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Paper Code : BS-M301/BSC 301/BSC301 Mathematics-III (Differential Calculus)

UPID : 003445

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer *any ten* of the following : [1 x 10 = 10]

(I) Find f_x and f_y where $f(x,y) = x^2 + xy$.

(II) The value of $\int_1^0 \int_0^1 (x+y)dxdy$ is.....

(III) The general solution of $px + \frac{a}{p}, where p = \frac{dy}{dx}$ is.....

(IV) The value of $\frac{1}{D}(x^2)$ is.....

(V) If a path is considered as a sub graph, then the degree of the intermediate vertices is.....

(VI) The series $\sum_{n=1}^{\infty} \frac{1}{n^p}$ is convergent if.....

(VII) If $u+v=x, uv=y, then \frac{\partial(x,y)}{\partial(u,v)} =$

(VIII) The value of $\int_0^{\frac{\pi}{2}} \int_0^1 r\sin\theta dr d\theta$ is.....

(IX) The singular solution of the equation $y = px + a\sqrt{(1+p^2)}$ is .....

(X) The value of D($\sin^3$x) is.....

(XI) A binary tree has exactly .....

(XII) The co-efficient of x^3 in the infinite series expansion of $f(x) = \sin x$ about $x = \frac{\pi}{2}$ is

Group-B (Short Answer Type Question)

Answer *any three* of the following : [5 x 3 = 15]

2. Show that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = \frac{-9}{(x+y+z)^2}, if\ u = \log(x^3+y^3+z^3-3xyz)$ [5]

3. Evaluate $\iint_R xy(x+y)dxdy$ over the region $\Re$ bounded by y = x^2 and y = x. [5]

4. Solve the ODE: $xp^2 + (y-x)p - y = 0$, where $p \equiv \frac{d}{dx}$ [5]

5. Find the Taylor's series expansion of sinx. [5]

6. Solve by variation of parameters, $\frac{d^2y}{dx^2} + a^2 y = \cos ax$. [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following : [15 x 3 = 45]

7. (a) Find the maxima and minima of the function $f(x,y) = x^3 + y^3 - 3x - 12y + 20$. Also find the saddle points. [10]

(b) Find $div\ \vec{F}$ and $curl\ \vec{F}$ where $\vec{F} = grad(x^3+y^3+z^3-3xyz)$ [5]

8. (a) Evaluate $\iint y dx dy$ over part of the plane bounded by y = x and the parabola $y = 4x - x^2$. [8]

(b) Change the order of integration and hence evaluate the integral $\int_0^1 \int_{e^x}^{e} \frac{dxdy}{y^2 \log y}$. [7]

9. (a) Solve the ODE: $(2x + 3y + 7)dx + (3x - 5y + 2)dy = 0$ [8]

(b) Find the orthogonal trajectory of the family of curve $x^2 + y^2 = r^2$, where r being the variable of parameter. [7]

10. Solve the ODE: $(x^2D^2 + 3xD + 2)y = \cos(\log x), where D \equiv \frac{d}{dx}$ [15]

11. Describe KrusKal and Prim's algorithm for finding the minimal spanning tree with examples. [15]

*** END OF PAPER ***