Full Marks: 35   **Time: 2 hrs**

Answer any five questions

1. (a) Show the synthesis of a atactic polymer using a metallocene, giving the structure of the metallocene catalyst.

(b) (i) Draw the structure of a DNA helix, (ii) Write the structure, synthesis and properties of PMMA.

$$3+4=7$$

2. (a) In a polystyrene polymer, there are 200 molecules of molecular weight 200, 200 molecules of molecular weight 2000 and 300 molecules of molecular weight 10,000. Find $\bar{M}_n$, $\bar{M}_w$, $\bar{D}_{pn}$ and PDI.

(b) What is "synthetic metal"? Show the structure of three conducting polymers and discuss their conducting properties. $3+4=7$

3. (a) What is protein and give two examples. How does it fold? Draw the primary structure and outline The synthesis of a chiral dipeptide.

(b) What is the difference of cellulose from amylose? Show the structure of β (+) lactose and α (+)-maltose. $4+3=7$

4. Explain the terms 'Phase', 'component' and 'degrees of freedom'. Define phase rule?
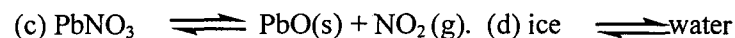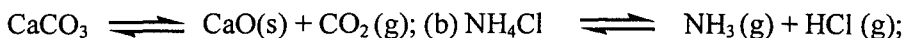
$$(2\times3)+1=7$$

5. (a) What do 'points', 'lines' and 'areas' signify in phase diagram of a one component system.

(b) Can four phases of a one component system co-exist at equilibrium?

(c) CO_2 vapour condenses to give solid dry ice at ordinary pressure if we lower the temperature whereas water vapour transforms into liquid water – Explain. $3+1+3 = 7$

6. How many phases, components and degrees of freedom are present in the following equilibrium? (a) $CaCO_3 \rightleftharpoons CaO(s) + CO_2(g)$; (b) $NH_4Cl \rightleftharpoons NH_3(g) + HCl(g)$;

(c) $PbNO_3 \rightleftharpoons PbO(s) + NO_2(g)$. (d) ice $\rightleftharpoons$ water $(2\times3)+1=7$