Q24. (a) Find the derivative of $f(x) = \frac{x + \cos x}{\tan x}$

(b) Let f be a function defined by

$$f(x) = \begin{cases} \frac{x}{|x|} & , x \neq 0 \\ 0 & , x = 0 \end{cases}$$

Does $\lim_{x \to 0} f(x)$ exist? (3+3)

Q25. Calculate mean, variance and standard deviation for the following distribution

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

Q26. On her vacations Veena visits four cities A, B, C and D in a random order. What is the probability that she visits

(i) A before B?

(ii) A before B and B before C?

(iii) A first and B last?

Summer vacations gives one an opportunity to go out and explore places. Do you think one should take a break from the monotonous routine and go out to enjoy. Do you agree? Why/why not?

OR

Find the probability that when a hand of 7 cards is drawn from a well shuffled deck of 52 cards, it contains (i) all Kings (ii) 3 Kings (iii) atleast 3 Kings. Playing cards for money is bad habit. Explain.

SUBJECT : MATHEMATICS (SET-II)

Time : 3 Hrs. **M.M.: 100**

General Instructions :

(i) All questions are compulsory.

(ii) 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 4 marks each and Section-C comprises of 7 questions of 6 marks each.

(iii) All questions in Section-A are to be answered in one word, one sentence or as per the exact requirement of the question.

(iv) There is no overall choice. However, internal choice has been provided in two questions of 4 marks each and two questions of 6 marks each.

(v) Use of calculators is not permitted.

SECTION-A

Q1. Given A = {x : x is a letter of the word ACCUMULATOR} write down the power set of the set of vowels in A.

Q2. Find the multiplicative inverse of $\sqrt{5} + 3i$

Q3. Solve $\frac{x}{4} > \frac{5x - 2}{3} - \frac{7x - 3}{5}$, $x \in R$

Q4. If $\frac{1}{8!} + \frac{1}{9!} = \frac{x}{10!}$, find x.

Q5. Write the negation of the following statement :

There does not exist a quadrilateral which has all sides equal.

Q6. Find the distance of a point (2, -1, 3) from x-axis.

SECTION-B

Q7. Let $\cup$ be the set of all digits in our decimal system,

A = {x : x is an odd integer}

B = {x : x is an even integer}

$C = \{x : x \leq 5\}$, then form the following sets.

(i) $(A \cup B)'$ (ii) $A - C$ (iii) $A \cap (B \cup C)$

Q8. Find the domain and range of $\frac{1}{1-x^2}$

Q9. Using principle of Mathematical induction $\forall\, n \in N$. Prove that $\frac{1}{1.4}+\frac{1}{4.7}+\frac{1}{7.10}+.....+\frac{1}{(3n-2)(3n+1)}=\frac{n}{3n+1}$

Q10. There are 3 candidates and 5 voters. In how many ways the votes can be given? If 3 candidates are included in 5 voters and they vote for themselves only, then how many ways of giving votes are possible? Why should everyone vote?

Q11. A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has (i) no girl? (ii) at least one boy and one girl? (iii) at least 3 girls?

Q12. The sum of the coefficients of the first three terms in the expansion of $\left(x-\frac{3}{x^2}\right)^m$, $x \neq 0$, m being a natural number, is 559. Find the term of the expansion containing x^3.

Q13. Find the middle term in the expansion of $\left(2x-\frac{x^2}{4}\right)^9$

Q14. If a, b, c, d are in G.P. Show that

$(a^2 + b^2 + c^2)(b^2 + c^2 + d^2) = (ab + bc + cd)^2$

OR

Between 1 and 31, m numbers have been inserted in such a way that the resulting sequence is an A.P. and the ratio of 7th and (m - 1)th numbers is 5:9, find the value of m.

Q15. If the lines $y = 3x + 1$ and $2y = x + 3$ are equally inclined to the line $y = mx + 4$, find the value of m.

Q16. Find the equation of the circle passing through the points (2, 3), (-1, 1) and whose centre lies on the line $x - 3y - 11 = 0$.

OR

Find the equation of the hyperbola whose foci are $(0, \pm\sqrt{10})$ and passing through the point (2, 3).

Q17. Using Section formula, prove that the three points (-4, 6, 10), (2, 4, 6) and (14, 0, -2) are collinear.

Q18. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that (i) the student opted for NCC or NSS (ii) the student opted neither NCC nor NSS (iii) the student has opted for NSS but not NCC. What do you mean by NCC? What role does NCC play?

Q19. In any triangle ABC, prove that

$(b^2 - c^2)\cot A + (c^2 - a^2)\cot B + (a^2 - b^2)\cot C = 0$

OR

Solve : $\tan x + \tan 2x + \sqrt{3}\tan x \tan 2x = \sqrt{3}$

SECTION-C

Q20. (a) Prove that $\cos^2 x + \cos^2\left(x+\frac{\pi}{3}\right) + \cos^2\left(x-\frac{\pi}{3}\right) = \frac{3}{2}$

(b) Find the value of $\sin 75°$. (4+2)

Q21. Solve the following system of inequalities graphically

$2x + y \leq 24,\ x + y < 11,\ 2x + 5y \leq 40,\ x > 0, y \geq 0$

Q22. sum the series $1 + 3 + 7 + 15 + 31 + ...$ to n terms.

Q23. Find the equations of the lines through the point of intersection fo the lines $3x + y + 3 = 0$ and $x - y - 3 = 0$, and whose distance from the origin is 3 units.

OR

Find the equations of the lines through the point (3, 2) which make an angle of 45° with the line $x - 2y = 3$.