**Code: 9ABS104**

**R09**

B.Tech I Year (R09) Supplementary Examinations June 2017

**MATHEMATICS - I**

(Common to all branches)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Solve : $y(2xy + e^x)dx = e^x\, dy$.

(b) Solve : $xy(1 + xy^2)\dfrac{dy}{dx} = 1$

2 (a) Apply the method of variation of parameters to solve $\dfrac{d^2y}{dx^2} + y = \operatorname{cosec} x$.

(b) Solve : $(D^2 + a^2)y = \tan ax$, by the method of variation of parameters.

3 (a) Verify Rolle's theorem for $f(x) = x(x + 3)\, e^{-x/2}$ in [-3, 0].

(b) Verify Lagrange's mean value theorem for $f(x) = \log x$ in [1, e].

4 (a) Find the radius of curvature $\rho$ at any point of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$.

(b) Prove that the radius of curvature of the curve $xy^2 = a^3 - x^3$ at the point (a, 0) is $\dfrac{3a}{2}$.

5 (a) Evaluate $\iint_R y\, dx\, dy$, where R is the region bounded by the parabola $y^2 = 4x$ and $x^2 = 4y$.

(b) Evaluate the integral by changing the order of integration $\int_0^1 \int_0^{\sqrt{(1-x^2)}} y^2\, dx dy$.

6 (a) Find the Laplace transform of f(t) defined as
$$f(t) = \begin{cases} t/\tau & \text{when } 0 < t < \tau \\ 1 & \text{when } t > \tau. \end{cases}$$

(b) Find $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$ Using Convolution theorem.

7 (a) Solve the D.E. $y'' + 3y' + 2y = 2t^2 + 2t + 2$, $y(0) = 2$, $y'(0) = 0$. Using Laplace transform.

(b) Using Laplace transform, Evaluate $\int_0^\infty e^{-2t} t \cos t\, dt$.

8 (a) Prove that $\nabla \cdot (\bar{A} \times \bar{B}) = \bar{B} \cdot (\nabla \times \bar{A}) - \bar{A} \cdot (\nabla \times \bar{B})$.

(b) Apply Greens theorem to evaluate $\int_C [(2x^2 - y^2)\, dx + (x^2 + y^2)\, dy]$, where C is the boundary of the area enclosed by the x-axis and upper half of the circle $x^2 + y^2 = a^2$.

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