GYAN GANGA INSTITUTE OF TECHNOLOGY AND SCIENCES, JABALPUR
GYAN GANGA COLLEGE OF TECHNOLOGY JABALPUR
B.Tech. 1st Semester, Engineering Mathematics I (BT 102)
Questions Bank

Q.1 Discuss Rolle's Theorem for the function $f(x) = \begin{cases} x^2+1\,, & 0 \le x \le 1 \\ 3-x\,, & 1 < x \le 2 \end{cases}$.

Q.2 Show that $\boldsymbol{tan^{-1}(x+h) = sin^{-1}x + hsin\theta.\frac{sin\theta}{1} - (hsin\theta)^2.\frac{sin2\theta}{2} + (hsin\theta)^3.\frac{sin3\theta}{3} - \cdots \ldots . + (-1)^n(hsin\theta)^n.\frac{sinn\theta}{n} + \cdots \ldots \ldots \ldots}$ **where** $\boldsymbol{\theta = cot^{-1}x}$

Q.3 Does the function $f(x) = x + \frac{1}{x}$ **satisfy the condition of mean value theorem in the range [1/2 ,3]?**

Q.4 Expand $\boldsymbol{e^{asin^{-1}x}}$ **by Maclaurin's theorem and show that** $\boldsymbol{(1-x^2)y_{n+2}}$**(2n+1)x**$\boldsymbol{y_{n+1}}$**-**$\boldsymbol{(n^2+a^2) = 0}$**.**

Q.5 Expand the function $\log_e x$ **in power of** $(x-1)$ **and hence evaluate** $\log_{\mathrm{e}}(1.1)$ **correct to 4 decimal places.**

Q.6 Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube.

Q.7 Expand $\boldsymbol{cosxcosy}$ **in power of** $\boldsymbol{x}$ **and** $\boldsymbol{y}$ **as far as term of fourth degree.**

Q.8 If the curve $x^x y^y z^z = c$ **then show that** $\frac{\partial^2 z}{\partial x \partial y} = -\{xlogex\}^{-1}$**at x=y=z**

Q. Discuss the maximum or minimum of the function u = $\mathbf{x^3 + y^3 - 3axy}$**.**

Q.10 Discuss the maximum or minimum of the function u=$x^2 + y^2 + z^2 + x - 2z - xy$

Unit - 5

Q.1 Reduce the matrix into Normal form then find the rank A = $\begin{bmatrix} \mathbf{8} & \mathbf{1} & \mathbf{3} & \mathbf{6} \\ \mathbf{0} & \mathbf{3} & \mathbf{2} & \mathbf{2} \\ \mathbf{-8} & \mathbf{1} & \mathbf{-3} & \mathbf{4} \end{bmatrix}$

Q.2 Solve the system of equation using matrix method

$2x - y + 3z = 0, \quad 3x + 2y + z = 0, \quad x - 4y + 5z = 0$

Q.3 Find the Eigen values and Eigen vectors of the matrix A=$\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

Q.4 Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

Q.5 Find the rank and nullity of the matrix, where

$$A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$$

Q.6 Reduce the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ **to the diagonal form.**

Q.7 If $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ **, Find** A^{-1} **using Cayley-Hamilton theorem and hence evaluate** $\boldsymbol{A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 + 2A + I}$**.**

Q.8 Solve the linear equation $5x + 3y + 7z = 4, 3x + 26y + 2z = 9,\ 7x + 2y + 10z = 5$
Q.9 Find that what value of λ and μ the equations
$x + y + z = 6,\ x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ **have [i] no solution [ii] a unique solution [iii] an infinite many solution**
Q.10 Show that Cayley-Hamilton Theorem is satisfied by matrix A

Where, A = $\begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{1} \\ \mathbf{3} & \mathbf{1} & \mathbf{0} \\ \mathbf{-2} & \mathbf{1} & \mathbf{4} \end{bmatrix}$ **and hence find** $\mathbf{A^{-1}}$**.**