

**END SEMESTER/RETEST EXAMINATION-2019**

Semester : 1st (New)

Subject Code : Sc-102

**MATHEMATICS-I**

Full Marks - 70

Time - Three hours

The figures in the margin indicate full marks  
for the questions.

**Instruction :**

1. Questions on both PART-A and PART-B are compulsory.

**PART - A**

Marks - 25

1. Choose the correct answer:  $1 \times 10 = 10$

(a) Square root of  $2i$  is

(i)  $\pm(4+i)$       (ii)  $\pm(1+i)$

(iii)  $\pm(2-i)$       (iv)  $\pm(2+i)$

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(b) Modules of  $\frac{2-i}{3-4i}$  is

- (i)  $\frac{1}{5}$  (ii)  $\frac{1}{\sqrt{5}}$

- (iii)  $\sqrt{3}$  (iv) 5

(c) Value of  $\log_2 \log_3 81$  is

- (i) 2 (ii) 3  
(iv) None of these

(d) Value of  $\omega^{120}$  is

- (i) -1 (ii) 1  
(iii) 0 (v)  $-\omega$

(e)  $\arg(2-2i)$  is

- (i)  $\pi$  (ii)  $\pi/2$   
(iii)  $\pi/4$  (iv)  $-\pi/4$

(f) Sum of the first 20 terms in  $-4 - 2 + 0 + \dots$  is

- (i) 1992

- (ii) 300

- (iii) 4620 (iv) None of these

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(g) 7th term of 2, 6, 18, .... is

- (i) 563 (ii) 2408  
(iii) 1458 (iv) 2048

(h) Number of ways that the letters of the word BOOK be arranged is

- (i) 10 (ii) 8  
(iii) 12 (iv) 13

(i) Number of terms in the expansion of  $(x+a)^n$  is

- (i) n (ii) n+1  
(iii) n-1 (iv)  $n^2$

(j) Minor of  $a_{22}$  in  $\begin{vmatrix} 2 & -1 & 0 \\ 1 & -2 & 1 \\ 4 & 3 & -1 \end{vmatrix}$  is

- (i)  $\begin{vmatrix} 2 & -1 \\ 1 & -2 \end{vmatrix}$  (ii)  $-\begin{vmatrix} 2 & -1 \\ 1 & -2 \end{vmatrix}$

- (iii)  $-\begin{vmatrix} 2 & -1 \\ 4 & 3 \end{vmatrix}$  (iv)  $\begin{vmatrix} 2 & 0 \\ 4 & -1 \end{vmatrix}$

2. Write true or false : 1×10=10

- (i)  $\tan(A+B) \cdot \tan(A-B) = \frac{\sin^2 A - \sin^2 B}{\cos^2 A - \cos^2 B}$

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(ii)  $\tan 27^\circ + \tan 18^\circ + \tan 27^\circ + \tan 18^\circ A = 1$

(iii)  $\frac{\sin \theta}{1 + \cos \theta} = \frac{1 - \cos \theta}{\sin \theta}$

(iv)  $\frac{\sin A + \sin B}{\cos A + \cos B} = \tan \left( \frac{A+B}{2} \right)$

(v)  $\cos 2\theta = 2\cos^2\theta - 1$

(vi)  $\sin^2 18^\circ + \sin^2 72^\circ = 1$

(vii) In any triangle ABC, we have  $C = b \cos B + c \cos C$ .

(viii) Slope of line passing through (7, 2) and (7, -5) is not defined.

(ix) The x-intercept of  $5x+4y+20 = 0$  is

(x) If  $m_1$  and  $m_2$  are slopes of two perpendicular lines, then  $m_1 = m_2$ .

3. Find the correct answer :

(a) The cost of digging a pit of size  $4 \times 5 \times 4$  at the rate of Rs. 50 is

- (i) Rs. 4,000    (ii) Rs. 2,000
- (iii) Rs. 3,500    (iv) Rs. 3,650

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(5)

(b) The length of the longest rod that can be kept in a box of size  $3 \times 12 \times 4$  is

- (i) 7.9    (ii) 8.2
- (iii) 12.5    (iv) 13

(c) The volume of a sphere of radius 6 is

- (i)  $287\pi$     (ii)  $346\pi$
- (iii)  $410\pi$     (iv)  $288\pi$

(d) The base radius of a cone is 7. If the height of the pyramid is 24 cm, its lateral surface is

- (i)  $175\pi$     (ii)  $174\pi$
- (iii)  $238\pi$     (iv)  $188\pi$

(e) The height of a cylinder is 6 cm and the ratio to its volume to the lateral surface area is

$2 : 1$ . The radius is

- (i) 4.5    (ii) 3
- (iii) 4    (iv) 2.5

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PART - B

Marks - 45

4. (a) Evaluate  $\log_3 \log_2 \log_{\sqrt{3}} 81$ . 2

- (b) If  $x = 1 + 2i$ , find the value of  $x^2 - 2x + 5$ . 2

$$(c) \text{ Prove that } \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & a^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a) \quad 3$$

5. (a) Determine the value of  $k$  if  $7k+3, 4k-5, 2k+10$  are in AP. 2

- (b) Find 9th term in  $\left(1 + \frac{1}{x}\right)^{19}$  2

- (c) If  $\tan nC_3 = nC_2 = 12 : 1$ , find  $n$ . 2

6. (a) In how many ways can the letters of the word MATHEMATICS be arranged without changing the order of the vowels in the word ? 2

- (b) Insert 5GMs between 576 and 9. 2

- (c) Resolve into simple fraction :  $\frac{x^2}{(x+1)^2(x+2)}$  3

7. Prove that (any four) :  $2 \times 4 = 8$

$$(i) \sin^2 48^\circ + \sin^2 42^\circ = 1$$

$$(ii) \tan 53^\circ = \frac{\cos 8^\circ + \sin 8^\circ}{\cos 8^\circ - \sin 8^\circ}$$

$$(iii) \tan \left( \frac{\pi}{4} + \frac{\theta}{2} \right) = \sec \theta + \tan \theta$$

$$(iv) \cos^4 \theta - \sin^4 \theta = \cos 2\theta$$

$$(v) \cos 130^\circ + \cos 110^\circ + \cos 10^\circ = 0$$

$$(vi) \frac{\cos \theta - \cos \varphi}{\sin \theta - \sin \varphi} = \frac{\sin \theta - \sin \varphi}{\cos \varphi - \cos \theta}$$

$$(vii) \frac{\sin(B-C)}{\cos B \cos C} = \tan B - \tan C.$$

8. Answer any two questions :  $3 \times 2 = 6$

- (i) If  $A + B + C = \pi$ , prove that  $\sin^2 A + \sin^2 B + \sin^2 C = 2 + 2 \cos A \cos B \cos C$

$$(iv) \text{Prove that } \tan^{-1} \frac{5}{12} = \sin^{-1} \frac{5}{13} = \cos^{-1} \frac{12}{13}$$

- (iii) For the triangle ABC, prove that  

$$\tan \frac{A-B}{2} = \frac{a-b}{a+b} \cot \frac{C}{2}.$$

9. (a) Find the equation of straight line which passes through the point (2, 3) and which is parallel to the straight line  $3x + 4y + 8 = 0$ . 2

(b) Find the angle between the lines  $7x - y = 1$  and  $6x - y = 11$ . 2

(c) Find the co-ordinate of the foot of the perpendicular from the points (-1, 3) to the line  $3x - 4y - 16 = 0$ . 2

10. (a) An irregular plot has the following offsets measured from one end at equal distance:

3

x	0	12	24	36	48	60	72	84	96	108	120
d	53	52	47	49	53	63	58	61	52	49	48

Find the area of the plot.

(b) The section of a right circular cone by a plane through its vertex perpendicular to the base is an equilateral triangle, each side of which is 12m. Find the volume of the cone. 2