B. N. BANDODKAR COLLEGE OF SCIENCE, THANE

F.Y.B.Sc. (INFORMATION TECHNOLOGY) SEMESTER – I EXAMINATION; OCTOBER 2014

COURSE CODE– USIT102

Duration: 2½ Hrs **Total Marks: 75**

N.B. 1. All questions are compulsory.

Q. 1 Answer *any two* out of following **10**

1. If $A=\begin{bmatrix}-1 & -2 & -2\\ 2 & 1 & -2\\ 2 & -2 & 1\end{bmatrix}$, show that Adj $A=3A^T$.
2. Show that every square matrix can be uniquely expressed as the sum of a Hermitian matrix and a skew-Hermitian matrix.
3. Show that, $A=\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$ is orthogonal matrix.
4. Discuss the consistency of the system and if consistent solve the equations:
   $4x-2y+6z = 8$ $x+y-3z = -1$ $15x-3y+9z = 21$

Q. 2 Answer *any two* out of following **10**

1. Determine Algebraic multiplicity of matrix $\begin{bmatrix}2 & 1 & 0\\ 0 & 2 & 1\\ 0 & 0 & 2\end{bmatrix}$
2. Show that given matrix is not diagonalizable, $\begin{bmatrix}1 & 2 & 2\\ 0 & 2 & 1\\ -1 & 2 & 2\end{bmatrix}$
3. Apply Cayley-Hamilton theorem to $A=\begin{bmatrix}1 & 2\\ 2 & -1\end{bmatrix}$ and show that $A^8=625\,I$.
4. Examine whether the given vector is linearly independent or dependent
   [1,1,-1], [2,3,-5], [2,-1,4]

Q. 3 Answer *any two* out of following **10**

1. If $\bar{A} = \nabla(xy + yz + zx), find\ \nabla.\bar{A}$.
2. Find curl(curl $\bar{A}$) where $\bar{A} = x^2y\hat{\imath} - 2xz\hat{\jmath} + 2yz\hat{k}$ at point (1,0,2)
3. Show that, $A = 3y^4z^2\hat{\imath} + 4x^3z^2\hat{\jmath} - 3x^2y^2\hat{k}$ is solenoidal.
4. If $\bar{F} = \text{grad}\,(xy + yz + zx)$, find (curl $\bar{F}$).

Q. 4 Answer *any two* out of following **10**

1. If the slope of curve is(x^2+2x+1)Find it's equation passes through the point (1,1).
2. Solve, $(4x + y)^2 \frac{dx}{dy} = 1$.
3. Solve, $\frac{dy}{dx} = 1 + \tan(y - x)$.
4. Find particular solution of, $\frac{dy}{dx} + yx^2 = 0$, when y=1, x=0.

Q. 5 Answer *any two* out of following **10**

1. Solve the given Linear Differential equation, $(D^4-6D^3+13D^2-12D+4)y=0$
2. Solve, $(D^2+1)^3 (D^2+D+1)^2y=0$
3. Solve, $(D^4+8D^2+16)y=0$
4. Find root value for $(D^4-6D^3+12D^2-8D)y=0$

Q. 6 Answer *any two* out of following **10**

1. Find n^{th} derivative for $y=\sin^3x$.
2. Verify Lagrange's Mean Value Theorem for $f(x) = x^{2/3}$ in [-8 , 8].
3. Find the absolute maximum and minimum for $f(x) = x^3$ in [-2 , 2]
4. Find y_n if $y=\frac{x^n-1}{x-1}$.

Q. 7 Answer *any three* out of following **15**

1. Find the matrix A if, $\begin{bmatrix}4 & 2\\ 2 & 3\end{bmatrix} \cdot A \cdot \begin{bmatrix}2 & -1\\ -3 & 2\end{bmatrix} = \begin{bmatrix}2 & 2\\ 3 & 7\end{bmatrix}$
2. Verify Cayley-Hamilton theorem and find A^{-1} where, $A = \begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$
3. Show that, $\nabla(f \pm g) = \nabla f \pm \nabla g$.
4. Solve, $\sqrt{1 - y^2}\,dx - \sqrt{1 - x^2}\,dy = 0$.
5. Find solution for $(D^3-2D^2-5D+6)y=0$ where $y(0)=0, y'(0)=0, y''(0)=1$
6. Verify Lagrange's Mean Value Theorem for f(x) = log x in [1 , e].

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