Code: R7210101 **R07**

II B.Tech I Semester (R07) Supplementary May 2012 Examinations
MATHEMATICS – II
(Common to Civil Engineering and Biotechnology)

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

Answer any FIVE questions
All questions carry equal marks

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1. (a) Find the rank of
$$\begin{bmatrix} 1 & 4 & 3 & -2 & 1 \\ -2 & -3 & -1 & 4 & 3 \\ -1 & 6 & 7 & 2 & 9 \\ -3 & 3 & 6 & 6 & 12 \end{bmatrix}$$
(b) Show that the system of equations $3x + 3y + 2z = 1; x + 2y = 4; 10y + 3z = -2, 2x - 3y - z = 5$ is consistent and hence solve it.

2. Determine the characteristic roots and vectors of the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

3. Reduce the quadratic form of $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to the canonical form and specify the matrix of transformation.

4. (a) Expand $f(x) = e^{-x}$ as a Fourier series in the internal (-1,1).
(b) Find the half range cosine series for the function $f(x) = (x-1)^2$ in the interval $0 < x < 1$. Hence show that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \pi^2/8$.

5. (a) Form the partial differential equation by eliminating the arbitrary constant of $x^2 + y^2 + (z-c)^2 = a^2$
(b) Find the differential equation arising from $\emptyset(x + y + z,\ x^2 + y^2 + z^2) = 0$.
(c) Form a partial differential equation by eliminating the arbitrary functions $f(x)$ and $g(x)$ from $z = yf(x) + xg(y)$.

6. (a) Solve $\partial^2 u/\partial x^2 = \partial u/\partial y + 2u$ in the form $u = f(x)g(x)$. Obtain the solution satisfying $u = 0$. $\partial u/\partial x = 1 + e^{-3y}$ when $x = 0$ for all values of y.
(b) Find the solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ corresponding to the triangular initial deflection
$$f(x) = 2kx/l \text{ where } 0 < x < 1/2$$
$$= 2k(l-x)/l \text{ where } l/2 < x < l$$

7. (a) Using Fourier integral show that $\int_0^{\infty} \frac{1-\cos\pi\lambda}{\lambda} \sin x\lambda d\lambda = \begin{cases} \frac{\pi}{2}, \text{if } 0 < x < \pi \\ 0, \text{if } x > \pi \end{cases}$
(b) Find the finite Fourier sine and cosine transforms of $f(x)$ defined by $f(x) = 2x$, where $o < x < 2\ \pi$.

8. (a) Find $z\left[\frac{1}{(n+2)(n+3)}\right]$.
(b) Find z-transform of $n^2 e^{n\theta}$.
(c) Using convolution find $z^{-1}\left[\frac{z^2}{(z-4)(z-5)}\right]$

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