**Birla Institute of Technology & Science Pilani, Pilani Campus, Rajasthan 333 031**

**COMPREHENSIVE Examination, First Semester 2022-2023**

**Course Number: CHEM F337** **Course Title: Green Chemistry and Catalysis**

**Max. Marks: 60** **Date: 22 Dec 2022** **OPEN BOOK** **Time: 120 min**

**Important Instructions**

- **There are FOUR questions printed using both sides of the question paper**
- **Answer all questions in the answer booklet only**
- **DO NOT use pencils for answering any part, even graphics**
- **Start answering each question from a fresh page, all sub-sections together**

**Q.1.(a)** (i) What is the necessity of immobilization of enzymes? (ii) Describe in brief the different methods for the immobilization of enzyme. (iii) What are the terms 'coupled enzyme' and 'coupled substrate approach'? **[8M]**

**(b)** The idea of active site is quite different for a solid catalyst and a biocatalyst - explain **[2M]**

**(c)** Describe the unique catalyst design involved in the UOP SMART styrene process **[2M]**

**(d)** Discuss the mechanistic aspects of functioning of a PTC. **[2M]**

**(e)** Why is a nanocaatalyst observed to have good catalytic activity in general? **[1M]**

**Q.2. (a)** (i) Present a strategy for immobilization of $PdCl_2(PPh_3)_2$ complex in water as an aqueous biphasic catalyst. (ii) Why is it called immobilization? **[3+1=4M]**

**(b)** What are the disadvantages of a homogeneous catalyst? **[2M]**

**(c)** Describe the catalytic route for amine synthesis from alkenes via hydroaminomethylation. What are the types of catalysts are used therein? **[3M]**

**(d)** Explain how a certain catalyst poison can help in a process. **[2M]**

**(e)** All zeolites are molecular sieves while all molecular sieves are not zeolites – explain **[2M]**

**(f)** State the difference between the LH model and ER models for heterogeneous catalysis. **[2M]**

**Q.3. (a)** What is Ostwald's Rule of Successive Transformations? **[2M]**

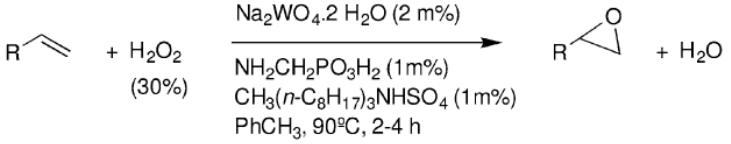
**(b)** Discuss the different history-dependent factors involved in zeolite synthesis. **[4M]**

**(c)** Explain all the terms of LCT mechanism for synthesis of mesoporous materials. How are the micellar assemblies helpful in mesoporous silicate synthesis? **[2+2=4M]**

**(d)** (i) Describe the layered atructure of clay silicates. (ii) Illustrate one covalent and one non-covalent modification of clays for use as catalysts. **[3+2=5M]**

**Q.4. (a)** What are the pros and cons of XRD technique? How are satellite peaks of SSNMR differentiated from any normal peaks? **[2+1=3M]**

**(b)** Identify the reaction and write any two green chemistry aspects of the process. **[1+1=2M]**




**(c)** What is COT phenomenon? Mention four important aspects of COT. **[1+2=3M]**

**(d)** Mention the enamine catalytic cycle for organocatalysts. **[2M]**

**(e)** Describe the terms $R_{max}$, $\Omega_{max}$ and $S_{occ}$ with their implications. **[3M]**

**(f)** Describe how Monsanto's DSIDA process is advantageous over the conventional process in terms of green chemistry **[2M]**

**DO NOT SCRIBBLE ON THE QUESTION PAPER**