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Total No. of Questions : 09]

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B.Tech. (Sem. - 1st)

ENGINEERING MATHEMATICS - I

SUBJECT CODE : AM-101 (2k4 & onwards)

Paper ID : [A0111]

[Note : Please fill subject code and paper ID on OMR]

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) *(Marks: 2 Each)*

a) Evaluate $\iint_A xy\,dx\,dy$, where A is the domain bounded by x-axis, ordinate $x = 2a$ and the curve $x^2 = 4ay$.

b) What is Homogeneous function? State Euler's theorem on Homogeneous functions.

c) Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = 2u \log u$ where $\log u = \frac{x^3+y^3}{3x+4y}$.

d) Using De-Moivre's theorem find the cube roots of unity.

e) Simplify $\frac{(\cos 3\theta + i\sin 3\theta)^4 (\cos 4\theta - i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3 (\cos 5\theta + i\sin 5\theta)^{-4}}$.

f) Test for convergence the series

$$\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+---\infty$$

g) What is Alternating Series? Explain the method to test the convergence of an alternating series.

h) Write the equations of Hyperboloid of one sheet, Hyperboloid of two sheets, Hyperbolic paraboloid and Ellipsoid.

i) In polar co-ordinates, $x = r\cos\theta$, $y = r\sin\theta$, show that $\frac{\partial(x,y)}{\partial(r,\theta)} = r$.

j) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dx\,dy\,dz$.

Section - B

(Marks: 8 Each)

Q2) Trace the curve $y^2(a - x) = x^2(a+x)$.

Q3) Find by double integration, the centre of gravity of the area of the cardioid $r = a\,(1+\cos\theta)$.

Q4) If $\theta = t^n e^{-r^2/4t}$, what value of 'n' will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\theta}{\partial r}\right) = \frac{\partial\theta}{\partial t}$.

Q5) If $xyz = 8$, find the values of x, y for which $u = 5xyz/(x + 2y + 4z)$ is a maximum.

Section - C

(Marks: 8 Each)

Q6) Find the equation of the right circular cone generated when the straight line $2y + 3z = 6, x = 0$ revolves about Z - axis.

Q7) Change the order of integration in $I = \int_0^1 \int_{x^2}^{2-x} xy\,dx\,dy$ and hence evaluate the same.

Q8) State, with reasons, the values of x for which the series

$$x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} \text{ ------- converges.}$$

Q9) Sum the series

$$\sin^2\theta - \frac{1}{2}\sin 2\theta\,\sin^2\theta + \frac{1}{3}\sin 3\theta\,\sin^3\theta - \frac{1}{4}\sin 4\theta\,\sin^4\theta + \text{----}\ \infty$$