

Total No. of Questions : 6

Total No. of Printed Pages : 3

EKS-151

B.E. I Sem. (CGPA) Electronics and Communication Engg. Examination 2017

ENGINEERING MATHEMATICS - I

Paper : EL-102

Time Allowed : Three Hours

Maximum Marks : 60

Note: Attempt all the questions. Attempt any two parts from question 2 to question 6. All questions carry equal marks.

Q.1. a) Evaluate $\int_0^a \frac{f(x)}{f(x)+f(a-x)} dx$

b) Find the third term in the expansion of $e^x \sin x$ by MacLaurin's theorem.

c) Evaluate $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right)^{\frac{1}{x^2}}$

d) If $u = x^2 y^3 \phi\left(\frac{y}{x}\right)$ then find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$

e) Find the curvature at the point (2, 2) of the curve $xy = 4$

(2)

- Q.2. a) Expand $x^5 - 7x^3 + 5x^2 + x + 3$ in powers of $(x-1)$ by Taylor's theorem.
 b) Verify Rolle's theorem for the function $f(x) = (x-a)^m (x-b)^n$ on the interval $[a, b]$, where m, n are positive integers.
 c) If the radius of a sphere is measured as 9cm with an error of 0.03cm, then find the approximating error in calculating its volume.

- Q.3. a) Prove that the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ touches the straight line $\left(\frac{x}{a}\right) + \left(\frac{y}{b}\right) = 2$ at point (a, b) whatever the value of n .
 b) Find the subtangent and subnormal and the intercept on the axes at the point t on the cycloid $x = a(t + \sin t)$, $y = a(1 - \cos t)$.
 c) Find the radius of curvature at any point t of the curve $x = a \cos^3 t$, $y = a \sin^3 t$.

- Q.4. a) Find the asymptotes of the curve $x^3 + 2x^2 y - xy^2 - 2y^3 + xy - y^2 = 1$

- b) If $u = \log_e(x^3 + y^3 + z^3 - 3xyz)$, then show that

$$\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z} \right)^2 u = -\frac{9}{(x+y+z)^2}$$

(3)

- c) Discuss the maxima and minima of the function

$$x^2y^2 - 5x^2 - 5y^2 - 8xy$$

Q.5. a) Evaluate $\lim_{n \rightarrow \infty} \left[\sum_{r=1}^n \frac{r^2}{r^3 + r^3} \right]$

- b) Find the length of the arc of the curve $3ay^2 = x(x-a)^2$
c) Find the surface area of the solid generated by revolution of the arc of the parabola $y^2 = 4ax$ bounded by its latus-rectum about the x-axis.

Q.6. a) Show that $\int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}} dx = \beta(m, n)$

- b) Evaluate $\iint_R x^2 dx dy$, where R is region in the first quadrant bounded by the curve $xy = 16$ and the lines $y = x$, $y = 0$ and $x = 8$.
c) Find the volume bounded by the cylinder $x^2 + y^2 = 1$ and the planes $x + y + z = 3$

