

Applied Maths Questions

Q. No. 2878-09.

SE (chemical) esem. III (R) may 09
Applied Maths III

134

8/6/09 VR-3372

(REVISED COURSE)

(3 Hours)

[Total Marks : 100

- B. : (1) Question No. 1 is compulsory.
(2) Attempt any four remaining six questions.
(3) Non-programable calculator is allowed.

(a) Given $L\left[2\sqrt{\frac{1}{\pi}}\right] = \frac{1}{s^{3/2}}$ then prove that $L\left[\frac{1}{\sqrt{\pi t}}\right] = \frac{1}{\sqrt{s}}$. 5

(b) Prove that— 5

$$J_2'(x) = \left(1 - \frac{4}{x^2}\right) J_1(x) + \frac{2}{x} J_0(x)$$

(c) Find the image of $|z| = 1$ under the transform $w = 2z + z^2$. 5

(d) If $A = \begin{bmatrix} 2 & 1 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ verify that $A(\text{adj}A) = |A|I$. 5

2. (a) Prove that— 6

$$\int_0^{\infty} \frac{\sin 2t + \sin 3t}{t e^t} dt = \frac{3\pi}{4}$$

(b) Prove that— 6

$$\int x J_{2/3}(x^{3/2}) dx = -\frac{2}{3} x^{1/2} J_{-1/3}(x^{3/2}) + c$$

(c) If $N = \begin{bmatrix} 0 & 1+2i \\ -1+2i & 0 \end{bmatrix}$ then prove that $(I - N)(I + N)^{-1}$ is a unitary matrix. 8

3. (a) Find the analytic function $f(z)$ whose imaginary part is $e^{-x}(y \cos y - x \sin y)$. 6

(b) Find $L[\text{erf} \sqrt{t}]$. 6

(c) Prove that— 8

$$4 J_n''(x) = J_{n-2}(x) - 2 J_n(x) + J_{n+2}(x)$$

using this hence P.T.

$$8 J_0''(x) + 2 J_3(x) + 6 J_0'(x) = 0$$

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