BCA(Sem-II)
GE – 2 (Math)

2021

Time : 3 hours

Full Marks : 70

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

*Answer from **all** the Parts as directed.*

Part – A

1. Choose the correct answer in each of the following : $1 \times 5 = 5$

(a) $\int \frac{x dx}{x^4 - x^2 - 2}$ is equal to :

(i) $\frac{1}{6} \log k \frac{x^2 - 1}{x^2 + 1}$

(ii) $\frac{1}{4} \log k \frac{x^2-2}{x^2+2}$

(iii) $\frac{1}{2} \log k \frac{x^2-4}{x^2+4}$

(iv) None of these

(b) Area of loop of the curve $y^2 = x(x-1)^2$ is :

(i) $\frac{2}{3}$

(ii) $\frac{4}{11}$

(iii) $\frac{8}{15}$

(iv) None of these

(c) The differential equation $(x^2 - 4xy - y^2)dx + (y^2 - 4xy - x^2)dy = 0$ is of :

(i) First order and first degree

(ii) First order and second degree

(iii) Second order and first degree

(iv) None of these

(d) Solution of the differential equation

$$\frac{dy}{dx}+\frac{y}{x}=x^3 \text{ is :}$$

(i) $yx=\frac{x^4}{4}+c$

(ii) $yx=\frac{x^5}{5}+c$

(iii) $yx=\frac{x^6}{6}+c$

(iv) None of these

(e) Which of the following is a mode of operation for Block Ciphers in cryptography ?

(i) Electronic Code Book (ECB)

(ii) Cipher Block Chaining (CBC)

(iii) Counter Mode

(iv) All of these

2. Fill in the blanks : $1\times5=5$

(a) Data Encryption Standard (DES) is a _____.

(b) An equation of the form $\frac{dy}{dx} + py = Q$, where P and Q are functions of x or constants is known as _____.

(c) The limit of

$$n\left[\frac{1}{n^2} + \frac{1}{n^2+1^2} + \frac{1}{n^2+2^2} + \ldots + \frac{1}{n^2+(n-1)^2}\right] \text{ is}$$

_____.

(d) The area bounded by the curve $r = f(\theta)$ and the radii vectors $\theta = \alpha$ and $\theta = \beta$ is given by the definite integral _____.

(e) If the convex set of feasible solutions of $Ax=b$, $x \geq 0$ is a convex polyhedron, then at least one of the extreme points gives _____.

Part – B

Answer any **four** questions of the following :

$5 \times 4 = 20$

3. (a) Examine whether the set

$S = \{(x_1, x_2) : x_1^2 + x_2^2\} \leq 9$ is a convex set.

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

Max $Z = x_1 + 3x_2$

Subject to the constraints

$3x_1 + 6x_2 \leq 8$

$5x_1 + 2x_2 \leq 10$

$x_1, x_2 \geq 0$

4. Evaluate $\int_0^{\pi/2} \cos^n x \cos nx \, dx$, where n is a positive integer.

5. Solve : $x\frac{dy}{dx} + y = y^2 \log x$.

6. Explain RC^4 Encryption Algorithm.

7. How can you combine hash function with public key encryption for message authentication ?

8. Find the perimeter of the curve $x^{2/3} + y^{2/3} = a^{2/3}$.

Part – C

Answer any **four** questions of the following :

$10 \times 4 = 40$

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

$$\text{Max } Z = 3x_1 + 5x_2 + 4x_3$$

Subject to $2x_1 + 3x_2 \leq 8$

$2x_2 + 5x_3 \leq 10$

$3x_1 + 2x_2 + 4x_3 \leq 15$

$x_1, x_2, x_3 \geq 0$

10. Find the valume and surface are of the solid generated by revolving the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ about its base.

11. What is RSA encryption and how does is work ? Is RSA encryption secure ?

12. Find the moment of inertia of a thin hollow spherical shell of radius a and mass M about a diameter.

13. (a) Find the orthogonal trajectories of $r = a(1 - \cos\theta)$, where a is the parameter.

(b) Solve : $(x - a)p^2 + (x - y)p - y = 0$

14. Solve :

(a) $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = x^2$

(b) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x + xe^{2x} - 2\sin x$