PL – 301 : POLYMER CHEMISTRY

L	T	P
3	1	0

Developments in Polymer/Petrochemical industries with reference to application. Basic concepts and terminology such as monomer, polymer, functionality and structure of polymers. Classification of polymers.

General characteristics of condensation polymerization, kinetics and mechanism, Molecular weight control and development of cross-linked structures. Step polymerization and its utility.

General theory of chain-growth polymerization. Free radical polymerization, initiators, kinetics of free radical polymerization.

Autoacceleration. Factors affecting molecular weight and molecular weight distribution. Chain-transfer reactions, retardars, inhibitors, Effect of temperature on polymerization, kinetics & mechanism.

Copolymerization reactions and its utility. Kinetics and copolymerization behavior. Block and graft copolymers. Stereo-chemistry of polymerization. Ring-opening polymerization.

References

1. Text Book of Polymer Science, by F. W. Billmeyer
2. Vinyl Polymerization, by G. E. Hom
3. Principles of Polymerization, by G. Odian
4. Radical Polymerization: Kinetics and Mechanism, by Buback, M. and Herk, A. M. V. (Editors)
5. Polymer Chemistry and Introduction, by Cemahar
6. Principles of Polymer Chemistry, by P. J. Flory
7. Organic Chemistry of Synthetic High Polymers, by R. W. Lenz
8. Polymer Chemistry : An Introduction, by M.P. Stevens
9. Principles of Polymer Engineering – 2nd Ed., N. G. McRum
10. Controlled/Living Radical Polymerization: Progress in ATRP, NMP and RAFT, by Matyjaszewski, K. (Other), Matyjaszewski, Krzysztof (Editor)
11. ACS Symposium #854: Advances in Controlled/Living Radical Polymerization, by K. Matyjaszewski

PL – 351 : ANALYSIS AND IDENTIFICATION OF POLYMERS

L	T	P
0	0	6

Quantitative estimation of the basic raw materials and auxiliaries used in polymer industries such as phenol, urea, formaldehyde, glycerol, plasticizers, initiators, inhibitors, antioxidants, etc.

Determination of purity of solvents, monomers and other auxiliaries.

Determination of physical properties such as boiling point, melting point, refractive index, specific gravity of polymer materials using standard techniques.

Identification of unknown polymer samples using heating, burning, solubility, element detection and chemical tests.

PL – 401 : POLYMERIZATION ENGINEERING - I

L	T	P
3	1	0

Industrial methods of polymerization such as bulk, solution, suspension, emulsion. Layout and arrangement of polymer plant. Developments in the automation of polymer plants

Concept of stereo-chemistry of polymers, stereo-specific polymerization. Catalyst – their utility in polymer manufacture, Zeigler Natta, Metallocene and other catalyst systems.

Manufacturing processes, properties and applications of various polyethylenes such as LDPE, HDPE, and their copolymer grades, polypropylene and it's copolymer grades.

Production technology, properties and application of polystyrene, PVC, and their copolymer grades.

Manufacturing details, properties and applications of various thermosetting resins such as phenol-formaldehyde, urea-formaldehyde and melamine-formaldehyde and preparation of moulding powders

References

1. Polymer Production, by Maya & Smith
2. Polymer Materials, by J. A. Brydson
3. Encyclopedia of Polymer Science & Tech., Vol 1-23, by Mark & Overberger
4. Handbook of Plastic Technology, Vol 1, by Allen W. S.
5. Metallocene based Polymers Vol II, by J. Scheries & W. Kaminsky
6. Polymeric Materials, by G. W. Ehrenstein
7. Polyolefins, by J. L. White & D. Choi
8. Industrial Polymers, by E. A. Campo

PL – 451 : SYNTHESIS OF POLYMERS LAB

L	T	P
0	0	6

Synthesis of polymers by various techniques, viz. bulk, solution, suspension and emulsion polymerization. Determination of molecular weight by viscosity.
Preparation of phenol- and urea-formaldehyde resins.
Preparation of unsaturated and saturated polyester resin and determination of acid value.

PL –501 : RHEOLOGY AND TESTING OF POLYMERS

L	T	P
3	1	0

Introduction to polymer rheology, Newtonian and non-Newtonian fluids, time independent and time-dependent fluids, elastic viscous fluids. Visco-elastic behaviour, dynamic and constitutive equations

Mechanical models, discussion of models for flow and deformation in polymers and treatment of measurable rheological properties.

Measurement of viscosity and normal stresses. Viscous heat generation. Interpretation of time-temperature sensitivity of viscoelastic solids and liquids. Rheometers.

Testing of polymers for their various properties viz. thermal, optical, electrical, and mechanical properties as per standard specifications, viz. ASTM, BS, IS and its importance, correlation of these tests with actual performance.

Introduction to polymer characterization by instrumental techniques such as IR, NMR, DSC, TGA, etc.

References

1. Non-Newtonian Fluids, by Wilkinson
2. Visco-elastic properties of polymers, by J. D. Ferry
3. The flow of high polymers, by Stantey Middleman
4. Applied fluid rheology, by J. Ferguson and Z. Kemblowski
5. Handbook of Plastics Test Method, by R.B. Brown
6. Handbook of Plastic Testing Technology, Brown and Vishnu Shah
7. Handbook of Plastics Test Methods, G.V. Eves, J.A. Mead, M.M. Riky.
8. Volume 8 of ASTM Standards, BIS Standards.
9. Introduction to Polymer Viscoelasticity, by John J. Aklonis and W.J. Mackmight
10. Melt Rheology & its Role in Plastics processing theory & applications, by John M. Dealy, Kurt F. Wissburn,
11. Flow Properties of Polymer Melts, by Brydson, JA,
12. Rheology, Principles, measurements and applications, by Christopher W.
13. Mechanical properties and testing of polymers, by G. M. Swallowe
14. Polymers and composite rheology, by R. K. Gupta

PL –502 : POLYMER PROCESSING – I

L	T	P
3	1	0

Processability of polymers and the role of rheology in polymer processing
Extrusion - basic operation and analysis, solids conveying, drag induced conveying, melting mechanism, power consumption in metering zone. Overall extruder performance, die and screw characteristics curves. Operation of single screw, twin screw, and co-extrusion systems. Design of barrel and screw for commodity, heat sensitive and engineering polymers.
Individual extrusion system viz. film, pipe, lamination, profiles, cables, etc. Casting of films. Reactive extrusion - Process details, basic principles equipment used, and applications.
Production polymer Foams like expanded polystyrene, polyurethane foams etc.
Compounding of polymers. Additives of compounding viz. fillers, plasticizers, colorants, stabilizers, blowing agents, flame-retardants, antioxidants, etc. Mixing, blending and compounding equipments. Finishing of Plastics.
Calendaring- description and features of calendaring process, calendar roll arrangements, application of calendaring.

References

1. Plastics Extrusion, by Allen Grief
2. Plastic Engineering Handbook (SPI), by Frados
3. Screw extrusion of Plastics, by Jacobi
4. Compression and Transfer moulding, Vol I, by Allen W. S.
5. Plastic Engineering, by R. C. CrawFord
6. Plastic materials and processes (a concise encyclopedia), by Charles Harper
7. Injection and Compression moulding fundamentals, by A. L. Isayev
8. Polymer Mixing and Extrusion Technology, by Nicholas Cheremisinoff
9. Modeling Of Polymer Processing, by Isayav
10. Plastics Extrusion Technology, Hanser SPE, 1996
11. Engineering With Polymers, by Powell

PL – 551 : POLYMER TESTING LAB - I

L	T	P
0	0	3

Testing of polymer samples as per IS, ASTM standards for mechanical properties like tensile strength, elongation at break, compressive strength, flexural strength, Charpy and Izod impact resistance, falling dart impact strength. Abrasion resistance of rubber sample.

PL – 552 : SYNTHESIS AND MODIFICATION OF POLYMERS LAB

L	T	P
0	0	6

Synthesis of copolymers based on common monomers like styrene, acrylates, maleic anhydride, acrylic acid and methacrylic acid, etc.
Preparation of phenolic moulding powder
Modification of epoxy resin, modification of natural polymers such as cellulose, rosin, natural rubber, etc. and determination of their characteristics
Depolymerization of waste thermoplastics such as polystyrene and polymethacrylate and characterization of the product

PL –601 : STRUCTURE AND PROPERTY OF POLYMERS

L	T	P
3	1	0

Basic structures in polymers. Effect of chemical composition and types of bonds structure of polymer, influence forces and molecular flexibility on polymer property. Molecular weight averages and distributions. Determination of molecular weight averages.
Orientation of crystalline and amorphous zones and study of its effects on polymer properties. Polymer single crystal, dimensions of polymer chain, degree of crystallinity and its measurement.
Polymer-in-solution: polymer-solvent interaction, good and poor solvents, solvents, intrinsic viscosity and Mark-Houwink equation, concept of fractionation processes.
Flexibility and movement of macromolecules, Glass transition temperature (Tg). Relationship between mechanical, thermal and morphological properties of polymers with the chemical structure.
Effect of copolymerization on properties. Degradation behaviour of polymers.

References

1. Polymer Science and Technology, by J.R.Fred
2. Introduction to polymer science, by F. W. Billmeyer
3. Properties and structure of polymers, by Tobolosky
4. Encyclopedia of Polymer science and Technology, H.F.Mark
5. Advanced Polymeric Materials: Structure property relationship, by G.O.Shonaike & S.G.Advani

PL –602 : POLYMER PROCESSING – II

L	T	P
3	1	0

Basic concepts of injection molding of thermoplastics. Types of injection units, machine layout, construction and specification of reciprocating screw injection molding m/c. Principle and theory of standard injection molding operation, molding cycle, screw plasticization, conveying output, screw drive principles, outline of mould features, clamping devices.

Process variables, temperature, pressure, injection rate, etc. and their importance for machine cycle and quality of product. Faults and remedies in injection molding, Injection molding of thermosets. Advances in injection molding.

Reaction injection moulding Process, its basic principles, process description and utility

Concepts of thermoforming process and various means of forming. Description of various thermoforming methods. Thermoforming process variables affecting the product quality. Thermoforming faults and remedies. Thermoforming machines.

General description of blow molding processes, type of blow molding machines, die shaping, parison control, process variables, problems and their remedies,

Stretch blow molding process. Concepts of stretching temperature, transparency, etc.

Rotational molding-description of process and features of rotational molding machines.

General description of compression and transfer molding and its applications in processing of thermosetting materials. Casting of polymers.

References

1. Plastic Engg. HandBook, by Frados
2. Injection and Compression Moulding Fundamentals, by Isayev
3. Encyclopedia of Polymer Science and Technology Vol. 1-23, by Mark & Overberger
4. HandBook of Injection Moulding, by Rosato & Rosato
5. Practical Thermoforming Principles & Applications, by J. Florian
6. HandBook of Plastic Technology, vol. I. by Allen W.S.
7. Plastic Engineering by R.C. Crawford

PL –603 : POLYMERIZATION ENGINEERING - II

L	T	P
3	1	0

General characteristics of commodity, engineering and high performance polymers. Monomers, chemistry of synthesis, manufacturing process, properties and applications of common engineering plastics such as ABS and polycarbonate, polyamides, polyesters, etc.

Monomers, chemistry of synthesis, manufacturing process, properties and applications of polyphenylene oxide, acetal resins, polysulphones and other specialty plastics.

Monomers, chemistry and manufacturing process of thermosetting resins such as epoxy, unsaturated polyesters and vinyl ester resins. Curing mechanism and its effect on properties and applications of polymers.

Synthesis and manufacturing of polyurethanes and fluorine-containing polymers, their properties and applications.

References

1. Polymer production, by Mayo & Smith
2. Polymer Materials, by J. A. Brydson
3. Encyclopedia of Polymer Science & Tech., Vol 1-23, by Mark & Overberger
4. Handbook of Plastic Technology, Vol 1, by Allen W. S.
5. Macromolecular synthesis, by J. R. Fllyott
6. Handbook of Plastic Technology, Vol 1, by Allen W. S. and G. M. Swallowe
7. Vinyl acetate emulsion polymerization and copolymerization with acrylic monomers, by H. Yildilin Erbil
8. Functionalization of polyolefins, by T. C. Mike Chung
9. The polyurethane book, by A . R. Stevelee
10. Plastic materials and processes (a concise encyclopedia), by Charles Harper
11. Handbook Of Thermoplastics, by Olagoke Olabisi
12. Polymers For High Technology, Electronics And Photonics, M.J. Bowden and S.R. Turner
13. Engineering polymers, R.W. Dyson Chapman Hall NY 1990

PL – 651 : POLYMER PROCESSING LAB

L	T	P
0	0	6

Installation of die, setting up and optimization of extrusion process for production of plastic film and pipe; study of various process variables on output.
Installation of mould on injection moulding machine, viz. hand operated and semiautomatic operated and setting up and optimization of process.
Compression moulding of moulding powder and rotational moulding.
Products from thermoforming and blow molding process.

PL – 652 : POLYMER TESTING LAB - II

L	T	P
0	0	3

Thermal properties like melt flow index, heat deflection temperature, vicat softening point, etc. Electrical properties. Rheological properties of polymer melts and solutions.

PL - 653 : SEMINAR

L	T	P
0	0	3

The students are required to prepare a presentation on a topic of latest developments/innovative technology and deliver it. They have to submit a dissertation report on the topic.

PL –701 : TECHNOLOGY OF ELASTOMERS

L	T	P
3	1	0

Sources and history of natural and synthetic elastomers, significant of structure of elastomers. Compounding ingredients and method of compounding, types of fillers, their characteristics and affect on rubber properties. Mechanism of reinforcement of elastomers. Mastication and processing techniques.

Production of different grades of natural rubber from latex, modified natural rubber and its derivatives. Application of latex, technically specified rubber, chemistry and technology of vulcanization.

Manufacturing processes, properties and application of synthetic elastomers viz. styrene-butadiene rubbers, acrylonitrile- butadiene rubber, butyl rubber, polychloroprene rubber.

Manufacturing processes, properties and application of ethylene-propylene rubber, polyurethane elastomers, chlorosulphonated polyethylene, polysulphide and silicon rubber, thermoplastic elastomers.

Industrial fabrication of rubber article such as transmission belts, hoses, tyres, dipped goods, compounding and processing techniques, direct manufacturer of articles from latex.

References

1. Rubber Technology & Manufacture, by C.M.Blow
2. Encyclopedia of Polymer Science and Technology Vol. 1-23, by Mark & Overberger
3. Rubber Technology, by Maurice Morton
4. Chemistry & Technology of Rubber, by Nonton
5. Natural & Synthetic Rubber, by P.W.Allen
6. Synthetic Rubbers, by D.C. Blacklay

TPL –702 : PLASTIC PRODUCT AND MOULD DESIGN

L	T	P
3	1	0

Design of polymeric products, design criteria based upon product functions and geometry, material selection by property assessment, selection of appropriate forming processes.

Moulding consideration : Draft, Radii, dimensional tolerances, wall thickness, ribs and bosses, inserts, sink marks, undercuts, feeding system, gate location, flow pattern, shrinkage and post moulding shrinkage.

Injection mould design: single, multicavity, semi automatic and automatic moulds, Types of injection mould, their applications, detailed structure and working. Material section for mould making. Mould making processes.

Design concepts for compression moulds, transfer moulds. Types of extrusion dies and their design

Concept of CAD/CAM in product design moulding and plastic. Modeling and Simulation applications for processing such as mouldflow etc.

References

1. Plastic Product Design, by R. D. Beck
2. Injection mould Design, by R.G.W. Pye
3. Plastic Mould Engg, Hand Book, by J. H. Dubois & W. I. Pribble
4. Dies for Plastic Extrusion, by M. V. Joshi
5. Injection Moulding Hand Book, by Rosato & Rosato

PL –703 : POLYMERIC ADHESIVES AND SEALENTS

L	T	P
3	1	0

Introduction to polymeric foams and adhesive, adhesion and adhesive joints, Advantages and Disadvantages of adhesive bonding over conventional joining techniques, theory and mechanism of adhesion.

Surface characterization, surface preparation and surface treatments for various substrates. Techniques for evaluation of adhesives.

Principle of adhesives formulation and production techniques, Adhesives formulation for various industries viz. construction, packaging, textiles, automotive, consumer, abrasives and friction material shoes, electrical, aerospace, etc. types of polymeric foams, viz. expanded polystyrene, polyurethanes, polypropylene, etc.

Hot melt, polymerizing, solution, solvent-activated anaerobic and pressure sensitive adhesives, etc. Bonding of polymeric materials to various substrates

Sealants, caulks, Mastics, Type of sealants, curing of sealants, properties and formulation relevant to different application.

References

1. Adhesives, by Skiest
2. Industrial Cold Adhesive, by Roga Dulac
3. Handbook of Adhesives Raw material, by Ernest W. Flick
4. Sealants & Adhesives, by H.A. Perry

OE – : OPEN ELECTIVE – PLASTIC TECHNOLOGY

L	T	P
3	1	0

Polymeric Materials and their macro molecular nature (e.g. Plastics, rubber, fibers), concept of polymer structure, classification of polymers.
Principle of addition and condensation polymerization, different techniques of polymerization, chemistry and kinetics of polymerization.
Chemistry and manufacturing process of some important polymers such as phenol-formaldehyde, urea-formaldehyde etc. Mechanical, thermal & electrical properties of polymers.
Chemical & Physical methods of processing of polymers, scope of polymeric materials industries in India, cost and availability of various plastics raw materials.

References

1. Polymer Science and Technology, by J.R.Fred
2. Introduction to polymer science, by F. W. Billmeyer
3. Properties and structure of polymers, by Tobolosky
4. Principles of Polymerization, by G. Odian
5. Plastics Materials, by J.A. Brydson
6. Plastic Engg. HandBook, by Frados

PL – 751 : POLYMER CHARACTERIZATION LAB

L	T	P
0	0	6

Determination of molecular weight and molecular weight distribution by viscometry.
Determination of K-value of PVC.
Study of rhelogical properties of concentrated polymeric solution by Brook field viscometer and rheoviscometer under variable shear rates.
Characterization of common polymers by thermal techniques viz. Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), etc.
Study of UV stabilization of polymer samples by UV-visible spectrophotometer.

PL – 752 : INDUSTRIAL TRAINING AND REPORT PRESENTATION

L	T	P
0	0	3

The students are required to undergo training in industries/research organizations for six weeks during summer vacations after sixth semester and submit a report for presentation/evaluation.

PL – 753 : PROJECT / DISSERTATION

L	T	P
0	0	3

The student(s) will be required to search literature pertaining to design of an equipment/process of a chemical product/production, comprehend it and prepare a report for assessment.

PL –801 : POLYMER COMPOSITES

L	T	P
3	1	0

Introduction to composite materials, comparision of different materials with composites-advantages and disadvantages. Principles of composite reinforcement. Effect of fibrous reinforcement on composite strength.

Types of reinforcement such as natural, glasses, carbon/graphite, aramid fibers, high strength and high modulus fibers. Surface treatment and various forms of fibers.

Thermosetting and thermoplastic materials for the composites and their selection for a particular application

Processing and production techniques like hand-layup, bag moulding, filament winding and pultrusion

Prepegs, their manufacture and characterization. Sheet moulding and dough moulding compounds and their processing. Preform and resin transfer mouldings. Hybrid and sandwich type composites.

References

1. Hand Book of Composites, by George Lubin
2. Hand Book of Fibre glass and Advanced Plastic Composites, by G. Lubin
3. Reinforced Thermoplastics, by W.V. Titov
4. Engineering Design for Plastics, by Eric Baer
5. Glass Engineering Hand Book, by E.S. Shend
6. Plastics and Composites welding Handbook by Grewell, Benatar & Park
7. Polymer and composite Rheology by R. K. Gupta
8. Reinforced Plastic Handbook by Rosato & Rosato

PL –802 :ADVANCED POLYMERIC MATERIALS

L	T	P
3	1	0

Role of polymers for high-tech areas such as light emitting diode, OSR in satellite communication, photovoltaic etc.
High temperature polymers such as polyimides, polyether-imides, PEEK, silicone etc, their preparations, properties & applications.
Liquid Crystalline Polymers- their synthesis and properties of such polymers and applications, self reinforced composites.
Polymer blends and alloys, theories of polymer miscibility, various commercial blends and their applications, reactive blending
Concept of nanofillers and polymer nanocomposites. High energy absorbing polymer. Super absorbent polymers - their synthesis, properties and applications. Polymers for biomedical applications.

References

1. Polymer Production , by Mayo Smith
2. Encyclopedia of Polymer Science and Technology Vol. 1-23, by Mark & Overberger
3. Plastics Materials, by J.A. Brydson
4. Polymer Science, by Gowarikar, Viswanathan & Jayadev
5. Macromolecular Synthesis, by J.R. Fllyott
6. Hand Book of Fibre glass and Advanced Plastic Composites, by G. Lubin
7. Hand Book of Composites, by George Lubin
8. Polymer modification by John J. Merister
9. Polymer gels and Network by Yoshihido osada
10. Fictionalization of Polyolefins by T.C. Mike Chung
11. Polymer Blends Hand Book – Vol. I & II, by L.A.Utracki

ELECTIVE

PL – 011 : PLASTICS PACKAGING AND FOAM

L	T	P
3	1	0

Introduction to packaging, scope and frictions of a package, advantages and disadvantages of polymeric packages over conventional packaging materials.

Foams of packages, selection criteria of suitable polymeric packages for oils, fats and allied products, soaps and detergents, cosmetics, food, dairy products, beverages, medicines, chemicals, paints, household and industrial goods, etc. printing on polymeric packages.

Testing, quality control and developments in polymeric packaging.

Introduction to rigid foam, chemistry & physical formation, forming ingredients, their effect on foam morphology and physical properties of cellular plastics.

Polyurethane foam (rigid & flexible), Polystyrene foams, Epoxy foams. Recent developments in foam technology.

References

1. Hand Book of Polymer Science and Technology – V0l. 4, by N.P.Cheremisinoff
2. Comprehensive Polymer Science – Vol. 7, by Sir Geoffrey Allen
3. Plastics films and packaging, by C.R.Oswin
4. Science and Technology of Polymer films, by J.F.Hamlin
5. Protective Wrapping, by C.R.Oswin

PL – 012 : PLASTIC WASTE MANAGEMENT

L	T	P
3	1	0

Plastics & environment value addition, Global policy, regulation, waste energy management. Recycling & recovery of various plastics items/materials their effect on environment.
Biodegradable polymers- prospects & utilization, renewable resources.
Biodegradable programs for various applications viz. food packaging, agriculture, etc.
Waste treatment of various plastic plants, estimation of power requirement & efficiency of size reduction operation of plastics, environment pollution.

References

1. Environmental effect on polymeric materials, by Dominick V. Rosato & Robert T. Schwartz
2. Plastic waste management and environment, by V.P.Malhotra
3. Synthetic Rubber Waste Disposal, by L.D.Dougan & J.C.Bell
4. Plastic waste and its recovery, by M.E.Bocqueye

PL – 013 : FIBER TECHNOLOGY

L	T	P
3	1	0

Introduction to natural and synthetic polymers. Essential characteristics and molecular architecture of fiber forming polymers.
Concept of order in polymers, crystallinity, orientation, physical structure of natural and manmade fibers, optical properties.
Melt spinning, dry and wet spinning of fibers. Fiber drawing, heat setting, texturing and mechanical properties of fibers based on viscose, cellulose acetate, polyamides.
Manufacturing details, properties and applications of fibers based on polyester, acrylic, polypropylene, glass and carbon-fibers.
General principles of finishing and dyeing of fibers. Common types of finishes applied to textile fibers. Dyeing of synthetic fibers in loose and yarn form, carrier dyeing, high temperature dyeing, thermosets process, acid and base dyeing.

References

1. Man made fibers, by Monkrieff
2. Hand Book of composites, by George Lubin
3. Hand Book of fiberglass and advanced plastics composites, by G. Lubin

PL – 014 : POLYMERIC COATINGS

L	T	P
3	1	0

Origin and development of surface coating, constituents of paint, varnishes and lacquers. Functions of coatings and mechanism of film formation. Characteristics of natural and synthetic film formers.

Pigment and pigmentation. Dispersion techniques. Fundamentals of coating formulation based on natural and synthetic polymers, role of wetting agents, driers, solvent and plasticizers in coatings.

Surface preparation and pretreatments. Rhelogical behaviour of coatings. Applications methods and curing techniques.

Specialty coatings like water based, powder and high solid, etc. Industrial and architectural finishes.

References

1. Organic Coating Technology Vol. I & II, by H.F.Pyne
2. Surface Coating, by OCCAA
3. Protective and Decorative coatings, by J.J.Mattiello
4. Paint and Varnishes Production Manual, by V.C.Bidlack & E.W.Fasig

PL – 851 : PROJECT

L	T	P
0	0	12

The student(s) will be required to prepare a detailed project report on fabrication of an equipment/process of a plant for production of chemical product in relevant area with complete lay-out and economic analysis for assessment.

PL – 852 : EDUCATIONAL TOUR

Students will be taken to the visit of industries/research organization, in their field of specialization, during the vacation period