Registration no: | | | | | | | | | | |

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M.Sc.I
FPYC501

5th Semester Back Examination 2017-18
Mathematical Methods - I
BRANCH(S): M.Sc.I(AP)
Time: 3 Hours
Max Marks: 70
Q.CODE: B630

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) Find the second order partial derivative with respect to x of F(x,y)= cosx+ xye^{xy}+ xsiny ?

b) What is the mixed second order partial derivative of F(x,y) =$(2x^2+y^2)^{1/2}$?

c) Find the angle between $\vec{a}=3\hat{\imath}+4\hat{\jmath}$ and $\vec{b}=5\hat{\imath}-2\hat{\jmath}$

d) Given $\vec{a}=m\hat{\imath}+2\hat{\jmath}+3\hat{k}$ and $\vec{b}=2\hat{\imath}-3\hat{\jmath}+4\hat{k}$,find the value of m such that $\vec{a}$ is perpendicular to $\vec{b}$.

e) Evaluate $\vec{\nabla}\left(-\frac{m}{r}\right)$ *where m is constant*

f) Find the directional derivative of f =xy+yz+zx in the direction of the vector $\vec{a}$ $=2\hat{\imath}+3\hat{\jmath}+4\hat{k}$ at the point (1,3,2)

g) Discuss the physical significance of divergence of a vector field.

h) If $\Phi=2xy^2z+x^2y$ evaluate $\int_c \Phi d\vec{l}$,where c is the curve at $x=t, y=t^2, z=t^3$ from t=0to t=1.

i) Write down an expression for equation of continuity in hydrodynamics.

j) If $\vec{a}$ and $\vec{b}$ are constant vector ,show that $\vec{\nabla}\left(\vec{a}.\vec{b}\times\vec{r}\right)=\vec{a}\times\vec{b}$

Q2 a) Use Lagrange multiplier method to find the greatest and least distance from the point (2,1,-2) to the sphere with the equation $x^2+y^2+z^2=1$ **(5)**

b) Solve $2xy^3+y^4+(xy^3-2y)dy/dx=0$ **(5)**

Q3 Express $\vec{\nabla}\times\vec{A}$ in **(10)**
orthogonal curvilinear coordinates
Cartesian co-ordinate system
Cylindrical co-ordinate system
spherical polar co-ordinate system

Q4 Compare velocity and Acceleration in cylindrical and spherical co-ordinate system. **(10)**

Q5 Using Levi-civita symbol ,show that **(10)**

$\vec{a}\times(\vec{b}\times\vec{c})=(\vec{a}.\vec{c})\vec{b}-(\vec{a}.\vec{b})\vec{c}$

$(\vec{a}\times\vec{b}).(\vec{c}\times\vec{d})=(\vec{a}.\vec{c})(\vec{b}.\vec{d})-(\vec{a}.\vec{d})(\vec{b}.\vec{c})$

$(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d})=[(\vec{a}\times\vec{b}).\vec{d}]\vec{c}-[(\vec{a}\times\vec{b}).\vec{c}]\vec{d}$

If $\vec{a}=3\hat{\imath}-\hat{\jmath}$,$\vec{b}=\hat{\jmath}+2\hat{k}$,$\vec{c}=\hat{\imath}+\hat{\jmath}-\hat{k}$ find $\vec{a}\times(\vec{b}\times\vec{c})$

Q6 **a)** Express $the\ laplacian\ \nabla^2$ in **(8)**

i) Cartesian co-ordinate
ii) cylindrical co-ordinate
iii) spherical polar co-ordinate system

b) Show that $\vec{\nabla} \times (r^2\vec{r})=0$, where $\vec{r} = x\hat{\imath}+y\hat{\jmath}+z\hat{k}$ **(2)**

Q7 **a)** State and prove the 1 st and 2 nd form of Green's theorem. **(5)**
b) Derive Green's theorem in a plane. **(3)**
c) Evaluate $\int_s \vec{r} \cdot \overrightarrow{ds}$ where s is the surface of a sphere or radius r. **(2)**

Q8 **Write short notes on :**

i) Line integral of vector field **(2)**
ii) surface integral of vector field **(2)**
iii) volume integral of vector field **(2)**
iv) Gauss divergence theorem **(2)**
v) Stokes theorem **(2)**