This question paper contains 2 printed pages.

4330 *Your Roll No.....*

A

M.Tech. / Sem. VI

CHEMICAL SYNTHESIS AND PROCESS TECHNOLOGIES
Paper - Module 28 : Green and sustainable Chemistry

Time : 2 hours *Maximum Marks : 38*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt six questions in all including Q. No. 1 which is compulsory.

Q.1 (a) Consider a reaction of the type:

$$A + B \longrightarrow P + W$$

where A and B are feeds, P is the desired product and W is the waste product

(i) **Find alternate A and/or B feeds to avoid or decrease the amount of W.**

(ii) **Find alternate A and / or B feeds to create a different W which is a useful by-product.**

(iii) **Find substitute of P that does not entail the coproduction of W.**

(6)

(b) What is the primary route in which humans are exposed to dioxins and furans.

(2)

Q.2 (a) List and explain four advantages of microreactor technology over conventional batch process employed in chemical syntheses. Give any one reaction that has been carried out using this technology.

(4)

(b) Adipic acid has been conventionally prepared as a petrochemical product. Compare its production with the Green method of synthesis.

(2)

Q.3 (a) Describe the redesigning of the compound Sertraline, an active ingredient of Antidepressent drugs, using Green Chemistry principles.

(4)

(b) Give two examples of Ionic liquids. List two of their characteristic properties.

(2)

Q.4 (a) At the heart of Green Chemistry are alternate reaction media. With the help of a real world example, discuss the role of Ionic liquids in the contribution towards cleaner chemical technologies.

(4)

(b) Give the structure of a green marine anti fouling agent used in ship hulls. What are the features of this compound that make it environmentally acceptable.

(2)

Q.5 (a) With the help of phase diagram, explain the conditions under which CO_2 behaves as a super-critical fluid.

(4)

(b) Give the name of a biocatalyst used in the production of ethanol. Write two approaches employed for the improvement in its production

(2)

Q.6 (a) How is the interesterification process for fats and oils superior to the chemical process. List at least two principles of Green Chemistry addressed in the process.

(4)

(b) Compare the traditional and green route for the synthesis of epoxides.

(2)

Q.7 (a) How has super-critical CO_2 been successful in the replacement of volatile organic solvents for dry cleaning applications. (4)

(b) Give the class of reactions that are inherently atom-efficient.

(2)

Q.8 (a) What are the environment and economic benefits of the BHC process developed for the synthesis of the drug-ibuprofen. Describe the merits of the catalysts used in each step of the synthesis.

(4)

(b) Which catalyst has been developed to improve the bleaching action of H_2O_2 in the delignification of paper pulp. List two advantages of this catalytic system against chlorine based bleaching process.

(2)