**R07**

**Code No: X0121**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year I Semester Examinations, November/December - 2017**
**MATHEMATICS – II**
**(Common to CE, AE)**

**Time: 3 hours** **Max. Marks: 80**

**Answer any five questions**
**All questions carry equal marks**
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1.a) Reduce the matrix $A=\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 2 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ to canonical form. Hence find its rank.

b) Test for consistency the following equations and solve them if consistent: $5x+3y+7z=4,\ 3x+26y+2z=9;\ 7x+2y+10z=5$ [8+8]

2.a) Find the Eigen values and Eigen vectors of the matrix $A=\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$.

b) Verify Cayley-Hamilton theorem for the matrix $A=\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ and hence find its inverse. [8+8]

3.a) Prove that the Eigen values of Hermitian matrix are real.

b) Reduce the quadratic form $6x^2+3y^2+3z^2-2yz+4zx-4xy$ into canonical form and also write the nature of the quadratic form. [6+10]

4.a) Obtain the Fourier series $f(x)=\left(\dfrac{\pi-x}{2}\right)^2$ in the interval 0 < x < $2\pi$. Deduce that $\dfrac{1}{1^2}+\dfrac{1}{2^2}+\dfrac{1}{3^2}+\dfrac{1}{4^2}+\ \cdots\cdots\ =\dfrac{\pi^2}{6}$.

b) Obtain the Fourier expansion of $f(x)=x\sin x$ as a cosine series in $(0,\pi)$. [10+6]

5.a) Form partial differential equation by eliminating the arbitrary functions from $z=f(x)+e^y g(x)$

b) Find the general solution of the partial differential equation $\left(x^2-y^2-z^2\right)p+2xyq=2zx$.

c) Solve the partial differential equation $p\left(1+q\right)=qz$. [5+5+6]

6.a) Solve by the method of separation of variables
$4u_x + u_y = 3u \; and \; u(0, y) = e^{-5y}$.

b) A string of length $L$ is initially at rest in equilibrium position and each of its points is given the velocity $\left(\frac{\partial y}{\partial t}\right)_{t=0} = b\sin^3\left(\frac{\pi x}{L}\right)$. Find displacement $y(x,t)$.

[8+8]

7.a) Express $f(x) = \begin{cases} 1 & for \; 0 \le x \le \pi \\ 0 & for \; x > \pi \end{cases}$ as a Fourier sine integral and hence evaluate $\int_0^\infty \frac{1-\cos(\pi\lambda)}{\lambda}\sin(x\lambda)\, d\lambda$.

b) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2 & for \; |x| \le 1 \\ 0 & for \; |x| > 1 \end{cases}$ hence evaluate

$\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3}\right)\cos\frac{x}{2}\, dx$. [8+8]

8.a) If $Z(u_n) = \bar{u}(z)$, $prove\, that \; Z(a^{-n} u_n) = \bar{u}(az)$. Hence find $Z(n^2 a^{-n})$.

b) Find the inverse Z-transform of $\frac{z^2+z}{(z-1)(z^2+1)}$.

c) Solve the difference equation $u_{n+2} - 4u_n = 0 \; given \; that \; u_0 = 0, \; u_1 = 2$ by using Z-transform. [5+5+6]

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