

This question paper contains 3 printed pages.

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Your Roll No.....

B.Tech (E/EC) / II

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EEE / EEC - 201

Paper - MATHEMATICS - II

Time : 3 hours

Maximum Marks : 70

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Attempt any five questions. Assume missing data, if any.
All questions carry equal marks.*

- 1 a) Find the angle between the tangent planes to the surfaces $x \log z = y^2 - 1$ and $x^2 y = 2 - z$ at the point $(1, 1, 1)$.

- b) Use Divergence theorem to evaluate

$$\int \int_S \vec{F} \cdot \vec{n} \, ds, \text{ where } \vec{F} = 4xi^{\wedge} - 2y^2 j^{\wedge} + z^2 k^{\wedge} \text{ taken}$$

over the region bounded by the cylinder $x^2 + y^2 = 4$ and the planes $z = 0, z = 3$.

- 2 a) Show that $\nabla^2 \left(\frac{1}{r} \right) = -\frac{4\pi}{r}$

- b) Find the work done by the force

$$\vec{F} = (2y + 3)i^{\wedge} + xz j^{\wedge} + (yz - x)k^{\wedge}$$

when it moves a particle from the point $(0, 0, 0)$ to the point $(2, 1, 1)$ along the curve $x = 2t^2$, $y = t$ and $z = t^3$.

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- 3 a) Show that

$$\int_0^1 x^m (\log x)^n dx = \frac{(-1)^n n!}{(m+1)^{n+1}},$$

where n is a positive integer and $m > -1$.

- b) Prove that $J_{-n}(x) = (-1)^n J_n(x)$, where n is a positive integer.

- 4 a) If $L[F(t)] = F(s)$, then show that $L[e^{at} f(t)] = F(s - a)$ and with the help of this find the value of $L(\cos at \sinh at)$.

- b) Solve the following differential equation by using Laplace transform :

$$\frac{d^2 y}{dx^2} + \frac{dy}{dx} - 2y = 1 - 2x$$

$$\text{given } y = 0, \frac{dy}{dx} = 4 \text{ at } x = 0.$$

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- 5 a) Using the convolution theorem, find

$$L^{-1} \left[\frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right], \quad a \neq b.$$

- b) Evaluate the following :

(i) $L(t^2 \cos at)$

(ii) $L \left[e^{-4t} \frac{\sin 3t}{t} \right]$

- 6 a) Determine the analytic function :

$$f(z) = u + iv, \text{ if}$$

$$u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 2x + 1.$$

- b) Integrate $f(z) = z^2$ from $A(1, 1)$ to $B(2, 4)$ along the curve $c : x = t, y = t^2$.

- 7 a) Using Contour itegration Evaluate

$$\int_0^{2\pi} \frac{\cos 3\theta}{5 - 4 \cos \theta} d\theta,$$

- b) Using Rodrigue's formula, evaluate

$$\int_{-1}^{+1} x^m P_n(x) dx.$$