DIRECTIONS: This examination is in two parts. PART I consists of 9 multiple choice questions (each worth 4 points). Circle the correct answer. PART II (64 points) involves questions of general nature requiring write-up on your part. Be brief, clear and to the point. RELAX, STAY CALM AND DO YOUR BEST. 
GOOD LUCK

PART I: MULTIPLE CHOICE QUESTIONS (36 pts)

I. Which compound(s) do (does) not show(s) E,Z-isomerism?

(a) all five 
(b) 1, 3, 4 and 5 
(c) 1 and 3 
(d) 3, 4 and 5 
(e) none of these

II. Which molecule(s) is (are) not chiral?

(a) 
(b) 
(c) 
(d) a and c 
(e) a and b

III. Which of the following molecule(s) is (are) optically inactive?
IV. Which of the following molecules is achiral?

(a) (2R, 3R)-2,3-butanediol
(b) (2R, 3S)-2,3-butanediol
(c) (2S, 3S)-2,3-butanediol
(d) (3R, 4S)-3,4-dinitrohexane
(e) more than one of these

V. The drawings

\[ \text{and} \]
are examples of:

(a) geometrical isomers
(b) constitutional isomers
(c) chiral isomers
(d) canonical structures
(e) none of the above

VI. Which of the following does not show aromatic behavior?

1

2

3

4

5

(a) only 1
(b) 1, 3 and 4
(c) 1 and 4
(d) 1, 4 and 5
(e) 1, 2, 4 and 5

VII. The molecules shown are:

(a) constitutional isomers
(b) enantiomers
(c) diastereomers
(d) identical
(e) none of these

VIII. Which of the following is the enantiomer of:
IX. Which of the following statement(s) is (are) true?

1. All racemic compounds can be resolved.
2. Erythro and threo isomers are diastereomers.
3. Cyclohexane is not planar.
4. In atropoisomerism, conformers can be separated.

(a) 1 and 2
(b) 2 and 3
(c) 3 and 4
(d) only 4
(e) all four

PART II

II. Draw ALL the isomeric structures for each of the following. Circle those which are optically active and list the cause for optical activity or lack of it. (30 pts)
III. In each of the following molecules, first specify the chiral center(s) and show the order of decreasing for the groups and/or atoms attached to the chiral center(s), and then specify the configuration of the stereogenic center(s).

(1) \( \text{500 C-CH=C=CH-CH(\text{NH})COOH} \)

(2) \( \text{500 C-CH=C=CH-CH(\text{NH})COOH} \)

(3) \( \text{500 C-CH=C=CH-CH(\text{NH})COOH} \)
IV. Draw the structural formula of a chiral molecule for each of the following type: 

(a) A spiro hydrocarbon of M.F. $C_7H_{12}$

(b) An allene carboxylic acid of M.F. $C_4H_3DO_2$

V. For each of the following pairs, predict which one in each pair will have a higher value for the listed property. Explain your reasoning briefly, but clearly.

(a) RESONANCE ENERGY: 

\[
\begin{align*}
\text{and} \\
\text{and}
\end{align*}
\]
(B) AROMATICITY: \[ \text{and} \]