Practice Question from MODULE 1- MODULE 5

Blueprint

Section	**MODULE 1**	**MODULE 2**	**MODULE 3**	**MODULE 4**	**MODULE 5**
	Number of Questions	Number of Questions	Number of Questions	Number of Questions	Number of Questions
A (5 marks)	1	1	1	1	1
B (9 marks)	1	1		1	
C (12 marks)			1		1

MODULE 1

1	Find the sets A and B if A − B = {1, 5, 7, 8}, B − A = {2, 10}, and A ∩ B = {3, 6, 9}. Also find A ∪ B, $A \cup \emptyset, A \cap \emptyset$.
2	Demonstrate that, if A, B and C are any sets, then $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.
3	Write short note on type of sets with an example?
4	Demonstrate that the relation R on set A of all books in a library of college given by R = {(a, b) | a & b have same number of pages}is equivalence relation.
5	Draw the Hasse diagram for the greater than or equal to relation on {0, 1, 2, 3, 4, 5}.
6	Consider the function f:R→R and g:R→R defined by f(x) = $x^2 + 3x + 1$ and g(x) = 2x-3.Find the composite function (i) fog (ii) gof
7	Let R be the relation on the set of ordered pairs of positive integers such that ((a, b), and (c, d)) ∈ R if and only if a + d = b + c. Demonstrate that R is an equivalence relation.
8	For any two sets A and B demonstrate the following: (i) A-B=A∩ $\overline{B}$ (ii) $\overline{A - B} = \overline{A}$ ∪B (iii) A-B=A-(A∩B) (iv) A-(A-B) = A∩B.
9	(a)Explain the types of function. (b)Find Domain and range of the function f(x)=$\frac{x^2+2x+1}{x^2-8x-12}$,x∈R.
10	Demonstrate that the divisibility relation on the set of positive integers is a partial order.
11	Determine Whether the relation R on the following set A is reflexive, irreflexive, symmetric, asymmetric, antisymmetric, and transitive. (a) A=set of all positive integers, aRb iff |a-b|≤2, (b) A=Z, a R b iff a≤b+1.
12	a) In a college of 350 students, every student needs to choose among the three subjects (i.e. Economics, Accounts & Taxation) offered along with the main course. The students who chose each of these subjects are 120, 80 & 95. The number of students who chose more than one of the three is 28 more than the number of students who chose all the three subjects. If there are no students who chose none of the three subjects, how many students study all the three subjects? b) In a group of 120 people, 54 like Coca Cola and 84 like Pepsi and each person likes at least one of the two beverages. How many like both Coca Cola & Pepsi?

MODULE 2

1	Illustrate or make the truth table for $((p \rightarrow q) \rightarrow r) \rightarrow s$.
2	Explain the converse, contrapositive, and inverse of each of these conditional statements. a) If it snows tonight, then I will stay at home. b) I go to the beach whenever it is a sunny summer day. c) When I stay up late, it is necessary that I sleep until noon.
3	Demonstrate that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.
4	Use a truth table to verify the distributive law $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$.
5	Find the dual of each of these compound propositions. Here T for true and F for False. a) $p \wedge \sim q \wedge \sim r$ b) $(p \wedge q \wedge r) \vee s$ c) $(p \vee F) \wedge (q \vee T)$
6	Determine whether the following is a tautology contingency and contradiction: (i)$p\rightarrow(p\rightarrow q)$ (ii) $p\rightarrow(q\rightarrow p)$(iii) $q\wedge\sim q$.
7	Explain the argument form for the following argument and determine whether it is valid. Can we conclude that the conclusion is true if the premises are true? If Socrates is human, then Socrates is mortal. Socrates is human. ∴ Socrates is mortal
8	Use rules of inference to show that the hypotheses "If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on," "If the sailing race is held, then the trophy will be awarded," and "The trophy was not awarded" imply the conclusion "It rained."
9	Translate each of these statements into logical expressions using predicates, quantifiers, and logical connectives. a) Something is not in the correct place. b) All tools are in the correct place and are in excellent condition. c) Everything is in the correct place and in excellent condition. d) Nothing is in the correct place and is in excellent condition.
10	Demonstrate that the compound propositions $[p\wedge(\sim q\vee r)]$and $[p\vee(q\wedge\sim r)]$ are logically equivalent.
11	Demonstrate that $p \leftrightarrow q$ and $\sim p \leftrightarrow \sim q$ are logically equivalent.
12	Demonstrate that $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$ is a tautology.

MODULE 3

1	Demonstrate that for every positive integer n, $1 \cdot 2 + 2 \cdot 3 + . . . + n (n + 1) = n (n + 1) (n + 2) / 3$ using Mathematical Induction.
2	A total of 1232 students have taken a course in Spanish, 879 have taken a course in French, and 114 have taken a course in Russian. Further, 103 have taken courses in both Spanish and French, 23 have taken courses in both Spanish and Russian, and 14 have taken courses in both French and Russian. If 2092 students have taken at least one of Spanish, French, and Russian, how many students have taken a course in all three languages?
3	How many one-to-one functions are there from a set with five elements to sets with the following number of elements? a) 4 b) 5 c) 6 d) 7 e) 3
4	In how many ways can the letters of the following words can be arranged: a) TALL b) APPLE c) FARIDABAD d) KOMOKO
5	Solve: a) In how many ways words with or without meaning can be formed with the letters of the vowels and consonants occur together b) How many 3-digit even numbers can be made using the digits 1,2,3,4,6,7 if no digit is repeated c)evaluate: 7! - 5!
6	Explain pigeonhole principle. Also give an application of this principle.
7	A) Explain the general form of the solutions of the recurrence relation $a_n = 8a_{n-2} - 16a_{n-4}$. Also solve the equation with $a_0=1$, $a_1=2$, $a_2=4$, $a_3=8$ B) State principle of Inclusion and Exclusion for 2 sets and 3 sets
8	A) Demonstrate that 1+3+5+…+(2n+1) =n^2 B) Find the solution to the recurrence relation $a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3}$ with initial conditions $a_0 = 1$, $a_1 = -2$, and $a_2 = -1$.
9	A) Find the solution to the recurrence relation $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with the initial conditions $a_0 = 2$, $a_1 = 5$, and $a_2 =15$. B) Use generating functions to solve the recurrence relation $a_k = 3a_{k-1} + 2$ with the initial condition $a_0 = 1$.
10	A) Find the number of positive integers not exceeding 1000 that are not divisible by 3, 17, or 35. B) Use generating functions to solve the recurrence relation $a_k = 5a_{k-1} - 6a_{k-2}$ with initial conditions $a_0 = 6$ and $a_1 = 30$.
11	A) Solve the recurrence relation $a_n = 6a_{n-1} - 12a_{n-2} + 8a_{n-3}$ with $a_0 = -5$, $a_1 = 4$, and $a_2 = 88$. B) solve the recurrence relation $a_k = 3a_{k-1} + 4^{k-1}$ with the initial condition $a_0 = 1$.
12	a) Illustrate what is mathematical induction. b) Solve by principle of mathematical induction 1.2+3.4+5.6+…+(2n-1) (2n) = $\frac{n(n+1)(4n-1)}{3}$

MODULE 4

1	Explain any 5 types of matrix with one example for each.

2	If 2A+B = $\begin{pmatrix} 15 & 4 & 8 \\ 9 & -3 & -5 \\ 7 & 16 & 23 \end{pmatrix}$, 2A-B= $\begin{pmatrix} 43 & 56 & 12 \\ 3 & 5 & 18 \\ 4 & 23 & 18 \end{pmatrix}$, Find A and B.
3	If A= $\begin{pmatrix} 3 & 5 & 6 \\ 8 & -4 & -9 \\ 9 & -34 & -54 \end{pmatrix}$, evaluate A^2+2A-25I, where I is the identity matrix.
4	Find the minors of the 1 0 0 2 1 0 3 0 1
5	Explain what is the inverse of a matrix with the help of an example. Are all matrices invertible? Justify your answer.
6	Find the inverse of A = $\begin{pmatrix} 8 & 4 & -3 \\ 1 & 1 & 2 \\ 1 & 2 & 1 \end{pmatrix}$.
7	Explain Cramer's rule and solve 3x+4y=7, 7x-y =6
8	Use Gauss Elimination solve the system of equation a) 2x+3y = 7, 3x-2y=4 b) 3x+5y=9, 2x+3y=7
9	Find the inverse a) $[3\,2\;-2\;-3]$ b) $[1\;-2\,3\,4]$
10	Determine the solution to the equations 2x+6y+11=0, 6x+20y-6z+3=0, 6y-18z+1=0 using gauss elimination method
11	Evaluate if the equations 2x+6y+11=0, 6x+20y-6z+3=0, 6y-18z+1=0 use gauss elimination method
12	Express the following system of equations in matrix form [A][X] = [B], and then solve for [X]: 2x - 3y + z = 7 x + 2y - z = 1 3x - y + 2z = 6
13	Solve the system of equations for x, y, and z: 2x + y - z = 7 3x + 2y + z = 12 x - 3y + 2z = -5 use either gauss elimination or Cramer's
16	You are managing a small coffee shop that offers three types of coffee: Regular, Decaf, and Espresso. In a given week, you sold a total of 200 cups of coffee, generating $1,200 in revenue. Regular coffee sells for $3 per cup, Decaf for $2 per cup, and Espresso for $4 per cup. You also know that the number of Decaf coffees sold is 20 more than the number of Espresso coffees sold. Calculate the number of each type of coffee sold in that week.

	a. Formulate this problem as a system of linear equations. b. Write the system of equations in matrix form [A][X] = [B], where [A] is the coefficient matrix, [X] is the variable matrix, and [B] is the constant matrix. a) Finally, find the number of Regular, Decaf, and Espresso coffees sold.
17	Define the following terms: a) Elementary matrix b) Row matrix c) Column matrix d) Diagonal matrix e) Scalar matrix f) Unit matrix OR Identity matrix g) Triangular matrix (upper and lower) h) Symmetric matrices i) Skew-symmetric matrix
18	Find adjoint of the following matrices: a) $\begin{bmatrix} 2 & -5 \\ 7 & 9 \end{bmatrix}$ b) $\begin{bmatrix} -4 & 3 \\ 8 & 7 \end{bmatrix}$ c) $\begin{bmatrix} 2 & -1 & 3 \\ 1 & 1 & 1 \\ 1 & -1 & 1 \end{bmatrix}$

MODULE 5

1	Suppose 3 bulbs are selected at random from a lot. Each bulb is tested and classified as defective (D) or non – defective(N). Write the sample space of this experiment.
2	A die is rolled. Let E be the event "die shows 4" and F be the event "die shows even number". Are E and F mutually exclusive?
3	Two unbiased coins are tossed simultaneously. Find the probability of getting (i) Exactly one head (ii) No tail (iii) Two tails (iv) Atleast one tail (v) Atmost one tail
4	A letter is chosen at random from the word 'ASSASSINATION'. Calculate the probability that letter is (i) a vowel (ii) a consonant
5	In a lottery, a person chooses six different natural numbers at random from 1 to 20, and if these six numbers match with the six numbers already fixed by the lottery committee, he wins the prize. What is the probability of winning the prize in the game?
6	In an entrance test that is graded on the basis of two examinations, the probability of a randomly chosen student passing the first examination is 0.8 and the probability of passing the second examination is 0.7. The probability of passing at least one of them is 0.95. What is the probability of passing both?

7	The probability that a student will pass the final examination in both English and Hindi is 0.5 and the probability of passing neither is 0.1. If the probability of passing the English examination is 0.75, what is the probability of passing the Hindi examination?
8	Two cards are drawn at random and without replacement from a pack of 52 playing cards. Find the probability that both the cards are black.
9	Two cards are drawn simultaneously (or successively without replacement) from a well shuffled pack of 52 cards. Find the mean, variance and standard deviation of the number of kings
10	Explain the probability distribution of number of heads in two tosses of a coin.
11	A. In a factory which manufactures bolts, machines A, B and C manufacture respectively 25%, 35% and 40% of the bolts. Of their outputs, 5, 4 and 2 percent are respectively defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured by the machine B? B. A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.
12	A. An urn contains 5 red and 5 black balls. A ball is drawn at random, its colour is noted and is returned to the urn. Moreover, 2 additional balls of the colour drawn are put in the urn and then a ball is drawn at random. What is the probability that the second ball is red? B. Of the students in a college, it is known that 60% reside in hostel and 40% are day scholars (not residing in hostel). Previous year results report that 30% of all students who reside in hostel attain A grade and 20% of day scholars attain A grade in their annual examination. At the end of the year, one student is chosen at random from the college and he has an A grade, what is the probability that the student is a hostler?
13	A. A person has undertaken a construction job. The probabilities are 0.65 that there will be strike, 0.80 that the construction job will be completed on time if there is no strike, and 0.32 that the construction job will be completed on time if there is a strike. Determine the probability that the construction job will be completed on time. B. In answering a question on a multiple choice test, a student either knows the answer or guesses. Let ¾ be the probability that he knows the answer and ¼ be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with probability ¼. What is the probability that the student knows the answer given that he answered it correctly?
14	A. A laboratory blood test is 99% effective in detecting a certain disease when it is in fact, present. However, the test also yields a false positive result for 0.5% of the healthy person tested (i.e. if a healthy person is tested, then, with probability 0.005, the test will imply he has the disease). If 0.1 percent of the population actually has the disease, what is the probability that a person has the disease given that his test result is positive? B. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accidents are 0.01, 0.03 and 0.15 respectively. One of the insured persons meets with an accident. What is the probability that he is a scooter driver?

15	A. A factory has two machines A and B. Past record shows that machine A produced 60% of the items of output and machine B produced 40% of the items. Further 2% of the items produced by machine A and 1% produced by machine B were defective. All the items are put into one stockpile and then one item is chosen at random from this and is found to be defective. What is the probability that it was produced by machine B? B. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both diamonds. Find the probability of the lost card being a diamond.
16	Alex is playing a dice game where they roll a fair six-sided die four times. To win, Alex needs the smallest number rolled to be at least 2, and the largest number rolled must be no more than 5. (i) Demonstrate your understanding of this dice game by stating what is the experiment, outcomes, event, and sample space in the dice game. (ii) Employ the game scenario to determine the probability that Alex wins the game.