CODE: MTH303
COURSE TITLE: VECTORS AND TENSORS(3 units)
TIME ALLOWED:3 HOURS
INSTRUCTION: ANSWERS ANY 4 QUESTIONS

1.(a) State which of the following are scalars and which are vectors
Weight,calories,specfic-heat,momentun,density,energy,volume,displacement,velocity and magnetic field intesity**5 mark**

(b) Given $r_1=3i-2j+k$, $r_2=2i-4j-3k$ and $r_3=-i+2j+2k$ .Find the magnitudes of (i) $r_1+r_2+r_3$

(ii) $2r_1-3r_2-5r_3$ **12 ½ marks**

2. (a) Evaluate each of the following (i) $j\cdot(2i-3j+k)$ (ii) $(2i-j)\cdot(3i+k)$ **10 marks**

(b) Determine a unit vector perpendicular to the plane of $A=2i-6j-3k$ and $B=4i+3j-k$ -

5 ½ marks

3. (a) If $A=2i-3j-k, B=i+4j-2k$ and $C=i-2j+2k$ .Find (i) $(A+B)\times(A-B)$ (ii) $(A\times B)\times C$ **10 marks**

(b) Show that $F=(2xy+z^3)i+x^2j+3xz^2k$ is a conservative force field -**7 ½ marks**

4. (a) (i) Find the unit tangent vector to the curve $x=t^2+1, y=4t-3, z=2t^2-6t$ **8marks**

(ii) Determine the unit tangent at the point where $t=2$ **4mrks**

(b) If A and B are differentiable function of a scalar u, prove

$$\frac{d(A\cdot B)}{du}=A\cdot\frac{dB}{du}+\frac{dA}{du}\cdot B$$

5 ½ marks

5. (a) Prove $\nabla(F+G)=\nabla F+\nabla G$,where F and G are differentiable scalar function of x,y,z

5 ½ marks

(b) Find $\nabla\varphi$ if (i) $\ln|r|$ (ii) $\varphi=\frac{1}{r}$ **12marks**

6. (a) If $A=x^2zi-2y^3z^2j+xy^2zk$,find $\nabla\cdot A$ at the point (1,-1,1). **8 marks**

(b) Given $\varphi=2x^3y^2z^4$.(i)Find $\nabla\cdot\nabla\varphi$ (ii) Show $\nabla\cdot\nabla\varphi=\nabla^2\varphi$,where $\nabla^2\equiv\frac{\partial}{\partial x^2}+\frac{\partial}{\partial y^2}+\frac{\partial}{\partial z^2}$ denotes the laplacian **9 ½ marks**