Seat No. : _____

NH-136

November-2025

M.Sc., Sem.-III

CHE(A) 503 : Analytical Chemistry
(Electroanalytical Techniques)

Time : 2:30 Hours] **[Max. Marks : 70**

1. (i) Describe the two types of experiments in detail for potentiometric measurements where significant current is allowed to flow. **7**

1. (ii) Write a note on Current measurement. **7**

OR

1. (i) Describe the electrode processes associated with particle transport responsible for the transport of dissolved species to and from an electrode surface. **7**

1. (ii) How electrocapillarity is useful in elucidating the properties and structure of double layer ? **7**

2. (i) How does a current in an electrochemical cell affect its potential ? **7**

2. (ii) Explain why electro-deposition at constant potential and constant current is not a selective method. **7**

OR

2. (i) Describe the experimental setup for constant current coulometry. And compare the constant current coulometry with conventional volumetric titration. **7**

2. (ii) The following cell has been used for the determination of cadmium in the presence of chloride ions by both electrogravimetry and coulometry : **7**

$Ag \mid AgCl_{(s)}, Cl\text{-}(0.200\ M), Cd^{2+}(0.00500\ M) \mid Cd$

$Cd^{2+} + 2e^- \rightleftharpoons Cd_{(s)} \qquad E^0 = -0.403\ V$

$AgCl_{(s)} + e^- \rightleftharpoons Ag_{(s)} + Cl^- \qquad E^0 = 0.222\ V$

Calculate the potential that (a) must be applied to prevent a current from developing in the cell when the two electrodes are connected and (b) that must be applied to cause an electrolytic current of 2.00 mA to develop. Assume that the internal resistance of the cell is 15.0 V.

3. (i) Discuss in brief – Differential pulse polarography along with its advantages. **7**

3. (ii) Write a note on Amperometric titrations. **7**

OR

3. (i) Explain the voltammetric technique used for the quantitation of trace electro-active analytes along with the merits and demerits of the technique. **7**

3. (ii) How can the reversibility of any electrochemical reaction be predicted using Cyclic voltammetry ? – Explain in brief. **7**

4. (i) Explain potentiometric sensors giving an example of Ion Selective electrode. **7**

4. (ii) Explain in brief about amperometric biosensors. **7**

OR

4. (i) Explain the working of amperometric gas sensors. **7**

4. (ii) Discuss in detail : Applications of Field Effect Transistors Sensors. **7**

5. Answer any **seven** out of **twelve** : (Each question carries **2** marks) **14**

(i) What is a working electrode ?

(ii) Define one coulomb.

(iii) Define current efficiency.

(iv) Why is an auxiliary reagent always required in coulometric titration ?

(v) What is Kinetic polarization ?

(vi) What is a depolarizer ?

(vii) What is a supporting electrolyte and what is its role in electrochemistry ?

(viii) What is polarography ?

(ix) What is HDME ?

(x) Write two characteristics of ion selective electrode.

(xi) Liquid ion exchange membrane is made of which material ?

(xii) Give two examples of a good mediator.

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