2021
B.A./B.Sc.
Third Semester
SKILL ENHANCEMENT COURSE – 1
MATHEMATICS
Course Code: MAS 3.11
(Logic & Sets)

PART–B
Total Mark: 15

Answer the following questions.

1. (a) Let $A = \{1, 2, 3, 4, 5, 6\}$. Define an equivalence relation $R = \{(1, 1), (1, 5), (2, 2), (2, 3),$ $(2, 6), (3, 2), (3, 3), (3, 6), (4, 4), (5, 1), (5, 5), (6, 2), (6, 3), (6, 6)\}$. Find the partition of A induced by R.   3
    (b) Prove that the set $\{1, 4, 9, 16, 25, ... \}$ is countable   2

2. (a) In a survey conducted on a sample of 25 new cars being sold at a local auto dealer to see which of three popular options– air conditioning, radio and power windows were already installed, the survey found that
    i)   15 had air conditioning
    ii) 12 had radio
    iii) 11 had power windows
    iv) 5 had air conditioning and power windows
    v)   9 had air conditioning and radio
    vi) 4 had radio and power windows
    vii) 3 has all the three options
    Draw an appropriate Venn diagram and find the number of cars that has
    i)   only power windows
    ii)   only air conditioning
    iii) only radio
    iv)   only radio and power windows
    v)   only air conditioning and radio
    vi)   only one option
    vii) at least one option
    viii) none of the options   3
    (b) Find the truth value of the following statement where p, q are false and r, s are true   2

    (i) $\left[p \rightarrow \left(q \wedge (\sim r) \right) \vee s \right] \wedge \left[(\sim p) \leftrightarrow (s \wedge r) \right]$

    (ii) $(p \vee q \vee s) \leftrightarrow \left[(\sim p) \wedge \left(q \wedge (\sim s) \right) \rightarrow (q \wedge r) \right]$

    (iii) $(\sim p \Rightarrow s) \Rightarrow \left((p \Rightarrow q) \Rightarrow (p \Rightarrow r) \right)$

    (iv) $\left[(p \wedge q) \vee (\sim r) \right] \Leftrightarrow \left[p \Rightarrow s \right]$

3. (a) Define contradictions and tautologies with an example in each. 1

(b) Write an equivalent formula for $p \wedge (q \Leftrightarrow r) \vee (r \Leftrightarrow p)$ without the biconditional as well as conditional statement. 2

(c) Establish the equivalence using the truth table 2

(i) $(p \vee q) \Rightarrow r \equiv (p \Rightarrow r) \wedge (q \Rightarrow r)$

(ii) $p \Leftrightarrow q \equiv \sim(p \vee q) \vee (p \wedge q)$