Course Title: Chemistry
Course Code: CSE-1105
1st Semester, 1st Year
Session: 2016-17

Time: 3 hours **Marks: 60**

Answer any five Questions from the followings. Parts of the same question should be answered consecutively.

1. a) What is orbit and orbital? What does the square of the wavefunction, ψ^2 for an orbital, describe? [3]
   b) What is quantum number? Explain different types of quantum number. [4]
   c) What are the relationship among *n*, *l* and *m*? What do "4" and "*d*" represent in *4d*? [2]
   d) What is Pauli Exclusion principle? According to this principle maximum how many electrons can be accommodated by the *p*, *d* and *f* orbitals? [3]

2. a) What is building up principle? Explain with example. [2]
   b) What is ionic radius? For each of the following pairs, indicate which one of the two species is larger: [4]

   (I) O^{2-} or F^- (II) Sr^{2+} or Ca^{2+} (III) Co^{3+} or Co^{2+}

   c) Define ionization energy. Which atom should have a smaller first ionization energy: oxygen or sulfur - why? [3]
   d) Write down group 1A and group 2A elements with electronic configuration. [3]

3. a) What is VSEPR model? Predict and draw the geometry of the following compounds using VSEPR model. [6]

   (I) CH_4 (II) XeF_4 (III) ClF_3 (IV) PCl_5 (V) SF_4 (VI) BrF_5 (VII) I_3^- (VIII) H_2O

   b) What is chemical bond? Explain different types of chemical bonds with example. [6]

4. a) Give two different possible electron configuration for $1s^2 2s^2 2p^4$ of the oxygen atom. One of which correspond to stable configuration. Give reason. [3]
   b) The Na^+ and Mg^{2+} occur in chemical compounds but the ions Na^{2+} and Mg^{3+} do not. Explain [5]
   c) Discuss the application of inert gasses in industry. [4]

5. a) What is Riemer-Tiemann reaction? Give an example with proper mechanism. [4]
   b) What is Wittig reaction? Give an example with proper mechanism. [4]
   c) What is Hoffmann degradation? Give an example with proper mechanism. [4]

6. a) What is molarity? 25 mL of 0.01 mol/L solution of NaOH was diluted to 75 mL. Calculate the molarity of the diluted solution. [3]
   b) What is colligative properties? Briefly describe all colligative properties. [5]
   c) What is osmotic pressure? State and derive the Van't Hoff's Laws of osmotic pressure. [4]

7. a) Define the following terms: [3]

   (I) Degree of freedom (II) Component

   b) Draw and explain the phase diagram of one component three phase system. [5]

c) What is hydrolysis constant of salt? Why aqueous solution of sodium carbonate is alkaline? [4]

8. a) Define the following terms: [4]

(I) Rate of reaction (II) Order of reaction (III) Rate constant and (IV) Half-life

b) State and derive first order reaction. Show that in a first order reaction the time of half decomposition is independent of the initial concentration. [6]

c) The decomposition of N_2O_5 dissolved in CCl_4 is a first order reaction. At 45°C starting with a solution of concentration 1.00 mol/L after 3.00 hours the concentration decreased to 1.21×10^{-3} mol/L. Calculate the half-life in minutes of the decomposition of N_2O_5 at 45°C. [2]