

B.E. CHEMICAL ENGINEERING SECOND YEAR SECOND SEMESTER EXAM 2018**SUBJECT: MATERIAL SCIENCE AND ENGINEERING****Time: 3 hours****Full Marks: 100**

Answer any four (4) questions. Answers must be brief and to the point. All parts of the same question must be answered contiguously.

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| 1 | (a) | What is passivity? Can there be break down of passivity? Give reasons. | 7 |
| | (b) | Which of these grain structures would exhibit the highest resistance to diffusional creep? a. Equiaxed, b. Directionally solidified, with the grain boundaries aligned parallel to the major stress axis, c. Directionally solidified, with the grain boundaries aligned perpendicular to the major stress axis, d. Single crystal. Justify. | 7 |
| | (c) | What is the ore for aluminium extraction? Why aluminium is not produced by carbothermic reduction? | 2+4 |
| | (d) | Can single crystal contain defect? Justify. | 5 |
| 2 | (a) | Is it possible use the complete load-elongation data till fracture from tensile test to get the true stress-strain curve? Give reasons. | 5 |
| | (b) | How does grain size influence the strength of material? | 5 |
| | (c) | Describe Kroll process. | 8 |
| | (d) | Differentiate: crevice corrosion and pitting corrosion | 7 |
| 3 | (a) | What are the chemical reaction sequences for making hot metal from haematite in blast furnace? | 5 |
| | (b) | What are direct and indirect reductions in case of blast furnace iron making? Does direct reduction at all occur inside blast furnace? Real extractions are not carried out at standard state. Then what is the use of Ellingham diagram? | 3+2+4 |
| | (c) | Differentiate: Smelting and Roasting. What are the advantages of hydrometallurgical extraction process compared to pyrometallurgical extraction process? | 6+5 |
| 4 | (a) | Differentiate: thermosetting polymers and thermoplastic polymers. Why does Barium Titanate exhibit piezoelectric property? Can polymer chains exhibit crystalline structure? Justify. | 6+6+4 |
| | (b) | Why does ceramic materials exhibit limited ductility compared to metals? How do you measure fracture toughness of ceramics? | 4+5 |

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- 5 (a) Differentiate: cathodic protection and anodic protection. What is intergranular corrosion in Austenitic stainless steel? How can you avoid this? 5+4+5
- (b) Mention the electrolytes and the reactions involved in hydrometallurgical extraction of Aluminium. Describe copper extraction following pyrometallurgical route. 5+6
- 6 (a) What is stress corrosion cracking? What is the use of the galvanic series? 5+5
- (b) What is Bravais lattice? What is solid solution? State the conditions of extensive solid solubility. 5+5+5