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Ans to the que NO - 1

Here,

1. $(p \wedge t) \rightarrow (r \vee s)$ premise 1
2. $q \rightarrow (u \wedge t)$ premise 2
3. $u \rightarrow p$ premise 3
4. $\neg s$ premise 4
5. q premise 5
6. $u \wedge t$ Modus Ponense 2, 5
7. u ~~Imp~~ Simplication 6
8. t simplication 6
9. p Modus Ponense 3, 7
10. $p \wedge t$ conjunction 8, 9
11. $(r \vee s)$ Modus ponense 1, 10
12. r : Disjunctive syllogism 4, 11

Ans to the que NO. 2. c)

L.H.S =

$\neg[(\neg p \to q) \wedge (\neg p \to \neg q)]$

$\equiv \neg(\neg p \to q) \vee \neg(\neg p \to \neg q)$; Demorgan's law

$\equiv \neg(\neg(\neg p) \vee q) \vee \neg(\neg(\neg p) \vee \neg q)$; Implication defination

$\equiv \neg(p \vee q) \vee \neg(p \vee \neg q)$; Double negetion

$\equiv (\neg p \wedge \neg q) \vee (\neg p \wedge \neg(\neg q))$; Demorgan's Law

$\equiv (\neg p \wedge \neg q) \vee (\neg p \wedge q)$; Double negetion

$\equiv (\neg p \wedge \neg p) \wedge (\neg q \vee q)$ Ideomtent Law and Negetion law

$\equiv \neg p \wedge q$;

$\equiv$ R.H.S

$\because$ L.H.S $\equiv$ R.H.S

$\therefore \neg[(\neg p \to q) \wedge (\neg p \to \neg q)]$ and $\neg p \wedge q$

is logically equilivalent.

Ans to the que NO 2 (d)

Rule of resalution,

$p \vee q$ Premise ①

$\neg q \vee r$ premise ②

$\therefore p \vee r$ conclusion

p	q	r	$\neg q$	$p \vee q$	$\neg q \vee r$	$\underbrace{p \vee r}_{=b}$	$\underbrace{(p \vee q) \wedge (\neg q \vee r)}_{=a}$	$(p \vee q) \wedge (\neg q \vee r) \rightarrow (p \vee r)$ $a \rightarrow b$
T	T	T	F	T	T	T	T	T
T	T	F	F	T	F	T	F	T
T	F	T	T	T	T	T	T	T
T	F	F	T	F	T	T	T	T
F	T	T	F	T	T	T	T	T
F	T	F	F	T	F	F	F	T
F	F	T	T	F	T	T	F	T
F	F	F	T	F	T	F	F	T

As it is a toutology.

$\therefore$ As the premise all are true,

the conclusion must be true for a valid arguement.

so it is valid.

Ans to que NO - 2(b)

① $\cancel{\exists p}\ \forall p\ \exists q\ (4pq = 4),\ p \in R^+, q \in N$

$p \in R^+$.

$\therefore\ p = 1,\ q = 1\ ;\ 4 \times 1 \times 1 = 4\ ;$ ~~true~~

$p = 2,\ q = 1\ ;\ 4 \times 2 \times 1 \cancel{=} 8 \neq 4$

$p = 3,\ q = 1 \quad 3 \times 3 \times 1 = 9 \neq 4$

$\therefore$ ~~the~~ the satement is true.

② $\exists p\ (p^8 < p^4)\ p \in R^+$

$p = 1\ ;\ p^8 = 1^8 = 1;\ p^4 = 1^4 = 1 \quad p^8 \not< p^4$

$p = 2\ ;\ p^8 = 2^8 = \cancel{64}\ 2^4 = \quad p^8 \not< p^4$

$p =$

$\therefore$ It is ~~false~~ true

③ $\forall x\ (12x \geq 3x)\ x \in Z$

$x = 1 \quad 12 \times 1 = 12 \quad 3 \times 1 = 3 \quad 12 > 3$

$x = 2 \quad 12 \times 2 = 24 \quad 3 \times 2 = 6 \quad 24 > 6$

$\therefore$ it is true