CHEMISTRY

Fourth Semester

(Inorganic + Physical + Organic)

Theory

Full Marks : 50

The figures in the margin indicate full marks for the questions. Answer all questions.

1. (a) What are non-transition elements? How many groups are there in non-transition elements? Give five members from each group along with detailed electronic configuration.
   (b) Draw the structure of two oxy-acids of phosphorus.

   1+1+5+1+1=9

   OR

   (a) What is the basicity of H_3PO_4 ? Draw its structure.
   (b) Explain the following:
   (i) Though nitrogen exhibits +5 oxidation state, it does not form pentahalides.
   (ii) Noble gases have low boiling points.
   (iii) Bond enthalpy of fluorine is lower than that of chlorine.

   1+3+6=9

2. In which energy level of quantum numbers do the lanthanide series belong? Give the general electronic configuration of lanthanides.
   What is lanthanide contraction? Give the causes and consequences of lanthanide contraction.
   Which elements show $5d^0$ and $5d^1$ configuration?

   8

   OR

   Give details of the general electronic configuration of elements having atomic numbers from 89-to-103 along with possible numbers.
   Np shows +7 oxidation state but acts as an oxidising power. Comment.

   8

3. (a) What is auto catalysis?
   (b) How does a promoter enhance the activity of a catalyst?
   (c) Write down the mechanism of enzyme catalysis suggested by Michaelis and Menten.

   1+2+5=8

   OR

   (a) Define ionic product of water.
   (b) What are the factors affecting the degree of ionization?

(c) Derive Handerson equation for acidic buffer.

1+2+5=8

4. (a) Define Solubility product.
   (b) Phenolphthalein is not a suitable indicator for titrating weak base and strong acid. Comment.
   (c) 50 ml of 6.0 x10^{-3} M $CaCl_2$ is mixed with 30 ml of 0.04 M NaF. Will precipitation of CaF_2 occur? Explain. (K_{sp} for $CaCl_2$ = 4.0 x 10^{11})

1+2+5=8

OR

(a) What is zero order reaction?
(b) For the reaction,

$$2A + 2B \rightarrow C + D$$

the rate law is given by, $r = [A][B]^2$. Find the order w.r.t. [A] and [B] and the overall order of the reaction. Also find the molecularity of the reaction.

(c) Derive the rate expression for the second order reaction when the reactants are same.

1+2+5=8

5. (a) State and explain HVZ reaction.
   (b) How will you convert carboxylic acid to:
      (i) Aniline
      (ii) Esters
      (iii) Acid chlorides

3+2+2+2=9

OR

(a) What are esters? Explain the acid and alkaline hydrolysis of ester with appropriate examples.

1+4+4=9

6. What are organometallic compounds? Classify them and explain with reference to their preparation, properties and uses.

4+4=8

OR

Explain any two of the following polymers with reference to their formation, properties and application:

(i) Polyamides
(ii) Polyesters
(iii) Polyvinyl chloride

4+4=8