TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Ashwin

Exam.	Regular (New Course-2080 Batch)		
Level	BE	Full Marks	60
Programme	BEL, BEI, BCT, BAM, BIE, BGE, BAS	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry (*SH 153*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. The standard reduction potential of Cd^{++}/Cd and Ni^{++}/Ni electrodes are -0.403 V and -0.25 V respectively. Construct a galvanic cell using these electrodes so the standard emf of the cell becomes positive. For what concentration of Cd the emf of the cell at 25°C becomes zero, if the concentration of Ni is 0.01M. [1+4]

OR

What is Lithium ion battery? Write the reactions involved during discharging and charging of this battery. Write its advantages and disadvantages. [1+2+2]

2. Taking suitable example, explain how the basic buffer solution resists the change in pH with the addition of small amount of acid or base.

   If 0.2 gm of NaOH is added to 1 liter of buffer solution containing 0.1M NH_4OH and 0.2M NH_4Cl, what will be the pH of resulting solution? (pK_b for ammonia = 4.74). [2+3]

3. How are the catalysts used in the field of pollution control? Explain. Write any two examples of biocatalyst used in degradation of dyes. [4+1]

4. What is Chromatography? Explain the principle and application of thin layer chromatography. How does it vary from paper chromatography? [1+3+1]

OR

Write the principle of IR spectroscopy. Mention its applications. [3+2]

5. a) What are inner and outer orbital octahedral complexes? On the basis of VBT predict the magnetism and geometry of $[Fe(CN)6]^{4-}$ [1+2.5]

   b) From the given IUPAC names write the molecular formula of the following complexes. [1.5]

   i) Potassiumtetraiodomercurate (II)
   ii) Dichloro-bis- ethylenediaminenickel (IV) sulphate
   iii) Tetraaquadichlorocobalt (III) chloride

6. What are metallic alloys? Give examples with their uses. Using CFT, explain the color formation and magnetic property of $[Cu(NH_3)_6]^{3+}$. [2+3]

7. a) What is the goal of green chemistry? Mention any four principles of green chemistry. [1+4]

   b) What is the degree of hardness of water? How are scales formed in boiler? Explain briefly the chemical oxygen demand and its consequences with reference to water pollution. [1+1.5+2.5]

8. What are nanofibers? Mention their applications in health and environment. [2+3]

9. a) Write the preparation and uses of polymethyl methacrylate (PMMA). Explain the mechanism of cationic polymerization reaction taking suitable example. [2+3]

b) Write the preparation and applications of Kevlar and polyurethane. [2.5+2.5]

OR

i) What are carbon fiber reinforced plastics? Show your acquaintance to collagen. [1+2]

ii) Write the hydration of cement. [2]

10. a) What are the requisites of a good paint? Discuss about the impact of paint on a human health.

b) How can TNG be prepared? Write its uses. [3+2]

***

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2082 Baishakh

Exam.	Back (New Course)		
Level	BE	Full Marks	60
Programme	BEL, BEI, BCT, BAM, BIE, BGE, BAS	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry (*SH 153*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define polarization and overvoltage. [1+4]
   An electrochemical cell consists of a nickel electrode dipped in 0.1 M $NiSO_4$ solution and a silver electrode dipped in 0.05 M $AgNO_3$ solution. Write the cell notation, cell reaction and calculate the emf of the cell at 30°C. The standard electrode potentials of nickel and silver electrodes are -0.25 V and +0.80 V respectively.

   OR

   Give the working principle of lead acid battery. What are its uses? Also mention its advantages and disadvantages. [2+1+2]

2. a) How does a solution containing the mixture of benzoic acid and sodium benzoate maintain its constant pH value even on the addition of small amount of strong acid or alkali? Explain. [3]

   b) Calculate the concentration of sodium format, that must be present in 0.10 M solution of formic acid to prepare a buffer solution of pH 3.80. Ka for formic acid is 1.8×10^{-4}. [2]

3. Discuss any four selection criteria of a catalyst. Explain the phenomenon of electrocatalytic water splitting. [2+3]

4. Write the principle and applications of NMR spectroscopy. Why is teramethylsilane is used as a reference compound in NMR spectroscopy? [4+1]

   OR

   a) Explain the principle involved in the separation of components of a mixture by paper chromatography. [2]

   b) Show your acquaintance to hypsochromic shift and bathochromic shift in UV visible spectroscopy. [3]

5. a) What is a complex compound? Explain crystal field splitting of d^7 orbitals in octahedral complex. [1+2]

   b) Define alloys with examples. Give application of aluminum alloys. [1+1]

6. a) $[NiCl_4]^{2-}$ is tetrahedral and paramagnetic while $[Ni(CN)_4]^{2-}$ is square planar and diamagnetic. Explain with reference to VBT. Write the IUPAC name of the following complexes: [4+1]

   i) $Na_3[AgF_4]$
   ii) $[Co(en)_3]\,Br_3$

7. a) Explain about any four principles of green chemistry. What are heavy metal ions? Discuss any suitable method for the removal of heavy metal ions from industrial wastewater. [2+3]

   b) What are air pollutants? How do particulate matter (PM) and Greenhouse gases (GHGs) cause air pollution? Write their effects and remedies. [1+2+2]

8. How is carbon nanotube different from graphene? Discuss nanomaterials of various dimensions with examples. [2+3]

9. a) Write the preparation and uses of polycarbonate and polyurethane. [2.5+2.5]

   b) Discuss about an addition polymerization with an example. Explain about the free radical mechanism of Polymerization. [2+3]

OR

What are conducting polymers? Explain the preparation and uses of polyaniline (PANI). Show your acquaintance with cellulose. [1+2.5+1.5]

10. a) What are solid lubricants? Why is graphite used as a lubricant? [1+2]

    b) Give the preparation of TNT and GTN. [2]

***