

General Instructions to candidates

- There is a cool off time of 15 minutes in addition to the writing time 2 hr 30 min.
 - You are not allowed to write your answers nor to discuss anything with others during the cool off time
 - Use the cool off time to get familiar with questions and to plan your answers
 - Read questions carefully before answering
 - When you select a question all the sub questions must be answered from the same Question itself
 - Calculations figures and graphs should be shown in the answer sheet itself
 - Give equations wherever necessary
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1. Consider $A = \{x : x \text{ is a natural number, } 1 \leq x \leq 6\}$. $B = \{x : x \text{ is a prime number, } x \leq 9\}$
 $C = \{x : x \text{ is an even number, } 1 \leq x \leq 8\}$.
 - i) Write A, B, C in the roster form. (3)
 - ii) Verify that $(A \cup B) \cap C = A \cup (B \cap C)$. (2)
2. Let $A = \{1, 2, 3, \dots, 14\}$.
 Define a relation R from A to A by $R = \{(x, y) : 3x - y = 0, x, y \in A\}$. Find its : (2)
 - i) Domain. (1)
 - ii) Codomain. (1)
 - iii) Range. (1)
3. i) Write the relation between degree measure and radian measure. (1)
 - ii) If $\sin x = 3/5$, x lies in the first quadrant, find $\cos x$ and $\tan x$. (2)
 - iii) Prove that $\tan 3x \tan 2x \tan x = \tan 3x - \tan 2x - \tan x$. (3)
4. Consider the statement " $7^n - 3^n$ is divisible by 4".
 - i) Verify the result for $n = 1$, and $n = 2$. (2)
 - ii) Prove the statement by using the principle of mathematical induction. (2)
5. i) Find the multiplicative inverse of $2 - 3i$. (1)
 - ii) Express the complex number $z = 1 + i\sqrt{3}$ in the polar form. (3)
 - iii) Solve $\sqrt{2}x^2 + x + \sqrt{2} = 0$ (1)
6. i) Solve the inequality $4(x - 1) \leq 3(x - 4)$. (2)
 - ii) Solve the following system of inequalities graphically:

$$\begin{aligned} x + 2y &\leq 8, \\ 2x + y &\leq 8, \\ x &\geq 0, y \geq 0. \end{aligned}$$
 (3)
7. i) Find the number of words that can be formed from the letters of the word MALAYALAM. (1)
 - ii) How many of these arrangements start with Y? (2)
8. i) If ${}^n C_6 = {}^n C_5$
 - a) Find n ? (1)
 - b) Find ${}^n C_2$ (1)
 ii) A bag contains 5 black and 6 red balls. Determine the number of ways in which 2 black and 3 red balls can be selected. (2)

9. i) Write the expansion of $(a + b)^n$ where n is a positive integer. (1)
- ii) Find the general term in the expansion of $(x + \frac{1}{x})^6$ (1)
- iii) Find the term independent of x in the above expansion. (2)
10. i) In an AP if m^{th} term is n and n^{th} term is m, where $m \neq n$. Find:
- (a) First term. (1)
- (b) Common difference. (1)
- (c) p^{th} term. (1)
- ii) Find the sum of the sequence 5, 55, 555, 5555, ... to n terms. (2)
11. i) Consider the equation of a line $3x - 4y + 10 = 0$. Find its :
- (a) Slope. (1)
- (b) x - intercept. (1)
- (c) y - intercept. (1)
- ii) Find the equation of a line perpendicular to the line $x - 2y + 3 = 0$ and passing through the point (1, -2). (3)
12. An ellipse whose major axis as X-axis and the centre (0, 0) passes through (4, 3) and (-1, 4).
- i) Find the equation of the ellipse. (3)
- ii) Find its eccentricity. (1)
13. Consider the triangle with vertices P (-2, 3, 5), Q (1, 2, 3), R (7, 0, -1).
- i) Find the sides PQ, QR, PR. (3)
- ii) Prove that P, Q, R are collinear. (1)
14. i) Find the derivative of $f(x) = \sin x$, using first principle. (3)
- ii) Compute the derivative of $f(x) = x \tan x$ using Leibnitz product rule. (2)
- iii) Evaluate $\lim_{x \rightarrow 0} \frac{\sin 3x}{\sin 4x}$ (2)
15. i) Write the negation of the statement. "The sum of 3 and 4 is 9". (1)
- ii) If x and y are odd then xy is odd. Write the contra positive of this statement. Prove the Statement using contra positive method. (2)
17. Consider the following data:

Class	30 - 40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

- i) Find the mean. (2)
- ii) Find the variance. (3)
- iii) Find the Standard Deviation. (1)
18. Three coins are tossed once.
- i) Write the sample space of this random experiment. (1)
- ii) Find the probability of getting :
- (a) exactly 2 heads. (1)
- (b) atleast 2 heads. (1)
- (c) atmost 2 heads. (1)