I B. Tech I Semester Supplementary Examinations, Nov/Dec - 2017
MATHEMATICS-I
Time: 3 hours   (Comm. to All Branches)   Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Solve $\dfrac{dy}{dx} + \dfrac{y}{x}\log y = \dfrac{y}{x^2}(\log y)^2$.   (8M)

   b) Find the orthogonal trajectories of the family of circles $x^2 + (y-c)^2 = c^2$.   (7M)

2. a) Solve $(D^2 + 2D + 1)y = 2x + \cos x$.   (8M)

   b) Solve $(D^2 + 4D + 3)y = e^{2x}$.   (7M)

3. a) Determine whether the functions $U = \dfrac{x}{y-z}$, $V = \dfrac{y}{z-x}$, $W = \dfrac{z}{x-y}$ are dependent. If   (8M)
dependent find the relationship between them.

   b) Find the volume of the largest rectangular paralleopiped that can be inscribed in the   (7M)
ellipsoid $\dfrac{x^2}{4} + \dfrac{y^2}{9} + \dfrac{z^2}{25} = 1$.

4. Trace the curve $y^2(a+x) = x^2(3a-x)$.   (15M)

5. a) Find the perimeter of the loop of the curve $9ay^2 = (x-2a)(x-5a)^2$.   (8M)
   b) Find the volume of the solid formed by revolving one loop of the lemniscates   (7M)
$r^2 = a^2\cos 2\theta$ about the line $\theta = \dfrac{\pi}{2}$.

6. a) Evaluate $\displaystyle\int_{0}^{a}\int_{0}^{\sqrt{a^2-x^2}} \sqrt{x^2+y^2}\,dy\,dx$ by changing into polar coordinates.   (8M)

   b) By changing the order of integration, evaluate $\displaystyle\int_{0}^{3}\int_{1}^{\sqrt{4-y}}(x+y)\,dx\,dy$.   (7M)

7. a) Find the directional derivative of $\phi = x^2yz + 4xz^2$ at $(1, -2, -1)$ in the direction of   (8M)
$2\bar{i} - \bar{j} - 2\bar{k}$.

   b) Find the angle between the normal to the surface $x^2 = yz$ at the points $(1, 1, 1)$ and   (7M)
$(2, 4, 1)$.

8. Verify Green's theorem for $\displaystyle\int_{C}(xy+y^2)\,dx + (x^2)\,dy$ where C is the curve bounded   (15M)
by $y = x^2$ and $y = x$.