AR 13 SET 02

Code : 13BS1001

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI (AUTONOMOUS)

I B.Tech I Semester Regular / Supplementary Examinations, December, 2015

ENGINEERING MATHEMATICS – I

(Common to CE, ME, CSE, IT, ECE & EEE)

Time : 3 Hours **Max. Marks : 70**

PART-A

Answer all questions **[10 x 1 = 10 M]**

1. a) Find the Integrating Factor of the linear differential equation $Cosx\frac{dy}{dx} + y.\sin x = Sec\, x$

   b) Find the General solution of the Exact Differential equation $(xy^4 + y^2)\, dx + 2(x^2y^3 + xy + y^5)dy = 0$.

   c) Solve $(D^2 + 25)y = 0$

   d) Find the particular integral $[y_p]$ of the differential equation $(D^2 + 9)y = \text{Sin}3x$

   e) If $u = Tan^{-1}\left(\frac{y}{x}\right)$, then find $\frac{\partial u}{\partial x}$ at (0, -1)

   f) If $u = xy$, $v = \frac{x}{y}$ then Find $\frac{\partial(u,v)}{\partial(x,y)}$

   g) Evaluate $\int_0^4\int_0^1\int_0^1 xyzdxdydz$

   h) Find the value of $\int_R\int xy.dxdy$ over the region R : +ve quadrant of the circle $x^2+y^2=a^2$.

   i) If $\Phi = 3xyz^2$, then find gradΦ at (1,-2,-1)

   j) Show that the vector $\bar{V} = e^x.\sin y\,\hat{i} + e^x.\cos y\,\hat{j}$ is irrotational.

PART-B

Answer one question from each unit **[5 x 12 = 60 M]**

UNIT - I

2. a) Solve $\frac{dy}{dx} + \frac{2x}{1+x^2}y = \frac{1}{(1+x^2)^2}$ given y = 0 when x = 1

   b) Solve $(x^2+y^2)dx = 2xydy$

   [6M + 6M]

(OR)

3. a) Solve $[\text{Cos } x.\ \text{Tany} + \text{Cos}(x + y)]dx + [\text{Sin } x.\ \text{Sec}^2y + \text{Cos}(x + y)]dy = 0$.

   b) Find the Orthogonal Trajectories of the families of $\left(\frac{dy}{dx}\right)^2 = \frac{a}{x}$. **[6M + 6M]**

UNIT - II

4. a) Solve $(D^2 + 2D - 3)y = x^2e^{-3x}$

   b) Solve $(4D^2 - 4D + 1)y = 100$ **[6M + 6M]**

(OR)

5. a) Solve $(D^2 - 4D + 3)y = e^x .\cos 2x$

   b) Solve $\frac{d^4y}{dx^4} - y = 2x^4 + x - 1$ **[6M + 6M]**

UNIT - III

6. a) Obtain the Taylor's series expansion of $f(x) = \sin x$ in powers of $x - \frac{\pi}{2}$.

   b) Show that $u = x^2 + y^2 + z^2$, $v = xy + yz + zx$ and $w = x + y + z$ are functionally dependent and also find the relation between them. **[6M + 6M]**

(OR)

7. A rectangular box open at the top is to have a volume of 32 cubic feet. Find the dimensions of the box requiring least material for construction **[12M]**

UNIT - IV

8. a) Evaluate $\int_0^a \int_y^a \frac{x\,dy\,dx}{x^2 + y^2}$ by changing into polar coordinates

   b) Evaluate $\int \int_R \int (x + y + z)\,dz\,dy\,dx$ where R is the region bounded by the planes x=0, x=1, y=0, y=1, z=0, z=1. **[6M + 6M]**

(OR)

9. a) Evaluate by changing the order of integration $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dy\,dx$

   b) Find the surface area generated by the revolution of one arc of a catenary $y = c.\cosh(x/c)$ about x-axis. **[6M + 6M]**

UNIT - V

10. a) A vector field is given by $\bar{F} = (x^2 + xy^2)\hat{i} + (y^2 + x^2y)\hat{j}$. Show that the field is irrotational and find its scalar potential.

    b) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at (2,-1,2) **[6M + 6M]**

(OR)

11. Verify Gauss divergence theorem for $\bar{F} = x^2\hat{i} + y^2\hat{j} + z^2\hat{k}$ over the rectangular parallelopiped formed by the planes x=0,x=a,y=0,y=b,z=0,z=c. **[12M]**