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**J-3818**

**[2037]**

**B.Sc. (BI) (Semester - 1<sup>st</sup>)**

**CALCULUS FUNCTION AND NUMBER SYSTEMS (B.Sc. (BI) - 104)**

**Time : 03 Hours**

**Maximum Marks : 75**

**Instruction to Candidates:**

- 1) Section-A is **compulsory**.
- 2) Attempt any **Nine** questions from Section-B.

**Section - A**

**Q1)**

**(15 × 2 = 30)**

- a) What do you mean by number system and define real numbers?
- b) Differentiate Rational and Irrational numbers.
- c) What are complex numbers? With an example define Real and Imaginary parts of a Complex number.
- d) Discuss the Modulus and Argument of a Complex Number. Also define Complex Conjugate.
- e) State De-Moivre's Theorem.
- f) What do you mean by Domain and Range of a function?
- g) Discuss in brief the Concept of Limit with suitable example.
- h) What are Asymptotes?
- i) Find derivative of Sin  $x$  and Cos  $x$  w.r.t.  $x$ .
- j) What do you understand by Inverse Trigonometry?
- k) Find Real part of  $\frac{1}{1-z}$  where  $z = x + iy$ .
- l) When does a function is derivable?
- m) Define Rectangular Asymptote.
- n) What do you mean by Rectification and length of a Curve?
- o) Prove that the function  $f(x) = x^3 - 3x^2 + 3x - 100$  is increasing on R.

**P.T.O.**

**Section - B**

(9 × 5 = 45)

**Q2)** (i) Define Onto function and One-One function.

(ii) Find the domain and range of the function  $f(x) = \frac{1}{(x-1)(x-2)}$ .

**Q3)** (i) High light the term ‘Removable discontinuity’.

(ii) Find the value of the constant K so that the given function is continuous at the indicated point :

$$f(x) = \begin{cases} Kx^2, & \text{if } x \leq 2 \\ 3, & \text{if } x > 2 \end{cases}$$

at  $x = 2$

**Q4)** Prove that  $\lim_{x \rightarrow 0} \sin\left(\frac{1}{x}\right)$  does not exist.

**Q5)** If  $y = \tan^{-1}\left(\frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}}\right)$ , prove that  $\frac{dy}{dx} = \frac{-x}{\sqrt{1-x^4}}$ .

**Q6)** If  $n$  is any integer then  $(\cos \theta + i \sin \theta)^n = \cos n\theta + i \sin n\theta$

**Q7)** Find the Cube root of unity?

**Q8)** Find the intervals in which the function ‘ $f$ ’ given by  $f(x) = x^3 + \frac{1}{x^3}$ ,  $x \neq 0$  is

- i) Increasing
- ii) Decreasing.

**Q9)** Trace the Curve  $y = x^3$ .

**Q10)** Find the absolute maximum and minimum value of function  $f$  given by  $f(x) = \cos^2 x + \sin x$ ;  $x \in [0, n]$ .

**Q11)** Find the length of the arc of the parabola  $y^2 = 4ax$

- i) from the vertex to an extremity of the latus rectum
- ii) cut off by the latus rectum

**Q12)** Prove that Addition, Subtraction, Multiplication and Division of a Complex number is also a Complex number.

**Q13)** Find the slope of the normal to the curve  $x = 1 - a \sin \theta$ ,  $y = b \cos^2 \theta$  at  $\theta = \frac{\pi}{2}$ .

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