

Total No. of Questions : 6

Total No. of Printed Pages : 4

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EH-177(A)

**B.E. I Semester (CGPA) Civil Engineering
Exam. 2014**

ENGINEERING MATHEMATICS - I

Paper : CE-101

Time Allowed : Three Hours

Maximum Marks : 60

Note : Attempt any two parts from Question no. 1 to Question no. 6. All questions carry equal marks.

Q.1. a) Expand $y^3 - 6xy = 8$ upto x^4 .

- b) In estimating the cost of a pile of bricks measured as 6'×50'×4', the tape is stretched 1% beyond the standard line. If the count is 12 bricks to ft^3 , and bricks cost Rs. 100 per 1000, find the approximate error in the cost.
- c) Verify Rolle's theorem for the function $f(x) = x(x+3) e^{-x/2}$.

Q.2. a) Show that the sub-tangent of the parabola $y^2=4cx$ at any point is divided into two by the vertex and the sub-normal is constant. Find the length of the sub-normal.

(2)

b) Find out the radius of curvature of the curve

$\sqrt{x} + \sqrt{y} = \sqrt{a}$ at the point at which the curvature has an extremum.

c) Prove that the locus of the extremity of the polar

subtangent of the curve $\frac{1}{r} = f(\theta)$ is

$$\frac{1}{r} + f'(\theta + \pi/2) = 0.$$

Q.3. a) Find the envelope of the straight line $\frac{x}{a} + \frac{y}{b} = 1$, where

the parameter a and b are related by $a^n + b^n = c^n$, c is a constant.

b) If $u = \sin^{-1}(x^3 + y^3)^{2/5}$ then find the value of

$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$$

c) A rectangular box open at the top, is to have a volume of 32 c.c., find the dimensions of the box requiring least material for its construction.

(S (3))

Q.4. a) Find $\int_a^b x^{-\frac{1}{2}} dx$ by the limit of the sum.

(3)
 (15) (20)
 (10) (25) 10

b) Find the area bounded by the curves $xy = 2$, $4y = x^2$ and $y = 4$.

c) A loop of the curve $y^2 = x^2(1-x^2)$ is rotated about the y -axis. Find the volume so generated.

Q.5. a) i) Prove that $\sqrt{n} \cdot \sqrt{1-n} = \frac{\pi}{\sin n\pi}$

ii) Find $\int_0^1 \log \sqrt{x} dx$.

b) Evaluate $\iint_R (x^2 + y^2) dx dy$, where R is the region bounded by $y = x$, $y = 2x$ and $y = 2a$ in the first quadrant.

c) Evaluate $\int_0^a \int_0^x \frac{f'(y) dx dy}{[(a-x)(x-y)]^{1/2}}$.

Q.6. Short answer type questions. (2×5=10)

a) If $U = \tan^{-1}(x+y)$ then the value of $U_x - U_y$ is

b) What error in the common logarithm of a number will be produced by an error of 1% in the number.

(4)

- c) If $f(x) = f(a+b-x)$, then the value of $\int_a^b x f(x) dx$ is
- d) Find the value of $\int_0^\infty x^{2n+1} \cdot e^{-x^2} dx$.
- e) The volume of the solid generated by revolving the area included between the parabola $y^2 = 4ax$ and its latus rectum about the x -axis is.

