No. of Printed Pages : **3**

21MNP4C11L

Sl. No.

M.Tech. IV Semester Degree Examination, Sept./Oct. - 2024

MINERAL PROCESSING

Mineral Processing Plant Design

(NEP)

Time : 3 Hours Maximum Marks : 70

Note : *Answer* ***any five*** *of the following and question* ***no.1*** *is* ***compulsory****.*

1. Answer the following questions in **one** or **two** sentences. **7x2=14**

(a) What is a 'closed-circuit' in mineral processing ?

(b) What is the primary purpose of metallurgical accounting ?

(c) What is meant by 'liberation' in mineral processing ?

(d) What does 'P80' signify in particle size analysis ?

(e) What is Bond's Work Index used for ?

(f) What role does dense media separation play in mineral processing ?

(g) What is meant by 'autogenous grinding' ?

(h) What are the advantages of using vibrating screens over other types of screens ?

2. (a) Describe the process of developing a metallurgical flow sheet for a mineral processing plant. What are the key steps involved, and how does each step contribute to the overall design and optimization of the plant ? **7**

(b) Calculate $\%Al_2O_3$ and $\%SiO_2$ present in China clay ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$). Atomic weights of Aluminium, Silica, Hydrogen and Oxygen are 26.98, 28.09, 16.00 and 1.00 respectively. **7**

P.T.O.

3. (a) Compare and contrast the design and application of Rod Mills and Ball Mills in mineral processing plants. What are the key factors that influence the choice between these two types of grinding equipments ? **7**

(b) For the Sieve analysis test data of a sample shown in Table below. Draw linear scale cumulative plot and determine 80% passing size. **7**

Mesh Number	**Retained mesh size in microns**	**Weight of material in gm**
+14	1200	2.5
−14+22	710	18.0
−22+30	500	18.5
−30+44	355	21.0
−44+60	250	27.5
−60+72	210	36.0
−72+100	150	31.5
−100+150	105	26.0
−150+200	74	18.5
−200		50.5
		250.0

4. (a) Describe the selection criteria and design features of primary crushers used in mineral processing plants. How do these criteria influence the performance and efficiency of the crushing process ? **6**

(b) In an iron ore concentration operation, samples of feed, concentrate and tailing are analysed and all stream flow rates are measured. Results are shown in Table below. **8**

Quantities and assay values

	Flow rates tons/hr	**Assay value %Fe**
Feed	1390	64.77
Concentrate	1112	68.08
Tailing	278	51.53

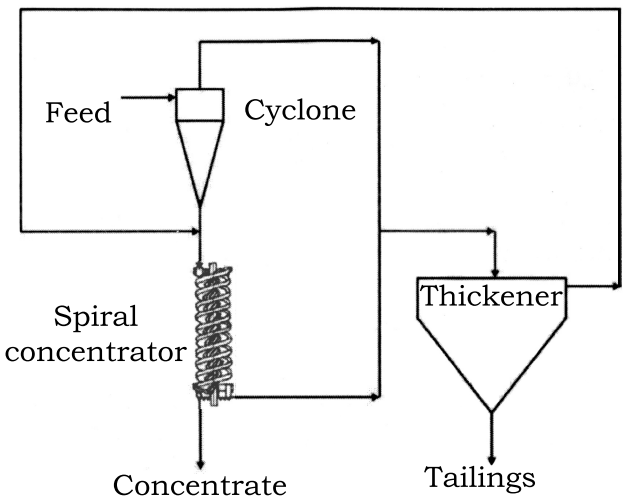
Calculate ratio of (i) concentration (ii) ratio of enrichment (iii) recovery and (iv) metallurgical efficiency

5. (a) Given that the Bond's work index (Wi) for a specific ore is 12.5 kWh/ton, calculate the energy required to grind the ore from a feed size of 2 mm to a product size of 100 mm. **4**

(b) Zinc ore containing 15% ZnS is fed at a rate of 1200 tons/hr to a flotation circuit consisting of rougher and cleaner cells. The rougher concentrate is treated in cleaner cells. The tailings from the rougher cells are the final tailings. The cleaner tailing of 20% ZnS is recycled to the rougher, and the circulating load is 0.25 (recycle/fresh feed). The concentrate assays 89% ZnS and the recovery of ZnS is 98%. Calculate the flow rates and assays of the respective streams. **10**

6. (a) Explain the process of Dense Media Separation (DMS) and its application in mineral processing. **4**

(b) In an Iron Ore concentrator, Iron ore fines are fed to a cyclone at the rate of 719 dry tons/hr after grinding to the required size in a ball mill. The cyclone feed contains 40% solids by weight. The cyclone underflow is discharged at the rate of 469 dry tons/hr and found to contain 50% solids by weight. This underflow slurry is diluted to 24% solids and treated in a 2-start spiral concentrator from which a concentrate with 60% solids is obtained at the rate of 347 dry tons/hr. The overflow of the cyclone and the tailings of spiral concentrator are disposed off as tailing after recovering water in a thickener. The thickened slurry is found to contain 30% solids. Draw a neat flow diagram and determine whether the water recovered will be sufficient to dilute the cyclone underflow. If the assays of cyclone feed, cyclone underflow and the spiral concentrate are 64.77% Fe, 65.97% Fe and 67.30% Fe respectively, calculate the Iron lost in disposed slurry. Calculate flow rates of slurry and solids of all streams and illustrate the complete material balance of the circuit. **10**



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