

II B.Tech I Semester Supplementary Examinations, May 2005

MATHEMATICS-II

(Common to Civil Engineering, Electrical & Electronic Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Metallurgy & Material Technology, Electronics & Computer Engineering, Production Engineering and Aeronautical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Define the rank of the matrix and find the rank of the following matrix.

$$\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$$

- (b) Find whether the following equations are consistent, if so solve them.

$$x+y+2z = 4 ; 2x-y+3z = 9 ; 3x-y-z=2$$

2. (a) Find the characteristic roots of the matrix and the corresponding eigen values

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

- (b) If $\lambda_1, \lambda_2, \dots, \lambda_n$ are the eigen values of A, then prove that the eigen values of $(A - kI)$ are $\lambda_1 - k, \lambda_2 - k, \lambda_3 - k, \dots, \lambda_n - k$.

3. (a) Define the following:

- i. Hermitian matrix
- ii. Skew-Hermitian matrix
- iii. Unitary matrix
- iv. Orthogonal matrix.

- (b) Show that the eigen values of a unitary matrix are of unit modulus.

4. (a) Define a periodic function. Find the Fourier expansion for the function

$$f(x) = x - x^2, -1 < x < 1.$$

- (b) Prove that the function $f(x) = x, 0 \leq x \leq \pi$ can be expanded in a series of sines as $x = 2 \left[\frac{\sin x}{1} - \frac{\sin 2x}{2} + \frac{\sin 3x}{3} - \dots \right]$.

5. (a) Form the partial differential equation by eliminating the arbitrary constants a, b from $z = ax + by + (a/b) - b$.

- (b) Solve the partial differential equation $x^2(y^2 - z^2)p + y^2(z^2 - x^2)q = z^2(x^2 - y^2)$.

- (c) Solve the partial differential equation $(2z - y) p + (x + z) q + (2x + y) r = 0$.
6. An elastic string is stretched between two points at a distance 'l' apart. One end is taken as origin and at a distance $(\frac{2L}{3})$ from this end, the string is displaced a distance 'd' transversely and is released from rest, when it is in this position. Find the equation of the subsequent motion.
7. (a) Evaluate the following using Parseval's identity $\int_0^{\infty} \frac{dx}{(x^2+a^2)^2}$
- (b) Find the Fourier transform of $f(x) = \begin{cases} 1 - |x| & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$
- and hence find the value of $\int_0^{\infty} \frac{\sin^4 t}{t^4} dt$
8. (a) If $Z(u_n) = [\frac{2z^2+3z+4}{(z-3)^3}]$. Find u_1 and u_2 .
- (b) Find $Z^{-1}[\frac{8z^2}{(2z-1)(4z-1)}]$
