Duration:2hours   Max.Marks: 80

Instructions:1) All question are compulsory (choice is internal)
2) Start each new question on a fresh page
3) Figures to the right indicate full marks
4) Use of non-programmable and non-scientific calculators are allowed

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

a) If p is true and q is false, find the truth values of the following:

   i. $\sim p \Rightarrow \sim q$ ii. $(p \wedge q) \Rightarrow (p \vee q)$ iii. $\sim(p \wedge q) \vee \sim(q \Leftrightarrow p)$
   iv. $(p \Rightarrow q) \vee \sim(p \Leftrightarrow \sim q)$

b) If $Rs.\,100$ amounts to $Rs.\,132$ at Simple interest in 4 years, find the rate of interest. Also find how much $Rs.\,400$ will appreciate at simple interest in 6 years if kept for at the same interest.

c) A student wishes to take a combination of three courses, one from each of the three science departments. There are 4 physics, 3 chemistry and 2 biology courses on offer. How many possible combinations are there?

d) Find three numbers in A.P. whose sum is 15 and the product is 45.

e) Solve the following equations by using determinants:

$$5x + 2y = 7, \qquad 6x - 5y = 38$$

OR

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

p) Construct the truth table for the following proposition:

$$(\sim p) \wedge (\sim q \wedge r) \vee (q \wedge r)$$

q) If $Rs.\,2000$ amounts to $Rs.\,2700$ at simple interest in 5 years, find the rate of interest. Also find, if a sum of $Rs.\,6000$ is kept at the same rate of interest, what will be the amount received after 8 years, compounded annually?

r) How many permutations can be made out of the letters of word "Sunday"? How many of these (a) begin with S (b) end with Y (c)begin with S and end with Y (d) S and Y always together?

s) Find out the first term, common difference, nth term and sum of n terms for anArithmetic progression whose sixth term is 1 and thirteen term is –6.

t) If $A = \begin{bmatrix} 2 & 3 \\ -1 & 0 \end{bmatrix}, B = \begin{bmatrix} 4 & 1 & 5 \\ 2 & 3 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 3 & 4 \\ -2 & 1 & 1 \end{bmatrix}$ verify that (i) $A(B + C) = AB + AC$
(ii)$A(B - C) = AB - AC$

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

a) Mandar invested a certain amount for 3 years at 4% per annum and got a simple interest of Rs. 1200. He then kept aside the interest and once again invested the same amount at the compound interest of 10 % per annum for another 4 years. If the compound interest is to be

calculated annually, find the final amount he receives at the end of the secon[...]

calculate his compound interest.

b) Find the cofactor A where $A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 3 & 3 \\ 5 & 7 & 4 \end{bmatrix}$

c) In a survey of 100 students, the no. studying various language were found to be[...] Portuguese 30, Germany 42, Spanish and Germany 10, Spanish and Portuguese[...] and Germany 5, all the three languages 3.

    i. How many students were studying either one of 3 languages?

    ii. How many students were studying none of these languages?

d) Expressing the terms of the following sum as an appropriate geometric progre[...]

$$1 + 11 + 111 + 1111 + \cdots \ldots \ldots upto\ n\ terms$$

e) An examinee is required to answer 7 questions out of two groups, each consist[...] questions and he is not permitted to attempt more than 4 questions from eith[...] how many different ways he may choose the question?

OR

Q.II Attempt the following:

p) When all banks are giving interest at 8.75% compounded quarterly, one bank [...] with a new scheme of simple interest at the rate of 10% $p.\,a.$ Calculate which [...] more beneficial to the customer for the investment of 4 years.

q) Solve the following system of equations using matrix method:

$$4x - 3y = 5, \qquad 3x - 5y = 1$$

r) If A = set of letters of the word "Mathematics"

    B = set of letters of the word "Physics"

    C = set of letters of the word "Statistics"

Verify that $i)\ A \cap (B \cup C) = (A \cap B) \cup (A \cap C)\ ii)\ (A \cap B) \cap C = A \cap (B \cap C)$

s) Find the first term, common ratio and sum of n terms for a geometric progressi[...] third term is 12 and the sixth term is 96.

t) In how many ways 5 software engineers can be selected from15 software engin[...] (a) there is no restriction on the selection, (b) a particular engineer is included [...]

Q.3 Attempt the following:

a) Show that the following inferences is fallacy:

"If the client is guilty, then he was at the scene of the crime. The client was at th[...] the crime. Hence the client is not guilty."

b) If $A = \{x|x^2 - 7x + 12 = 0\}, B = \{x|x^2 - 5x + 6 = 0\}, C = \{x|x^2 - 3x + 2$ [...] that$(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$

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

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d) Out of 9 girls and 15 boys, how many different committees can be formed each consisting of 6 boys and 4 girls if (a) particular girl is always included, (b) particular boy is always excluded?

e) From a small town 50 girls completed graduation in the year 2001. It was observed that, every year the number of girls completing graduation from that town, increased by 25 than the preceeding year. As per the above estimation, find out how many girls from the same town, would complete their graduation in the year 2010. Also the total number of girls completing graduation from 2001 upto 2010.

OR

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

p) Show that the following pair of propositions are logically equivalent :

$$(p \lor q) \Rightarrow r \ and \ (p \Rightarrow r) \land (q \Rightarrow r)$$

q) Out of 80 students in a class. 60 play football, 53 play hockey and 35 play both the games. How many students
   i.   Do not play any of these games
   ii. Play only hockey but not football.

r) Find the principal, if the compound interest payable annually at 12% per annum for 2 years is Rs.2544.

s) Find how many arrangements can be made with the letters of the word "MATHEMATICS". In how many of them the vowels occur together?

t) Sagar wants to invest $Rs.14560$ in 6 instalments. If each of his investment is three times the previous one, find out his first and the last instalments.

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

a) A person is offered two types of contractual jobs for one year by a company. The first one begins with $Rs.4000$ p.m. with monthly increment of $Rs.600$, whereas the second one has starting salary of $Rs.5000$ p.m. with a monthly increment of $Rs.200$. He is confused about the selection of the job. Advise him.

b) Meera received $Rs.8240$ as maturity amount at the end of 2 years on her annuity, the period of payment being the end of each year. Find the size of her yearly instalment, if the rate of interest was 6% compounded on yearly basis.

c) A committee of 5 is to be formed from a group of 12 students consisting of 8 boys and 4 girls. In how many ways can the committee be formed if it:

   i.   Consist of exactly 3 boys and 2 girls?
   ii. Contains atleast 3 girls?

d) A loan of $Rs.100000$ is to be repaid in 4 years in 4 equal instalments with the 1st instalment at the end of the 1st year. The rate of interest is 10% p.a. Find the yearly instalment using flat interest rate.

e) Find the point of intersection of following of lines:

$$x + z = 0, \quad 2x + 3y + 3z = 5, \quad x = 2 - y - z$$

OR

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Q.IV Attempt the following:

p) Sheetal wants to buy a house worth $Rs. 3\ lacs$. Since she does not have the funds in hand, she was allowed to pay for the house in four instalment. The first instalment being 2000 and each of the next instalment would be five times the previous instalment. Find how much more she paid for the house?

q) Find the present value of an ordinary annuity of $Rs. 1500$ per half year, for 4 years at 8%, to be calculated half yearly.

r) In how many different ways can the letters of the word "SALOON" be arranged if (a) the two O's must not come together (b) the consonant and vowels must occupy alternate places?

s) A loan of $Rs. 80000$ is to be returned in 3 monthly at the rate of 12 % p .a. compounded monthly. Find the EMI using reducing balance method.

t) Find x and y if

$$\frac{1}{x-1}+\frac{3}{y+2}+5=0, \qquad \frac{6}{x-1}+\frac{5}{y+2}=9$$

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