Course Code & Name	26CAPC1001 Discrete Mathematics		
Teaching Hours /week (L: T:P: R)	3:1:0:0	Credits	4
CIE Marks	40	ESE Marks	60
Course Type	Theory (PCC)	Exam Hours	3
Prerequisites (if any)	-		

Course Objectives:

1. To develop a foundational understanding of set theory, mathematical logic, and Congruences.
2. To cultivate the ability to apply discrete mathematical concepts to model and solve problems in computer science, information theory, and related fields.

Course Outcomes (COs)

At the end of the course students should be able to:

CO#	Course Outcomes	Bloom's Knowledge Level (KL)
CO 1	Apply the fundamental concepts of sets, relations, and functions to model, represent, and solve basic mathematical problems.	K3
CO 2	Apply the principles of mathematical logic and inference rules to construct valid arguments and verify logical statements	K3
CO 3	Solve mathematical problems by applying fundamental concepts of number theory.	K3
CO 4	Apply combinatorial principles and counting principles to solve counting problems.	K3

Note: *K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	2	1	1	-	-	-	-
CO 2	3	3	1	-	1	-	-	-
CO 3	3	2	1	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), - : No Correlation*

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE)

Attendance	Assignment/ Micro-project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
8	12	10	10	40 Marks

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

PART A	PART B	TOTAL
■ 2 Questions from each module. ■ Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	■ Each question carries 9 marks. ■ Two questions will be given from each module, out of which 1 question should be answered. ■ Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60 Marks**

SYLLABUS

Module #	Syllabus Description	Hours
1	Sets, Relations, and Functions- Sets and Subsets, Set Operations and Venn Diagrams, Cartesian Products. Relations: Properties (reflexive, symmetric, transitive), Equivalence Relations , Partial Order Relations, Functions: Types (injective, surjective, bijective), Composition and Inverse of Functions.	12
2	Mathematical logic, Logical operators – Conjunction, Disjunction, Negation, Conditional and bi-conditional. Construction of Truth tables. Equivalence and Implication, Tautology and Contradiction, methods of proof-direct, indirect, contradiction, Inference Theory,	12

	Validity by truth table, Rules of Inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction. Predicates, Quantifiers.	
3	Number Theory: Introduction, Division Algorithm, GCD, Primes, Euclidean Algorithm (without proof), Linear Congruences, Solutions of Linear Congruences, Diophantine Equation. Chinese Remainder Theorem(without proof)	**12**
4	Permutations, Circular Permutations, Combinations, Binomial Theorem, Pigeonhole Principle, Mathematical Induction.	**12**

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition & Year
1	Elements of Discrete Mathematics: A Computer Oriented Approach	C. Liu	McGraw-Hill	4th Edition 2012
2	Elementary Number Theory	David M. Burton	McGraw-Hill	7th Edition 2012
3	Discrete and Computational Mathematics-an applied introduction	Ralph P Grimaldi	Pearson Education	2007
4	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley.	10th Edition

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition & Year
1	Discrete Mathematical Structures with applications to Computer Science	Jean-Paul Tremblay	McGraw-Hill	1st Edition 2001
2	Discrete Mathematics and its Applications	Kenneth H. Rosen	McGraw-Hill,	7th Edition
3	Elementary Number Theory with Programming	Marty Lewinter, Jeanine Meyer	Wiley-Blackwell	2015

Web References/ Video Links (NPTEL, SWAYAM…)	
Sl.No	**Link ID**
1	https://nptel.ac.in/courses/106103205
2	https://nptel.ac.in/courses/111106052/
3	https://onlinecourses.nptel.ac.in/noc21_ma68/preview
4	https://onlinecourses.nptel.ac.in/noc25_ma76/preview
5	https://onlinecourses.nptel.ac.in/noc25_ma53/preview

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define equivalence relation with suitable example.
2. Let f,g:R R be defined by f(x)= x+1, g(x)= 2x2+3, find fog and gof. Is fog = gof ?
3. Describe the relation R if A={1, 2, 3, 4} and B={ 1, 4, 6, 8} and a R b iff b =a. Find the domain and range of R.
4. If R be a relation on the set Z of all integers defined byR={(x, y): x, y ϵ Z, (x –y) is divisible by 6 . Check whether R is an equivalence relation on A or not.

Course Outcome 2 (CO2):

1. Express $(\neg p \rightarrow q) \wedge (r \vee \neg q)(\neg p \rightarrow q) \wedge (r \vee \neg q)(\neg p \rightarrow q) \wedge (r \vee \neg q)$ in both CNF and DNF.
2. Show that R is a valid conclusion from $(P \rightarrow Q)$, $(Q \rightarrow R)$ and P.
3. Show using laws of logic that $(p \rightarrow q) \wedge (q \rightarrow r) \Rightarrow (p \rightarrow r)$
4. Prove that $(\neg P \rightarrow \neg Q) \rightarrow (Q \rightarrow P)$ is a tautology
5. Determine whether the following argument is valid using a truth table:
   a) If I study, then I will pass.
   b) I did not pass.
   Therefore: I did not study.
6. Show that $R \rightarrow S$ can be derived from the premises $P \rightarrow (Q \rightarrow S)$, $(\neg R \vee P)$ and Q

Course Outcome 3 (CO3):

1. Define GCD. Find GCD (2406 , 654)
2. Solve the linear Diophantine Equation 60x + 33y = 9
3. Solve the set of simultaneous congruences, $x \equiv 3 (mod 5)$; $x \equiv 4 (mod 7)$;$x \equiv 6 (mod 9)$.

Course Outcome 4 (CO4):

1. Define Permutation and Combination. Give one example of each.
2. How many 4-digit numbers can be formed using the digits 0–9 without repetition?
3. In how many ways can 6 identical balls be distributed among 3 boxes? (Boxes can be empty.)
4. Expand (1+2x)5 using the Binomial Theorem..
5. How many arrangements can be made using the letters of the word "BALLOON"?
6. In how many ways can 5 boys and 5 girls be seated alternately around a circular table?
7. Using the Principle of Inclusion and Exclusion, find the number of integers between 1 and 1000 that are divisible by 3 or 5 or 7.

Model Question Paper

Reg No.:_____ Name:_____

FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY

MCA Integrated S1 (R) Examination ---------- 2026 (2026 Scheme)

Course Code: 26CAPC1001

Course Name: Discrete Mathematics

Max. Marks: 60 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

		CO	Marks
1	Verify De-Morgan's laws for the following sets. A={1,2,3}, B={2,3,4} and U={1,2,3,4,5,6}	CO1	(3)
2	Let f(x) = x - 4, g(x) = x and h(x) = 3x – 5, prove that f o (g o h)= (f o g) o h	CO1	(3)
3	Define conjunction and disjunction with suitable examples.	CO2	(3)
4	Construct a truth table for the statement $(p \vee q) \rightarrow (\neg p \wedge r)$and determine whether it is a tautology, contradiction, or contingency	CO2	(3)
5	Find GCD (2406 , 654)	CO3	(3)

6	If a≡b(mod m) show that ac≡bc(mod m)	CO3	(3)
7	Find the number of permutations of the letters in the word "APPLE."	CO4	(3)
8	Find the value of 5C2and 5P2.	CO4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module I

9	a)Define the following and give one example for each. i)one- one function ii) on to function	CO1	(4)
	b) Let f,g:R →R be defined by f(x)= x+1, g(x)= 2x2+3, find fog and gof. Is fog = gof		(5)

OR

10	a)Let A = {1,2,3} and B = {u,v} and R1 = {(1,u), (2,u), (2,v), (3,u)}, R2 = {(1,v),(3,u),(3,v)} find R1 U R2, R1 ∩ R2, R1 - R2, and R1'		(2)
	b) Explain equivalent relations.	CO1	(2)
	c)Let R be the relation on the set N of positive integers defined by R={(a, b): a+b is even}. Prove that R is an equivalent relation.		(5)

Module II

11	a) Determine whether the following argument is **valid** using a truth table: a) If I study, then I will pass. b) I did not pass. *Therefore:* I did not study.	CO2	(4) (5)
	b)Show that R→S can be derived from the premises P→(Q → S) , (¬R∨ P) and Q		

OR

12	a)Explain the difference between universal and existential quantifiers		(2)
	b)Show using laws of logic that (p→q)∧(q→r)⇒(p→r)		
	c)Prove the following using rules of inference: Premises: If it is raining, then the ground is wet. If the ground is wet, then the match will be canceled.	CO2	(3) (4)

It is raining.

Conclusion: The match will be canceled.

Module III

13	a)Solve the linear Diophantine Equation 60x + 33y = 9	CO3	(5)
	b)Solve the linear congruence 3x≡9(mod12).		(4)
	OR		
14	a)Solve the set of simultaneous congruences, x≡3(mod5); x≡4(mod7);x≡6(mod9)	CO3	(6)
	b)Express 414 and 662 as a linear combination of the two numbers.		(3)

Module IV

15	a) What is a circular permutation? Give an example	CO4	(3)
	b) Prove by mathematical induction that 1+2+3+···+n=n(n+1)/2		(6)
	OR		
16	a)There are 11 pairs of socks in a drawer. Using the Pigeonhole Principle, show that selecting 12 socks ensures at least one matching pair.	CO4	(4)
	b) Use the Binomial Theorem to find the coefficient of x^5 in (2−3x)^10		(5)

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