**SET - 1** | **GR 14** | CODE: GR14A1013

# I B. Tech I Semester Regular Examinations, January, 2015
## Mathematics for Biotechnology-I
**(Biotechnology)**

**Time: 3 hours** **Max Marks: 70**

**PART – A**
**Answer ALL questions**
**All questions carry equal marks**
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**2 * 10 = 20 Marks**

**1). a** Evaluate $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x=\frac{\pi}{4}$ for the function $y=2\sin 2x+5\cos 2x$ **[2]**

**b** If $u=x^2+2xy+2y^2$, find $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ in terms of $u$ **[2]**

**c** If $A=\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}$, show that $AA^T$ is symmetric. **[2]**

**d** What does the Cayley Hamilton theorem confirm for the matrix $A=\begin{pmatrix}5 & 2\\ -2 & 6\end{pmatrix}$? Express mathematically. **[2]**

**e** Evaluate the definite integral $\int_0^1 x e^{-x^2}\,dx$ **[2]**

**f** Find the rank of the matrix $A=\begin{pmatrix}1 & 1 & 2\\ 2 & 3 & 1\\ 3 & 5 & 0\end{pmatrix}$ **[2]**

**g** Find the eigenvalues of the matrix $AA^T$ given the matrix $A=\begin{pmatrix}1 & 4\\ 2 & 8\end{pmatrix}$ **[2]**

**h** Form the differential equation of the family of curves $y = ax+\frac{b}{x}$ **[2]**

**i** Solve the homogeneous differential equation $y''+4y'-5y=0$ **[2]**

**j** Find the particular integral of the differential equation $y''+y'+2y=\sin 3x$ **[2]**

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**PART – B**
**Answer any FIVE questions**
**All questions carry equal marks**
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**5 * 10 = 50 Marks**

**2.** **[10]**

(a) Evaluate $\frac{y''}{\left[1+(y')^2\right]^{3/2}}$ at x = 0 for the parabola $y = x^2$ [5]

(b) Evaluate $\int \frac{\cos\sqrt{x}}{\sqrt{x}}\,dx$ [5]

**3.** (a) Investigate the consistency of the linear algebraic system given below and solve if possible $2x + y - z = 0,\ 2x + 5y + 7z = 52,\ x + y + z = 9$ [5] **[10]**

(b) Verify Cayley Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & -2 & 1 \\ 1 & 1 & -2 \\ -2 & 1 & 1 \end{pmatrix}$ [5]

**4.** Reduce the quadratic form $Q(X) = 3x_1^{\,2} + 5x_2^{\,2} + 3x_3^{\,2} - 2x_2x_3 + 2x_1x_3 - 2x_1x_2$ using an orthogonal transformation. Specify the transformation. **[10]**

**5.** (a) Solve the first order differential equation $y' + y\cot x = 2x\,\mathrm{cosec}\,x$ [5] **[10]**

(b) Find the orthogonal trajectories of the family of parabolas $y = ax^2$ [5]

**6.** (a) Solve the linear differential equation $y'' + y' - 12y = \cos 3x + e^{2x}$ [6] **[10]**

(b) Solve the Cauchy's equation $x^2y'' + 4xy' + 2y = 2x^2$ [4]

**7.** **[10]**

(a) Evaluate the definite integral $\int_0^2 \frac{x+1}{x^2+4}\,dx$ [4]

(b) Find the rank, index and signature of the quadratic form [6]

$$3x_1^{\,2} + 5x_2^{\,2} + 3x_3^{\,2} - 2x_2x_3 + 2x_1x_3 - 2x_1x_2$$

**8.** (a ) Find the area bounded by the curves $y = \sin x$ *and* $y = \cos x$ between any two consecutive points of intersection. [6] **[10]**

(b) Evaluate $u_{xx} + u_{yy}$ for the function $u = \frac{1}{2}\ln\left(x^2 + y^2\right)$ [4]

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