

Jaypee University of Information Technology, Waknaghat

Test - 2, October 2018

B.Tech (ECE/CSE/IT/CE)

Dr. R. S. Raju Durai

Course Code: 18B11MA111

Max. Marks: 25

Course Title: Engineering Mathematics - I

Course Credits: 4

Max. Time: 90 min

Instructions: ALL questions are compulsory. Use of calculator is not allowed.

1. (a) If $u = \log(\tan x + \tan y + \tan z)$, prove that $(\sin 2x) \frac{\partial u}{\partial x} + (\sin 2y) \frac{\partial u}{\partial y} + (\sin 2z) \frac{\partial u}{\partial z} = 2$.
(b) If $z = y + f(u)$, where $u = \frac{x}{y}$, prove that $u \frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 1$. (4 Marks)
2. Find the double integral $\iint_{\mathcal{R}} \sin(x+y) \, dx \, dy$, where the region $\mathcal{R}$ is bounded by the lines $y = x$, $x + y = \frac{\pi}{2}$, $y = 0$. (4 Marks)
3. Evaluate $\int_0^{\pi/2} \sqrt{\cos \theta} \, d\theta$ using the beta function. (3 Marks)
4. Find the equation of *tangent plane* to the surface $z = xe^y$ at $(3, 0)$. (2 Marks)
5. The temperature at a point (x, y, z) is given by $T(x, y, z) = 200e^{-x^2-3y^2-9z^2}$. (3 Marks)
 - (a) Find the rate of change of temperature at the point $P(2, -1, 2)$ in the direction towards the point $Q(3, -3, 3)$.
 - (b) Compute the maximum rate of increase at P .
6. Evaluate $\int_C (z + y^2) \, ds$, where C is the line segment from $(3, 4, 0)$ to $(1, 4, 2)$. (3 Marks)
7. Compute the surface integral $\iint_S (x + y + z) \, d\sigma$, where S is a surface given by $\mathbf{r}(u, v) = \langle u + v, u - v, 1 + 2u + v \rangle$ and $0 \leq u \leq 2$ and $0 \leq v \leq 1$. (3 Marks)
8. Compute Laplace inverse $\mathcal{L}^{-1} \left\{ \frac{2}{s^2(s-2)} \right\}$. (3 Marks)

* * * * *