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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## April 2024 Semester End Main Examinations

**Programme: B.E.** **Semester: III**
**Branch: Chemical Engineering** **Duration: 3 hrs.**
**Course Code: 19CY3DCMCA** **Max Marks: 100**
**Course: Materials Chemistry and Applications**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.





### UNIT - I

1 a) Define ionization energy. Explain any two factors that govern the ionization energy. **06**

b) Arrive at the limiting radius ratio for a compound with coordination number four. **04**

c) Justify (i) electron gain enthalpies for noble gases are positive
(ii) oxygen is paramagnetic in nature. **04**

d) Give two examples for each of the following: **06**
(i) Molecules with octahedral geometry
(ii) Species with bond order three
(iii) Molecules with intra molecular hydrogen bonding.

### UNIT - II

2 a) Calculate the angle at which (i) first order reflection and (ii) second order reflection occur when X-rays of wavelength 1.54 Å are diffracted by the atoms of a crystal where the interplanar distance is 0.202 nm. **06**

b) Discuss the types of metal deficient defects. **04**

c) What is neutron diffraction? Mention its applications. **04**

d) TEM enables researchers to view samples on a molecular level. Validate the statement and describe the construction and working of TEM. **06**

### UNIT - III

3 a) Define catalytic promoters and inhibitors with examples. **04**

b) Explain the mechanism of base catalyzed ester hydrolysis. **05**

c) What is a three-way catalyst? Justify the use of three-way catalysts in environmental catalysis. **05**

d) What are zeolites? Discuss the following properties of zeolites (i) acidity (ii) product selectivity. **06**

**OR**

4 a) What are organometallic complexes? Elucidate the mechanism of alkene hydrogenation using an organometallic catalyst. **06**

b) Justify the need for bifunctional catalysts in steam reforming. **05**

c) Discuss the mechanism of enzyme catalysis. **04**

d) What is Fenton's reagent. Elucidate its application in waste water treatment with mechanism. **05**

**UNIT - IV**

5 a) Explain the following with suitable example (i) condensed phase rule (ii) eutectic mixture. **06**

b) Depict the phase diagram for one component iron system. **04**

c) Explain the composition, properties and applications of nickel chromium alloys. **05**

d) What are TTT diagrams? Sketch the TTT diagram for eutectoid steel. **05**

**OR**

6 a) Draw and explain the phase diagram of Pb-Sn system. **08**

b) Differentiate between metals and non-metals. **05**

c) Justify the need for making alloys. Discuss the classification and applications of various brasses. **07**

**UNIT - V**

7 a) Highlight the differences between thick and thin film lubrication. **05**

b) Describe the manufacturing of soda glass. **06**

c) Explain the advantages of ceramics as insulating materials. **04**

d) Discuss the classification of lubricants. **05**

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