M. Tech. in Materials Science and Nanotechnology, Semester II

MSN -608: POLYMER SCIENCE AND TECHNOLOGY

L	T	P			
4	0	0	**Internal Marks**	**:**	**50**
			External Marks	**:**	**100**
Credits: 4			**Duration of Exam**	**:**	**3 hours**

Objectives:

1. Basic concepts about polymers
2. Review and details dealing with the mechanisms of polymerization processes.
3. To be able to evaluate and analyze any polymeric material on the basis of Average molecular weight.
4. Understanding of different types of plastic polymeric materials.
5. Knowledge about the reactants involved to prepare a specific polymer and the optimized conditions required for synthesis of the polymers.
6. To understand the synthesis, characteristics and uses of some known polymers, viz. PVC, PVA and other polymers mentioned in the course.
7. Concept and mechanism of vulcanization of rubber.
8. Differences between natural rubber and synthetic rubber viz. Buna-S, Butyl rubber and Neoprene.
9. Classification of polymers based on their thermosetting and thermoplastic behavior.
10. To know the preparation of textile fibers viz. nylon-6 and nylon-66.
11. Understating the importance of Glass transition temperature with reference to polymeric substances.
12. Concept and idea about conducting polymers and their importance.
13. Mechanical strength enhancement of conducting polymers.
14. Incorporation of carbon materials which can enhance the strength and add to the conducting behavior of conducting polymers.
15. How to prepare nanocomposites of conducting polymers based on the CNT, Graphene and Nanofibers.

Outcome:

Students will be able to know;

1. How to optimize and synthesize the polymers.
2. To modify the mechanisms involved in the polymerization process to terminate the reaction at oligomeric state.
3. To modify the synthesis parameters as per the requirement of the application.
4. The differentiation between amorphous and crystalline characteristics of the polymers.
5. How to achieve and maintain synergy in the constituents of a nano composite.
6. Incorporation of sulphur, performed via cross-linking, in natural rubber.

UNIT I

- Types of polymeric materials and their structures,
- Classification and mechanism of polymerization reactions.
- Preparation, and properties
- Uses of PVC, PVA, PMMA, Nylon, PET,

- Bakelite, and urea formaldehyde resin.
- Average molecular weight concept
- Elastomers –structure of natural rubber,
- Vulcanization,
- Synthetic rubber
- Buna-S, Butyl rubber and Neoprene

UNIT II

- Thermoplastic and thermosetting polymers
- Strengthening mechanism
- Properties of textile Fibres with example of nylon-6 and nylon -66
- Glass transition temperature and its importance
- Conducting polymers- introduction, classification,
- Ppreparation and properties
- Carbon substrate- conducting polymer nanocomposite

TEXT/REFERENCE BOOKS:

1. The Plastic Engineer's Data Book – A. B. Glanvill, The Machinery Pub.
2. A review of *The Goodyear Story: An Inventor's Obsession and the Struggle for a Rubber Monopoly* - Richard Korman, Encounter Books, 2002.
3. Engineering Properties of Spider Silk - Ko, Frank K., Sueo Kawabata, Mari Inoue, Masako Niwa, Stephen Fossey and John W. Song.
4. Textbook of Polymer Science - Billmeyer F, Wiley Interscience, 1994
5. Principles of Polymer Chemistry – P.J. Flory, Cornell University Press.
6. Polymers: Chemistry and Physics of Modern Materials, J.M.G. Cowie, Blackie Academic and Professional.
7. Principles of Polymerization, G. Odion, John Wiley publishers.
8. Polymer Science, V.R. Gowariker, N.V. Viswanathan and J. Sreedhar, Wiley-Eastern.
9. Functional Monomers and Polymers, K. Takemoto, Y. Inake and R.M. Otta.

ASSIGNMENTS **:** 4 assignments will be given during the semester.

EVALUATION PROCEDURE: Candidate is evaluated as per ordinance of the University.

ATTENDANCE RECORD **:** It is mandatory for a student to attend at least75% attendance of the total classes held of the subject.

CONSULTATION HOUR : Any vacant period.

(Prof. Ashok K Sharma)