This question paper contains 3 printed pages.

3287 • *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 $x^2y = 2 - z$ at the point $(1, 1, 1)$.

b) Use Divergence theorem to evaluate $\int\int_S \vec{F}.\hat{n}\, ds$, where $\vec{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ taken over the region bounded by the cylinder $x^2 + y^2 = 4$ and the planer $z = 0, z = 3$.

2 a) Show that $\nabla^2(r\vec{r}) = \frac{4}{r}\vec{r}$

b) Find the work done by the force $\vec{f} = (2y + 3)\hat{i} + xz\hat{j} + (yz - x)\hat{k}$ 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

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

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 :

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

given $y = 0, \frac{dy}{dx} = 4$ 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 :

$f(z) = u + iv$, 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

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