Indian Statistical Institute

MSLIS, Mid-semester Examination

Paper-12-ELEMENTS OF MATHEMATICS-II

Time: 1 hr 30 minutes   **Total Marks: 40**

Answer All Questions

Q1	Explain with suitable examples the meaning of relations and sets. If $(\frac{x}{3} + 1, y - \frac{2}{3}) = (\frac{5}{3}, \frac{1}{3})$ find the values of x and y.	(2)
Q2	If G = {7,8} and H = {5,4,2} find G x H and H x G.	(2)
Q3	Given A={1,2,3,4,5} S ={(x,y): x ∈ A, y ∈ A} Find the ordered pairs which satisfies the below condition i) x + y = 5 ii) x + y <5	(2)
Q4	What are functions? Is the following relation a function? Justify your answer (i) R1 = {(2, 3), (12 , 0), (2, 7), (− 4, 6)} (ii) R2 = {(x, |x|) | x is a real number} $y = |x|$	(2)
Q5	Explain Invertible functions with appropriate examples.	(2)
Q6	If f and g are real functions defined by f (x) = x^2 + 7 and g (x) = 3x + 5, find each of the following (a) f (3) + g (− 5) (b) f (− 2) + g (− 1)	(2)
Q7	What are Composite functions. Let f: R -> R be defined by f(x) = 2x - 3 and g:R ->R be defined by g(x) = (x+3)/2, find i) fog (x) ii) gof (x)	(2)
Q 8	Let the function f : R → R be defined by f (x) = 4x − 1, ∀ x ∈ R. Then, show that f is one-one.	(2)
Q9	In each of the following cases, state whether the function is one-one, onto or bijective. Justify your answer. (i) f : R → R defined by f (x) = 3 − 4x	(2)

	(ii) f : R → R defined by f (x) = 1 + x2	
Q10	What is an Equivalence relation. Show that the relation R in the set A = {1,2,3,4,5} given by R = {(a,b) : |a - b| is even} is an equivalence relation.	(4)
Q11	Find the inverse function of f given by a) $f(x) = (x - 3)^2$, if x >= 3 b) $f(x) = (x + 1)/(x - 2)$	(4)
Q12	Describe the following real functions and draw their graphs. i) Constant function ii) Modulus function iii) Exponential function iv) Logarithm function	(4)
Q13	Differentiate the following with respect to x. i) $\dfrac{\sin(ax+b)}{\cos(cx+d)} \cdot \cos x^3 \cdot \sin x^5$ ii) $\sqrt{\dfrac{(x-3)(x^2+4)}{3x^2+4x+5}}$	(6)
Q14	State Rolle's Theorem and apply for the given function and interval . Also, determine all the number(s) c which satisfy the conclusion of Rolle's Theorem. $g(t) = 2t - t^2 - t^3\ on\ [-2,1]$.	(2)
Q15	State Mean Value Theorem and apply for the given function and interval. Also, determine all the number(s) c which satisfy the Mean Value Theorem. $h(z) = 4z^3 - 8z^2 + 7z - 2\ on\ [2,5]$.	(2)