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

Uni. Roll No. …………….

Program: B.Tech. (Batch 2018 onwards)

Semester: 1st/2nd

Name of Subject: Mathematics-II

Subject Code: BSC-104

Paper ID: 15940

Time Allowed: 02 Hours **Max. Marks: 60**

NOTE:

1. Each question is of 10 marks.
2. Attempt any six questions out of nine.
3. Any missing data may be assumed appropriately.

13-07-21(M)

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

2. (a) Find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ where $u - \cos^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ (5)

   (b) If u = xlog xy, where $x^3 + y^3 + 3xy = 1$, then find the value of $\frac{du}{dx}$. (5)

3. (a) Expand $x^2y + 3y - 2$ in terms of (x+1) and (y-2) . (7)

   (b) For the function f(x,y) =xy(1-x^2-y^2) , check whether $\left(\frac{1}{2},\frac{1}{2}\right)$ is point of maximum or point of minimum. (3)

4. Find $\frac{\partial(x,y,z)}{\partial(r,\theta,\phi)}$, where r,θ,ϕ are spherical polar coordinates. Hence find the volume of sphere $x^2 + y^2 + z^2 = a^2$

5. Evaluate the integral by changing the order of integration for the integral $I = \int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dydx$ (Clearly mention the formulae and results being used in the solution)

6. (a) Find div($\vec{F}$) and curl($\vec{F}$) where $\vec{F} = grad(x^4 + y^4 + z^4 - 3xyz)$ (5)

   (b) Find half range sine series expansion of functionf(x) = x, 0 < x < π. (5)

7. Compute the work done by the vector $\vec{F} = (x^2 + xy)\hat{i} + (x^2 + y^2)\hat{j}$ along the closed curve C, where C is the square formed by the lines x= ±1 and y = ±1.

8. (a) Determine the value of constant b such that $\vec{A} = (bx^2y + yz)\hat{i} + (2xy^2 - xz^2)\hat{j} + (4xyz - 2x^2y^2)\hat{k}$ is solenoidal. (3)

   (b) Prove that the vector $\vec{A} = (x+2y+4z)\hat{i} + (2xy^2 - xz^2)\hat{j} + (4xyz - 2x^2y^2)\hat{k}$ is irrotational .Also find its scalar potential ϕ such that $\vec{A} = \nabla\phi$. (7)

9. Find Fourier series expansion of the function f(x) = $f(x) = \frac{1}{2}(\pi - x)$, $0 < x < 2\pi$.

Hence find the value of $\frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} - - - - - - - - - =$

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