

MORNING

[Total No. of Questions: 09]

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Uni. Roll No.

28 JUN 2022

Program: B.Tech. (Batch 2018 onward)

Semester: 2nd

Name of Subject: Mathematics-11

Subject Code: BSC-104

Paper ID: 15940

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) Define a periodic function. Also find the period of the function
 $f(x) = \cos \frac{x}{3} + 5 \sin \frac{x}{4}$.
- b) Find the points of inflexion for the curve $a^2 y^2 = x^2 (a^2 - x^2)$.
- c) If $z = \frac{x^2 + y^2}{\sqrt{x+y}}$, find the value of $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y}$.
- d) Evaluate $\iint (x^2 + y^2) dx dy$ over the region in the positive quadrant for which $x + y \leq 1$.
- e) Show that gradient field describing a motion is irrotational.
- f) Transform the integral to spherical polar form and hence evaluate $\iiint dx dy dz$ over the sphere $x^2 + y^2 + z^2 = a^2$.

Part – B

[Marks: 04 each]

- Q2. If $u = r^m$, where $r^2 = x^2 + y^2 + z^2$, find the value of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$.
- Q3. Trace the curve $r = 4 \sin \theta$ by discussing its features.
- Q4. Evaluate the integral $\int_0^4 \int_y^4 \frac{x}{x^2 + y^2} dx dy$ by Changing the order of integration.
- Q5. Discuss the physical interpretation of curl of a vector point function.

- Q6. Calculate the angle between the normals to the surface $xy = z^2$ at the points $(3,3,-3)$ and $(4,1,2)$.
- Q7. Expand $f(x) = x \sin x$; $-\pi \leq x \leq \pi$ as a Fourier Series

Part – C

[Marks: 12 each]

- Q8. Verify Green's theorem for $\oint_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where c is the boundary of the region defined by the lines $x = 0$, $y = 0$, $x + y = 1$.

OR

- a) Using triple integration find the volume enclosed between the cylinders $x^2 + y^2 = ax$ and $z^2 = ax$. (6)
- b) Using double integration find the area lying inside the circle $r = a \sin \theta$ and outside the cardioid $r = a(1 - \cos \theta)$. (6)
- Q9. (a) Expand $f(x) = \sqrt{1 - \cos \theta}$; $-\pi \leq x \leq \pi$ as a Fourier Series. (6)
- (b) Find half range sine series for $f(x) = 2x - 1$; $0 < x < 1$. (6)

OR

- a) The dimensions of a cone are, radius = 4 cm, height = 6 cm. What is the error in its volume if the scale used in taking the measurements is short by 0.01 cm per cm? (6)
- b) Use Lagrange's method, find the point upon the plane $ax + by + cz = p$ at which the function $f = x^2 + y^2 + z^2$ has a minimum value, also find this minima of f . (6)
