Please check that this question paper contains ___9___ questions and ___2___ printed pages within first ten minutes.

[Total No. of Questions: 09]
Uni. Roll No. ....

[Total No. of Pages: ......]

Program: B.Tech. (Batch 2018 onward)
Semester: 2^{nd}
Name of Subject: Mathematics-11
Subject Code: BSC-104
Paper ID:15940

MORNING
11 MAY 2023

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 conditions for a function f(x) to be expressed as Fourier series.

b) Define concavity and convexity of a curve y = f(x).

c) Evaluate the first order partial derivatives of u = $\frac{x-y}{x+y}$.

d) Evaluate $\iint (x^2 + y^2)dxdy$ over the region in the positive quadrant for which $x + y \leq 1$.

e) If $\vec{E}$ and $\vec{F}$ are irrotational then prove that $\vec{E}\ X\ \vec{F}$ is solenoidal.

f) Evaluate $\int_0^2 \int_1^2 \int_0^{yz} xyz\, dx\, dy\, dz$.

Part – B **[Marks: 04 each]**

Q2. If u = $sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$, Prove that : $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = -\frac{sinu\ cos2u}{4cos^3u}$.

Q3. Trace the curve r = a (1 + sinθ) by discussing its features.

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11 MAY 2023

Q4. Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} xy \; dy \, dx$.

Q5. Discuss the Physical interpretation of curl of a vector point function.

Q6. What is the directional derivative of the function $4xz^3 - 3x^2yz^2$ at the point (2, -1, 2) along z- axis.

Q7. Expand $f(x) = x^2$; $-\pi \le x \le \pi$ as a Fourier Series.

Part – C **[Marks: 12 each]**

Q8. Verify Green's theorem for $\oint_c (xy + x^2)dx + (x^2 + y^2)dy$, where c is the boundary of the region defined by the lines $x = \pm 1$, $y = \pm 1$.

OR

a) Find the smaller of the areas bounded by the ellipse $4x^2 + 9y^2 = 36$ and the straight line 2x + 3y = 6, Using double integration. (6)

b) Using triple integration find the volume of the tetrahedron bounded by $x = 0$, $y = 0, z = 0$ and $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$. (6)

Q 9. Expand $f(x) = x \, sinx$; $0 \le x \le 2\pi$ as a Fourier Series.

OR

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

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