



# Manipal University, Manipal

## Department of Sciences

### III SEMESTER M. Sc. (CHEMISTRY)

### END SEMESTER EXAMINATIONS, NOV/DEC 2015

### SUBJECT: GREEN CHEMISTRY [CHM 705]

### REVISED CREDIT SYSTEM

Time: 3 Hours

30/11/2015

MAX. *marks*: 50

#### Instructions to Candidates:

- ❖ Answer ANY FIVE FULL questions.
- ❖ Missing data may be suitable assumed.

- 1A. Define the terms: Atom economy, Effective mass yield, carbon efficiency, E-factor. (2)
- 1B. Compare and explain the E-factor of various chemical industry segments. (3)
- 1C. Discuss the different methods of heterogenization of catalysts used for sustainable chemical processes. (5)
  
- 2A. Explain the six steps involved in cleaner production (2)
- 2B. Explain the following in connection with green chemistry (3)
  - (a) Electrochemical synthesis of adiponitrile and sebacic acid
  - (b) Asymmetric synthesis
- 2C. (a) Explain the instrumentation and mechanism involved in microwave synthesis (5)
  - (b) Discuss different types of oxidation, reduction and hydrolysis reactions using Enzyme catalysts
  
- 3A. What are the supporting reagents in heterogenization of a catalyst? How are they prepared? (2)
- 3B. Discuss the conventional and green methods of preparation of citral. (3)
- 3C. What are the five methods of designing a safer chemical? Which of these require the greatest toxicological data to utilize? (5)
  
- 4A. What is a Phase Transfer Catalyst (PTC)? Explain the three important roles of PTC in organic synthesis. (2)
- 4B. What is SC CO<sub>2</sub>? Discuss its advantages and applications (3)
- 4C. (a) Explain different roles of various green solvents in organic reactions (5)
  - (b) With the help of a neat diagram, explain the water-softening process by

- 5A. What are the most atom economical feed stocks and reagents? (2)
- 5B. Write the various conventional and alternative green solvents. Justify, how they are green solvents? (3)
- 5C. (i) Explain the difference between severity of a toxic effect and potency of a toxic chemical.  
(ii) What are the advantages and disadvantages of using CO<sub>2</sub> as a feedstock? (5)
- 6A Discuss the environmentally benign reactions using polyethylene glycol (2)
- 6B Explain the waste treatment in dye industries by photochemical degradation (3)
- 6C (a) Discuss the methods of preparation of Ionic liquids and Phase Transfer Catalysts (PTC).  
(b) Explain in detail, the effect of chemical substances and fuels on environment. (5)

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