Answer the following questions:

1. Differentiate between the two types of electrochemical cells 2M
2. The EMF of the cell having Ni and Cu as the electrodes in contact with their respective electrolytes $NiCl_2$ and $CuCl_2$ is 0.5735 V at 298 K and 0.5951 V at 273 K. Calculate ΔG, ΔH and ΔS for the reaction at 298 K. Write the cell representation. 2M
3. What are the conditions for an electrochemical cell to act as a standard cell? Give an example. Describe the Poggendorff's method of determination of EMF of a cell using a standard cell. 3M
4. Derive Nernst equation for the following cell and calculate its EMF at 298 K

   $Mg \mid Mg^{2+}$ (2 M) $\parallel Ag^{+}$ (1 M) $\mid Ag$ 3M

5. The emf of a cell consisting of a hydrogen and the normal calomel is 0.664 V at 25 °C. Calculate the pH of the solution containing the hydrogen electrode. Write the cell representation and net reaction 2 M

6. Justify the following statements 3 M

   i)Glass electrode functions in the pH range 2 to 10.

   ii)Calomel electrode serves as secondary reference electrode.

   iii) Performance of lead acid battery reduces at low temperature.

7. Explain the construction and charging reactions of lead storage battery. Mention any two of its limitations. 3 M

8. A glass electrode dipped in a soln. of pH = 4 offered an emf of 0.2066 V with decinormal calomel electrode at 298 K. When dipped in a soln. of unknown pH at the same temperature, the recorded emf was 0.1076 V. Calculate the pH of unknown soln. 2 M

9. 1. Explain the construction and working of Li-ion battery. (2M)
10. Give reasons for the following. (2M)

    a) Ni-Cd battery can be used at low temperatures.

    b) Proper water management is crucial for the efficient operation of PEMFC.

11. a) Describe the working of Hydrogen-oxygen fuel cell. (2M)

b) Give reason. Ambient air cannot be used in alkaline fuel cell.

12. Explain the experimental determination of decomposition potential. (2M)

13. Give reasons for the following. (2M)

a) Activation polarisation cannot be eliminated.

b) For the discharge of gaseous products, the actual decomposition potential is much higher than its theoretical decomposition potential.

14. What is the effect of temperature and current density on the nature of the deposit? (2M)

15. Explain pickling and electropolishing for cleaning the metal surface before electroplating. (2 M)

16. Give reason – a) Hard chromium coating needs undercoating of nickel/copper. b) Inert anode is used in the chromium plating. (2 M)

17. Write the chemical reactions involved in electroless plating of copper. Why the addition of buffer to the bath is essential in this process? (2 M)