# SCHEME OF TEACHING AND EXAMINATION (2016-2017)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Subject</th>
<th>Teaching Hours per Week</th>
<th>End Term</th>
<th>Mid Term</th>
<th>Total Marks</th>
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<tr>
<td>CHE 701</td>
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<td>3  1  -  4</td>
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**Practicals**

<table>
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<tr>
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<th>Mid Term</th>
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<tr>
<td>CHE 751</td>
<td>Process Plant Design-III</td>
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<td>Project Work</td>
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| Total | 12  | 4  | 8  | 21  | 200 | 325 | 525 |

**Departmental Elective -I**

1. Analytical techniques
2. Polymer Science and Engineering

**Department Elective-II**

1. Alternate Energy Technology
2. Low Temperature Engineering
3. Plant Utilities
### SCHEME OF TEACHING AND EXAMINATION (2016-2017)

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<tr>
<td>CHE 801</td>
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#### Practicals

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<tr>
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<td>Project Work</td>
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**Total**

| | 12 | 4 | 7 | 23 | 250 | 275 | 525 |

*All independent/self study courses shall be graded in terms of ‘S’ (Satisfactory) or ‘X’ (Repeat).*

#### Departmental Elective III

1. Petrochemicals Technology  
2. Nano Technology  
3. Complex Flow Hydrodynamics  
4. Fluidization Engineering  
5. Polymer Synthesis and Characterization

#### Open Elective III

1. Project Management  
2. Financial Management  
3. Human Resource Management  
4. Industrial Relations and Labour Laws

**Requirement for the award of B.E. (Chemical) is 200 credits.**
SYLLABUS FOR
BACHELOR OF ENGINEERING (CHEMICAL)
SEVENTH SEMESTER

Paper Title: PROCESS ENGINEERING ECONOMICS (Theory)
Paper Code: CHE 701 Max. Marks 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

SECTION-B

Books Recommended:
Incentives for chemical process control, design aspects of a process control system. Difference between feedback and feed forward control configuration. Hardware elements of a control system, Block Diagrams.

Laplace transform and transfer functions. Difference between lumped and distributed parameter systems, Dynamic behaviour of first and higher order systems, interacting and non-interacting systems, dead time.

Different modes of control actions and their basic characteristics, controllers and their characteristics, control valve.

SECTION-B

Closed-loop transfer functions, transient response of simple control systems, Routh stability criterion, Root Locus.

Introduction to frequency response: Bode diagrams, control system design by frequency response: Ziegler-Nichols controller settings, stability using frequency response, gain margin and phase margin.

Introduction to advanced control techniques such as cascade control, feed forward control, ratio control, inferential control.

Books Recommended

Paper Title: Department Elective -1 (Theory)

Paper Code : CHE 703  Max. Marks 50  Credits : 4  Time: 3 hours

Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

1. ANALYTICAL TECHNIQUES (Theory)

Section A

1. **Complexometric titrations**: Complexes-formation constants; chelates – EDTA, Cheloneffect, EDTA equilibria, effect of pH on EDTA equilibria, EDTA titration curves, endpoint – detection and indicators; Importance of complexometric titrations.

2. **Solvent Extraction**: Distribution law, extraction process, factors effecting extraction, technique for extraction, quantitative treatment of solvent extraction equilibria, classification of solvent extraction systems. Advantages and applications of solvent extraction.

3. **Chromatography**: Introduction to chromatography, principles, classification of chromatographic techniques, thin layer and paper chromatography – principle and technique.


4. **Thermoanalytical methods**: Principle, classification of methods.
   
   - TGA – Instrumentation, factors affecting results and analysis of data. applications.
   - DTG – Instrumentation, analysis of data and applications.
   - DTA – Principle, Instrumentation and applications.

Section B


7. **NMR**: Principle, chemical shift, spin-spin coupling shift reagents, instrumentation, spectra and molecular structure, identification of organic compounds on the basis of NMR.

**Electron Microscopy**: Introduction to electron microscopy, classification of electron microscopy methods, Scanning electron microscopy, Instrumentation and applications. Scanning Tunnelling microscopy –Principle and comparison with SEM

**Atomic force microscopy AFM-** Principle Instrumentation and its basic application

**Books Recommended:**


2. POLYMER SCIENCE AND ENGINEERING (Theory)

SECTION-A

Chemistry of polymers:
Monomers, functionality, degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness,
Polymerization methods: addition and condensation; their kinetics, copolymerization, monomer reactivity ratios and its significance, kinetics, different copolymers, random, alternating, azeotropic copolymerization, block and graft copolymers, techniques for copolymerization-bulk, solution, suspension, emulsion.

Polymer Characterization:
Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights, polymer crystallinity, analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques.

SECTION-B

Polymer Technology:
Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, crosslinking and vulcanization

Polymer processing:
Compression molding, transfer molding, injection molding, blow molding, reaction injection molding, extrusion, pultrusion, calendaring, rotational molding, thermoforming, rubber processing in two-roll mill, internal mixer.

Books Recommended:

Paper Title: Department Elective -1I (Theory)

Paper Code : CHE 704        Max. Marks 50        Credits : 4        Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.
1. Alternate Energy Technology

**SECTION-A**

Solar Energy Fundamentals, Solar Radiation Characteristics and Measurements. Low temperature energy collection, high temperature energy collection, solar thermal power generation systems, Domestic industrial and agricultural applications of solar energy.

**SECTION-B**


**Books :**

Energy Technology, S. Rao, Dr. B.B. Parulekar, Khanna Publisher, 2000.
Non Conventional Energy Sources, G.D. Rai, Khanna Publisher, 1997

2. LOW TEMPERATURE ENGINEERING

**SECTION-A**


**SECTION-B**


**Books Recommended:**

3. PLANT UTILITIES (Theory)

SECTION-A

Importance of Process utilities in Chemical Plant.
*Compressed air and Vacuum*: Reciprocating air compressors, vacuum pumps, air receivers, piping systems.
*Steam*: Boiler, steam handling and distribution steam nozzles.

SECTION-B

*Refrigeration*: Air refrigeration cycle, vapour compression cycle, liquification processes.
*Power Generation*: Internal Combustion engines. Gas turbines, steam power plants.

Books Recommended:

Paper Title: PROCESS PLANT DESIGN-III (Practical)

Paper Code CHE 751        Max. Marks 50        Credits: 2

1. Design of liquid-liquid and liquid-solid extraction equipment (stagewise and continuous contact).
2. Design of Heterogeneous catalytic Reactors.
   2.1 Fixed-bed reactors
      (i) Isothermal and adiabatic
      (ii) Non-isothermal non-adiabatic
   2.2 Fluidized-bed reactors
      (i) Two-phase fluidized bed model
      (ii) Slurry reactors and
      (iii) Trickle-bed reactors.
3. Layout of chemical plant equipment, safety and hazard aspects of layout.

Books Recommended:
Paper Title: MASS TRANSFER LAB. (Practical)

Paper Code CHE 752  Max. Marks 50  Credits: 2
1. Determination of mass transfer coefficients for naphthalene-air system.
2. To determine drying rate curves for different wet solids in a batch drier under constant drying conditions.
3. Fractional approach to equilibrium for liquid-liquid extraction from single drop.
4. Verification of Rayleigh’s equation for differential distillation.
5. Determination of flooding velocities in packed columns.
6. Determination of HETP for packed distillation columns.
7. Study and operation of a pilot sized distillation column under total reflux.
8. Study of different mass transfer equipments.

Paper Title: PROJECT WORK

Paper Code CHE 851
Each student is required to submit a project report on the design of a chemical plant, selecting the best process with optimum equipment size and operating conditions. The object is to test the ability of the student to apply his entire knowledge of Chemical Engineering principles to conceptualize, analyze and solve the problems. To judge his knowledge and originality and capacity for application of laboratory data in designing chemical plants and to determine the level of his proficiency at the end of the course.
SYLLABUS FOR
BACHELOR OF ENGINEERING (CHEMICAL)
EIGHTH SEMESTER

Paper Title: INDUSTRIAL SAFETY & HAZARDS (Theory)
Paper Code: CHE 801  Max. Marks 50  Credits: 4  Time: 3 hours

Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of
8 questions. 4 questions from section A and 4 questions from section B are to be set. The students
will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Definition, identification, classification and assessment of various types of hazards in work-place
environment, protective and preventive measures in hazard control.
Toxic Chemicals: maximum allowable concentrations and other standards. Biological threshold limit
values.
Mechanical and electrical hazards. Personal protective equipments. Explosives and inflammable

SECTION-B

Standard safety procedures and disaster control. Indian Legislation on safety and prevention of hazards
Case Studies of typical hazardous industries.

Books Recommended:

Paper Title: PROCESS INSTRUMENTATION (Theory)
Paper Code: CHE 802  Max. Marks 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of
8 questions. 4 questions from section A and 4 questions from section B are to be set. The students
will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

General Concept: Need and classification of measurements and instruments, Basic and auxiliary
functional elements of a measurement system.
Static and Dynamic Characteristics of Instruments:
Static Characteristics: Range and span, accuracy and static error, reproducibility and drift, sensitivity and
dead zone.
Dynamic Characteristics: Speed of response and lag, fidelity and dynamic error, dead time.
Temperature measurement:
Thermocouples, metal resistance thermometers and thermistors, optical and radiation pyrometers, radiation receiving elements.
Pressure measurement:
Use of manometers, Bourdon gauge, bellows type gauge. Vacuum measurement—McLeod gauge, thermoionic type ionization gauge, pirani vacuum gauge. Measurement of pressure in corrosive fluids: Diaphragm seal, liquid seal and purge system.

SECTION-B

Liquid level measurement:
Direct measurement of liquid level – Float & tape liquid level gauge, float and shaft liquid level unit, hydraulic remote transmission of liquid level.
Level measurement in open vessels: Bubbler system, diaphragm box system, air trap system. Level measurement in pressure vessels – Differential pressure manometer, use of liquid seals with a manometer, displacement float liquid level gauge. (6 Hrs.)
Measurement of viscosity, conductivity, humidity and pH.
Density measurement – liquid level method, displacement meter and hydrometer.
Measurement of weight – spring scale, pneumatic force meter and hydrostatic force meter.
Process Instrumentation—Recording instruments, indicating and signaling instruments, control centre, transmission of instrument reading, instrumentation diagrams.

Books Recommended:
1. Eckman, Donald P.: Industrial Instrumentation, CBS Publisher and Distributors, Indian Reprint 2004.

Paper Title: Open Elective-III (Theory)
Paper Code : CHE 803 Max. Marks 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

1. PROJECT MANAGEMENT

SECTION-A

Project Management: concept of project management, project management systems, responsibilities and qualities of a project manager, project management team-composition, functions and responsibilities, co-ordination procedures. Manpower planning; recruitment and selection job description, specification and evaluation, performance appraisal, basis of remuneration and incentives. Project Identification: Principles of project identification, importance of capital investment, decision making industrial policy resolution, industrial development and regulation act, supply and demand analysis, incentives for industrially
backward areas and small scale industries, foreign collaboration and foreign exchange regulations. Appraisal criteria and selection of investment: Non discounting criteria, discounting criteria, appraisal and selection in practice.

SECTION-B


Books Recommended:


2. FINANCIAL MANAGEMENT

SECTION-A

Introduction to Financial Management: Meaning; Scope; Finance Function; Financial Goals; Agency Problem; Relationship of Finance with Accounts and Economics.

Sources of Finance: Features; Advantages and Limitations of Equity Shares; Preference Shares; Debentures; Term-Loans; Right Issue, Venture Capital, Private Equity GDR, ADR.

Cost of Capital: Meaning; Calculation of Cost of Debt Capital; Equity Capital; Preference Capital; Retained Earnings; Weighted Average Cost of Capital.

Capital Structure: Meaning; Determinants; Assumptions; Net Income and Operating Income Approach; Traditional Position; M-M Position; EBIT and EPS Analysis; Capital Structure and Taxation.

Leverage Analysis : Meaning; Types; Estimation of Financial; Operating and Combined Leverage; Relation of Financial Leverage with Risk and Return.

Management of Working Capital : Meaning of WC; Need of WC Management; Determinants of WC; Operating Cycle; Estimation of WC; Working Capital Financing; Trade Credit, Bank finance, commercial paper, factoring, money market instruments.

SECTION-B

Cash Management: Meaning; Facets of Cash Management; Motives for Holding Cash; Optimal Cash Balance; Short-term and Long-Term Cash Forecasting.

Receivable Management: Meaning; Credit Policy Variable; Credit Evaluation; Credit Decisions; Control of Account Receivable.

Inventory Management: Meaning; Need to hold Inventory; Objective of Inventory Management; Inventory Investment Analysis; Inventory Control System.
**Capital Budgeting:** Meaning; Basic Principles of Costs and Benefits; Investment Criteria; Pay back Method; Accounting Rate of Return method; Net Present Value Method; Benefit-Cost Ratio; Internal Rate of Return; Capital Rationing; Introduction to Basic Techniques of Risk Analysis in Capital Budgeting.

**Dividend Decisions:** Meaning and Types of Dividend; Issues in Dividend Policy; Traditional Model; Walter Model; Gordon Model; Miller and Modigliani Model; Bonus Shares and Stock Splits.

**Corporate Restructuring:** Meaning and forms of corporate restructuring, merger and amalgamation takeover and acquisition, types or forms of mergers and takeovers, their benefits and motives.

**Suggested Readings:**

3. **HUMAN RESOURCE MANAGEMENT (Theory)**

**SECTION-A**

**Introduction:** Meaning, scope, objectives and functions of HRM; Importance of Human Resource Management; HRM & HRD a comparative analysis;

**Environment of HRM:** Role of government, internal and external forces; Human Resource Management practices in India.

**Human Resource Planning:** Definition, objectives, process and importance; Job analysis, description, specification & job evaluation; Recruitment, selection, placement and induction process;

**Human Resource Development:** Concept, Employee training & development; Career Planning & development; Promotions, demotions, transfers, separation, absenteeism & turnover;

**SECTION-B**

**Job Compensation:** Wage & salary administration, incentive plans & fringe benefits.

**Performance Management:** Concept & process, performance appraisal, Potential appraisal;

**Quality of work life (QWL):** Meaning, techniques for improving QWL.

**Industrial Relations:** Concept and theories, trade unions; Health, Safety & Employee welfare measures; Employee grievances and discipline, participation & empowerment; Introduction to collective bargaining.

**Books Recommended:**
4. INDUSTRIAL RELATIONS AND LABOUR LAWS

SECTION – A

Overview of Industrial Relations: Concept of IR, Nature of IR, Objectives of IR, Evolution of IR in India, Theories of IR, Systems approach to IR.

Trade Unionism: Concept of Trade Unions, Functions of Trade Unions, Approaches, Structures of Trade Unions.

The Trade Unions Act, 1926: Trade Union, Registration of Trade Unions, Rights and Liabilities of registered trade unions.

Grievance Handling: Grievance, Causes/Sources of Grievances, Grievance Redressal Machinery, Legislative Aspects of the Grievance Redressal Procedure in India, Domestic enquiry.


SECTION – B

The Workmen's Compensation Act, 1923: Workman, employer’s liability to pay compensation, disablement, amount of compensation.

Tripartite and bipartite bodies: Workers Participation in Management.


Industrial Relations and emerging scenario: Industrial Relations and technological change, International Labour Organisation (ILO): Objectives and Structure, Future of Industrial Relations

Standing Orders Act, 1948: Standing orders, certification of draft standing orders, duration and modification of certified orders.

Employee’s State Insurance Act, 1948: Contribution, principle employer, immediate employer, different benefits.

Suggested Readings:
6. S.N. Dhayani: Industrial Relations System, Sultan Chand and Sons
1. PETROCHEMICAL TECHNOLOGY

SECTION-A

*General Introduction:* Definition, history and economic perspective of petrochemical industry, raw materials for petrochemical industry-petroleum, natural gas, coal, bio-mass, agro-residues, etc.

*First Generation Petrochemicals:* Petrochemicals based on aliphatic, olefinic, acetylene, aromatics, etc. Hydrocarbons-processing and applications.


SECTION-B

Nylon Monomers, Polyester Monomers, Styrene, Other Monomers - Bisphenol A, Epichlorohydrin, diisocyanates, Pentaerythritol, etc. - properties, process technologies and applications.

*Third Generation Petrochemicals:* Important Polymers such as Polyethylene, Polypropylene and their Copolymers and other Derivatives Rubbers, Diene Polymers, Styrene Polymers, Vinyl Polymers and Condensation Polymers - properties, process technologies and applications.

*Books Recommended:*
6. Frank, H.G. & Stadelhofer, J.W.

2. NANO TECHNOLOGY (Theory)

SECTION-A

*Introduction:* Plenty of room at the bottom-Feynman’s concept, evolution of ultra-fine materials, the missing link between conventional laws in physics and chemistry and new theories.

*Building Blocks of Nanotechnology:* covalent architecture, coordinated architecture and weakly bound aggregates, Interactions and topology.
**Chemical Properties**: The effect of nanoscale metals on chemical reactivity, effect of nanostructure on mass transport, metal nanocrystallites support on oxides, supported nanoscale catalysts.

**General principles for synthesis** of monodispersed nanoparticles, metals and intermetallics, Ceramics, composites, nanoparticles, colloids/Micelles/vesicles/Polymer/glasses, Crystalline, and zeolite hosts.

**Review of fundamental behaviour** of 0-D(nanoclusters), 1-D(nanowires), 2-D(thin film multilayers), and 3-D(bulk nanostructures) materials. Introduction to size dependent phenomenon in nanostructure for various applications, specific production techniques like chemical vapor deposition, arc ignition etc. Formation of clusters and nanoparticles from supersaturated vapor and selected properties, sputtering and thermal evaporation and laser methods. Synthesis of nanoparticles by chemical routes.

**SECTION-B**

**Approaches to production**: Top down and bottom up, Mechanical attrition, high energy ball milling, and mechanical attrition, nanocomposites by mechano-chemistry, mechanism of grain size reduction, property of microstructure relationships.

**Characterization techniques**: Tools in nanotechnology: Scanning electron microscopy(SEM), Transmission electron microscopy and high resolution(TEM), energy dispersive spectroscopy (EDX), Atomic force microscopy(AFM), Magnetic force microscopy(MFM), Chemical Force Microscopy(CFM), Focused ion beam, nanolithography, powder x-ray diffractometry, UV visible.

**Nanomaterials**: CNTs, Polymer Nanocomposites nanoceramics, nanometals, nanopolymers, structures-properties-applications, Quantum dots. Concepts Bio-Nanotechnology.

**Applications**: Nanotherapeutics, Molecular diagnostics, tissue engineering, nanopumps, nanorobtoics cells, molecular motors, nanomembranes, Organic molecular based computers, bionanodevices (sensors & actuators).

**Books Recommended**
2. *Nanotechnology – An introduction to nanostructure of technique* by Michel Kohler and Wolfgang Frittsche 2004- Wiley VCH
3. *Springer Handbook of Nanotechnology* by Bharat Bhushan
5. *Nanostructures and Nanomaterials* by G. Cao, Imperial College Press, 2004
6. *Introduction to Nanotechnology* by Owen and Poole, Wiley
7. *Nano-materials* by A. K. Bandopadhyay, New Age International

**4. Complex Flow Hydrodynamics**

**Section-A**

Shell balance for momentum transfer: Velocity profiles; Residence time distribution measurement techniques; RTD for single phase flow in tubes, coils, packed beds, stirred vessels;

Rheology of Fluids and Suspensions.

Motion of particles, drops and bubbles through quiescent Newtonian and non-Newtonian fluids.
Drop/Bubble shapes characterization. Drag and terminal velocity of particles, bubbles and drops.

**Section-B**

Operational hydrodynamic characteristics of: Packed beds, fluidised beds, Trickle beds, Bubble columns, spray columns, plate columns.

Prediction of pressure drop; Friction factor; drag coefficient, single phase flow, multiphase flow; Lockhart Martinelli approach.

**Reference Books**


**4. Fluidization Engineering**

**SECTION-A**

Introduction to fluidisation, Industrial applications, Behaviour of fluidised beds—classification of particles, regimes of fluidization, minimum fluidization velocity, particulate and aggregative fluidization, Bubbling fluidization, Bubbling bed models for catalytic reactions.

**SECTION-B**

Turbulent and fast fluidization, dilute and dense phase transport, cyclone, stand pipes, circulating fluidized beds, spouted beds, three phase fluidization, performance modeling of multiphase fluidized systems.

Reference Books:
1. **Fluidisation Engineering** by D.Kunii and Octave Levenspiel, Butterworth-Heinemann; 2nd edition

5. POLYMER SYNTHESIS AND CHARACTERIZATION

Section A
Step reaction (condensation) polymerization – Mechanism of step reaction polymerization, carbonyl addition elimination, carbonyl addition – substitution, nucleophilic substitution, and aromatic electrophilic substitution. Kinetics of step reaction polymerization, reactivity and molecular size. Kinetic expressions for polymerization in absence and in presence of a catalyst. Statistics of linear step reaction polymerization – number distribution and weight distribution functions, molecular weight control, Polyfunctional step reaction polymerization, prediction of gel point, its experimental observation, molecular wt. distribution
Free radical vinyl polymerization: free radical initiators, techniques for free radical polymerization (bulk, suspension, solution, and emulsion), kinetics and mechanism of polymerization, monomer reactivity, and copolymerization, Controlled/”living” radical vinyl polymerization: ATRP (Atom Transfer Radical Polymerization) and RAFT (reversible addition-fragmentation chain transfer radical polymerization)
Vinyl polymerization with ionic initiators: cationic polymerization and anionic polymerization,
Vinyl polymerization with complex coordination catalysts: Ziegler-Natta catalysts
Copolymerization – types of copolymerization- the copolymer composition equation, monomer reactivity rations, rate of copolymerization, composition of copolymers, variation of copolymer composition with conversion, mechanisms of copolymerization, block and graft copolymers.

Section B
Chemical analysis: Introduction, Physical tests, burning characteristics, Density, refractive index, chemical tests. Qualitative and quantitative elementary analysis, Solubility and acid numbers, acetyl number, iodine number end group analysis
Other Polymer Characterization Techniques; Differential Scanning Calorimetry, Dynamic Mechanical Analysis, Thermogravimetric Analysis, Gel Permeation Chromatography Viscosity, Nuclear Magnetic Resonance spectroscopy, Infrared spectroscopy,

5. Polymer Characterization, E.Schröder, G.Müller , K.F.Arnt, Hanser Publishers
Paper Title: PROCESS MODELING & SIMULATION LAB. (Practical)
Paper Code CHE 852        Max. Marks 25        Credit : 1

Functional design, property estimate as inputs for design. System concepts for computer aided design, computer aided flow sheet design. Process analysis. Process variables selection, equipment design through the selection of free parameters subject to constraints and other parameters, modular design. Simulation optimality. Dynamic design including control stability.

Typical equipments to be considered: heat exchangers, distillations columns, reactor and process equipments.

Books Recommended:

Paper Title: PROCESS CONTROL LAB. (Practical)
Paper Code CHE 853        Max. Marks 50        Credits: 2

1. U-Tube manometer
   (a) To plot the response curve for a given input to a U-tube manometer.
   (b) To determine the transfer function from the response curve obtained in part (a).
2. Time constant of a mercury thermometer
   To study the dynamics of the given thermometer and compare the theoretical value of its time constant with the experimental value.
3. Analysis of valve
   Develop a block diagram representing the dynamic bahaviour of the given globe valve.
4. (a) Liquid level measurement
   With the given Bubbler System for Liquid Level Measurement, evaluate liquid height in the tank and compare it with actual values.
   (b) Calibration of Pressure Gauge
   Calibrate a pressure gauge in the range 0 psi to 60 psi.
5. Temperature control system
   To maintain the temperature of the fluid at the set point value.
6. Time constant of liquid level tank
   To study the dynamics of liquid level in a tank and compare the analytical value of the time constant with the experimental value.
7. Liquid level control
   (a) To carry out the closed loop experiment on the given liquid level control system and record its response for step change in the inlet flow.
   (b) To plot the experimental response curve and comment on the response obtained.
8. Compute pressure control simulation with step input and sinusoidal input.

Paper Title: LITERATURE SURVEY, REPORT WRITING AND SEMINAR
Paper Code CHE 854        No Credit        Qualifying

Forms of technical reports: aims and forms according to type of readership and extent of circulation. Abstracts, extended abstracts, tables, graphs. Visual representation of data: slides, microfilms, others techniques including those of audio-visual representation. Correct use of audio equipment.
Research papers and their presentation and publication. Information retrieve direct and through abstracts.
Practical training in writing and presentation of technical reports through audio-visual means. Technique of effective public speaking organized and imprompt discussions.
Preparation of technical report on an assigned topic after survey of scientific, technical and commercial literature, using card indexes, microfilms and other information retrieval methods.
Use of Computer softwares for report writing.

Books Recommended:
2. Sottle, R.T. : The Use of Chemical Literature, Butter Worths.

Paper Title : VIVA VOCE-II (COMPREHENSIVE)
Paper Code CHE 855 Max. Marks 50 Credits: 2

The viva-voce examinations will be comprehensive and covering mainly chemical engineering and technology subjects covered during all the semester including the Eight Semester.