COURSE OUTLINE

Subject & Code: Introduction to Polymer Science and Engineering SKV 2513
Total Lecture Hours: 42 Hours

Synopsis:
This course provides a basic knowledge of polymer science and engineering. It will emphasize on classification and naming of polymers, molecular weight and molecular weight distribution, polymerization techniques, concepts of polymer solubility, concepts of amorphous and crystalline structures, introduction to commercial plastics and rubbers, and overview of polymer processing. Upon completing this course, students will be able to explain the fundamental principles of science and engineering. The students should also be able to explain how polymers are processed into end-products.

Learning Outcomes:
At the end of the course, students should be able to know the fundamentals of polymer science and engineering that emphasis on polymeric materials and their classifications, molecular weight, polymers in solution and solid state, thermal properties and the relationship as well as the implication on polymer synthesis and how polymers are processed in general to become end-products.

Generic Skills Addressed:

COURSE OUTLINE

Week	Topic	Learning Outcome
1&2	Introduction • History • Polymer Industry • Definition, Structure • Configuration and Conformation • Basic Properties of Polymers • Classification Of Polymers • Nomenclature –Naming Of Polymers	It is expected that students will be able to: • know the history of polymers in general • describe the organization of the polymer industry • distinguish each definition used in polymer • draw and identify structures of polymers according to their various isomerism and relate to its basic properties • classify and describe polymers according to their respective groups • identify and determine names for the monomers and polymers according to their molecular structure
3-5	Molecular Weight and Molecular Weight Distribution • Molecular Weight Average and Distribution • Significance Of Molecular Weight Control • Techniques for Molecular Weight Determination	It is expected that students will be able to: • distinguish the concepts used in polymers compared to the exact molecular weight of a compound • determine and calculate the average molecular weight of the polymers • describe the implications arises from the molecular weight differences with respect to properties and processing in general • identify and used the correct techniques for the molecular weight determination • compare and contrast the various techniques used for molecular weight determinations
6-7	Polymerization • Step-wise polymerization and kinetics • Addition polymerization and kinetics • Co-polymerization • Polymerization Systems	It is expected that students will be able to: • demonstrate understanding on the various polymerization techniques to form polymers • compare and contrast between the step growth polymerization and the addition polymerization techniques • apply the respective polymerization method for appropriate monomers • determine the simple reaction kinetics involved in each polymerization techniques • solve common problems involving polymerization kinetics and molecular weight implications • describe and identify the various polymerization system for conducting polymerization reactions • compare and contrast the advantage and the disadvantage of the various system
8	Mid Semester Break	

9	Polymer solution • Polymer Solubility • Thermodynamics Of Polymer Solution • Phase Separation	It is expected that students will be able to: • explain the concepts of polymer solubility • determine the solubility parameter based on the molecular structure of the polymer • compare and contrast the types of phase separation occurring in polymers • describe the effects of each type of phase separation with regards to general polymer properties • identify and distinguish the factors affecting the polymer solubility
10-12	Polymer Solid • Crystalline Polymers • Structure Of Polymer Crystal • Crystallization and Melting • Strain-Induced Morphology • Polymer Morphology Analysis • Amorphous Polymers • Thermal Transitions • Factors Affecting Glass Transition Temperature and Melting Point • Property-Application Relationship	It is expected that students will be able to: • describe the properties of the crystalline polymers • explain the formation of crystallinity in polymers • demonstrate the importance of crystallinity in polymers • determine the factors affecting the crystallization inpolymers • explain the relationship between crystallinity and melting • describe the change in morphology as strain is induced in polymers • distinguish the commons morphology adopted by the polymers such as thermoplastic thermoset and fibre reinforced plastics • compare and contrast the structure between the amorphous and crystalline polymers • demonstrate understanding on the types of thermal transitions occurring in thermoplastic and thermosets • identify and classify the factors affecting the transition temperature and melting point • describe the effects of thermal properties and relates to polymer materials application
13&14	Polymer Processing • Plastics Technology • Fiber Technology • Elastomer Technology	It is expected that students will be able to: • identify the general processing techniques used to process thermoplastic • demonstrate the understanding on the general working of injection molding and the components involved in injection molding machine • able to identify common faults occurring during processing of polymer on injection molding and simple ways of rectifying • describe in general how fibre is process and

		simple properties of a fibre. • compare and contrast the characteristic of an elastomer and its relationship to applications • describe in general the process available for manufacturing an elastomeric products
15	Revision Week	
16-18	Examination Week	

Teaching Methodology:

References:

Students are strongly advised to refer to at least one of the following texts:

1. Joel R. Fried, "Polymer Science & Technology", Prentice Hall International , New Jersey, 1996.
2. Fred W. Billmeyer Jr., "Text of Polymer Science", Third Edition, Wiley Interscience Publication, London, 1988.
3. Alfred Rudin, "Unsur Sains & Kejuruteraan Polimer : Teks Pengenalan Untuk Jurutera & Ahli Kimia", Terjemahan oleh Mat Zakaria, DBP, Kuala Lumpur, 1992.
4. Cowie, J.M.G., "Polymers: Chemistry and Physics of Modern Materials", Chapman & Hall, London, 1991.

Assessment:

Test 1: 25%
Test 2: 25%
Final : 50%

*Test 1 and Test 2 will be tentatively held in Week 5 and Week 12 respectively.