Open Electives for B. Tech. Sem. V/VI students:

CMO-319: Polymer Composites

L	T	P
3	1	0

Unit 1: **(12 Lectures)**

Definition and Classification of Composites Reinforcing fibres-Natural fibres (cellulose, jute, coir etc), boron, carbon, ceramic glass, aramids, polyethylene (UHMWPE), polybenz-thiazoles etc.

Unit 2 **(12 Lectures)**

Particulate fillers-importance of particle shape and size, matrix resins thermoplastics and thermosetting matrix resins, coupling agents-surface treatment of fillers and fibres, significance of interface in composites.

Unit 3 **(15 Lectures)**

Nanocomposites, short and continuous fibre reinforced composites, critical fibre length, anisotropic behaviour, SMC, BMC, DMC etc., fabrication techniques-pultrusion, filament winding, prepreg technology, injection and compression moulding, bag moulding, resin transfer moulding, reaction injection moulding. Properties and performance of composites, applications

Textbooks:

1. 'Nanocomposite Science and Technology' by Pulickel M. Ajayan, Linda S. Schadler, Paul V. Braun Hardcover, September 2003 Wiley.
2. 'Polymer-Clay Nanocomposites' by T. J. Pinnavaia (Editor), G. W. Beall (Editor) Hardcover, December 2000 Wiley.
3. 'Metal-Polymer Nanocomposites' by Luigi Nicolais (Editor), Gianfranco Carotenuto (Editor) Hardcover, November 2004 Wiley
4. 'Fillers and Filled Polymers' Jean-François Gerard (Symposium Editor), I. Meisel (Editor), C. S. Kniep (Associate Editor), S. Spiegel (Associate Editor), K. Grieve (Assistant Editor) Wiley July 2001

CMO-317: Engineering Plastics and Speciality Polymers

L	T	P
3	1	0

Unit 1 **(5 Lecture)**

Polymers of commercial importance, additives for plastics: stabilizers, fillers, plasticizers, lubricants, flame retarders, foaming agents, crosslinking agents, etc.

Unit 2 **(10 Lectures)**

Manufacture, properties and applications of major, thermoplastic and thermosetting polymers: polyethylene, polypropylene, polyvinyl choloride, polystyrene and other styrenics, polyamides, polyesters, acrylics, ABS, polycarbonate, polyamides, polyurethanes, polyphenylene oxide, polyphenylene sulfide, PEEK and Engg. Thermosets such as USP, Epoxy, phenolics and aminoplasts

Unit 3 **(8 Lectures)**

Materials selection for engineering plastics for various applications based on mechanical properties, high temperature stability, electrical properties, oxidative, UV, hydrolytic and chemical stability.

Unit 4 **(10 Lectures)**

Processing and application of engineering plastics, definition and characteristics of speciality polymers, important speciality polymers such as fluropolymer, silicone, liquid crystalline polymers,conducting polymers, polymeric hydrogels, processing and application of speciality polymers.

Textbooks:

1. Introduction to Physical Polymer Science, L.H.Sperling, Wiley Interscience, New York, 1986.
2. Principles of Polymerization, G.Odian, Third edition, Wiley Interscience. New York, 1992.
3. Principles of Polymer Chemistry, P.J. Flory, Cornell University, Press lthaca, 1953.
4. Textbook of Polymer Science, F.W. Billmeyer, 3rd Edition, John Wiley, London, 1994.
5. "Polymer Science", Gowariker et aI, Wiley Eastern, New Delhi, 1990.

CMO – 320 (e): Bionanotechnology

L	T	P
3	1	0

Unit 1: Introduction

Nanotechnology and Bio-nanotechnology, Notable Nano Images in Bio-nanotechnology, AFM-qd, Nano-Drug Delivery Chip, Atomic Force Microscopy Image (AFM) of SWNT, Scanning Electron Microscopy lmage (SEM) of SWNT, Opportunities and Challenges of Bio-nanotechnology, Growth potential of Nanotechnology. The Significance of Nano Domain.

Unit 2: Nano Drug Delivery

Conventional Drug Delivery, Targeted Drug Delivery, Chemistry of Drug Delivery Vehicles, Delivery Profiles, The role of Nanotechnology in Drug Delivery, Advantages of Targeted Drug Delivery Systems.

Unit 3: Bio-Nanoimaging.

Quantum Dots, Ultrasound contrast Agents, Magnetic Nanoparticles.

Unit 4: Successful Applications of Bio-nanotechnology

Nanostructures and Nano-systems, Nano-particles, in Vitro Diagnostics. Medical Application of Nano-systems and Nano-particles. Synthesis of Gold, Titania and Zinc Oxide nano-particles and their applications in Bio-nanotechnology, Bio-nanotechnology today and its future.

Textbooks:

1. Bio-Nanotechnology by Elisabeth S. Papazolou, Aravind Parthasarathy, SchooI of Biomedical Engineering. Drexel University, M & C Morgan & Claypool publishers.
2. Bio-nanotechnology lesson from Nature by David S. Goodsell, Ph.D., Department of Molecular Biology, The Scripps Research Institute La Jolla, California John Wiley & Sons Inc. Publications.

CMO-316: CATALYSIS (PRINCIPLES AND APPLICATIONS)

L	T	P
3	1	0

Unit 1: Basic Principles of Catalysis
Adsorption isotherms, surfaces area, pore size and acid strength measurements.

Unit 2: Enthalpy and entropy of adsorption
Interpretation of chemisorption based on the structure and the nature of the solid state theories – role of defects in catalysis.

Unit 3: Kinetics of surface reactions
Rate determining step, various types of reactions, simple, parallel and consecutive reactions.

Unit 4: Selection, preparation and evaluation of catalysts
Test reactions, promoters, carriers and stabilizers.

Unit 5: Mechanism of selected reactions
Hydrogenation and dehydrogenation reactions, hydration of alcohols, olefin dehydrogenation, decomposition of nitrous oxide, oxidation of CO, Ketonization of carboxylic acids, cracking of hydrocarbons.

Unit 6: Applications
Petrochemical industry – reforming and refining, value added chemicals, environmental protection, auto exhaust catalysis, novel catalytic materials – clusters, zeolites, mesoporous materials.

Textbooks:

1. J. M. Thomas and W. J. Thomas, Introduction to the principles of Hetrogeneous Catalysis, Academic Press, 1967.
2. J. C. Kuriacose, Catalysis, Mcmillan Indian Limited, 1991.
3. D. K. Chakrabarty, Adsorption and Catalysis by Solids, Wiley Eastern Ltd. 1990.
4. A. W. Adamson, Physical Chemistry of Solid Surfaces, Academic Press, 1995.