

Hi-Tech Institute of Engineering & Technology
DEPARTMENT OF APPLIED SCIENCES
Course - B.Tech 1st Year (SEM- I) ODD SEMESTER

Subject Code: BAS-103

Subject Name: ENG. MATHS-I

Model Paper-1

Time: 3: 00 Hours

Total Marks: 70

SECTION-A

1. Attempt all question in brief.

2x 7 = 14

Q. No	Attempt all questions.	Marks	CO
1.	Find the eigen values of $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$.	2	1
2.	Find the value of $\frac{\partial^3 u}{\partial x \partial y \partial z}$ if $u = e^{xyz}$.	2	2
3.	Find the nth derivative of x^n .	2	2
4.	If $x = uv$, $y = \frac{u+v}{u-v}$ find $\frac{\partial(x,y)}{\partial(u,v)}$.	2	3
5.	Examine $f(x, y) = x^3 + y^3 - 3xy$ for maximum and minimum values.	2	3
6.	Evaluate $\int_0^{\infty} \sqrt{x} e^{-\sqrt[3]{x}} dx$.	2	4
7.	If $\phi = 3x^2y - y^3z^2$ find the grad ϕ at the point (1,-2,-1).	2	5

SECTION-B

2. Attempt any three of the following:

7 x 3 = 21

Q. No	Question	Marks	CO
a.	If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, Find two non singular matrices P and Q such that $PAQ = I$. Hence find A^{-1} .	7	1
b.	If $y = \sin(\sin^{-1}x)$, prove that $(1-x^2) y_{n+2} - (2n+1) xy_{n+1} - (x^2-a^2) y_n = 0$, Also find y_n at $x=0$	7	2
c.	Verify the Euler's theorem for $u = \sin^{-1}(x/y) + \tan^{-1}(y/x)$.	7	3
d.	Evaluate $\int_0^{\log 2} \int_0^x \int_0^{x+y} e^{x+y+z} dz dy dx$.	7	4
e.	Given the vector field $V = (x^2 - y^2 + 2xz)i + (xz - xy + yz)j + (z^2 + x^2)k$ find curl V. Show that the vectors given by curl V at $P(1,2,-3)$ and $P_1(2,3,12)$ are orthogonal.	7	5

SECTION-C

3. Attempt any one parts of the following:

7*1 = 7

Q. No	Question	Marks	CO
a.	Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$.	7	1
b.	Find the values of λ and μ so that the system of equations $2x - 5y + 2z = 8$, $2x + 4y + 6z = 5$, $x + 2y + \lambda z = \mu$, have (i) No solution, (ii) a unique solution, (iii) Infinite solutions.	7	1

4. Attempt any one parts of the following:

7*1 = 7

Q. No	Question	Marks	CO
a.	If $u = \tan^{-1} \frac{x^3+y^3}{\sqrt{x}+\sqrt{y}}$, Find the value of $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \frac{25}{16} \sin 4u - \frac{5}{4} \sin 2u$.	7	2
b.	If $y = e^{3 \sin^{-1} x}$, prove that $(1 - x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = 9y$.	7	2

5. Attempt any one parts of the following:

7*1 = 7

Q. No	Question	Marks	CO
a.	The temperature T at any point (x, y, z) in space is $T=400xyz^2$. Find the highest temperature on the surface of $x^2+y^2+z^2=a^2$.	7	3
b.	If $u = x+2y+z$, $v = x-2y+3z$, $w=2xy-xz+4yz-2z^2$. Show that they are functionally related and find the relation.	7	3

6. Attempt any one parts of the following:

7*1 = 7

Q. No	Question	Marks	CO
a.	Change the order of integration and evaluate $\int_0^2 \int_{\sqrt{2y}}^2 \frac{x^2}{\sqrt{x^4-4y^2}} dx dy$.	7	4
b.	Evaluate $\iint x^2 dx dy$ in the first quadrant bounded by the hyperbola $xy=16$ and the lines $y=x$, $y=0$ and $x=8$.	7	4

7. Attempt any one parts of the following:

7*1 = 7

Q. No	Question	Marks	CO
a.	Find the value of n for which the vector $r^n r$ is solenoidal, where $r = xi + yj + zk$.	7	5
b.	Use divergence theorem to evaluate the surface integral $\iint_S (x dy dz + y dz dx + z dx dy)$ Where, S is the portion of the plane $x + 2y + 3z = 6$ which lies in the first octant.	7	5