*Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.*

[Total No. of Questions: 09]   [Total No. of Pages: 02]

Uni. Roll No. ................

Program: B.Tech. (Batch 2018 onward)
Semester: 1/2
Name of Subject: Mathematics-II
Subject Code: BSC-104
Paper ID: 15940
Scientific calculator is Not Allowed.

EVENING

13 MAY 2024

**Time Allowed: 03 Hours**   **Max. Marks: 60**

**NOTE:**

1) Parts A and B are compulsory.
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

**Part – A**   **[Marks: 02 each]**

**Q1.**

a) State Dirichlet's condition for expansion of $f(x)$ in Fourier series .

b) Find the point of inflexion of the curve $y=\dfrac{(x^3-6x^2+9x+6)}{6}$.

c) Evaluate $\int_0^1\int_0^3 (x+5)dydx$.

d) Prove that $div(\vec{r})=3$, where $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$.

e) State Stoke's theorem .

f) Find the equation of tangent plane to the surface $\dfrac{x^2}{2}-\dfrac{y^2}{3}=z$ at (2,3,-1) .

**Part – B**   **[Marks: 04 each]**

**Q2.** Find the Fourier series of the function $f(x)=|x|$ , $-\pi<x<\pi$ .

**Q3.** Trace the curve $r=a(1+\cos\theta)$ .

**Q4.** Change the order of integration and hence evaluate : $\int_0^\infty\int_x^\infty \dfrac{e^{-y}}{y}\,dydx$

**Q5.** What is the directional derivative of the function $2xy+z^2$ at the point (1,-1,3) in the direction of the vector $\hat{i}+2\hat{j}+2\hat{k}$ ?

**Q6.** If $\vec{A}=(3xz^2)\hat{i}-(yz)\hat{j}+(x+2z)\hat{k}$ , find $Curl(Curl\,\vec{A})$ .



**P.T.O.**

**Q7.** If $u=\sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\tan u$.

**Part – C** **[Marks: 12 each]**

**Q8.** Find a Fourier series to represent $f(x)=x-x^2$ in the interval $-\pi<x<\pi$.

Hence, show that $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\ldots\ldots\ldots\ldots\infty=\frac{\pi^2}{12}$.

OR

Find the minimum value of $x^2+y^2+z^2$, given that $xyz=a^3$ using Lagrange's method.

**Q9.** Find the volume of the tetrahedron bounded by the co-ordinate planes and the plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$.

OR

Verify Green's theorem for $\oint_C[(3x^2-8y^2)dx+(4y-6xy)dy]$, where C is the boundary of the region bounded by $x=0$, $y=0$, $x+y=1$.

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