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06 DEC 2019

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Uni. Roll No. ....

Program/ Course:B.Tech.(Sem-1/2)
Name of Subject: Mathematics-II
Subject Code: BSC-104
Paper ID: 15940

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

NOTE:

1) **Part – A & B are compulsory**
2) **Part- C** has two Questions Q8 & Q9 and 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) Find the points of inflexion of the curve $Y = x^3 + 8x^2 - 270x$.

c) Find the equation of the tangent plane and normal line to the surface $\frac{x^2}{2} - \frac{y^2}{3} = z$, at the point (2 , 3 , -1).

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

e) If $r = |\vec{r}|$, where $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, Prove that $\Delta(\log r) = \frac{\vec{r}}{r^2}$.

f) Show that gradient field describing a motion is irrotational.

Part – B **[Marks: 04 each]**

Q2. Obtain the half range sine series for the function f(x) = x^2 in the interval $0 \leq x \leq 3$.

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

Q4. Evaluate the integral $\int_0^1 \int_{4y}^4 e^{x^2}\, dxdy$ by Changing the order of integration .

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Q5. If z is a function of x and y and u , v be two other variables such that $u = lx + my$, $v = ly - mx$, show that $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = (l^2 + m^2)(\frac{\partial^2 z}{\partial u^2} + \frac{\partial^2 z}{\partial v^2})$.

Q6. Find the smaller of the areas bounded by the ellipse $4x^2 + 9y^2 = 36$ and the straight line $2x + 3y = 6$.

Q7. If $u\vec{F} = \Delta v$, where u, v are scalars fields and $\vec{F}$ is a vector field , show that $\vec{F} . curl\, \vec{F} = 0$.

[Marks: 12 each]

Part – C

Q8 (a) Verify Green's theorem for $\oint_c (x^2 - \cosh y)dx + (y + \sin x)dy$, where c is the boundary of a rectangle whose vertices are O(0,0) , A(π,0) , $B(\pi, 1)$, $C(0,1)$.

OR

Q8 (b) Verify Divergence theorem for $\vec{F} = (x^2 - yz)\hat{\imath} + (y^2 - zx)\hat{\jmath} + (z^2 - xy)\hat{k}$ taken over the rectagular parallelopiped $0 \le x \le a , 0 \le y \le b , 0 \le z \le c.$

Q9. (a) Expand $f(x) = x \sin x$; $0 < x < 2\pi$ as a Fourier Series .

OR

Q9. (b) Use Lagrange's method to find the shortest distance between the line $y = 10 - 2x$ and the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$

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