AR16

CODE: 16BS1001 **SET-2**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

I B.Tech I Semester Supplementary Examinations, March-2017

ENGINEERING MATHEMATICS – I

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

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

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT-I

1. a) Solve $x\,dx + y\,dy = \frac{a^2(x\,dy - y\,dx)}{(x^2+y^2)}$ **7 M**

   b) Show that the family of curves **7 M**
   $r^n = a\sec n\theta$ and $r^n = b\,\text{cosec}\, n\theta$ are orthogonal.

(OR)

2. a) Solve $y\log y\,dx + (x - \log y)\,dy = 0$ **7 M**

   b) The number N of bacteria in a culture grew at a rate proportional to N . The value of N was initially 100 and increased to 332 in one hour. What would be the value of N after $1\frac{1}{2}$ hours ? **7 M**

UNIT-II

3. a) Solve $(D^2 - 2D + 1)y = e^x$ **7 M**

   b) Solve $(3x+2)^2\frac{d^2y}{dx^2} + 5(3x+2)\frac{dy}{dx} - 3y = x^2 + x + 1$ **7 M**

(OR)

4. a) Solve $(D^3 + 2D^2 + D)y = x^2$ **7 M**

   b) Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x\log x$ by the method of variation of parameters. **7 M**

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UNIT-III

5. a) If $f(x,y)=0$, show that $\frac{d^2y}{dx^2} = -\frac{q^2r - 2pqs + p^2t}{q^3}$ **7M**

where $p=\frac{\partial f}{\partial x}, q=\frac{\partial f}{\partial y}, r=\frac{\partial^2 f}{\partial x^2}, s=\frac{\partial^2 f}{\partial x \partial y}, t=\frac{\partial^2 f}{\partial y^2}$

b) Expand $f(x,y) = x^2y + 3y - 2$ in power of $(x-1)$ and $(y+2)$ using taylor's theorem. **7M**

(OR)

6. a) Find the Maximum and Minimum values of **7M**

$x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$

b) If $u^3 + v^3 = x + y$ and $u^2 + v^2 = x^3 + y^3$, show that $\frac{\partial(u,v)}{\partial(x,y)} = \frac{1}{2}\frac{y^2 - x^2}{uv(u-v)}$ **7M**

UNIT-IV

7. a) Evaluate the integral $\int_0^{\infty}\int_x^{\infty} \frac{e^{-y}}{y}\, dy\, dx$ by changing of order of integration **7M**

b) Find the Volume bounded by the xy-plane, the cylinder $x^2 + y^2 = 1$ and the plane $x + y + z = 3$ **7M**

(OR)

8. a) Evaluate $\int_1^e \int_1^{\log y} \int_1^{e^x} \log z\, dz\, dx\, dy$ **7M**

b) Evaluate the integral $\int_0^{4a}\int_{\frac{y^2}{4a}}^{y} \frac{x^2 - y^2}{x^2 + y^2}\, dx\, dy$ by changing to polar co – ordinates. **7M**

UNIT-V

9. a) Show that $\text{div}(\text{grad}\, r^n) = n(n+1)r^{n-2}$ **7 M**

b) Using Green's theorem evaluate **7 M**

$\int_C [(y - \sin x)\, dx + \cos x\, dy]$ where C is the plane triangle enclosed by the lines $y = 0, x = \frac{\pi}{2}$ and $y = \frac{2x}{\pi}$

(OR)

10. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\vec{i} - 2xy\vec{j}$ taken around the rectangle bounded by the lines $x = \pm a,\ y = 0,\ y = b$ **14 M**

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ENGINEERING MATHEMATICS - I
(Common to All Branches)

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

PART-A

ANSWER ALL QUESTIONS **[1 x 10 = 10 M]**

1. a) Define the orthogonal trajectories.
   b) Find the integrating factor of the linear differential equation $\frac{dy}{dx}+\frac{y}{x}=\frac{logx}{x}$.
   c) Solve (D^2 -1) y = 0.
   d) If f(D) = D^2 + 4, then find $\frac{1}{f(D)}\ cos3x$.
   e) If U = x^2+y^2, x=t^2 and y =2t , find du/dt.
   f) Find f_x for f(x, y) = x^2 + y^2 - 6x+12 .
   g) Evaluate $\int_0^2\int_0^3 xydxdy$
   h) Transform to Cartesian form $\int_0^{\pi/2}\int_0^a f(r,\ \theta)\ dr\ d\theta$..
   i) If $\bar{r}$ = x$\bar{\imath}$ +y$\bar{\jmath}$ +z$\bar{k}$, then find curl $\bar{r}$
   j) State Stoke's theorem.

PART-B

Answer one question from each unit **[5x12=60M]**

UNIT-I

2. a) Form the differential equation of the family of circles having centre on x-axis and passing through the origin. [6M]
   b) Solve $\frac{dy}{dx}+y=\ x^3y^6$. [6M]

(OR)

3. a) Solve $(1-x^2)\frac{dy}{dx}+2xy=x\sqrt{1-x^2}$. [6M]
   b) Solve $x^2y\ dx-(x^3+y^3)dy=0$ [6M]

UNIT-II

4. a) Solve (D^2+1)y =e^{-x} [6M]
   b) Solve (D^3-3D^2+3D-1)y = x^2 . [6M]

(OR)

5. a) Solve (D^2+4)y = sec2x by method of variation of parameters. [6M]
   b) Solve (D^2+9)y = sin 2x [6M]

UNIT-III

6. a) Find the Taylor series of f(x, y) = e^{xy} in powers of x-1 and y-1 [6M]
   b) If x+ y + z = u, y + z = uv and z = uvw find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$. [6M]

(OR)

7. Find the maximum and minimum values of f(x,y) = x^3-3xy^2-15x^2-15y^2+72x [12M]

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UNIT-IV

8. a) Evaluate $\int_0^{\pi}\int_0^{asin\theta} r dr d\theta$. [6M]

   b) Change the order of integration and evaluate $\int_0^{\infty}\int_x^{\infty}\frac{e^{-y}}{y}dydx$. [6M]

(OR)

9. Find the volume common to the cylinders $x^2+y^2=a^2$ and $x^2+z^2=a^2$. [12M]

UNIT-V

10. a) Find div $\bar{f}$ where $\bar{f} = (x^2-yz)\,\bar{\imath} + (y^2-xz)\,\bar{\jmath} + (z^2-xy)\bar{k}$ at (1,2,1) [6M]

    b) Find a unit normal to the surface $x^2+y^2+2z^2=26$ at (2,2,6) [6M]

(OR)

11. Evaluate $\int \bar{F}.\bar{n}dS$ where $\bar{F} = z\bar{\imath} + x\bar{\jmath} - 3y^2z\,\bar{k}$ and Sis the surface $x^2+y^2=16$ included in the first octant between z = 0 an z =5. [12M]

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