

**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  $(A \cup B) \cap C = A \cap (B \cup C)$ . (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 :
  - 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  $m^{\text{th}}$  term is n and  $n^{\text{th}}$  term is m, where  $m \neq n$ . Find:
- (a) First term. (1)
- (b) Common difference. (1)
- (c)  $p^{\text{th}}$  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)