Roll No. ....

Total No. of Questions : 09] [Total No. of Pages : 02

Paper ID [AM101]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 1st/2nd)

ENGINEERING MATHEMATICS - I (AM - 101)

Time : 03 Hours Maximum Marks : 60

Instruction to Candidates:

1) Section - A is **Compulsory.**
2) Attempt any **Five** questions from Section - B & C.
3) Select atleast **Two** questions from Section - B & C.

Section - A

Q1) *(10 × 2 = 20)*

a) Find the radius of curvature of the curve $x^2 + y^2 = a^2$ at (x, y).

b) Find mean square value of $f(x) = \sin x$ in the interval $(0, 1)$.

c) Find df/dt at $t = 0$, where $f(x, y) = x\cos y + e^x \sin y$, $x = t^2 + 1$, $y = t^3 + t$.

d) Find the approximate value of $(4.05)^{1/2}\,(7.97)^{1/3}$, using derivatives.

e) Write the expansion of the Taylor's series $f(x_0 + h, y_0 + k)$ up to second order.

f) Write the equation of Ellipsoid and draw a rough sketch of it.

g) Write two applications of double and triple integral each.

h) State the integral test of convergence of infinite series.

i) How the convergence of alternating series is checked.

j) Separate into real and imaginary parts $\exp\left(5+\frac{i\pi}{2}\right)$.

Section - B

(Marks: 8 Each)

Q2) Sketch the graph of the curve $y = x + \frac{1}{x}$.

Q3) Find centre of gravity of a lamina in the shape of a quadrant of the curve $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1$, the density being $\rho = kxy$, where k is a constant.

Q4) If $f(x, y)$ is a homogeneous function of degree n in x and y and has continuous first and second order partial derivatives, then show that

$$x^2 \frac{\partial^2 f}{\partial x^2} + 2xy \frac{\partial^2 f}{\partial x \partial y} + y^2 \frac{\partial^2 f}{\partial y^2} = n(n-1) f$$

Q5) Using Lagrange's method find the minimum value of $x^2 + y^2 + z^2$ subject to the condition $xyz = a^3$.

Section - C

(Marks: 8 Each)

Q6) Find the equation of the right circular cylinder having for its base the circle $x^2 + y^2 + z^2 = 9$, $x - y + z = 3$.

Q7) Express $\int_0^1 x^m (1 - x^p)^n \, dx$ in terms of Beta function and hence evaluate the integral $\int_0^1 x^{3/2} (1 - \sqrt{x})^{1/2} \, dx$.

Q8) Find the radius of convergence and circle of convergence of the power series $\sum \frac{(n!)^2 z^n}{(2n)!}$.

Q9) Find the sum of the trigonometric series

$$\sin\alpha + x\sin(\alpha + \beta) + \frac{x^2}{2!}\sin(\alpha + 2\beta) + \ldots\infty.$$

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