COMMERCIAL ARITHMETIC

Duration: 2 hours   **Marks: 80**

Instructions: 1. Attempt all questions
                       2. Figures to the right indicate full marks.

Q.1 Attempt the following: **(5 X 4 = 20)**

a)   Verify using truth table that $\sim (p \vee q) = (\sim p) \wedge (\sim q)$.

b)   In what time will, the interest on ` 5000 at 9%  be equal to the interest on ` 3000 for 6 years at 15%, both the interest being the simple interest.

c)   If $^nP_5 : {}^nP_3 = 2:1$, find n.

d)   Find the sum $5 + 55 + 555 + \ldots$ up to n terms.

e)   If $A = \begin{bmatrix} 9 & 1 \\ 4 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 5 \\ 7 & 12 \end{bmatrix}$, find the matrix X such that
$3A + 5B + 2X = 0$.

OR

Q.I Attempt the following: **(5 X 4 = 20)**

p)Construct the truth table for $(p \wedge q) \wedge \sim(p \vee q)$.

q) A bank offers fixed deposit for 5 years under the following scheme:

   i) At 15%, if the interest to be calculated half-yearly

   ii) At 12%, if the interest to be calculated quaterly.

State which scheme is more beneficial to the public.

r)A 3 digit number is to be formed using the digits from 0 to 9.

How manysuch numbers can be formed if the repetition of digits in

the number is allowed.

s) If foran A.P. $t_{10} = 20$, find S_{19}.

t) If $M = \begin{bmatrix} 3 & -2 \\ 4 & 0 \end{bmatrix}$ and $N = \begin{bmatrix} 2 & 0 \\ 3 & 1 \end{bmatrix}$, find the matrix $3M - 2N + I$, where I is

the identity matrix of order 2.

Q.2 Attempt the following: (5 X 4 = 20)

a) Sharad invested in an annuity with half yearly period for 4 years at the rate of interest of 8% to be compounded half yearly. If he received ` 27642.88 as the maturity value, what is his periodic payment?

b) Using Cramers's rule solve the following equations
$$3x - 5y = 4 \text{ and } x + 4y = 2.$$

c) The universal set $X = \{x/x \text{ is positive integer less than } 11\}$

$A = \{2, 4, 7, 9\}$ and $B = \{1, 3, 5, 7\}$. Verify $(A \cup B)^c = A^c \cap B^c$.

d) In   a G.P. the fourth and seventh terms are 24 and 81 respectively. Find   the first term and common ratio.

e) If $^{18}C_r = {}^{18}C_{r+2}$, find the value of r.

OR

Q.II Attempt the following: (5 X 4 = 20)

p) A person is promised the final amount of a half yealy ordinary annuity with periodic payment of ` 1600, the duration of the annuity being 4 years and the rate of interest is 10% to be compounded half-yealy. Find the present value of the annuity.

q) Using Cramer's rule, solve the following equations.
$$x + 3y = 13, \quad 4x - 5y = 1.$$

r)Use Venn diagram to show that for any sets A and B, $A \cup B = A \cup (B - A)$.

s) The third term of a G.P. is 12 and the sixth term is 96, find its first term and the common ratio.

t) A committee of 5 members is to be formed out of 6 men and 4 women. In how many ways committee can be formed to have at least 4 men?

Q 3. Attempt the following: (5 X 4 = 20)

a) Prove that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.

b) A and B are two subsets of the universal set X such that n(X)=99, n(A^c)=80, n(B^c) = 85 and n[$(A \cap B)^c$] = 94, find n(AU B).

c) Most of the banks giving interest at 8.75% compounded quaterely, one bank comes up with a new scheme of simple interest at the rate of 10% per annum. Calculate which scheme is more beneficial to the customer, for the investment of 4 years.

d) If $^nC_r = 120$ and $^nP_r = 720$, find the value of n and r.

e) Find the 3 terms of an A.P. whose sum is 15 and the product is 80.

OR

Q III. **Attempt the following:** (5 X 4 = 20)

p) Prove that **(p ∧ q) ∧ ~ (p∨ q)** is a contradiction.

q) Find x if
$$\begin{vmatrix} x & 1 & 2 \\ 3 & x & 3 \\ 1 & 3 & 2 \end{vmatrix} = 0$$

r) Ketan borrows ` 2000 from Sachin at compound interest of 10% per annum, to be compounded on quaterly basis. What amount is due to him after 9 month? Also state his interest.

s) A club has 5 girls and 7 boys. If 4 persons out of these are to be selected, find the total number of choices if 1) there is no restriction on gender 2) 3 boys and 1 girl is to be selected.

t) A sum of ` 72800 is to be paid in 6 monthly instalments, such that each instalment is three times the previous instalment. Find the first and the last instalment.

Q 4. **Attempt the following:** (5 X 4 = 20)

a) Vishal takes a friendly loan from his friend and promises to pay him regularly a sum of ` 800 at the end of each month, for a duration of 1 year. Assuming the rate of interest at 11% compounded monthly, find the amount received by his friend at the end of the year, using the ordinary annuity principle.

b) How many words can be formed from letters of the wordCENTRAL, so that it begins with a consonant and end with a vowel.

c) Mr. Fernandes invests ` 10,000 in the first month and increases his investment by` 1000 in every subsequent month. Calculate his total investment at the end of 2 years.

d) Find the principal, if the compond interest payable quaterly at 12% per annum for 2 years is ` 420.

e) If $P = \begin{bmatrix} 1 & -2 \\ 2 & 0 \end{bmatrix}$ find the matrix P^2-3P+I.

OR

Q IV **Attempt the following:**   **(5 X 4 = 20)**

p) A person is promised the final amount of a half yearly ordinary annuity with periodic payment of ` 1600, the duration of the annuity being 3 years and the rate of interest is 10% to be compounded half-yearly. Find the present value of the annuity.

q) From 5 professors and 7 students, a committee of 4 is to be formed. In how many ways this can be done, if the committee contains
   i)   Exactly 3 professors
   ii)   At least 3 professors.

r) Find the sumof all the numbers between 200 and 400, which are exactly divisible by 3.

s) Find the sum borrowed by Rahul from a bank on compound interest of 5% per year, to be calculated annually, if he had to pay back ` 26,460 after 2 years.

t) If $A = \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix}$, find the matrix $A^2 + 2A$.