

**2020**

Full Marks : 70

Time : 3 hours

*The figures in the right-hand margin indicate marks*

Answer from **all** the Parts as directed

Part—A

**(Objective Type Questions)**

1. Choose the correct answer in each of the following : 5×1

(a) The length of the arc of the curve  $y = \log \sec x$  between  $x = 0$  and  $x = \frac{\pi}{6}$  is equal to

(i)  $\log 3$

(ii)  $2 \log 3$

(iii)  $\frac{1}{2} \log 3$

(iv) None of these

(b)  $\int \frac{dx}{x^2 + x + 1}$  is equal to

(i)  $\frac{1}{2} \log \left| \frac{x-1}{x+1} \right|$

(ii)  $\frac{1}{\sqrt{2}} \log \left| \frac{x - \sqrt{2}}{x + \sqrt{2}} \right|$

( 2 )

- (iii)  $\frac{2}{\sqrt{3}} \tan^{-1} \left( \frac{2x+1}{3} \right)$   
(iv) None of these
- (c) What is DES ?  
(i) Block cipher  
(ii) Stream cipher  
(iii) Byte cipher  
(iv) None of these
- (d) Moment of inertia of a circular plate about a line perpendicular to the plate through the centre is  
(i)  $Ma^2$  (ii)  $\frac{1}{2} Ma^2$   
(iii)  $\frac{1}{3} Ma^2$  (iv)  $\frac{1}{4} Ma^2$
- (e) The degree of differential equation satisfying

$$\left( \frac{d^2 y}{dx^2} \right)^{3/2} - \left( \frac{dy}{dx} \right)^{1/2} - 4 = 0$$

is

- (i) 6 (ii) 3  
(iii) 2 (iv) 4

Kx(369)

(Continued)

( 3 )

2. Fill in the blanks :

5×1

- (a) In cryptography the order of the letter in a message is rearranged by \_\_\_\_\_.  
(b) The equation  $y = px + f(p)$  is known as \_\_\_\_\_.  
(c) Integration

$$\int \frac{dx}{\sqrt{(x-2)(x-3)}}$$

is \_\_\_\_\_.

- (d) Integrating factor of the differential equation

$$\cos^2 x \frac{dy}{dx} + y = \tan x$$

is \_\_\_\_\_.

- (e) The linear function of the variables which is to be maximize or minimize is called \_\_\_\_\_.

Part—B

(Short Answer Type Questions)

Answer any four questions of the following : 4×5

3. (a) Define hyperplane. Show that a hyperplane is a convex set.

Kx(369)

(Turn Over)

(4)

(b) Solve the following linear programming problem by graphical method :

$$\text{Max } Z = 5x_1 + 7x_2$$

subject to

$$x_1 + x_2 \leq 4$$

$$3x_1 + 8x_2 \leq 24$$

$$10x_1 + 7x_2 \leq 35$$

$$x_1, x_2 \geq 0$$

4. (a) Find the limit of

$$\frac{n}{n^2 + 1^2} + \frac{n}{n^2 + 2^2} + \dots + \frac{n}{n^2 + n^2}$$

as  $n \rightarrow \infty$ .

(b) Evaluate :

$$\int_0^{\pi/2} \sin^4 x \cos^4 x \, dx$$

5. (a) Solve :

$$(1 + y^2) \, dx = (\tan^{-1} y - x) \, dy$$

(b) Find the orthogonal trajectories of  $r\theta = a$ .

6. (a) Give differences between block cipher and stream cipher.

Kx(369)

(Continued)

(5)

(b) Describe the basic use of hash function.

7. Explain DES algorithm.

8. Find the moment of inertia of a thin uniform rod of length  $2a$  about the line through its one extremity perpendicular to the rod.

Part—C

(Long Answer Type Questions)

Answer any four questions of the following :

4×10

9. Solve the following linear programming problem by simplex method :

$$\text{Min } Z = x_1 - 3x_2 + 2x_3$$

subject to

$$3x_1 - x_2 + 2x_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0$$

Kx(369)

(Turn Over)

(6)

10. Show that in the catenary  $y = c \cosh \frac{x}{c}$

(a) the length of the arc being measured from the vertex to any point is given by  $y = c \sinh \frac{x}{c}$ ;

(b)  $y^2 = c^2 + s^2$ , the arc being measured from the vertex.

11. Explain RSA algorithm and give example of generation of public and private key.

12. The cardioid  $r = a(1 + \cos \theta)$  revolves about the initial line. Find the surface and volume of cardioid.

13. (a) Find the orthogonal trajectories of the curve

$$\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$$

where  $\lambda$  being the parameter of the family.

(b) Solve :

$$y = px + p - p^2$$

Kx(369)

(Continued)

(7)

14. Solve :

(i)  $\frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} + 6y = \sin x + \cos x$

(ii)  $\frac{d^2 y}{dx^2} - 3 \frac{dy}{dx} + 2y = e^x$

\*\*\*

Kx(369)—500

BCA (Sem II) - Math (GE-2)