Total No. of printed pages = 8

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 :   1×10=10

(a) Square root of 2i is

(i) ±(4+i)   (ii) ±(1+i)

(iii) ±(2–i)   (iv) ±(2+i)

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

(i) $\dfrac{1}{5}$ (ii) $\dfrac{1}{\sqrt{5}}$

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

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

(i) 2   (ii) 3

(iv) 1   (iv) None of these

(d) Value of ω^{120} is

(i) −1   (ii) 1

(iii) ω (v) $-\omega$

(e) arg (2 − 2i) is

(i) π (ii) $\pi/2$

(iii) $\pi/4$ (iv) $-\pi/4$

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

(i) 1992   (ii) 300

(iii) 4620   (iv) None of these

110/Sc-102/Maths-I(N)   (2)

(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) $\tan(A + B).\tan(A - B) = \dfrac{\sin^2 A - \sin^2 B}{\cos^2 A - \cos^2 B}$

110/Sc-102/Maths-I(N)   (3)   [Turn over

(ii) $\tan 27° + \tan 18° + \tan 27° + \tan 18°·A = 1$

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

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

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

(vi) $\sin^2 18° + \sin^2 72° = 1$

(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 5.

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

3. Find the correct answer : $1 \times 5 = 5$

(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

(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) 287π (ii) 346π

(iii) 410π (iv) 288π

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

(i) 175π (ii) 174π

(iii) 238π (iv) 188π

(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

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

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

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

(c) If find $2n_{C_3} : = n_{C_2} = 12 : 1$, 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 : $\dfrac{x^2}{(x+1)^2(x+2)}$ 3

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

(i) $\sin^2 48° + \sin^2 42° = 1$

(ii) $\tan 53° = \dfrac{\cos 8° + \sin 8°}{\cos 8° - \sin 8°}$

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

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

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

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

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

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

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

(iii) For the triangle ABC, prove that

$\tan\dfrac{A - B}{2} = \dfrac{a - b}{a + b} \cot\dfrac{c}{2}$.

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

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