# EC-177

## B.E. I Sem. (CGPA) Civil Engineering Exam.-2012-13

## ENGINEERING MATHS - I

**Paper : CE-101**

*Time Allowed : Three Hours*

*Maximum Marks : 60*

Note : Solve all questions.

Q.1. 1) If y satisfies the equation $\frac{dy}{dx} = x^2 y - 1$ and y = 1 when x = 0. Use Taylor's expansion of y in powers of x to find y at x < 0.03.

2) Find the first four terms in the expansion of $\log_e$ Sin (x+h) ascending powers of h. Hence find the value of $\log_e \sin 31^\circ$ to four places of decimals. Given $\log_e 2 = 0.69315$.

Or

1) Expand $Sin^{-1} \frac{2x}{1+x^2}$ in ascending powers of x. upto $x^n$ by Maclaurin's theorem.

2) Expand $\sqrt{1+\sin x}$ upto sixth power of x.

Q.2. 1) Show that the length of the Portions of the tangent to the curve $x = a\cos^3\theta$, $y = a\sin^3\theta$ intercepte between the coordinate axes is constant.

2) Find the Pedal equation to the curve $r = a(1+\cos\theta)$

Or

1) If the curve $x^{m+n} = a^{m-n} y^{2n}$, show that for any point (x,y) the, $m^{th}$ power of the sub tangent varies as the $n^{th}$ power of the sub normal.

2) If the tangent to the curve $\sqrt{x}+\sqrt{y}=\sqrt{a}$ at any point on it cuts the two axes at P and Q. Show that OP+OQ = a, O being the origin.

Q.3. 1) If $u=\left(1-2xy+y^2\right)^{-1/2}$ prove that

$$\frac{\partial}{\partial x}\left[\left(1-x^2\right)\frac{\partial u}{\partial x}\right]+\frac{\partial}{\partial y}\left(y^2\frac{\partial u}{\partial y}\right)=0$$

2) Evaluate $\lim_{x\to\pi/2}\left(\cos x\right)^{\frac{\pi}{2}-x}$

Or

1) A given quantity of metal is to be moulded into a rod with rectangular base and square ends. Find the ratio of the length of the side of the square if the surface area of the rod is minimum.

2) If $u = x^y$ show that

$$\frac{\partial^3 u}{\partial x^2 \partial y} = \frac{\partial^3 u}{\partial x \partial y \partial x}$$

Q.4. 1) Show that $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx = \frac{\pi^2}{4}$

2) Find the limits as $n \to \infty$ of the sum of the series

$$\frac{1}{n} + \frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \dots\dots\dots + \frac{1}{8n}$$

Or

1) Find the whole perimeter of the cardioid $r = a(1+\cos\theta)\, d\theta$.

2) Find the surface of the solid generated by the revolution of the leminscate $r^2 = a^2\cos 2\theta$ about the line $\theta=0$.

Q.5. 1) Evaluate $\iint_A x^2\, dx\, dy$ where A is the region in the first quadrant bounded by the hyperbola $xy = 16$.

2) Find the C.G of the arc of the curve $x = a(\theta+\sin\theta)$, $y = a(1-\cos\theta)$

Or

1) Evaluate $\int_0^1 x^4\left(1-\sqrt{x}\right)^5 dx$

2) Evaluate $\int_{-1}^{1}(1+x)^{p-1}(1-x)^{q-1}\,dx$

Q.6. 1) T or F $\int_0^{\pi/2}\sqrt{Cot\,\theta}\,d\theta = \frac{1}{2}\,\overline{\frac{1}{3}}\,\overline{\frac{3}{4}}$

2) $\overline{m}\;\overline{m+\frac{1}{2}} = \frac{\sqrt{\pi}}{2^{2m+1}}\,\overline{2m}$ $(T\ or\ F)$

3) Find the equation of tangent $y^2=3x^2+1$ at the point (1, 2)

4) T or F $S=\int_\alpha^\beta\sqrt{r^2+\left(\frac{dr}{d\theta}\right)^2}\,d\theta$

5) Evaluate $\int_0^{\pi/2}\log(\tan x+\cot x)\,dx$

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