Kingdom of Saudi Arabia
Ministry of Education
Al-Imam Mohammad Ibn Saud
Islamic University
--- College of Science ---

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة التعليم
جامعة الإمام محمد بن سعود الإسلامية
كلية العلوم
قسم الرياضيات و الإحصاء

Department: Mathematics & Statistics
Semester/Year: First /1436-1437
Duration: 75 minutes

Course Elements of sets and structures
Course Code: MAT 220

Midterm 1

NAME: **ID:**

<u>QUESTION 1</u> [8=3+2+3 marks]

Let P, Q and R be three statements.

1. Prove that the following compound statements are logically equivalent: $(\neg P \wedge Q) \vee (P \wedge \neg Q) \equiv (P \vee Q) \wedge (\neg P \vee \neg Q)$

2-Complete the following with T or F:

P	Q	R	$(P \vee Q) \Rightarrow \neg R$
F	………	……..	F

3. Without using the truth table, prove that the following statement is tautology

$$[(P \vee Q) \wedge (P \Rightarrow R) \wedge (Q \Rightarrow R)] \Rightarrow R$$

QUESTION 2 [5=2+2 marks]

1- Determine whether the following statement is a tautology, a contradiction, or neither:

$$[P \wedge (P \Rightarrow Q)] \Rightarrow Q$$

2. Let P(x) and Q(x) be open sentences in x with nonempty universe U.

Give the **negation** of quantified statement: $(\exists x)(P(x) \vee \neg Q(x))$

<u>QUESTION 3</u> [7=3+2+3 marks]

1. Let m and n be integers. Prove that the integer m^2+n^2 is even if and only if m and n are both even integers or m and n are both odd integers .

2. Let m and n be two integers. Prove, by a direct proof, that :
If m and n are both odd integers, then $5m+7n+2$ is an even integer..

3. Prove, by the principle of mathematical induction, that:

$$\frac{2}{1\times 3}+\frac{2}{3\times 5}+\cdots+\frac{2}{(2n-1)\times(2n+1)}=\frac{2n}{2n+1}, \quad \forall n\geq 1$$