

MATHEMATICS-I

(Common 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 $z' + \frac{z}{x} \log z = \frac{z}{x} (\log z)^2$.
- (b) Find the orthogonal trajectories of the family of curves $r = \frac{2a}{1 + \cos \theta}$ [8+7]
2. (a) Solve $(D^2 + 4D + 5)y = e^{-2x}(1 + \cos x)$.
- (b) Solve $(D^2 + 3D + 2)y = x$. [8+7]
3. (a) If $u = \frac{2yz}{x}$, $v = \frac{3xz}{y}$, $w = \frac{4xy}{z}$. Calculate $\frac{\partial(x, y, z)}{\partial(u, v, w)}$.
- (b) Examine the function $x^3 + y^3 - 3axy$ for maxima & minima. [8+7]
4. Trace the curve $y^2(a - x) = x^3$, $a > 0$. [15]
5. (a) Find the area of the surface generated by revolving the curve $y = x^2$ included between $x = 0$ and $x = \frac{6}{5}$ about y-axis.
- (b) Find the volume of solid generated by revolving the plane area bounded by $y^2 = 4x$ and $x = 4$ about $x = 4$. [8+7]
6. (a) Evaluate $\int_0^1 \int_0^{1-x} e^{x+y} dy dx$.
- (b) Evaluate $\int_R xy dx dy$ where R is the region bounded by the parabola $x^2 = 4y$ and $y^2 = ax$. [8+7]
7. (a) Find the directional derivative of $xy + yz + zx$ in the direction of $i + 2j + 2k$ at $(1, 2, 0)$
- (b) Find the constants a and b so that $(2xy + 3yz)i + (x^2 + axz - 4z^2)j + (3xy + 2byz)k$ is irrotational. [8+7]
8. Verify Green's theorem for $\oint_c [(2x - y^3)dx - xydy]$ where c is the boundary of the region enclosed by $x^2 + y^2 = 1$ and $x^2 + y^2 = 9$. [15]

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