PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem & AY: Odd Sem. 2019 -20
Course Code: CSE 203
Course Name: DISCRETE MATHEMATHIES
Program & Sem: B.Tech (ISE/IST/COM/CCE/CSE) & III

Date: 30.09.2019
Time: 2:30PM TO 3:30PM
Max Marks: 40
Weightage: 20%

Instructions:

i. Use Semi-log graph sheet for plotting data.
ii. Question paper consists of 3 parts.
iii. Scientific and Non-programmable calculators are permitted.

Part A (Memory Recall Question)

Answer all the Questions. Each question carries three mark. (3Qx4M=12M)

1. Define a Tautology and By constructing truth table prove that $(p \wedge q) \rightarrow (p \rightarrow q)$ is a tautology, where p, q are propositions?

(C.O.NO.1) [Knowledge]

2. Obtain the DNF of $(p \leftrightarrow q)$. (C.O.NO.1) [Knowledge]
3. If A = {p, q, r}, B = {a, b, c}, then prove that $A \times B \neq B \times A$.

(C.O.NO.1) [Knowledge]

Part B (Thought Provoking Question)

Answer both the Questions. Each Question carries eight mark. (2Qx8M=16M)

4. How that $(\neg p \wedge (\neg q \wedge r)) \vee (q \wedge r) \vee (p \wedge r)$ is logically equivalent to r .

(C.O.NO.01) [Knowledge]

5. Define a Bijection and give an example of a function, from positive integers to positive integers, which is not one-one but onto

(C.O.NO.01) [Knowledge]

Part C (Problem Solving Questions)

Answer the Question. Each Question carries **twelve mark.** **(1Qx12M=12M)**

6. Show that the premises "If today is Tuesday, I have test in mathematics and Economics"
"If my Economics professor is sick, I will not have a test in Economics"
"Today is Tuesday and My Economics professor is sick" imply the conclusion "I have test in Mathematics".

(C.O.NO.01) [Comprehension]

	..... 5 marks	
Proving validity by using rules of inferences.	..... 5 marks	

SCHOOL OF ENGINEERING

Semester: III sem 2019-2020
Course Code: CSE 203
Course Name: Discrete Mathematics

Date: 30.09.2019
Time: 2.30 to 3.30
Max Marks: 40
Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1	CO 1	Module1 / Foundations of Logics and Proofs		1	Level 1		1	Level 1		2		4
2	CO 1	Module1 / Foundations of Logics and Proofs		1	Level 1		1	Level 1		2		4
3	CO 2	Module 2/ Basic Structures: Sets, Functions, Sequences and Induction		1	Level 1		1	Level 1		2		4
4	CO 1	Module1 / Foundations of Logics and Proofs		1	Level 2		1	Level 2		6		8
5	CO2	Module 2/ Basic Structures:		2	Level 2		2	Level 2		4		8

		Sets, Functions, Sequences and Induction								
6	CO1	Module1 / Foundations of Logics and Proofs	2	Level 3	4	Level 3	6		12
	Total Marks		8		10		22		40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

SCHOOL OF

SOLUTION

Semester: III sem 2019-20

Course Code: CSE 203

Course Name: Discrete Mathematics

Date: 30.09.2019

Time: 2.30 to 3.30

Max Marks: 40

Weightage: 20%

Part A (3 x4M = 12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Tautology **def**: A statement formula which is always true for irrespective of truth value of its statement variables Then truth table for $(p \wedge q) \rightarrow (p \rightarrow q)$	Def ..... 1 mark Truth table .... 2 marks Concluding from truth table...1 mark	**6 min**
2	**DNF:** ($\wedge$) $\vee$ ($\wedge$) Eliminating biconditional Apply distributive law and convert in to DNF.	DNF ..... 1 mark Eliminating biconditional..... 1 mark	**6 min**

		Apply distributive law..... 2 marks	
3	$A \times B$ $\{(p,a),(p,b),(p,c),(q,a),(q,b),(q,c),(r,a),(r,b),(r,c)\}$ and $B \times A$ $\{(a,p),(a,q),(a,r),(b,p),(b,q),(b,r),(c,p),(c,q),(c,r)\}$.	$A \times B$.....2 $B \times A$.....2	**6 min**

Part B (2 x 8 = 16 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4	$(\neg p \wedge (\neg q \wedge r)) \vee (q \wedge r) \vee (p \wedge r)$ $\Leftrightarrow (\neg(p \vee q) \wedge r) \vee ((p \vee q) \wedge r)$ $\Leftrightarrow (\neg(p \vee q) \vee (p \vee q)) \wedge r$ $\Leftrightarrow T \wedge r$ $\Leftrightarrow r$	..... 2 marks ..... 2 marks ..... 2 marks ..... 1 mark ..... 1 mark	10 min
5	Def: A function which is both one-one and onto is called a Bijection. Example : F(x) = n/2 n is even (n+1)/2 n is odd	..... 2 ..... 6 marks(including explanation)	10 min

Part C (1 x 12 =12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	Introducing statement variables Converting arguments in symbolic form	..... 4 marks	15 min

Roll No.													

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20 | **Date**: 18.11.2019

Course Code: CSE 203 | **Time**: 2:30 PM to 3:30 PM

Course Name: Discrete Mathematics | **Max Marks**: 40

Branch & Sem: B.Tech. (CSE) & III Sem | **Weightage**: 20%

Instructions:

i. Read the question properly and answer accordingly.
ii. Question paper consists of 3 parts.
iii. Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries four marks. (3Qx4M =12M)

1. Show that the **set of Odd integers is countable**. (C.O.NO.2)[Knowledge]
2. In English alphabet all alphabets are allowed and in numbers all digits are allowed. Find out how many license plates can be made if two alphabets are used followed by two numbers. (C.O.NO.2)[Knowledge]
3. How many minimum number of students are required in DMAT class to be sure that at least 7 will get the same grade if there are A, B, C & D four grades? (C.O.NO.2)[Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries eight marks. (2Qx8M =16M)

4. Define the **Principle of Mathematical Induction**. Prove that n^3-n is divisible by 3 using mathematical induction. (C.O.NO.3)[Comprehension]
5. Define and state the **initial, successor and projection** functions. Show that the following function is **Primitive Recursive**.
   Multiplyproduct: N X N → N multiplyproduct(x,y) = x * y. (C.O.NO.3)[Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The Question carries twelve marks. (1Qx12M =12M)

6. (a) Find all solutions to the **system of congruences**.
   1. $x \equiv 1 \pmod 2$
   2. $x \equiv 2 \pmod 3$
   3. $x \equiv 3 \pmod 5$ (9)

   (b) How many permutations of the letters ABCDE contain the string BC? (3)
   (C.O.NO.3)[Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

Odd Semester: 2019-20
Course Code: CSE203
Course Name: **Discrete Mathematics**

Date: 18 Nov 19
Time: 2:30 PM – 3:30 PM
Max Marks: 40
Weightage: 20 %

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1	CO2	2		4								4
2	CO2	2		4								4
3	CO2	2		4								4
4	CO3	3					8					8
5	CO3	3					8					8
6	CO3	3								12		12
	Total Marks			12			16			12		40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60% Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Odd Semester: 2019-20
Course Code: CSE203
Course Name: Discrete Ma

Date: 18 Nov 19
Time: 2:30 PM – 3:30 PM
Max Marks: 40
Weightage: 20 %

Part A (Q x M = Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	A-1.docx	Indicated	6
2	~~25 x 25 x 9 x 9~~ 26x26x10x10	Indicated	6
3	4 x 6 + 1 = 27	Indicated	6

Part B (Q x M = Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4	A-4.docx	Indicated	12
5	A-5 & 6.docx	Indicated	12

Part C (Q x M = Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6 (a)	A-5 & 6.docx	Indicated	18
6 (b)	A-5 & 6.docx	Indicated	6

A-5. Mult $N \times N \rightarrow N$; Multprod(x,y) = x*y

Base Case : MP(x,0) = f(x) = 0

F = $Zero^1$

Recursive Case MP(x,y+1) = g(x,y,MP(x,y)) = MP(x,y) + x

g(x1,x2,x3) = add (x1,x3)

g = add o { $Proj_1{}^3$, $Proj_3{}^3$}

Hence MP = ρ^1($Zero^1$, add o { $Proj_1{}^3$, $Proj_3{}^3$}

A-6a	Bi	Ni	xi	Bi x Ni x xi
	1	15	1	15
	2	10	1	20
	3	6	1	18

Hence 53(mod 30) = 23 Answer

A-6b A, BC, D, E Hence 4 ! = 24 Answer

Q.1. Answer.

SOLUTION

Given: S is the set of odd integers.

To proof: S is countable.

PROOF S is not finite, thus we need to proof that S is countable infinite.

Let us definite the function f as:

$$f : S \to \mathbf{Z}^+, f(n) = \begin{cases} n & \text{if } n \text{ positive} \\ -n+1 & \text{if } n \text{ positive} \end{cases}$$

Note: The image of the positive odd integers are the positive odd integers itself, while the image of the negative odd integers are the positive even integers.

f is **one-to-one**: Let $f(a) = f(b)$.

If a and b are positive, then by definition of f: $a = b$.
If a and b are negative, then by definition of f: $-a+1 = -b+1$ which implies $a = b$.
If a positive and b negative, then by definition of f: $a = -b+1$, which is impossible for odd integers a and b.
If a negative and b positive, then by definition of f: $b = -a+1$, which is impossible for odd integers a and b.

Thus $f(a) = f(b)$ implies a and b both positive or both negative and then also implies $a = b$, which means that f is one-to-one.

f is **onto**: Let $b \in \mathbf{Z}^+$.

If b odd, then $a = b \in S$ with $f(a) = f(b) = b$.
If b even, then $a = -b+1 \in S$ with $f(a) = f(-b+1) = -(-b+1)+1 = b-1+1 = b$

Thus f is onto.

Since f is onto and one-to-one, f is a **one-to-one correspondence** from S to the positive integers. This then means that S is infinitely countable and thus S is countable.
□

A – 4 Prove by induction that (n^3)-n is divisible by 3 for all integers n>0

Let P(n) be the statement "(n^3)-n is divisible by 3"
First we'll examine the base case: P(1)
(n^3)-n=1^3-1=1-1=0
0=3*0, so is divisible by 3, and so P(1) is true
Now assume for some k>0, an integer, that P(k) holds true, i.e. there exists an integer a such that (k^3)-k = 3a.
We want to show that this implies that P(k+1) is true:
(k+1)^3-(k+1)
=k^3+3k^2+3k+1-k-1 (This is just a binomial expansion)
=k^3-k +3k^2+3k (The 1's cancel. Since we want to use our assumption we put k^3-k together)
=3a+3k^2+3k (Using the inductive hypothesis)
=3b (b is clearly an integer so we're done)
Now since we've shown that P(n) holds for n=1 and that P(k) implies P(k+1), then by mathematical induction it follows that P(n) is true for all integers n>0. q.e.d.

Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 2020
Course Code: CSE 203
Course Name: DISCRETE MATHEMATICS
Program & Sem: B.Tech. (CSE) & III

Date: 26 December 2019
Time: 1:00 PM to 4:00 PM
Max Marks: 80
Weightage: 40%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) No choice, answer all the questions.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 1 marks. (20Qx1M=20M)

1. Fill in the blanks for the following:

i. A statement that is always true is called _____. (C.O.No.1) [Knowledge]

ii. A v (A ∧ X) = A is _____ law. (C.O.No.1) [Knowledge]

iii. An equivalence relation is _____. (C.O.No.4) [Knowledge]

iv. Number of elements in the power of a set of A = {a,b,d,f} is_____ . (C.O.No.2) [Knowledge]

v. Inverse of 3 modulo 7 is _____. (C.O.No.3) [Knowledge]

vi. Among 100 people at least _____ are born in the same month. (C.O.No.3) [Knowledge]

vii. The output of a successor function with input x is _____. (C.O.No.3) [Knowledge]

viii. The sequence a, a+d, a+2d,....., a+nd is in _____ progression. (C.O.No.3) [Knowledge]

2. Match the following:

i. Contradiction	- a. Bijection	(C.O.No.1) [Knowledge]
ii. Invertible	- b. always false	(C.O.No.4) [Knowledge]
iii. Permutations	- c. DNF	(C.O.No.3) [Knowledge]
iv. Set of Integers	- d. Arrangement	(C.O.No.3) [Knowledge]
v. Hasse Diagrams	- e. Countable	(C.O.No.5) [Knowledge]
vi. Sum of Elementary Products	- f. POSET	(C.O.No.1) [Knowledge]

3. **State whether the following are true or false:**

i. In a distributive lattice, a given element a can have any number of complements.

(C.O.No.5) [Knowledge]

ii. A partial ordered relation is reflexive, anti-symmetric and equivalence.

(C.O.No.5) [Knowledge]

iii. 2 + 2 = 4 iff 1 + 1 = 2 is true. (C.O.No.1) [Knowledge]

iv. Two numbers are said to be relatively prime if their greatest common divisor is 0.

(C.O.No.3) [Knowledge]

v. $p \rightarrow q \equiv \neg p \vee q$. (C.O.No.1) [Knowledge]

vi. An empty set is a subset of itself. (C.O.No.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 4 marks. (4Qx4M=16M)

4. Determine whether $(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$ is a tautology. (C.O. No.1) [Knowledge]
5. Show that if n is a positive integer then, $1 + 2 + 3 + \text{-----} + n = \frac{n(n+1)}{2}$.
(C.O.No.3) [Comprehension]
6. Find the reflexive and transitive closure of relation R = {(1,1), (2,3), (3,4) (2,2), (4,1), (4,2)} for A = { 1, 2, 3, 4 5 }. (C.O. No.4) [Comprehension]
7. Draw the Hasse diagram for the POSET relation ({1, 2, 3, 4, 6, 12}, |).
(C.O.No.5) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 8 marks. (2Qx8M=16M)

8. Define Equivalence relation. Prove that for any m>1 the relation R = {(a, b) | $a \equiv (b \bmod m)$} is an equivalence relation on Z^+. (C.O.No.4) [Comprehension]
9. Prove that (P(X), $\subseteq$) is a lattice where X = {a, b, c}. (C.O.No.5) [Comprehension]

Part D [Problem Solving Questions]

Answer both the Questions. Each Question carries 14 marks. (2Qx14M=28M)

10. a. Prove that in a distributive lattice L, every element can have at most one complement.
(C.O.No.5) [Comprehension]

    b. How many ways are there to distribute 6 identical books into 3 different bags?
(C.O.No.3) [Comprehension]

11. Prove that the POSET (D30, |) is a Boolean algebra. (C.O.No.5) [Comprehension]

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1, 2, 4, 9, 14, 17, 19	CO1	MODULE 1	1M EACH			7
10, 20	CO2	MODULE 2	1M EACH			2
5, 6, 7, 8, 11, 12, 18,	CO3	MODULE 3	1M EACH			7
3	CO4	MODULE 4	1M EACH			1
13, 15, 16	CO5	MODULE 5	1M EACH			3
1	CO1	MODULE 1	2	2		4
2	CO2	MODULE 2	2	2		4
3	CO4	MODULE 4	2	2		4
4	CO5	MODULE 5	2	2		4
1	CO5	MODULE 5	2	6		8
2	CO5	MODULE 5	2	6		8
1.a	CO5	MODULE 5	2	5		7
1.b	CO3	MODULE 3	2	5		7
2	CO5	MODULE 5	4	10		14
	Total Marks		40	40		80

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: CSE 203
Course Name: DISCRETE MATHEMATICS
Program & Sem: B.TECH. & III

Date: 26.12.2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

Part A (0Q x 0M = 0Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1-20	I 1. Tautology 2. Absorption Law 3. Reflexive, Symmetric, transitive 4. 2^5 5. 5 6. 9 7. x + 1 8. AP II. 9-b, 10-a, 11-d, 12-e, 13-f,14-c III. False, False, True, False, True, True	1m each	30 mins

Part B (4Q x 4M = 16 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Proof of tautology by truth table or by logical equivalence laws.	1 mark for each column =8M or Proof – 4M Laws – 4M	10 Mins
2	Mathematical Induction Basis Step Induction step	 1M 3M	10 Mins
3	Reflexive closure Transitive closure	2M 2M	5 Mins
4	Relation Hasse diagram Maximal, minimal elements	1M 2M 1M	10 Mins

Part C (2Q x 8M = 16Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Define Equivalence relation Proof : Each Proof	2M 2 + 2+ 2 = 6M	10 Mins
2	Proof: Hasse diagram For each pair LUB and GLB with generalization Hasse diagram for S = {1,2 } Lattice Proof	 2M 3M 1M 2M	20 Mins

Part D (2Q x 14M = 28Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Distributive lattice L, a given element a can have at most one complement proof with laws Success: Formula Application	7M 2M 5M	25 Mins
2	Poset (D30, |) is a Boolean Algebra. POSET Lattice Distributive Complement	 6M 3M 2M 3M	25 Mins