Model Question Paper Set - 2 with effect from 2022(CBCS Scheme)

USN

Fourth Semester B.E Degree Examination

DISCRETE MATHEMATICAL STRUCTURES (BCS405A)

TIME:03Hours **Max.Marks:100**

Note:

1. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**
2. M: Marks, L: RBT levels, C: Course outcomes.

		Module - 1	M	L	C
Q.1	a	Define tautology. Show that $[(p\vee q)\wedge(p\rightarrow r)\wedge(q\rightarrow r)]\rightarrow r$ is a tautology by constructing the truth table.	6	L1	CO1
	b	Prove the following using the laws of logic $[\neg p\wedge(\neg q\wedge r)]\vee[(q\wedge r)\vee(p\wedge r)]\Leftrightarrow r$.	7	L2	CO1
	c	For any two odd integers m and n, show that (i) m+n is even (ii) mn is odd.	7	L2	CO1
		OR			
Q.2	a	Define i) an open statement ii) Quantifiers	6	L2	CO1
	b	Write the following argument in symbolic form and then establish the validity If A gets the Supervisor's position and works hard, then he will get a raise. If he gets a raise, then he will buy a car. He has not purchased a car. Therefore he did not get the Supervisor's position or he did not work hard.	7	L1	CO1
	c	For the following statements, the universe comprises all non-zero integers. Determine the truth value of each statement. a) $\exists\, x \ni y\,[xy=1]$ b) $\exists\, x\forall y\,[xy=1]$ c) $\forall x \ni y\,[xy=1]$ d) $\exists\, x \ni y[(2x+y=5)\wedge(x-3y=-8)]$ e) $\exists\, x \ni y[(3x-y=7)\wedge(2x+4y=3)]$	7	L2	CO1
		Module – 2			
Q.3	a	Define the well ordering principle. By Mathematical Induction, Prove that $(\boldsymbol{n}!)\geq \mathbf{2}\boldsymbol{n}\mathbf{-1}$ for all integers $\boldsymbol{n}\geq\mathbf{1}$.	6	L2	CO2
	b	Prove that every positive integer n≥24 can be written as a sum of 5's and/or 7's.	7	L3	CO2
	c	How many positive integers n, can we form using the digits 3,4,4,5,5,6,7, if we want n to exceed 5,000,000.	7	L1	CO2
		OR			
Q.4	a	By Mathematical Induction Prove that $1.3+2.4+\cdots\ldots\ldots..+n(n+2)=\frac{n(n+1)(2n+7)}{6}$.	6	L1	CO2
	b	Find the number of permutations of the letters of the word MASSASAUGA. In how many of these all four $A's$ are together? How many of them begin with S?	7	L2	CO2
	c	i) Obtain the Coefficient of a^5b^2 in the expansion of (2a-3b)^7 ii) Using the Binomial theorem find the coefficient of x^5y^2 in	7	L1	CO2

		the expansion of $(x+y)^7$.			
		Module – 3			
Q.5	**a**	State Pigeon –hole principle. Prove that if any number from1 to 8 are chosen then two of them will have their sum as 9.	6	L1	CO3
	b	Let $f: R \rightarrow R$ be defined by ,$f(x) = \begin{Bmatrix} 3x-5\,, & if\ x>0 \\ 1-3x\,, & if x \leq 0 \end{Bmatrix}$ $find, f^{-1}([-6,5])\ and\ f^{-1}([-5,5])$.	7	L1	CO3
	c	Let $A=B=C=R$, and $f: A \rightarrow B$ and $g: B \rightarrow C$ be defined by $f(a)=2a+1, \quad g(b)=\frac{1}{3}b, \forall a \in A, \forall b \in B.$ Compute gof and show that $gof$is invertible. What is $(g\ o\ f)^{-1}$?	7	L2	CO3
		OR			
Q.6	**a**	Let f and g be functions from R to R defined by $f(x)=ax+b$ and $g(x)=1-x+x^2$, If $(g\ o\ f)(x)=9x^2-9x+3$ determine a and b.	6	L3	CO3
	b	Draw the Hasse (POSET) diagram which represents positive divisors of 36.	7	L2	CO3
	c	Let $A = \{1,2,3,4,6\}$ and R be a relation on A defined by aRb if and only if "a is a multiple of b". Write down the relation R, relation matrix $M(R)$ And draw its diagraph. List out its in degree and out degree.	7	L2	CO3
		Module – 4			
Q.7	**a**	Determine the number of positive integers n such that $1 \leq n \leq 100$ and n is not divisible by 2, 3, or 5	6	L2	CO4
	b	In how many ways can the 26 letters of the English alphabet be permuted so that none of the patterns CAR, DOG, PUN or BYTE occurs?	7	L2	CO4
	c	Solve the recurrence relation $a_n = na_{n-1}$ where n ≥ 1and $a_0 = 1$.	7	L2	CO4
		OR			
Q.8	**a**	In how many ways 5 number of a's, 4 number of b's and 3 number of c's can be arranged so that all the identical letters are not in a single block?	6	L3	CO4
	b	Five teachers T_1, T_2, T_3, T_4, T_5 are to be made class teachers for five classes, C_1, C_2, C_3, C_4, C_5, one teacher for each class. $T_1$and T_2 do not wish to become the class teachers for C_1or C_2, T_3 and T_4 for C_4 or C_5 , and $T_5$for C_3 or C_4 or C_5 .In how many ways can the teachers be assigned the work (without displeasing any teacher	7	L2	CO4
	c	Solve the recurrence relation $F_{n+2} = F_{n+1} + F_n$where n ≥ 0 and $F_0 = 0, F_1 = 1$.	7	L2	CO4
		Module – 5			
Q.9	**a**	Define group. Show that fourth roots of unity is an abelian group.	6	L2	CO5
	b	If G be a set of all non-zero real numbers and let a* b = ab/2 then show that (G,*) is an abelian group.	7	L2	CO5
	c	Define Klein 4-group. And if A = { e,a,b,c} then show that this is a Klein -4 group	7	L1	CO5
		OR			
Q.10	**a**	Define Cyclic group and show that (G,8) whose multiplication table is as given below is Cyclic	6	L2	CO5

*	a	b	c	d	e	f
a	a	b	c	d	e	f
b	b	c	d	e	f	a
c	c	d	e	f	a	b
d	d	e	f	a	b	c
e	e	f	a	b	c	d
f	f	a	b	c	d	e

	b	State and prove Lagrange’s theorem	7	L1	CO5
	c	If G be a group with subgroup H and K. If $\lvert G \rvert$ = 660 and $\lvert K \rvert$ = 66 and K C H C G and find the possible value for $\lvert H \rvert$	7	L2	CO5