1. **[Marks 20]**
Consider the propositions,
p: You drive over 120 km per hour.
q: You get caught by Saher camera.

Express the following propositions using p and q and logical connectives, i.e. $\wedge$ (and), $\vee$ (or), and $\neg$ (not).

A	You drive over 120 km per hour, but you do not get caught by Saher camera.	$p \wedge \neg q$
B	You will get caught by Saher camera if you drive over 120 km per hour.	$p \rightarrow q$
C	If you do not drive over 120 km per hour, then you will not get caught by Saher camera.	$\neg p \rightarrow \neg q$
D	Driving over 120 km per hour is sufficient for getting caught by Saher camera.	$p \rightarrow q$
E	You did get caught by Saher camera, but you did not drive over 120 km per hour.	$q \wedge \neg p$

2. **[Marks 10]**
Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.

3. **[Marks 10]**
Consider the set $S = \{\varnothing, a, 2, (b,3)\}$. Write the subset of the power set of S where each element has a cardinality of 3.

4. **[Marks 10]**
Let $f(x) = 1/x^2$ and $g(x) = x/\sqrt{x+1}$. Compute:
a. $(f \circ g)(x) =$ $f(g(x)) = f\left(\frac{x}{\sqrt{x+1}}\right) = \frac{1}{\left(\frac{x}{\sqrt{x+1}}\right)^2} = \frac{x+1}{x^2}$
b. $(f \circ f)(x) =$ $f(f(x)) = f\left(\frac{1}{x^2}\right) = \frac{1}{\left(\frac{1}{x^2}\right)^2} = x^4$

5. **[Marks 10]**
Find the prime factorization of the number 197351.
$= 7 \cdot 11^2 \cdot 233$

6. **[Marks 10]**
You are given the sequence $a_{35} = 45, a_{36} = 53, a_{37} = 61$ and $a_{38} = 69$. Find the sum $\sum_{k=10}^{20} a_k$. Show all the details.

7. **[Marks 10]**
Determine if the numbers: 22, 35, and 63 are pairwise relatively prime.
if gcd for all pairs is = 1 then they are pairwise relatively prime
(22,35), (22,63), (35,63)

8. **[Marks 10]**
Calculate the summation, $\sum_{i=1}^{n} \prod_{j=1}^{i} c$. Show all the details.
$\prod_{j=1}^{i} c$ → $c \cdot c \cdot c \cdots$ (i times) $\therefore c^i$

$$\rightarrow \sum_{i=1}^{n} c^i = \frac{c^{n+1} - c}{c - 1}$$

Q2: $(P \wedge \neg q) \rightarrow (P \vee q)$

truth table

Q3: $S = \{\emptyset, a, 2, (b,3)\}$

subset of $P(S)$ ⟩ cardinality = 3

$\{\{\emptyset, a, 2\}, \{\emptyset, a, (b,3)\}, \{a, 2, (b,3)\}$

$\{\emptyset, 2, (b,3)\}\}$

Q6: $a_{35} = 45$, $a_{36} = 53$, $a_{37} = 61$, $a_{38} = 69$

$$\sum_{K=10}^{20} a_K = a_{10} + a_{11} + a_{12} + \dots + a_{20}$$

$$a_K = a_1 + 8(K-1)$$

$K = 35$

$45 = a_1 + 8(34)$

$a_1 = 45 - 8(34)$

$a_1 = -227$

* $a_K = -227 + 8(K-1)$

$$\therefore \sum_{K=10}^{20} -227 + 8(K-1) = \sum_{K=10}^{20} -227 + 8\sum_{K=10}^{20} (K-1)$$

$20-10+1$

$$= -227 \cdot 11 + 8\sum_{K=10}^{20} K - \sum_{K=10}^{20} 8$$

$$= 8\left[\sum_{K=10}^{20} K - \sum_{K=1}^{9} K\right] - 8 \cdot (20-10+1)$$

$$= 8\left[\frac{1}{2} \cdot 20 \cdot 21 - \frac{1}{2} \cdot 9 \cdot 10\right] - 8 \cdot 11$$

$$-2497 + 1232 = -1265$$