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. Compute \((1 + 2i)i - \frac{3 + 2i}{1 - i}\)

2. Write the domain and range of the function \(\cos^{-1} x\)

3. Find the sign of \(y\) if \(y = \sin(\cos^{-1} x)\)

4. Find \(\sin^{-1}\left(\sin\left(\frac{6\pi}{7}\right)\right)\)

5. Write the coordinates of the point of intersections of the parabola represented by \(y^2 = 4ax\) and its latus rectum

6. Find \(x\) and \(y\) if \((x + 7, 8) = (10, x + y)\)

Section B

7. Solve \(\sin^2 x + \sin^2 2x = 1\)

8. Find the value of \(i^{30} + i^{40} + i^{60}\)

9. Determine whether the points \((0,0)\) and \((5,5)\) lie on different sides of the straight line \(x + y - 8 = 0\) or on the same side of the straight line.

10. Prove that \(\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}\)

11. Prove by mathematical induction that \(11^{n+2} + 12^{2n+1}\) is divisible by 133 for all positive integer values of \(n\)
12. A, B, C are 3 sets and U is the universal set such that
\[ n(U) = 800, n(A) = 200, n(B) = 300, n(A \cap B) = 100 \]
Find \( n(A' \cap B') \)

13. If \( \alpha, \beta \) are the roots of the equation \( x^2 - bx + c = 0 \) find the value of \( \alpha^2 + \beta^2 \)

14. If P be the sum of the odd terms and Q the sum of the even terms in the expansion of \((x + a)^n\), prove that \( P^2 - Q^2 = (x^2 - a^2)^n \)

15. Solve the inequality \( \frac{x^2 - 3x + 6}{3 + 4x} < 0 \)

16. Prove that \( \cot(A+15) - \tan(A-15) = \frac{4\cos 2A}{1 + 2\sin 2A} \)

17. Find the domain of the function \( f(x) = \sqrt{4 - x^2} \)

18. Evaluate \( \frac{1}{2 + \cos \theta + \sin \theta} \) if \( \tan \frac{\theta}{2} = 2 \)

19. Find the limit \( \lim_{x \to 0} \frac{\sin 5x}{x + x^3} \)

**Section C**

20. Differentiate \( \log_{10} x \) with respect to \( x \)

21. How many 6 digits numbers can be formed with the digits 1, 2, 3, 4, 5, 6, 7 if the 10th, unit’s places are always even and repetition is not allowed.

22. Shift the origin to a suitable point so that the equation \( x^2 + y^2 - 4x + 6y = 36 \) representing a circle is transformed in to an equation of a circle with centre at origin in the new coordinate axes.

23. The mean and variance of 7 observations are 8 and 19 respectively. If 5 of the observations are 2, 4, 12, 14, 11. Find the remaining observations.

24. Prove that \( \frac{1}{\log_a b} \), \( \frac{1}{\log_b a} \), \( \frac{1}{\log_a b} \) form an AP

25. On the average one person dies out of every 10 accidents find the probability that at least 4 will be safe out of 5 accidents.

26. In the expansion \( (1 + x)^{10} \), the coefficients of \( T_{2r+1} \) and \( T_{r+2} \) are equal, find \( r \)