Reg No.:

Name :

U8347

University of Kerala

First Semester Degree Examination, November 2024

Four Year Undergraduate Programme

Discipline Specific Course

Mathematics

UK1DSCMAT100, Foundations of Mathematics

Academic Level: 100-199

Time: 2 hours **Max. Marks: 56**

Part A. 6 Marks. Time:5 Minutes
Objective Type. 1 Mark Each. Answer all Questions
(Cognitive Level: Remember/Understand)

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
1.	State Well ordering Principle	Remember	CO3
2.	Define prime number	Remember	CO3
3.	Is 7 and 35 are relatively prime?	Understand	CO3
4.	Find the rank of the matrix $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$.	Understand	CO3
5.	List the elements of the set $A = \{x \in \mathbb{N} \mid x \text{ is even}, x < 11\}$	Remember	CO2
6.	Under what condition a relation R on a set A is anti-symmetric?	Remember	CO1

Part B. 10 Marks. Time:20 Minutes
Two-Three sentences. 2 Marks Each. Answer all Questions
(Cognitive Level: Remember/Understand/Apply)

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
7.	Define the binary operators div and mod.	Remember	CO3
8.	State the Inclusion-Exclusion Principle	Remember	CO3
9.	Define LCM and GCD of two positive integers	Remember	CO3
10.	Give an example of a relation on $A = \{1, 2, 3\}$ such that R is neither symmetric nor antisymmetric.	Understand	CO1
11.	Find $g \circ f$ if $f : \mathbb{R} \to \mathbb{R}$ and $g : \mathbb{R} \to \mathbb{R}$ defined by $f(x) = 2x + 1$, $g(x) = x - 2$.	Apply	CO1

Part C. 16 Marks. Time:35 Minutes
Short-Answer. 4 Marks Each. Answer all Questions, choosing among options within each question.
(Cognitive Level: Understand/Analyse/Apply)

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
12.	**A.** If $a\|b$ and $c\|d$, show that $a\|c$. **OR** **B.** Prove that there are infinitely many primes of the form 4n+3.	Understand Apply	CO3
13.	**A.** Solve the system of equations using determinents $$5x + 2y + 16 = 0$$ $$x + 3y - 7 = 0$$ **OR** **B.** If $$3\begin{bmatrix} x & y \\ z & w \end{bmatrix} = \begin{bmatrix} x & 5 \\ -1 & 2w \end{bmatrix} + \begin{bmatrix} 6 & x+y \\ z+w & 5 \end{bmatrix}.$$ Find x, y, z, and w.	Apply Apply	CO2 CO2
14.	**A.** Let b be an integer greater than or equal to 2. Suppose $b + 1$ integers are randomly selected. Prove that the difference of two of them is divisible by b. **OR** **B.** Find the remainder when 3^{181} is divided by 17.	Analyse Analyze	CO3 CO3
15.	**A.**If $U = \mathbb{N}$. $A = \{1, 2, 3, 4\}, B = \{3, 4.5, 6, 7\}$. Find $(A \setminus B) \cup (B \setminus A)$ and $A^c \cap B^c$. **OR** **B.** Determine whether $f : \mathbb{R} \to \mathbb{R}$ defined by $f(x) = 2x - 3$ is bijective and find f^{-1} if exists.	Apply	CO3

Part D. 24 Marks. Time:60 Minutes

Long-Answer. 6 Marks Each. Answer all 4 Questions, choosing among options within each question. (Cognitive Level: Understand/Analyse/ Apply)

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
16.	A) Find the values of a and b for which the equation $x+ay+z=3,\ x+2y+2z=b,\ x+5y+3z=9$ are consistent. When will these equations have a unique solution. **OR** B) Solve the equations $x_1-x_2+x_3+x_4=2,\ x_1+x_2-x_3+x_4=-4,\ x_1+x_2+x_3-x_4=4,\ x_1+x_2+x_3+x_4=0$ by finding the inverse by elementary row operations.	Understand	CO1, CO2
17.	A) Suppose $R=$\{(1,1), (1,5), (2,2), (2,3), (2,6), (3,2), (3,3), (3,6), (4,4), (5,1), (5,5), (6,2), (6,3), (6,6) \} is a relation on $A=\{1,2,3,4,5,6\}$. Show that R is an equivalence relation. Also find the equivalent classes in R. **OR** B) Let $A=\{a,b,c\},\ B=\{x,y,z\},\ C=\{r,s,t\}$. Let $f: A\to B$ and $g: B\to C$ be defined by: $f=\{(a,y),(b,x),(c,y)\}$ and $g=\{(x,s),(y,t),(z,r)\}$. Find: (a) composition function $g\circ f: A\to C$; (b) Im(f), Im(g), Im($g\circ f$).	Understand	CO1, CO4
18.	A) Show that $a\equiv b(\text{mod } m)$ if and only if a and b leave the same remainder when divided by m. **OR** B) A six digit number is cut up in the middle into 2 three digit numbers. If the square of their sum yields the original number, find the number	Analyse	CO3.
19.	A) Find the last nonzero digit (from the left) in the decimal value of 234!. **OR** B) Find the remainder when $(n^2+3n+41)^2$ is divided by 12	Apply	CO3