Proceedings of Adhoc BOS of M.Sc. Chemistry with specialization in Polymer Science and Chemical technology

A meeting of adhoc BOS was held on 16/08/2019 in the Department of Chemistry, C.C.S.U., Meerut at 10.00 am. The following members were present:

1. Dean Faculty of Science
   Ch. Charan Singh University, Meerut
2. Prof. P.C. Thapliyal
   Senior Principal Scientist & Professor
   CBRI Institute, Roorkee
3. Prof. Om Prakash
   Dept. of Chemistry
   Kurukshetra University, Meerut
4. Prof. R. K. Soni
   Department of Chemistry
   C.C.S.U., Meerut

The committee considered the old syllabus of M.Sc. (PSCT) and several changes were made in the syllabus. The revised copy is enclosed. The following changes were made:

1. Papers of Organic Chemistry and Physical Chemistry have been included in M.Sc. Chemistry (PSCT) I semester.
2. Polymer Characterization paper has been shifted to semester II with modifications as 'Analytical Techniques'.
3. The important contents of the two papers namely Chemical Technology and Polymer Viscoelasticity have been included in other papers and these two papers have been thus removed.

The syllabus was approved by BOS unanimously for the academic session 2019-2020 and onwards. The Dean, Faculty of Science and Coordinator together were authorized to make petty changes after the approval of Honourable Vice Chancellor if required.

16/8/19
(Dean Faculty of Science)
C.C.S. University, Meerut

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C.C.S.U., Meerut

V.C.

Sir, may kindly approve the proceedings & allow to place before the Academic Concil meeting scheduled to be held today on 16/8/19.

16/8/19
Approved VC

16/8/19

16.8.19

Syllabus

of

M.Sc. Chemistry

With

Specialization in Polymer Science & Chemical Technology

(2019)

Department of Chemistry

Ch. Charan Singh University, Meerut.

S.No	Paper code	PSCT Paper name	Internal marks	External marks	Total
		First semester			
1	1001	Polymerization	50	50	100
2	1002	Properties of Polymers	50	50	100
3	1003 N	Organic Chemistry	50	50	100
4	1004 N	Physical Chemistry	50	50	100
5	PSCT-1005	Polymer Practical 1st semester		100	100
		Second semester			
1	2001	Synthesis and application of polymer	50	50	100
2	2002 N	Analytical Techniques	50	50	100
3	2003 N	Polymer Processing	50	50	100
4	2004 N	Polymer testing and specifications	50	50	100
5	PSCT- 2005	Polymer practical 2nd semester		100	100
		Third semester			
1	3001	Rubber technology	50	50	100
2	3002	Tyre Technology	50	50	100
3	3003	Polymer blends and composites	50	50	100
4	3004	Fibre Technology	50	50	100
5	PSCT-3005	Polymer practical 3rd semester		100	100
		Fourth semester			
1.		Research Project		600	600

SEMESTER I

PSCT (1001) Polymerization

Unit-1

Historical development of polymer material: Natural and synthetic polymers, Evolution of vinyl plastics, Raw materials for plastics, Market & Future of plastics, Chemical nature of plastics.

Introduction, thermoplastic & thermosetting behavior and types of polymerization – addition, condensation, ring opening, ionic polymerization, coordination polymerization, Ziegler Natta catalysis.

Unit-2

States of aggregation in polymer: Introduction, linear-amorphous, crystalline, polymer (cross-linked structure and polymer blends & polymer composites, introduction to block & graft copolymers.)

Unit-3

Radical polymerization: Initiation, growth, termination, kinetic and molecular chain lengths and distribution of molecular weights.

Radical Copolymerization: Instantaneous copolymer composition equation, azeotropic systems, alteration, Copolymerization to high conversion, Remote unit effects, Polycomponent system, polymerization kinetics studies, polymer branching and end group measurements, degradation, configuration and conformation, crystalline, amorphous regions in polymers, longitudinal acoustical modes, molecular orientation – orientation functions, experimental, application, biaxial orientation.

Unit-4

Stepwise polymerization- General principles, condensation and rearrangement process, dependence of degree of polymerization on extent of reaction, importance of stoichiometry and impurities and ring opening polymerization.

Stereo chemical consideration: Diffusion control of termination, propagation polymer chain, transfer reactions, chain branching.

Unit-5

Polymerization technique: Introduction to polymerization on a commercial scale-bulk, solution, dispersion, suspension, and emulsion, solid state polymerization, phase transition, polymerization method.

PSCT (1002) Properties of polymers

Unit-1

Molecular weight determination: Introduction, average molecular weights, Colligative methods-theoretical background, apparatus for determination of molecular weight by Colligative methods, End group analysis- determination of the carboxyl and the amino groups of a polyamide, light scattering methods-theoretical background, light scattering instruments, Differential refractometry, experimental aspects of light scattering and application to polymer solutions, viscometric methods, limiting viscometry number, analysis of viscosity data.

Unit-2

Relation of structure to thermal and mechanical properties: Introduction, factors affecting the glass transition temperature, factors affecting the ability to crystallize, factors affecting the crystalline melting point, some individual properties.

Unit-3

Relation of structure to chemical properties: Introduction, chemical bonds, polymer solubility, chemical reactivity, ageing and Weathering, Diffusion & permeability, toxicity, fire & plastics.

Unit-4

Relation of structures to electrical & optical properties: Introduction, Dielectric constant-Power factor & structure, electronic application of polymers, electrically conductive polymers, LEDs, Optical properties.

Unit-5

Additives for Plastics: Introduction, fillers, plasticizers and softeners, lubricants and flow promoters, anti-ageing-antioxidants, ultra violet and related materials additives, flame retarders, blowing agents, photodegradation, cross-linking agents, sealants.

PSCT (1003) Organic Chemistry

Unit-1 Basics of Organic Chemistry

Types of mechanisms, thermodynamic and kinetic requirements, Hammond's postulate. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. Effect of structure on reactivity-resonance and field effects, inductive effect, steric effect, quantitative treatment.

Unit-2 Stereochemistry

Structural isomerism, stereomerism, geometrical isomerism (E and Z nomenclature), optical isomerism. optical activity, meso compound, specific rotation, chirality, chiral center, enantiomers, diasterioisomer. D, L, R, S, threo, erythro rotations, conformation and configuration, dihedral angle, conformational analysis of ethane, n-butane, cyclohexane, mono and di substituted cyclohexanes, Epimers, Anomers, Mutarotation, basic idea of stereospecific and stereoselective reactions.

Unit-3 Types of Organic Reactions

Substitution, S_N1, S_N2, and S_Ni, neighboring group participation, addition, elimination, E1, E2 and E1cb, with stereochemical aspects and effect of solvent, temperature, concentration; nucleophilic substitution vs. elimination.

Unit-4 Aromatic Hydrocarbons

Aromaticity: Huckle's rule, aromatic character of arenes, cyclic carbocations/carbanions with suitable examples. Electrophilic aromatic substitution: halogenations, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups. Nucleophilic substitution in aromatic compounds.

Unit-5

Oil and fats: Structure and applications of Vegetables oils, solvent and other extraction processes, processing of animal fats, hydrogenation and transesterification.

Soaps and detergents: Detergents, fatty acids, fatty alcohols, soaps, essential oils, alkaloids, terpenoids, cellulose, starch, perfumes and cosmetics, manufacturing of glycerin.

PSCT (1004) Physical Chemistry

Unit-1

Solutions and Colligative Properties: Dilute solutions; lowering of vapour pressure, Raoult's and Henry's laws and their applications. Thermodynamic derivation using chemical potential to derive relations between the four Colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) depression of freezing point, (iv) osmotic pressure] and amount of solute, surface active agents and surface excess; emulsions, CMC, stability and factors affecting, Microemulsion and suspension.

Unit-2

Conductance: Quantitative aspects of faraday's laws of electrolysis Arrhenius theory of electrolytic dissociation, Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of

ions, Debye-Huckle-Onsager equation, Wein effect, Debye-Falkenhagen effect, Walden's rules.

Unit-3

Photochemistry: Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficient, Laws of photochemistry, quantum yield.

Unit-4

Phase Equilibria: Concept of phases, components and degrees of freedom, derivation of Gibbs Phase rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its application to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems (H_2O and S), with applications, phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, Three component systems; triangular plots, water-chloroform-acetic acid system.

Unit-5

Surface Chemistry: Physical adsorption, chemisorption, adsorption isotherms (Langmuir and Freundlich), nature adsorbed state, Qualitative discussion of BET.

I Semester

Polymer Practical

1. To prepare urea-formaldehyde resin
2. To prepare aniline formaldehyde resin
3. To prepare Bakelite plastic
4. To prepare resol resin
5. To prepare Novolac resin
6. To prepare polystyrene by bulk polymerization techniques
7. To prepare polystyrene by solution polymerization technique
8. To prepare polystyrene by emulsion polymerization techniques.
9. To prepare polystyrene by suspension polymerization techniques.
10. To prepare viscocity average molecular weight of polymer with the help of Ostwald viscometer.

SEMESTER II

PSCT (2001) Synthesis and Application of Polymers

Unit-1

Introduction: General introduction to industrial polymer, historical overview, raw material for the polymer industry, application of polymer as plastics, rubber fibers etc.

Brief introduction to the preparation, structure, properties and applications of the followings.

Polyolefin's: Introduction, polyethylene, polyvinyl chloride, polyvinylidene, chloride, polytetrafluoroethylene, polypropylene, polyisobutylene, polystyrene, polyvinyl diene, polybutadiene, polyisoprene and polychloroprene.

Unit-2

Olefin Copolymers: Introduction, styrene acrylonitrile copolymers, acrylonitrile butadiene styrene terpolymers, ethylene – methyl metha acrylic acid copolymers, styrene butadiene rubber, nitrile rubber, ethylene propylene elastomers, butyl rubber, thermoplastic olefin, elastomers, fluoro-elastomers.

Unit-3

Acrylic: *introduction*, polyvinyl acetate, polyvinyl alcohol, polyvinyl formate, polyvinyl pyrrolidene, polyvinyl carbazole.

Polyurethanes: Introduction rigid polyurethane foam, polyurethane coatings, flexible polyurethanes foam, polyurethane elastomers.

Unit-4

Polyesters: Introduction, polyethylene terephthalate, polybutylene terephthalate, poly-dihydroxymethyl cyclohexyl terephthalate, cellulose esters, unsaturated polymers, aromatic polyesters, polycarbonate.

Polyamides: introduction, aliphatic polyamides, aromatic polyamides, polyamides, imides and polyimides.

Heat resistant polymers: Introduction, sulphide polysulfene, polyphenyl imidazole.

Unit-5

Silicones and other inorganic polymers: Silicones, polyphosphazene, polythiazyl.

Functional polymers: Introduction, photoconductive polymers, electroconductive polymers, piezoelectric polymers, light sensitive ion exchange resins, polymeric reagents.

PSCT (2002) Analytical Techniques

Unit-1 Ultraviolet Visible Spectroscopy

Various electronic transitions (185-800 nm), Beer-Lambert law, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes., Fieser-Woodward rules for conjugated dienes and carbonyl compounds ultraviolet spectra of aromatic and heterocyclic compounds, steric effect in biphenyls.

Unit-2 Infrared Spectroscopy Instrumentation and sample handling

Characteristic vibrational frequencies of alkanes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines, detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds), effect of hydrogen bonding and solvent effect on vibrational frequencies.

Unit-3 Nuclear Magnetic Resonance Spectroscopy

General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanisms, of measurement chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercapto), intensity of NMR reagents, chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra) virtual coupling, stereochemistry hindered rotation, Karplus curve variation of coupling constant with dihedral angle. Simplification of complex spectra, nuclear magnetic double resonance, contact shift reagent, solvent effects, Fourier transform technique, nuclear overhauser effect (NOE)

Unit-4 Carbon-13 NMR Spectroscopy

General considerations, chemical shift (aliphatic, olefinic, alkynes, aromatic, heteroaromatic and carbonyl carbon), coupling constant, introduction to 2 D NMR

Unit-5 Electron Spin Resonance Spectroscopy

Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron)

Unit-6 Thermal Analysis

Introduction DSC, DTA, TGA and DMA; basic principle and instrumentation. Application in polymer systems.

Unit-7 Optical Microscopy

Basic principle of SEM and TEM, SEM imaging, sample preparation, TEM direct examination and indirect examination.

PSCT (2003) Polymer Processing

Unit-1

Principle of mixing and mixers: Introduction, mechanism of mixing, practical mixing variables.

Types of mixers: Roll mill, Kneader, sigma mixers, high speed mixers, internal batch mixer, ball mill, blender and extruder.

Unit-2

Extrusion: General features of single screw extruders, constructional features of dies, equipment for extrusion of monofilaments, tubes, rods, pipes, blown film, flat film, sheet, wire and cable covering, extrusion coating.

Calendaring: Introduction, calendar configuration and operations, calendar roll temperature control, roll deflection and methods of correction.

Unit-3

Compression and Transfer Moulding processes: Machine description study- Compression moulding machine – types – principles of operations- sources of heat and pressure moulding cycle – meaning of terms bulk factor- and flow properties as applied to moulding materials- the interplay of heat, pressure, friction, catalysts, etc., for thermosetting materials

Unit-4

Injection moulding process: Machine description study – Types and limitations – Working principles- Constructional features- Specifications maintenance- types starting and shut down procedures – press capacity. Hydraulics – basic principles hydraulic systems as used in injection moulding machine hydraulic oil requirements – safety rules, General constriction, types of injection moulds.

Unit- 5

Blow moulding process: Introduction, types of blow moulding – injection blow moulding, extrusion blow moulding, rotational moulding and thermoforming.

Decoration of plastics: Electroplating, Machining of plastics, Paintings, vacuum metallization & finishing.

PSCT (2004) Polymer Testing & Specifications

Unit-1

Fundamentals of Polymer testing: Introduction, methods of testing polymers and polymer products, specification & standards professional and testing organizations.

Test Piece Preparation: Cutting flexible material, buffing, machining rigid materials, dimensional measurements and gravimetric measurements.

Processing Properties: Difference in approach to processability of plastics and rubber, capillary viscometers, rotational viscometers, miniature, Processing machine, torque rheometers, compression Plastimeters, plasticity retention, rotations and oscillating rotor Plastimeters, extrusion Plastimeters, tack testing, scorch and cure rate, tests on latex.

Unit-2

Mechanical Properties: Hardness Durometer, dead load instruments and other indention tests, static stress and strain measurements, tensile machines, grips and jigs, extensiometry environmental cabinets, dynamic stress and strain properties, forced vibrations machines, free vibration machines, rebound resilence, impact strength falling weight, Charpy and Izod, tensile impact. Frictio abrasion, creep, stress relaxation of rubber, dynamic fatigue of cellular materials, dynamic fatigue of plastics, static fatigue of plastics.

Unit-3

Electrical properties: Resistance & resistivity, insulating materials, conductive materials, electric strength, resistance to surface discharges and tracking, surface charge and discharge measurements, permittivity and power factor.

Thermal properties: Specific heat, thermal conductivity, thermal diffusivity, transfer coefficient, effect of temperature, thermal expansion, Glass transition temperature, softening and melting point, low temperature tests, modulus tests, heat ageing and conditioning, air ovens, liquid bath, oxygen bombs.

Unit- 4

Environmental Resistance: Humidity, effects of liquids, effect of ozone, light ageing and weathering, fire testing, smoke, oxygen, index test.

Optical Properties: Microscopy, stereo bimolecular, microscopes, standard microscopes, Microtomes, electron microscope, Ultramicrotomy.

Unit- 5

Permeability: Vapour permeability, gas permeability.

Chemical Properties: Chemical resistance, Extrusion, swelling, adhesion, corrosion, staining, chromatography, Gas chromatographs, High performance liquid chromatography.

SEMESTER II

Polymer Synthesis Practical

1. To prepare polyacrylonitrile polymer by solution polymerization technique.
2. To prepare PMMA sheet.
3. To prepare thiocol rubber
4. To determine K value of PVC region.

Analytical Techniques Practical

1. To verify Lambert's Beer's Law with the help of U.V. visible spectrometer.
2. To determine the concentration of unknown sample with the help of U. V. visible spectrophotometer.
3. To determine λ_{max} of a given sample.
4. To determine the concentration of Na^+, Ca^+, K^+ with the help of flame photometer.
5. To scan the U.V. visible spectra of unknown sample with the U.V. visible spectra of unknown sample with the U.V. –visible double beam spectrophotometer.
6. To determine the calorific value of unknown sample.
7. To determine the degradation peak, T_g, T_m of unknown sample.
8. To determine kinematics viscosity of plasticizer with the help of Redwood viscometer.
9. To determine the dynamic viscosity of polymeric plasticizer at different temperature with the help of Brookfield viscometer.
10. To separate the chlorophyll pigments with the help of TLC.
11. To separate the chlorophyll pigments with the help of paper chromatography.
12. To separate the amino acids with the help of TLC.
13. To separate the lead anions and cations with the help of paper chromatography.

Polymer Processing Practical

1. To prepare PVC sheet with the help of compression molding machine.
2. To prepare PVC compound.
3. To prepare natural rubber sheet.
4. To prepare nitrile rubber sheet

5. To prepare nitrile-PVC rubber sheet.
6. To prepare E.P.D.M. rubber sheet.
7. To prepare hypalon rubber sheet.
8. To prepare neoprene rubber sheet.

SEMESTER III

PSCT (3001) Rubber Technology

Unit-1

A historical introduction on the application of latex and rubber for the manufacturing of rubber goods, an introduction to compounding, classification of materials.

Rubber additives and compounding: Vulcanizing agents, activators, accelerators, fillers, plasticizers, softeners, antioxidants, peptisers, retarders, stiffeners, flame retarders, colors and pigments, tackifying agents, blowing agents etc, compound development and compounding of rubbers.

Unit-2

Natural rubber: Introduction, types of natural rubber, natural rubber latex, concentration and stabilization of latex, latex processing and applications, latex compounding from latex.

Diene Homopolymer rubbers: Synthesis of monomers- isomerism in diene rubber-characterization of microstructure, polymerization of dienes structure and properties of diene rubber.

Unit-3

Styrene butadiene rubber (SBR): Introduction, manufacturing of butyl rubber, properties of butyl rubber, butyl rubber compounding, halogenated butyl rubber and application.

Nitrile and polyacrylic rubber: Introduction, manufacturing of nitrile rubber, properties of nitrile rubber, application of nitrile rubber, mixing and processing of nitrile, polyacrylic rubber, manufacturing of polyacrylic rubber, compounding and processing of polyacrylic rubber.

Unit-4

Neoprene and Hypalon rubber: Introduction, commercial neoprene-compounding, processing and application of neoprene latex, Hypalon-manufacturing process, processing of Hypalon rubber, properties and application of Hypalon rubber.

Silicon rubber: Introduction, types of silicon rubber, vulcanization, compounding of silicone rubber, liquid silicone rubber compounding, relation properties of silicon rubber, application of silicon rubber.

Unit-5

Reclaimed rubber: Introduction, types of reclaimed, evolution of reclaiming process, dynamic revulcanization, advantages of using reclaimed rubber, reclamation of waste, rubber from latex waste.

PSCT (3002) Tyre Technology

Unit-1

Introduction: Current status of the tyre industry in India and its future prospects, characterization, performance and the basis of materials required for the construction of solid tyres for light and heavy vehicles, pneumatic tyres for bicycles and light motor vehicles, tyres for heavy motor vehicles, off the road tyre, and air craft tyre, component parts and relative merits for different tyres of automotive tryes such as cross-ply, Bias-belted, concentrates, minter and tubeless tyres.

Unit-2 Design and Sizing: Factors to be considered in the designer of tyres-safety requirements tread life requirements, vehicle weight distribution and load carrying capacity, desired inflation, pressure of operation, axle height and clearance for the basis, suspension and breaking system.

Unit-3

Tyre Sizing: General system for indicating tyre dimensions-typical compound formulations with different elastomers and reclaimed rubbers for the production of the component parts of the different tyres. Compounding techniques and procedures for the production of different components/compounds required for various components of tyres.

Unit-4

Manufacture of tyre components and tyre construction: Manufacture of cycle tryes and tubes, automotive tubes, tyre treads, beads, carcass, side walls adhesive solutions and misc. components.

Unit-5

An introduction to tyre building and building drum Building of standard diagonal ply tyres, belted bias tryes and redial ply tryes. Tyre moulds, shaping machines, curing bags, bladders and diaphragms. Preparation of raw tyres for vulcanization, Tyre curing, curing plastics-autoclave and pans, ordinary pressures, bagomatic and autoform cure temperature and times after treatment.

PSCT (3003) Polymer Blends and Composite

Unit-1

Classification, methods, properties and applications: Polymer blends classification, principles of polymer compatibility, different theories of predicting compatibility, factors governing compatibility, compatibilisers, properties achieved by blending. Methods of blending, characterization of blends, commercial polyblends their properties and applications, crystallization in polyblends, morphology of blends and its determination. Introduction to rheology of polymer blends its relevance in processing, rheology phase, morphology relationships and their relevance.

Unit-2

Classification, methods, properties and applications: Classification of composite, particulate and fibrous composite, introduction to reinforcing material, particulate filled composites, mechanical and physical properties, environmental effects on composites, test methods for composites, applications of composites, ceramics, refractories.

Unit-3

Enhancement of polymer miscibility: Compatibilization, reactive compatibilization, non-reactive compatibilization, modification of structures, incorporation of block and graft copolymers, interpenetrating network formation, cross-linking, introduction of interacting groups.

Unit-4

Criteria for selection of polymers: Physical and chemical properties, miscibility, polydispersity, molecular weight distribution, enthalpy of mixing, polarity, energy parameters, lower critical solution temperature (LCST), upper critical solution temperature (UCST), crystallization.

Utilization of miscible polymers: Industrial examples, mechanical compatibilities versus miscibility in polymer blends.

Unit-5

Structural application of composites: Aerospace applications, transportations, marine, infrastructures, constructions, sporting goods, composites, clean energy generation.

PSCT (3004) Fiber Technology

Unit-1

Introduction to natural and synthetic polymers. Essential characteristics of fiber forming polymers.

Melt spinning process: Melt-extrusion, spinning conditions such as spinneret size, rate of extrusion, spinning stretch and its effect on filament structure and properties with special reference to polyamide and polyester fibers.

Unit-2

Polyamide fibers: Introduction to important polyamides, polyamidation reaction, Synthesis of nylon-6 and 66, production of newer nylons.

Polyester fibers: A detailed study of polyester, Esterification and poly-condensation reactions, industrial process for fiber production of PET and copolyesters

Unit-3

Viscous Rayon: A detailed study of the manufacture of regenerated cellulose fibers, Specification for raw materials. The formation and chemical constitution of alkali cellulose, ageing of alkali cellulose, cellulose xanthate and the xanthation reaction, the ripening process and its effect on molecular structure. Coagulation and the effect of variations in the composition of the coagulation bath on fiber properties, self crimping of fibers. High tenacity and polynosic fibers.

Cellulose Acetate fiber: Introduction to raw materials. Acetylation and hydrolysis of cellulose into primary and secondary acetate. Manufacturing of cellulose acetate. Commercial production methods. Preparation of dope, spinning and solvent recovery. Solution properties of triacetate and secondary acetate, Spinning stretch and its effect on orientation.

Unit-4

Fibers from addition polymers: Polyethylene, polypropylene and fibers based on polyacrylonitrile, copolymers for fiber production, polyvinyl alcohol fibers, Elastomeric fibers of spandex type, chloro fiber, bicomponent fibers.

Fiber production and post-spinning operation; Drawing effect on orientation and crystallization. Principles of setting of fibers and fabrics. Production of staple yarns on various systems. Problems of blending, static problems and remedies. Melt spinning and wet spinning of fibers, fiber drawing heat setting, texturing and mechanical properties of fibers.

Unit-5

Dyeing and finishing: chemistry and application of common dyes to natural and synthetic fibers. Bath, semi-continuous dyeing operations. Central principles of finishing and common types, applied to textiles-their theory and practice.

SEMESTER III

Polymer Testing Practical

1. To determine the S-content of polymer sheet.
2. To determine M.F.I. of Polypropylene.
3. To determine the impact strength of PVC sheet with the help of Izode impact strength.
4. To determine flash point of plasticizers.
5. To determine hydroxyl value of polymer.
6. To determine acid value of polymer.
7. To determine amine value of polymer.
8. To determine aniline point of plasticizers.
9. To determine volatile loss polymer.
10. To determine the compatibility of PVC sheet with the help of Loop-compatibility.
11. To determine migration loss of PVC sheet at different solvents as water, 10% NaOH solution, petrol, etc.
12. To determine dry rubber contents of latex.
13. To determine M.F.I. of PVC.
14. To determine thermal stability of PVC sheet with the Congo red method.