

**END-EXAM MODEL PAPERS**  
**STATE BOARD OF TECHNICAL EDUCATION, A.P**  
**C-23 ENGINEERING MATHEMATICS-I, C- 102**

**TIME: 3 HOURS**

**MODEL PAPER- I**

**MAX.MARKS: 80M**

**PART-A**

**Answer All questions. Each question carries THREE marks.**

**10x3=30M**

1. If  $A = \left\{0, \frac{\pi}{4}, \frac{\pi}{2}\right\}$  and  $f : A \rightarrow B$  is a function defined by  $f(x) = \cos x$ , then find the range of  $f$ .

(CO1)

2. Resolve the function  $\frac{x}{(x-1)(x-2)}$  into partial fractions. (CO1)

3. If  $A = \begin{bmatrix} 3 & 9 & 0 \\ 1 & 8 & -2 \end{bmatrix}$  and  $B = \begin{bmatrix} 4 & 0 & 2 \\ 7 & 1 & 4 \end{bmatrix}$ , find  $A+B$  (CO1)

4. Find the determinant of the matrix  $\begin{bmatrix} 2 & -1 & 4 \\ 0 & -2 & 5 \\ -3 & 1 & 3 \end{bmatrix}$  by Laplace's expansion. (CO1)

5. Show that  $\frac{\cos 16^\circ + \sin 16^\circ}{\cos 16^\circ - \sin 16^\circ} = \tan 61^\circ$ . (CO2)

6. Prove that  $\frac{\sin 2\theta}{1 - \cos 2\theta} = \cot \theta$ . (CO2)

7. Find the modulus of the complex number  $3 + 4i$ . (CO2)

8. Find the distance between the parallel lines  $4x - 3y + 9 = 0$  and  $4x - 3y + 5 = 0$ . (CO3)

9. Evaluate  $\lim_{x \rightarrow 0} \frac{\sin 77x}{\sin 11x}$ . (CO4)

10. Find  $\frac{dy}{dx}$ , if  $y = x^4 + 1$  (CO4)

**PART-B**

**Answer any FIVE questions. Each question carries TEN marks.**

**5x10=50M**

11. Solve the system of linear equations  $x + y + z = 6$ ,  $x - y + z = 2$  and  $2x + y - z = 1$  using matrix inversion method. (CO1)

12. A) Show that  $\frac{\sin 7\theta + \sin 5\theta}{\cos 7\theta + \cos 5\theta} = \tan 6\theta$ . (CO2)

- B) Prove that  $\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \tan^{-1}\left(\frac{2}{9}\right)$  (CO2)

13. A) Solve  $(2 \sin x - 1)(\tan x - \sqrt{3}) = 0$ . (CO2)  
 B) If  $a = 10$ ,  $b = 12$ ,  $c = 5$ , then find the area of the  $\Delta ABC$ . (CO2)
14. A) Find the equation of the circle with  $(4, 2)$  and  $(1, 5)$  as the two ends of its diameter. (CO3)  
 B) Find the equation of the conic whose focus is  $(1, 0)$ , directrix is  $3x + 4y + 1 = 0$  and eccentricity is 2. (CO3)
15. A) Find the derivative of  $3 \tan x - 4 \log x - 7e^x + \sin^{-1} x$  w.r.t  $x$ . (CO4)  
 B) Find the derivative of  $x^2 e^{3x}$  w.r.t  $x$ . (CO4)
16. A) If  $x = a(1 - \cos \theta)$ ,  $y = a(\theta + \sin \theta)$ , then find  $\frac{dy}{dx}$ . (CO4)  
 B) If  $u(x, y) = x^2 y + y^2 x$ , then find  $\frac{\partial u}{\partial x}$  and  $\frac{\partial u}{\partial y}$  (CO4)
17. A) Find the equation of tangent to the curve  $y = x^2 + 1$  at  $(2, 1)$ . (CO5)  
 B) If the radius of a circular plate is increasing at 0.7 cm/sec, find the rate of increase in its area when the radius is 10 cm. (CO5)
18. A) Find maximum or minimum value of  $f(x) = x^2 - 4x + 3$ . (CO5)  
 B) If an error of 0.02 cm is made in the side of a square, what is the approximate error in the area and perimeter of the square? (CO5)

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TIME: 3 HOURS

MODEL PAPER- II

MAX.MARKS: 80M

PART-A

Answer All questions. Each question carries THREE marks.

10x3=30M

1. If  $A = \{-1, 0, 1\}$  and  $f: A \rightarrow B$  is defined by  $f(x) = x^2 - x + 1$ , then find the range of  $f$ .  
(CO1)
2. Resolve the function  $\frac{1}{(x+1)(x-2)}$  into partial fractions.  
(CO1)
3. If  $A = \begin{bmatrix} 3 & 9 & 0 \\ 1 & 8 & -2 \end{bmatrix}$  and  $B = \begin{bmatrix} 4 & 0 & 2 \\ 7 & 1 & 4 \end{bmatrix}$ , then find  $(A+B)^T$ .  
(CO1)
4. If  $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$ , then find  $A^2$ .  
(CO1)
5. Find the value of  $\frac{\cos 36^\circ + \sin^\circ}{\cos 36^\circ - \sin 36^\circ} = \tan 81^\circ$ .  
(CO2)
6. Prove that  $\frac{1+\cos}{\sin 2\theta} = \cot \theta$ .  
(CO2)
7. Find the modulus of the complex number  $3+2i$ .  
(CO2)
8. Find the point of intersection of the non-parallel lines  $x + y + 1 = 0$  and  $2x - y + 5 = 0$ .  
(CO3)
9. Evaluate  $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x - 3}$   
(CO4)
10. Find  $\frac{dy}{dx}$ , if  $y = x^3 + 5x$ .  
(CO4)

PART-B

Answer any FIVE questions. Each question carries TEN marks.

5x10=50M

11. Solve the system of linear equations  $x - y + 3z = 5$ ,  $4x + 2y - z = 0$  and  $-x + 3y + z = 5$  using Cramer's rule.  
(CO1)
12. A) Show that  $\cos 40^\circ + \cos 80^\circ + \cos 160^\circ = 0$ .  
(CO2)  
B) Prove that  $\tan^{-1} \left( \frac{1}{4} \right) + \tan^{-1} \left( \frac{3}{5} \right) = \frac{\pi}{4}$   
(CO2)
13. A) Solve  $2 \cos^2 \theta - 3 \cos \theta + 1 = 0$ .  
(CO2)  
B) If  $a = 5$ ,  $b = 7$ ,  $C = 30^\circ$ , then find the area of the  $\Delta ABC$ .  
(CO2)
14. A) Find the equation of the circle passing through the points  $(0, 0)$ ,  $(2, 0)$ , and  $(0, 3)$   
(CO3)

- B) Find the vertex, focus, directrix and latus rectum of the parabola  $y^2 = 16x$ . (CO3)
15. A) Find the derivative of  $3 \sin x + \log x + 2 \tan^{-1} x + 8e^{-x}$  w.r.t.  $x$ . (CO4)
- B) Find the derivative of  $\frac{1-x^2}{1+x^2}$  w.r.t.  $x$ . (CO4)
16. A) If  $y = x^{\sin x}$ , then find  $\frac{dy}{dx}$ . (CO4)
- B) If  $y = \tan^{-1} x$ , then prove that  $(1+x^2) \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} = 0$ . (CO4)
17. A) Find the equation of tangent to the curve  $y = x^3 - 2x^2 + 4$  at  $(2,4)$ . (CO5)
- B) If  $s(t) = t^2 + 2t + 3$  is the displacement of a particle, find its velocity and acceleration at the time  $t=3$  sec. (CO5)
18. A) Find maximum or minimum value of  $f(x) = 3 + 10x - 5x^2$ . (CO5)
- B) If an error of 0.02 cm is made in the side of a square, then what is the percentage error in the calculated value of its area? (CO5)