

B.E. Metallurgical and Material Engineering - Third Year - Second Semester 2022
SUBJECT : EXTRACTION OF NON-FERROUS METALS

Time Three hours

Full Marks 100

Answer any five questions , all questions are of equal marks

1. Distinguish between Pyrometallurgical and Hydrometallurgical extraction in tabular form on the following points a. Theory and Principle b. Example with reaction c. Advantages d. Disadvantages e. Application

20

2. Explaining roasting of sulphide ore with reaction for two metal sulphides. What is predominance area diagram Explain how the it helps to determine the operating conditions of roasting. Why in Cu extraction an additional step of smelting and converting are there ,unlike Zn or Pb extraction from sulphide ore

5+4+2+4+5

3. Draw a flowchart to produce pure Al_2O_3 from the bauxite ore. Explain the following on Bayer process. (i). How will you decide temperature, pressure and concentration of leaching solution for the ore with different percentage of Boehmite and Gibbsite in the ore. (ii) Why bauxite ore with high % of Silica is not considered as economically viable (iii) Why a critical cooling temperature is required during precipitation stage. (iv) the various factors which control the kinetics of precipitation and agglomeration and how to get very fine precipitate.

5+4+2+4+5

4. Describe with example how E-pH diagrams of the wanted metal and gangue help in selecting proper leachant. State the other factors in choosing a leachant. Explain how cyanide leaching of Au is an electrochemical process with anodic and cathodic areas and reactions. Derive the equation of the rate of this leaching involving leachant concentration. Is cyanide leaching activation or concentration polarization controlled? Explain and show how to enhance the rate.

3+ 4+ 3+ 3 +4+3

5. Distinguish between following

5X4

- i. Electro refining of Cu and Electrowining of Cu
- ii. Smelting and on Reduction
- iii. Aqueous solution Electrolysis and Fused Salt Electrolysis
- iv Pressure Leaching and Bio leaching

[Turn over

B.E. Metallurgical and Material Engineering – Third Year – Second Semester 2022
SUBJECT : EXTRACTION OF NON-FERROUS METALS

6. Write only flow sheet with reactions ,how the following metals are produced

a. Ti from Rutile b. Mg from Seawater c. U from Pitch Blende d. Ni from Pentlandite

5X4

7. How pure metals are extracted by Electrometallurgy ? How you decide whether go for aqueous or Fused salt electrolysis ? Write the steps to find out total Cell potential to deposit metals at cathode ? what is the reaction at anode, how to find out energy requirement and efficiency of the process. How to produce shining or dull electrodeposited metal

4+4+4+4 +4

8. Write short notes on the followings

6+ 6+4 +5

a. E-pH diagram and its utility to extract multi-metals from waster such as mother board

b. Environmental pollution with extraction of Non Ferrous Metals extraction and remedy with green process

c. Electrolytic Production of Al , factors controlling it

d. Cell Potential from aqueous solution and fused salt electrolysis