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**BCA-105**

**B.C.A. (I Year) EXAMINATION, 2018**

**Paper V**

**(Basic Mathematics)**

**Time allowed : Three Hours**

**Maximum Marks : 100**

**Part A (खण्ड 'अ') [Marks : 20]**

*Answer all questions (50 words each).*

*All questions carry equal marks.*

सभी प्रश्न अनिवार्य हैं । प्रत्येक प्रश्न का उत्तर 50 शब्दों से अधिक न हो । सभी प्रश्नों के अंक समान हैं ।

**Part B (खण्ड 'ब') [Marks : 50]**

*Answer five questions (250 words each),*

*selecting **one** question from each Unit.*

*All questions carry equal marks.*

प्रत्येक इकाई से एक प्रश्न चुनते हुए, कुल पाँच प्रश्न कीजिए । प्रत्येक प्रश्न का उत्तर 250 शब्दों से अधिक न हो । सभी प्रश्नों के अंक समान हैं ।

P.T.O.

Answer any two questions (300 words each).

All questions carry equal marks.

कोई दो प्रश्न कीजिए । प्रत्येक प्रश्न का उत्तर 300 शब्दों

से अधिक न हो । सभी प्रश्नों के अंक समान हैं ।

**Part A**

1. Answer the following questions :

**Unit I**

- (i) Define equivalent sets.
- (ii) Define identity relation.

**Unit II**

- (iii) Find  $f \circ g$  where  $f : \mathbb{R} \rightarrow \mathbb{R}$  and  $g : \mathbb{R} \rightarrow \mathbb{R}$  are defined by  $f(x) = 2x + x^2$  and  $g(x) = x^3$ .

- (iv) Evaluate :

$$\lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x - 2}$$

### Unit III

- (v) Find roots of the equation  $2x^2 + 5x - 7$ .
- (vi) Find equation of the straight line passes through  
(0, 0) and whose slope is 5.

### Unit IV

- (vii) If  $y = \left( \frac{x^4}{4} - \frac{3}{2}x^2 - 1 \right)$ , then find  $\frac{dy}{dx}$ .
- (viii) Define critical points.

### Unit V

- (ix) Evaluate :

$$\int \left( 2e^x - \frac{5}{x} + 3\sec^2 x \right) dx.$$

- (x) Evaluate :

$$\int e^x \sec(e^x) \tan(e^x) dx.$$

## Part B

### Unit I

2. Let  $R$  be a relation in  $N$  defined by  $(a, b) \in R \Leftrightarrow a + 2b = 8$ . Express  $R$  and  $R^{-1}$  as sets of ordered pairs.

Or

3. For any set  $A$ , prove that :
- (i)  $A \cup A = A$
  - (ii)  $A \cap A = A$ .

### Unit II

4. Let  $A = \{-2, -1, 0, 1, 2\}$  and  $f : A \rightarrow Z$  given by  $f(x) = x^2 - 2x - 3$ .

Find :

- (i) the range of  $f$
- (ii) pre-image of 6, -3 and 5.

Or

5. Find the value of :

$$\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$$

### Unit III

6. If

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \text{ and } I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix},$$

show that :

$$A^2 - (a + d)A = (bc - ad)I.$$

Or

7. Prove that :

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ bc & ca & ab \end{vmatrix} = (b - c)(c - a)(a - b).$$

### Unit IV

8. If

$$y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots \infty}}}$$

then show that :

$$\frac{dy}{dx} = \frac{\cos x}{2y - 1}.$$

Or

9. Trace the following curve :

$$x^3 + y^3 = 3axy.$$

### Unit V

10. Evaluate :

$$\int \frac{dx}{\sqrt{4x^2 - 5x + 1}}.$$

Or

11. Evaluate :

$$\int \frac{x^2 + 1}{x^4 + 1} dx.$$

### Part C

### Unit I

12. Prove that the relation  $R$  on the set  $Z$  of all integer number defined by  $(x, y) \in R \Leftrightarrow x - y$  is divisible by  $n$  is an equivalence relation on  $Z$ .

### Unit II

13. Check the continuity of  $f(x)$  at  $x = 0$  and  $x = 1$  if

$$f(x) = |x| + |x - 1|.$$

### Unit III

14. Solve the following system of equations :

$$5x - 6y + 4z = 15$$

$$7x + 4y - 3z = 19 \text{ and}$$

$$2x + y + 6z = 46.$$

### Unit IV

15. Prove that the function  $x^5 - 5x^4 + 5x^3 - 10$  has its maximum value at  $x = 1$ , minimum value at  $x = 3$  and neither maximum nor minimum value at  $x = 0$ .

### Unit V

16. Prove that :

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

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The following table shows the results of the

analysis of the data for the year 1964.

The results are as follows:

Table 1

Table 2

The following table shows the results of the

analysis of the data for the year 1965.

The results are as follows:

Table 3

The following table shows the results of the

analysis of the data for the year 1966.

The results are as follows:

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