

Code: AE1T1, CE1T2, CS 1T2, EC 1T1, EE1T2, EM1T2, IT1T2, ME1T2

I B.Tech-I Semester-Regular Examinations-February 2013
ENGINEERING MATHEMATICS-I
(Common for all branches)

Duration: 3 hours

Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Solve: $(1 + y^2)dx + (x - e^{-\tan^{-1}y})dy = 0$. [6M]

b) Find the orthogonal trajectories of the family of coaxial circles $x^2 + y^2 + 2gx + c = 2$, g being the parameter. [8M]

2. a) Solve: $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = x^2 \cos x$. [7M]

b) Solve: $(D^2 + a^2)y = \tan ax$. [7M]

3. a) Find the Laplace transform of $f(t) = |t-1| + |t+1|$, $t \geq 0$. [7M]

b) Evaluate $L\left\{\int_0^t e^{-t} \cos t dt\right\}$. [7M]

4. a) Apply convolution theorem to evaluate $L^{-1}\left\{\frac{1}{(s-2)(s+2)^2}\right\}$. [6M]

b) Solve: $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^t \sin t$, $y(0) = 0$, $y'(0) = 1$, by the Laplace transform method. [8M]

5. a) Using mean-value theorem, prove that $1+x < e^x < 1+xe^x$, $\forall x > 0$.

[7M]

b) Show that the rectangular solid of maximum volume that can be inscribed in a given sphere is a cube. [7M]

6. a) Evaluate $\int_0^{\sqrt[3]{4-y}} \int_1^x (x+y) dx dy$ by changing the order of integration. [7M]

b) Find the volume of the tetrahedron bounded by the coordinate planes $x=0, y=0, z=0$ and the plane $x+y+z=1$. [7M]

7. a) Prove that $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$. [7M]

b) A vector field is given by $F = (x^2 - y^2 + x)\bar{i} - (2xy + y)\bar{j}$. Show that the field F is irrotational and find its scalar potential. [7M]

8. a) Find the work done by $\bar{F} = (2x - y - z)\bar{i} + (x + y - z)\bar{j} + (3x - 2y - 5z)\bar{k}$ along a curve C in the xy -plane given by $x^2 + y^2 = 9, z = 0$. [6M]

b) Verify Greens theorem for $\oint_C (y^2 dx - x^2 dy)$ where C is the boundary of the triangle whose vertices are $(1, 0), (0, 1)$ and $(-1, 0)$. [8M]