

I B. Tech I Semester Supplementary Examinations, May - 2018

MATHEMATICS-I

(Com. to All branches)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks

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1. a) Solve $(y \cos x + \sin y + y)dx + (\sin x + x \cos y + x)dy = 0$. (8M)
 - b) Find the orthogonal trajectories of the family of curves: $r^n = a^n \sin n\theta$. (7M)
 2. a) Solve $(D^3 - 3D^2 + 4)y = e^{2x} + 6 + 80\cos 2x$. (8M)
 - b) Solve $(D^2 + 3D + 2)y = xe^x \sin x$. (7M)
 3. a) Prove that $u = \frac{x^2 - y^2}{x^2 + y^2}$, $v = \frac{2xy}{x^2 + y^2}$ are functionally dependent and find the relation between them. (8M)
 - b) Expand $\tan^{-1} x$ in powers of $(x - 1)$ up to the term containing fourth degree. (7M)
 4. Trace the curve $x = a(\theta + \sin \theta)$, $y = a(1 + \cos \theta)$. (15M)
 5. a) Find the perimeter of the curve $r = a \cos \theta$. (8M)
 - b) Find the volume of the solid generated by the revolution of the cardioid $r = a(1 + \cos \theta)$ about the initial line $\theta = 0$. (7M)
 6. a) Evaluate $\iint (x + y) dx dy$, over the region in the positive quadrant bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (8M)
 - b) By changing the order of integration, evaluate $\int_0^1 \int_1^{2-x} xy dx dy$. (7M)
 7. a) Find the directional derivative of $\phi = x^2 yz + 4xz^2$ at $(1, -2, -1)$ in the direction of $2\bar{i} - \bar{j} - 2\bar{k}$. (8M)
 - b) Find the constants a, b, c so that the vector $\bar{f} = (x + 2y + az)\bar{i} + (bx - 3y - z)\bar{j} + (4x + cy + 2z)\bar{k}$ is irrotational. Also find the scalar potential ϕ . (7M)
 8. Verify Stoke's theorem for $\bar{F} = (x^2 - y^2)\bar{i} + 2xy\bar{j}$ over the box bounded by the planes $x = 0, x = a, y = 0, y = b, z = c$. (15M)