CORE COURSE 4 : COMMERCIAL ARITHMETIC -I

Duration: 02 Hours   **Total Marks** : 80

Instructions : i) All questions are compulsory, however internal choice is available.

ii) Figures against every question indicate marks allotted.

iii) Use of simple (non Scientific) calculator is allowed.

Q 1) Answer the following: (**5 × 4 = 20**)

a) Draw the truth table for the following statement:

(p ↔ q) ∨ (~p ∧ ~q)

b) Vaishnavi obtained a loan Rs. 56500 at 9% p. a. flat rate of interest to be paid back in monthly instalments over a period of 2 years. How much is the value of each **EMI**?

c) In how many ways can 6 students be selected for a competition from a class of 20 students?

d) If for an **Arithmetic progression(AP)**, $t_{26} = 205$ and $t_{22} = 173$, then find a and d .

e) If A and B are 2 matrices given by $A = \begin{bmatrix} 2 & 7 & 7 \\ 8 & 2 & 10 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 9 & 6 \\ 1 & 1 & 8 \end{bmatrix}$, then find A + B and 2A .

<div align="center">OR</div>

Q I) Answer the following: (**5 × 4 = 20**)

p) Check the validity of the following argument:

p ↔ ~q, p ∧ ~q therefore p → q

q) Find the future value of the following ordinary annuity:
Rs. 13310 a year for 7 years at 11% p. a. compounded annually.

r)How many different 5 digit numbers can be formed using the digits 2,3,6,7,8 and 9 which begin with 9? (**Repetition of digits is not allowed**)

s) If for a **Geometric Progression (GP)**, $t_2 = 12$ and $t_9 = 1536$, then find a and r.

t) If A and B are two matrices given by $A = \begin{bmatrix} 2 & 7 \\ 4 & 3 \\ 10 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 8 & 10 \\ 9 & 11 \end{bmatrix}$, then find AB .

<div align="center">*1*</div>

Q 2) Answer the following: $(5 \times 4 = 20)$

  a) In how many years will Rs. 18000 yield Rs. 15120 as Simple Interest at 12%p. a. rate of interest.

  b) Check if the matrix $A = \begin{bmatrix} 4 & 8 & 5 \\ 6 & 9 & 9 \\ 2 & 20 & 30 \end{bmatrix}$ is Singular.

  c) If $X = \{7, 11, 22, 25, 30, 33, 39, 41, 60, 65, 70, 95\}$ is the Universal set,

    $A = \{22, 33, 39, 65, 95\}, B = \{22, 30, 41, 60, 95\}$ and $C = \{x | x \in X, x^2 - 18x + 77 = 0\}$

    are 3 sets, then find $A \cup B$, $A \cap B$, B' and C.

  d) Find t_{35} and t_{51} for the following **Arithmetic Progression** (AP):

    $60, 65, 70, 75, \ldots$

  e) Find the number of different words that can be formed using each letter of the word

    "**OPPOSITE**".

<p align="center">OR</p>

Q II) Answer the following: $(5 \times 4 = 20)$

  p) A loan of Rs. 56000 is to be returned in 5 monthly instalments at the rate of 15%p. a. compounded monthly. Find the EMI using Reducing Balance Method.

  q) If $A = \begin{bmatrix} 2 & 1 & 9 \\ 4 & 5 & 12 \\ 3 & 13 & 4 \end{bmatrix}$, then find M_{31} and C_{33}.

  r) If A, B and C are three sets, such that :

    $n(A) = 120, n(B) = 100, n(C) = 110, n(A \cap B) = 40, n(A \cap C) = 50, n(B \cap C) = 30,$

    $n(A \cup B \cup C) = 226$, then find $n(A \cap B \cap C)$.

  s) A sum of Rs. 745481 is to be repaid in 5 monthly instalments such that each instalment is 9 times that of previous instalment. What is the value of first instalment.

  t) Find the value of i) $^{23}P_5$

              ii) $^6P_6$

Q 3) Answer the following: $(5 \times 4 = 20)$

  a) Check if the following statements are logically equivalent:

    $\sim(p \wedge q)$ and $(p \rightarrow q) \vee (\sim p)$

<p align="center">2</p>

b) If X is the Universal set given by $X = \{2, 3, 6, 12, 15, 18, 20, 21\}$,

   $A = \{2,3, 15,18\}$ and $B = \{2, 6,12, 18\}$ are 2 sets,

   then i) find $A - B$

      ii) verify if $(A \cap B)' = A' \cup B'$

c) Find the present value of an annuity of Rs. 9000 payable at the end of each year for 4 years the interest being 13% p. a. compounded annually.

d) Find the value of $^{16}C_2 \times {}^{53}C_1$.

e) Which term of the **Arithmetic Progression(AP)** , $55, 75, 95, 115, \ldots$ is 455?

OR

Q III) Answer the following: $(\mathbf{5 \times 4 = 20})$

p) Prove that the following statement is a Tautology:
   $(p \wedge q) \rightarrow (p \vee q)$

q) 210 students of a certain Higher Secondary were surveyed. The survey revealed that:

   75 took Biology, 85 took Mathematics and 40 students took both Biology and Mathematics.

   i) Find the number of students who have taken either Biology or Mathematics.

   ii) How many students have taken neither Biology nor Mathematics?

r) Find the future value of Rs. 80 after 3 years if the compound interest rate is 7% p. a.

s) In how many ways can 7 Pink and 4 yellow balls be arranged in a straight line so that balls of the same colour are always together?

t) Rinki invests Rs. 225 on the first day and increases her daily investment by Rs. 30 every succceding day. Find the total investment done by her at the end of 28th day?

Q 4) Answer the following: $(\mathbf{5 \times 4 = 20})$

a) Find the Simple Interest on Rs. 25800 invested for 11 years at 15% p. a. rate of interest.

b) How many 7 digit numbers can be formed using the digits 1,2 and 5 which are divisible by 5? (**Repetition of digits is allowed**)

c) Find S_{70} for the following **Arithmetic Progression(AP)**:
   $40, 49, 58, 67, \ldots$

d) Find the compound interest on Rs. 14500 invested for 7 years at 9.7% p. a. rate of interest compounded annually.

e) Solve the following equations using Cramer's Rule:

$9x + 3y = 48$ and $3x + 6y = 21$

OR

Q IV) Answer the following: $(5 \times 4 = 20)$

p) Find the present value of Rs. 12480 required 2 years from now if the compound interest rate is 6.27% p. a.

q) In a certain factory there are 81 skilled and 13 unskilled workers. In how many ways can 3 workers be chosen from this factory, so that exactly 1 is skilled and 2 are unskilled workers?

r) Find S_6 for the following **Geometric Progression(GP)**:

3 ,27 ,243 ,2187, ...

s) Find the effective rate of interest equivalent to the nominal rate of 23% p. a. when compounded semi $-$ annually .

t) A store owner keeps a record of number of bottles of soft drinks of brand R and S sold in the first 3 quarters of the year. The records are as follows:

Brand	Quarter		
	1	2	3
R	75	100	61
S	42	105	77

If the selling price of 1 bottle of brand R is Rs. 19 and 1 bottle of brand S is Rs. 16, then by using matrix multiplication find the total selling price of soft drink bottles for all the three quarters separately.

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