SWAMI KESHVANAND INSTITUTE OF TECHNOLOGY, MANAGEMENT & GRAMOTHAN, JAIPUR

Subject: Engineering. Mathematics-I [Course Code:1FY2-01]

Assignment: 1

Sem/Sec: …… Branch:……Session: 20__/__ M. M: __

Date of issue:…… Date of submission:…….

SECTION –A (*Short answer questions*)

1 Find $\lim\limits_{\substack{x\to 1\\ y\to 2}} \dfrac{2x}{x^2+y^2+1}$

2 Check the limit of $f(x,y)=\dfrac{2xy}{x^2+y^2}$ at (0, 0).

3 Check the continuity of $f(x,y)=\begin{cases} xy, & xy\neq 0 \\ 1, & xy=0 \end{cases}$ at (0, 1).

4 Verify $\dfrac{\partial^2 u}{\partial x\partial y}=\dfrac{\partial^2 u}{\partial y\partial x}$ for $u=x^y$

5 If $u=x^3y-xy^3$ show that $\left[\frac{1}{u_x}+\frac{1}{u_y}\right]_{\substack{x=1\\ y=2}}=-\frac{13}{22}$

6 Find the tangent plane to the surface $f(x,y,z)=x^2+y^2+z-9=0$ at the point (1, 2, 4).

7 Find the Normal line to the surface $f(x,y,z)=x^2+2y^2+3z^2-12=0$ at the point (1, 2, -1).

SECTION –B (*Analytical/ problem solving questions*)

8 Verify the Euler's theorem for $u=\dfrac{x\left(x^3-y^3\right)}{x^3+y^3}$.

9 Verify the Euler's theorem for $u=ax^2+2hxy+by^2$.

10 If Resisters of R_1, R_2 and R_3 ohms are connected in parallel to make an R-ohm resistor, find the value of $\frac{\partial R}{\partial R_2}$ when R_1 = 30, R_2 = 45 and R_3 = 90 ohms.

11 The altitude of a right circular cone is 15 cm and is increasing at 0.2 cm/sec. The radius of the base is 10 cm and is decreasing at 0.3 cm/sec. How fast is the volume changing?

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12 In order that the function $u = 2xy - 3x^2y$ remains constant, what should be the rate of change of y (w.r.t. t) given that x increases at the rate of 2 cm/sec at the instant when x = 3 cm and y = 1 cm

13 If $u = f(y-z, z-x, x-y)$, prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$

SECTION –C (*Descriptive/Analytical questions*)

14 If $z = \tan^{-1}\left(\frac{y}{x}\right)$ then prove $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = 0$.

15 If $u = \left(1 - 2xy + y^2\right)^{-1/2}$ then prove $\frac{\partial}{\partial x}\left\{\left(1-x^2\right)\frac{\partial u}{\partial x}\right\} + \frac{\partial}{\partial y}\left\{y^2\frac{\partial u}{\partial y}\right\} = 0$.

16 If $z = \tan(y+ax) + (y-ax)^{3/2}$ then prove $\frac{\partial^2 z}{\partial x^2} - a^2\frac{\partial^2 z}{\partial y^2} = 0$.

17 A rectangular box, open at the top, is to have a volume of 32 cm^3. Use Lagrange's method to find the dimension of the box having least material for its construction

18 Find the maximum value if $u = \sin x \sin y \sin(x+y)$

19 Discuss the maxima and minima of the function $x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$