USN ☐☐☐☐☐☐☐☐☐☐          **BCHEM102/202**

## First/Second Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
## Applied Chemistry for ME Stream

Time: 3 hrs.                                                        Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.*
*2. VTU Formula Hand Book is permitted.*
*3. M : Marks , L: Bloom's level , C: Course outcomes.*

| | | **Module – 1** | M | L | C |
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| Q.1 | a. | Define GCV. Explain the determination of calorific value of a fuel using Bomb calorimeter. | 07 | L1 | CO1 |
| | b. | Explain the construction, working and applications of Photovoltaic cells. | 07 | L1 | CO1 |
| | c. | Explain the construction, working and applications of Lithium-ion battery. | 06 | L2 | CO1 |
| | | **OR** | | | |
| Q.2 | a. | A coal sample with 93% C, 5% $H_2$ and 2% ash is subjected to combustion in a Bomb calorimeter. Calculate the gross and net calorific values, given that mass of coal sample taken is 0.95g, mass of water in the calorimeter is 2000g, water equivalent of calorimeter is 700g, rise in temperature of water is 2.8°C, latent heat of steam is 2457 J/g and specific heat of water is 4.2 J/g/°C. | 07 | L2 | CO1 |
| | b. | What are fuel cells? Explain the construction, working and applications of methanol-oxygen fuel cell. | 07 | L2 | CO1 |
| | c. | Justify biodiesel is a great fuel. Explain the synthesis of biodiesel by transesterification method. | 06 | L2 | CO1 |
| | | **Module – 2** | | | |
| Q.3 | a. | Define metallic corrosion. Explain electrochemical theory of corrosion taking ion as an example. | 07 | L2 | CO2 |
| | b. | Describe electroplating of hard and decorative chromium. | 07 | L2 | CO2 |
| | c. | What is cathodic protection? Explain the principle, process and applications of sacrificial anode method. | 06 | L2 | CO2 |
| | | **OR** | | | |
| Q.4 | a. | What is CPR? A steel sheet of area 100 inch$^2$ is exposed to air near the ocean. After 1 year period it was found to experience a weight loss of 485g due to corrosion. If the density of steel is 7.9 g/cm$^3$, calculate the CPR in mpy and mmpy. | 07 | L2 | CO2 |
| | b. | What is stress corrosion? Explain the process of stress corrosion taking caustic embrittlement as an example. | 07 | L2 | CO2 |
| | c. | Explain the process of Galvanization and its applications. | 06 | L2 | CO2 |
| | | **Module – 3** | | | |
| Q.5 | a. | In a polymer sample, 20% of molecules have molecular mass 15000 g/mol, 35% molecules have molecular mass 25000 g/mol, remaining molecules have molecular mass 20000 g/mol, calculate the number average, weight average molecular mass of the polymer. | 07 | L2 | CO3 |
| | b. | Explain the synthesis, properties and applications of chlorinated poly vinyl chloride | 07 | L2 | CO3 |
| | c. | Explain the synthesis of Teflon. Mention its applications. | 06 | L2 | CO3 |

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| | | **OR** | | | |
| Q.6 | a. | Explain the synthesis, properties and applications of Kevlar fiber. | 07 | L2 | CO3 |
| | b. | Explain the properties and industrial applications of lubricants. | 07 | L2 | CO3 |
| | c. | Explain the properties and industrial applications of metal matrix polymer composites. | 06 | L2 | CO3 |
| | | **Module – 4** | | | |
| Q.7 | a. | Define Phase, Components and degree of freedom with example. | 07 | L2 | CO4 |
| | b. | Explain the principle, instrumentation and applications of potentiometric titration. | 07 | L2 | CO4 |
| | c. | Describe the estimation of total hardness of water by using EDTA method. | 06 | L2 | CO4 |
| | | **OR** | | | |
| Q.8 | a. | With the help of phase diagram, describe Lead-Silver system. | 07 | L2 | CO4 |
| | b. | Explain the application of colorimetric sensors in the estimation of copper. | 06 | L2 | CO4 |
| | c. | Explain the principle, instrumentation and applications of glass electrode in the determination of pH of beverages. | 07 | L2 | CO4 |
| | | **Module – 5** | | | |
| Q.9 | a. | Define an Alloy. Explain the composition, properties and applications of stainless steel. | 07 | L1 | CO5 |
| | b. | Explain size dependent properties of nanomaterials with respect to i) Catalytic property ii) Thermal property. | 07 | L2 | CO5 |
| | c. | Explain the properties and applications of carbon nanotubes. | 06 | L3 | CO5 |
| | | **OR** | | | |
| Q.10 | a. | Explain the composition, properties and applications of Alnico. | 07 | L2 | CO5 |
| | b. | Explain the chemical composition, properties and applications of Perovskites. | 07 | L2 | CO5 |
| | c. | Explain the synthesis of nanomaterials by Sol-Gel method. | 06 | L2 | CO3 |

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