Mathematics
Class – XI

Time allowed: 3 hours   Maximum Marks: **100**

General Instructions:

a) All questions are compulsory.
b) The question paper consists of 26 questions divided into three sections A, B and C. Section A comprises of 6 questions of one mark each, Section B comprises of 13 questions of four marks each and Section C comprises of 7 questions of six marks each.
c) All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.
d) Use of calculators is not permitted.

Section A

1. Solve for x if $|x| + x = 2 + i$

2. Write the sum of first n odd numbers

3. Write the nth tern if the sum of n terms of an AP is $2n^2 + 3n$

4. If $a < b$ write the length of latus rectum of an ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$

5. If $f(x) = 5$ for all real numbers of x find $f(x+5)$

6. What is the maximum number of objects you can weigh if you have four distinct weights.

Section B

7. Prove that $f'(a+b) = f'(a) + f'(b)$ when $f(x) = x^2$ and when $f(x) = x^3$

8. If α, β are the roots of the equation $x^2 + px + q = 0$ Find $\alpha^3 + \beta^3$.

9. A positive 3 digit number has its units digit zero. Find the probability that the number is divisible by 4.

10. Prove that $\tan(45 + x) = \sec 2x + \tan 2x$

11. Prove by mathematical induction that $n(n+1)$ is even

12. Find $n[(A \cup B \cup C)]$ if $n(A) = 4000\ n(B) = 2000\ n(C) = 1000$ and

$n(A \cap B) = n(B \cap C) = n(A \cap C) = 400$, $n(A \cap B \cap C) = 200$

13. Find the latus rectum, eccentricity and coordinates of the foci of the ellipse $x^2 + 3y^2 = k^2$

14. Find the area of the circle passing through the points $(-8,0),(0,8),12,0)$

15. If S_1, S_2, S_3 are the sums of $n, 2n, 3n$ terms respectively of an AP prove that $S_3 = 3(S_2 - S_1)$

16. Find the least value of $f(x)$ if $f(x) = 3x^2 - 6x - 11$

17. Find $f(x) + f(1-x)$ if $f(x) = \dfrac{a^x}{a^x + \sqrt{a}}$

18. Prove that $\dfrac{\tan 2x \tan x}{\tan 2x - \tan x} = \sin 2x$

19. Find the limit $\lim\limits_{n \to \infty} \dfrac{(n+2)! + (n+1)!)}{(n+2)! - (n+1)!}$

Section C

20. Find $\dfrac{dy}{dx}$ given that $y = (\sin^n x \cos nx)$

21. If $(5a),(a-b),b$ are in GP prove that $\log\left(\dfrac{1}{3}(a+b)\right) = \dfrac{1}{2}(\log a + \log b)$

22. If the nth term of a series is denoted by $\dfrac{7^{n-1}}{10^n}$. Find the sum to infinity of the series.

23. Calculate the variance and standard deviation of the following data $8,12,13,15,22,14$

24. $f(x) = (1+x)^{\frac{1}{x}}, x \neq 0$. Find $f(1 + \dfrac{a}{y})^{by}$

25. The probability of A hitting a target is $\dfrac{4}{5}$; the probability of B hitting the target is $\dfrac{3}{4}$ and the probability of C missing the target is $\dfrac{1}{3}$.What is the probability of the target being hit at least twice.

26. Find the term independent of x in the expansion $\left(ax^2 - \dfrac{b}{x}\right)^9$