KONERU LAKSHMAIAH EDUCATION FOUNDATION
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I/IV B. Tech. Even Semester :: A.Y. 2024-25

Linear Algebra & Calculus for Engineers (23MT1001)

CO-2

Tutorial-4

1. Compute all first and second order partial derivatives of $f(x,y)=e^{xy}+3x^2-5y^3$ and verify $f_{xy}=f_{yx}$.
2. Compute the first and second order partial derivatives of $z=x^2y^3+\sin x\cos y$.
3. Verify $\frac{\partial^2 u}{\partial x\partial y}=\frac{\partial^2 u}{\partial y\partial x}$ for the function $u=\tan^{-1}\left(\frac{x}{y}\right)$.
4. Given $u=e^x\cos y,\ x=t^2+1, y=2t$ then find the total derivative $\frac{du}{dt}$.
5. Given $u=\log(x+y+z),\ x=e^t, y=\sin t, z=\cos t$ then find the total derivative $\frac{du}{dt}$.
6. Find the Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ of following functions:

   (a). $u=x^2-2y,\ v=5x+7y$ (b). $u=x(1-y),\ v=xy$
7. Find the Jacobian $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ of $u=\frac{yz}{x}, v=\frac{xz}{y}, w=\frac{xy}{z}$.

Tutorial-5

1. Apply Taylor's series to expand f(x, y)=$x^3+2xy+y^3$ in powers of (x+1)and (y+2) up-to second degree terms.

2. Applying Taylor's series expansion expand the function f(x, y)= e^xsiny at (-1,π/4) up to the terms of second degree.

3. Examine the maximum and minimum for the function $f(x,y)=x^3+y^3-63(x+y)+12xy$.

4. The sum of three numbers is constant. Prove that their product is maximum when they are equal.

5. Evaluate minimum values of $x^2+y^2+z^2$, given that ax + by + cz=p.

6. A rectangular box open at the top is to have a volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction

7. The temperature T at any point (x, y, z) in space is $T = k\,xyz^2$.Find the highest temperature on the surface of the unit sphere of $x^2+y^2+z^2=1$.

Tutorial-6

1. Solve the DE $\frac{d^3y}{dx^3} - 9\frac{d^2y}{dx^2} + 23\frac{dy}{dx} - 15y = 0.$
2. Solve the DE $y''' + 4y'' + 4y' = 0$.
3. Determine the solution of the initial value problem $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 15y = 2$, given that y(0) = 0, $y'(0) = 1$.
4. Determine the charge on the capacitor in an LRC series circuit at t when inductance 1 H, resistance 4**Ω**, capacitance 0.25 F, E(t) = 0 V, q(0) =5 C, and i(0) =0 A.

5. Determine the charge on the capacitor in an LC series circuit at t when inductance 1 H, capacitance 1F, E(t) = e^t V, q(0) = 2 C, i(0) = 0 A.

6. The motion of a mass spring system without damping is described by the initial value problem $\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = e^{4t}, x(0) = 0, x'(0) = 1$, where x is the distance of the mass from the equilibrium position, downward being taken as positive direction. Calculate the displacement of the motion.
7. The motion of a mass spring system without damping is described by the initial value problem $\frac{d^2x}{dt^2} + 4x = \cos 3t, x(0) = 0, x'(0) = 0.$, where x is the distance of the mass from the equilibrium position, downward being taken as positive direction. Identify the displacement of the motion.