Appendix - V (E)

CURRICULUM FRAMEWORK AND SYLLABUS
(OUTCOME BASED EDUCATION)

M. TECH. POLYMER TECHNOLOGY (EXECUTIVE)

(with effect from the academic year 2024–25)

COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY

Kalamassery, Cochin - 682022 Kerala, India Phone: 0484 – 2575723

April 2024

Vision

The Department strives to develop a Centre of Excellence in Polymer Technology in the country by strengthening in-house infrastructure and taking up collaborative Research and Development in frontier areas.

Mission

As a Department we are committed to:

- Acquire state-of-the-art infrastructure and take up inter-disciplinary research in frontier areas.
- Achieve academic excellence in the field of Polymer Science and Rubber Technology through innovative teaching - learning processes.
- Prepare well-trained human resource in Polymer Science and Rubber Technology who can contribute positively to the developmental efforts of the Nation.
- Promote good academia - industry interaction.

Programme outcome

PO1.Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, techniques, skills, and modern tools of polymer Science and engineering to the solution of polymer engineering problems.

PO2.Problem Analysis: Identify, formulate, research literature, and analyze engineering problems related to Polymer Science and Engineering to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components, processes to meet the needs of public health and safety, and the cultural, societal, and environmental considerations in the field of Polymer Science and Rubber Technology.

PO4. Conduct investigations of complex Problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the **information to provide valid conclusions for broadly defined polymer science and engineering problems.**

PO5. Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to Polymer Science and Engineering activities with an understanding of the limitations.

PO6. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice related to Polymer Science and Engineering.

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POST GRADUATE PROGRAMME IN TECHNOLOGY:

M. TECH. IN POLYMER TECHNOLOGY (EXECUTIVE)

FOR WORKING ROFESSIONALS

REGULATIONS

1. SCOPE

1.1 These Regulations shall apply to the Executive M. Tech. programme (Web-enabled) run in by the Departments /Schools of the Cochin University of Science and Technology.

1.2 The provisions herein supersede all other Regulations with respect to such programmes unless otherwise provided.

2. DEFINITIONS

- Department/School means Departments/Schools instituted in the University as per Statutes and Act.
- Core course means a course that the student admitted to a particular programme must successfully complete in order to receive the Degree and which cannot be substituted by any other course. Core course is offered by the Department where the student takes admission.
- Elective course means a course, which can be substituted by equivalent courses from the same or other Departments/Schools.
- Audited course means a course which can be opted by a student but which will not accrue any credit.

3. ADMISSIONS

3.1 Eligibility

This programme is open to working professionals sponsored by an industry.

a) B.Tech or equivalent degree / AMIE in Polymer Science and Rubber Technology/ Chemical Engineering /Technology or B. Tech in Mechanical Engineering/ Civil Engineering/ Electrical Engineering or M.Sc. Polymer Chemistry/ Chemistry/Applied Chemistry/Physics/Mathematics/Statistics with at least 60% marks in the qualifying examination from any recognized University or Institution.

b) Professional experience of at least two years in the relevant field

3.2 Selection

The candidates who meet the above eligibility critieria will be identified and sponsored by the industry. University will prepare rank list based on the percentage of marks in the qualifying degree plus extra one mark for every additional full year of experience beyond

the minimum requirements. The maximum in this category will be limited to five.

4. PROGRAMME STRUCTURE

4.1 The programme will be of six semester duration.

4.2 The theory classes will be conducted in online mode. The practicals and end- semester examination will be conducted in physical mode. Other activities can be in hybrid mode.

4.3 The minimum credits to be acquired for awarding the degree will be 94.

4.4 The minimum number of candidates for running this programme will be ten and the maximum will be twenty.

4.5 The Department Council (DC) shall make recommend the core and elective courses including the detailed syllabus which are to be approved by the concerned Board of Studies, Faculty and Academic Council

4.6 There shall be two kinds of courses: Core and Elective. Elective courses, if any offered through Massive Open On line Course (MOOC) can have three credits. Practical course / seminar will have one or two credits.

4.7 In the case of online courses attended by the student, a certificate of satisfactory completion and marks/ grade if any issued by the authority who conducted the course must be submitted to the Head of the Department. The Department can conduct a viva on the subject of the online course if necessary. On the completion of this, the Department council can award the respective weightage/grade to the student.

4.8 The number of credits for the project work in fourth, fifth and sixth semesters shall be in the range of 10 – 12 each.

5 COURSE REGISTRATION

5.1 Every Department/School shall have Faculty Members as Student Advisors. Each student will be assigned to an Advisor/Mentor, by the Department council within one week from the commencement of the classes, who will counsel the student on the choice of elective courses depending on the student's academic background and objective. The student will then register for the courses he plans to take for the semester within the time prescribed by the University. The student should have completed the prescribed prerequisites if any for a course before registration.

5.2 The Department offering a course shall prescribe the maximum number of students that can be admitted taking into consideration the facilities available.

5.3 The student can drop any elective/audit course(s) within 15 working days after the commencement of the classes.

5.4 University shall publish a Bulletin listing all the courses offered in every semester specifying the credits, prerequisites, list of topics the course intends to cover, the instructor who is giving the courses, the time and place of the classes for the courses. Each course shall have a code consisting of first two digits indicating the year of revision of syllabus/curriculum, following three digits denoting the program code, the next two digits indicating the semester and last two digits denote the serial number of the course.

6 EVALUATION

6.1 A student would be considered to have progressed satisfactorily at the end of a semester if he/she has a minimum of 75 % attendance. The evaluation is completely internal.

6.2 The entire system of evaluation is internal. The evaluation scheme for each semester contains two parts, a continuous assessment and a semester end examination. The student shall be evaluated continuously throughout the semester and marks shall be awarded on the basis of tests / assignments as detailed below :

6.3 There shall be two class tests, assignment and an end semester examination. The first class test carries 20 marks and will be based on the portions of the syllabi covered till then. The second class test also carries 20 marks and will be based on the portions covered till then after the first class test. A maximum of 10 marks will be awarded for the assignments

6.4 The end semester examination will be for 50 marks and shall contain questions from the entire syllabus of the course. The duration of the end semester examination shall be three hours.

6.5 All practical examinations will also be internally evaluated as per the procedures laid down by the Department Councils concerned.

6.6 Marks obtained in the continuous assessment shall be displayed on the notice board and grievances if any may be addressed to the teacher concerned/Head of the Department with supporting documents. The teacher and the HOD will examine the case and decide on his/her grievance. If the student is not convinced with the decision, he/she can approach the appellate authority, which is the Department council, in writing and the Council shall examine the same and take a final decision which has to be intimated to the student in writing. The decision of the appellate authority shall be final.

6.7 There shall be only a single evaluation for the semester end examination. Immediately after the end semester examination is over, the Head of the Department shall make arrangements to complete the evaluation and finalize the

results within 10 working days.

6.8 The pass minimum in a subject is 50 %, with a separate minimum of 45% for end semester examination

6.9 The final marks and grade in all the courses obtained by the students in that se- mester will be displayed in the notice board. Those who could not obtain 50% marks (Grade D) in total for a course will be declared as failed in that course. Those who fail in any course shall approach the teacher concerned if necessary, for a re- examination of the semester end examination. Within ten days of the dis- play of the results in the notice board, the department shall conduct an additional semester end examination for these candidates. They will be awarded 75% of the marks scored in the re-examination.

6.10 If the candidate fails again in the re-examination, he/she may appear for the supplementary examination along with the junior batches which will be governed by the rules of the University regarding supplementary examinations.

7 PROJECT WORK

7.1 The major project work will be done in the parent company with one supervisor from the Department and one from the parent company. For combined supervision the Department Council shall verify the academic/ research credentials of the Supervisor from the Industry.

7.2 The research problem will be decided in mutual agreement of the supervisors from the Company and the Department.

7.3 The evaluation at the end of IV, V Semesters shall be conducted by an examination committee consisting of the Head of the Department and both the supervisors.

7.4 At the end of Semester VI, the students will have to submit a dissertation on his / her project work to the Head of the Department/School within the last date prescribed for the purpose.

7.5 The dissertation will be evaluated by an examination committee consisting of the Head of the Department and another faculty member and the project supervisors. The candidate shall make an open presentation of his/her dissertation which will be followed by a viva-voce examination.

For the purpose of assessment, the performance of a student in the project dissertation may be divided into the following sub components:

At the end of IV & V semesters Assessment by the project guide (based on periodic assessment of the work of the candidate) -	50%
Assessment by the examination committee	- 50%

At the end of VI semester Assessment by the project guide (based on periodic assessment of the work of the candidate) - 50%

Assessment by the examination committee - 50%

8 DECLARATION OF RESULTS

The result of the examinations will be finalised and published by the Department Council, which will act as the passing board and the minutes shall be sent to the Controller of Examinations for issue of Grade card. The University shall issue mark lists/Grade card at the end of each semester.

9 GRADE CARD

9.1 The University under its seal shall issue a Grade Card to the students on completion of each semester. The Grade card shall contain the following:

a. Title of the course taken as core and elective.

b. The grades awarded for each course along with the course credit.

c. The number of credits (core and elective separately) earned by the student and the Grade Point Average.

d. The total credits (core and elective) earned till that semester.

9.2 The following grades will be awarded based on the overall performance in each subject.

Range of marks	Grades	Weightage
90 and above	S-Outstanding	10
80 to <90	A-Excellent	9
70 to <80	B-Very good	8
60 to >70	C-Good	7
50 to <60	D-Satisfactory	6
Below 50%	F-Failed	0

Overall performance at the end of the semester will be indicated by Grade Point Aver- age (GPA) calculated as follows.

$$GPA = \frac{(G1C1+G2C2+G3C3+ \ +GnCn)}{(C1+C2+C3+ +Cn)}$$

Where 'G' refers to the grade weightage and 'C' refers to the credit value of corresponding course

undergone by the student. At the end of the final semester Cumulative Grade Point Average (CGPA) will be calculated based on the above formula, considering the Credits and Grades earned during the entire programme of study.
Classification for the Degree/Diploma will be given as follows based on the CGPA :

First Class with distinction:	8 and above
First Class	6.5 and above
Second Class	6 and above

9.3 The Grade Card issued at the end of the final semester shall contain the details of all the courses taken which shall include the titles of the courses, the credits associated with each course, the CGPA and the class.

9.4 A student shall complete the M.Tech. programme in 6 (six) consecutive semesters by acquiring the minimum total credit requirement of 94.

10. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Vice-Chancellor shall, for a period of one year from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.

PROGRAMME STRUCTURE

	Credits						
Semester	I	II	III	IV	V	VI	**Total**
Core 1	3	3	3	3			**12**
Core 2	3	3	0	0			**6**
Core 3	3	0	0	0			**3**
Elective1		3	3	3	3	3	**15**
Elective2			3	3			**6**
Total (theory)	**9**	**9**	**9**	**9**	**3**	**3**	**42**
Lab	1	1	1	1			**4**
Seminar	1	1	1	1	1	1	**6**
Mini Project	2	2					**4**
LS & PP			4				**4**
Major project				10	12	12	**34**
Sem total (theory plus others)	**13**	**13**	**15**	**21**	**16**	**16**	**94**

LS & PP Literature survey and project proposal

Sl No.	Courses	Core/ Elective
1	A**dvanced Polymer Science**	**Core**
2	A**dvanced Rubber Processing**	**Core**
3	**Advanced Tyre Compounding and Manufacture**	**Core**
4	**Advanced Polymer Rheology**	**Core**
5	**Testing and Characterisation**	**Core**
6	**Research Methodology and IPR**	**Core**
7	**Rubber Products Manufacture**	**Core**
1	Latex Technology1	Elective
2	Simulation and Modelling	Elective
3	CAD/ CAM	Elective
4	Statistical Analysis	Elective
5	Advanced Polymer Nanocomposites	Elective
6	Mould and Die Design	Elective
7	Tyre reinforcement materials	Elective
8	Latex Technology2	Elective
9	Tyre Engineering	Elective
10	Tyre testing	Elective
11	Speciality polymers and composites	Elective
12	Polymer recycling	Elective
13	Biopolymers	Elective
14	Adhesives	Elective
15	Surface coatings	Elective
16	MOOC course	Elective
17	MOOC course	Elective

Curriculum for first semester

Course code	Subject	C/E	Hrs per week			Credit	Marks		
			L	T	P		CE	EE	Total
24-511-0101	Advanced Polymer Science and Technology	C	3	0	0	3	50	50	100
24-511-0102	Advanced Rubber Processing	C	3	0	0	3	50	50	100
24-511-0103	Advanced Tyre Compounding and Manufacture	C	3	0	0	3	50	50	100
20-511-0111	Lab 1 (Advanced Polymer Science)	C	0	0	4	1	100	–	100
24-511-0151	Seminar	C	0	0	1	1	50		50
24-511-0152	Mini project	C	0	0	2	2	100		100
	Total						400	150	550

SYLLABUS

SEMESTER I

24-511-0101 Advanced Polymer Science and Technology

Course Outcome

On successful completion of the course, the students will be able to:

CO1: Explain the mechanism and kinetics of addition and condensation polymerization. (Understand)

CO 2: Explain basics of copolymerization and coordination polymerisation reactions and describe the synthesis of polymers according to the need of polymer industry. (Analyse)

CO 3: Understand the special synthesis routes for polymerisation. (Understand)

CO 4: Analyze polymer structure and properties based on molecular weight determination, spectroscopic, thermal and microscopic techniques. (Analyze)

CO 5: Get an insight in to the degradation of commercial polymers and the management of polymer wastes. (Analyse)

Mapping of course outcomes with program outcomes:

Level - Low (1), medium (2) and high (3)

Unit 1. Mechanistic aspects of polymerization– Chain reaction (Addition) polymerization – Basics. Free radical Polymerization: monomers, generation of initiators, mechanism of free radical polymerization, chain transfer reactions, inhibition and retardation, kinetics of free radical polymerization. Ionic Polymerization: cationic and anionic, selection of monomers, chain transfer reactions, kinetics. Step reaction (condensation) polymerization–Basics. Mechanism of condensation polymerisation, poly condensation reaction, network condensation reaction. Kinetics of step reaction polymerization: catalyzed and non catalyzed, Carothers equation, prediction of gel point.

Unit 2. Copolymerisation: general characteristics, mechanisms, free radical, ionic, condensation, kinetics of copolymerization, composition of copolymers, block and graft copolymers. Coordination polymerization: basics, stereo regular polymers, tacticity in polymers. Mechanism of coordination polymerization: coordination catalysts, monometallic, bimetallic . Polymerization techniques: homogeneous polymerization techniques-bulk, solution, heterogeneous polymerization techniques- emulsion, suspension.

Unit 3. Special synthesis routes– Cyclopolymerisation: general features, mechanism. Ring-opening polymerization, Metathesis polymerisation, ring -opening metathesis polymerisation (ROMP). Living polymerization: atom -transfer-radical-polymerization (ATRP), reversible addition fragmentation chain transfer (RAFT).

Unit 4. Characterization techniques – Molecular characterization of polymers– average molecular weight, molecular weight distribution, determination of molecular weight – end group analysis, colligative property measurement –Osmometry; light scattering, solution viscosity and gel permeation chromatography. Spectroscopy techniques: Infra red, NMR and UV-visible. Thermal properties: differential scanning calorimetry, differential thermal analysis, thermogravimetry, dynamic mechanical analyzer. Microscopic techniques: optical and electron microscopy. Crystallinity studies: density measurements, XRD.

Unit 5. Polymer Degradation and Stabilization–Principles of thermal, photo, oxidative and biodegradation in polymers. Methods/equipments used for monitoring the degradation in polymers. Mechanism of degradation of some commercial polymers. Biodegradation of polymers. Waste Management.

References

1 F.W. Billmeyer, A Text Book of Polymer Science, 3rd Edn., Wiley & Sons (2009).

2 Herman F. Mark (Ed.),Encyclopedia of Polymer Science and Engg., Vol 15, 4th Edn., Wiley & Sons (2014).

3 P.J.Flory, Principle of Polymer Chemistry, Cornell University Press (1986).

4 V. R. Gowariker, N. V. Viswanathan and J. Sreedhar,Polymer science, John Wiley & Sons (2010).

5 J.F.Rabek, Experimental methods in polymer chemistry, Wiley & Sons, Imprint:Academic Press (2012).

6 Hans-George-Elias, Macromolecules Vol.1, Plenum press, Springer (1986).

7 George Odion, Principles of Polymerization, 4th Edn., Wiley & Sons (2007).

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	3	3	3	2	2
CO 2	3	2	3	3	2	2
CO 3	2	2	2	2	2	2
CO 4	2	3	3	3	2	2
CO 5	3	3	3	2	2	2

24-511-0102 Advanced Rubber Processing

Course Outcome
On successful completion of the course, the students will be able to:

CO 1: Explain the basics of NR latex preservation, processing and dry rubber production.

CO 2: Understand the types and role of compounding ingredients, their mechanism of action.

CO 3: Understand the role of fillers and reinforcement, design rubber compounds.

CO 4: Explain various rubber processing techniques used to manufacture rubber products.

CO 5: Identify different unit operations for rubber product manufacturing.

Unit 1. Natural rubber – Preserved field latex, latex concentrates - centrifuging and creaming, ribbed smoked sheets, crepe rubber, technically specified solid block forms (crumb rubber), superior processing rubbers and other modified forms of natural rubber.

Unit 2. Rubber Compounding: Vulcanization: sulphur and non-sulphur systems, assessment of state of cure, mechanism of vulcanization. Additives used in rubber compounding: accelerators, activators, antidegradants, plasticisers, special purpose additives. Quality tests for additives.

Unit 3. Reinforcement: principle of reinforcement, filler properties-particle size, surface area and filler structure, carbon black-types, structure, properties and manufacture. General compound design.
Unit 4. Rubber Processing – Machinery used for mixing: two roll mill, internal mixers and continuous mixers, extrusion technology, calendering, fabric coating and spreading process.

Unit 5. Moulding techniques – Compression, transfer and injection moulding. Vulcanisation methods: rotocure, autoclave open steam, hot air, fluidised bed, LCM, molten salt bath and high energy radiation curing.

References

1 C. M. Blow, C. Hepburn, Rubber Technology and Manufacture, 2nd Edn., Butterworth Scientific (1982).
2 Werner Hofmann, Rubber Technology Handbook, Hanser Gardner Publications (1990).
3 P. K. Freakly, Rubber Processing and Production Organisation, Springer Science & Business Media (2012).
4 Anil K. Bhowmick, Howard L. Stephens, Handbook of Elastomers, 2nd Edn., CRC Press (2000).
5 Anil K Bhowmick, Malcolm M.Hall Henry A.Benarey (Eds.), Rubber Products Manufacturing Technology, Marcel Dekker Inc. (1994).
6 Robert F. Ohm (Ed.), The Vanderbilt Rubber Handbook, 13th Edn., R. T. Vanderbilt Company, Inc. (1990).

Mapping of course outcomes with program outcomes:
Level - Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	2	2	2	1	2
CO 2	3	2	2	2	3	2
CO 3	3	2	3	2	3	2
CO 4	2	2	2	2	3	2
CO 5	3	3	3	2	3	2

24-511-0103 Advanced Tyre Compounding and Manufacture

Course Outcome

On successful completion of the course, the students will be able to:

CO 1: Learn the history of the development of tyre technology (Understand)

CO 2: Gain familiarity with the design of various types of tyres and their functions. (Understand)

CO 3: Get an insight into the materials used for the manufacture of tyres and tubes. (Understand)

CO 4: Comprehend and envisage the processes involved in the design and production of the components of various types of tyres and tubes.(Apply)

CO 5: Learn the non-destructive and destructive tests done on tyres and tubes. (Understand)

Unit 1. Introduction to the history and development of tyres. Indian and global status of tyre industry. Performance of various types of tyres: bias, bias belted and radial. Components of a tyre : geometry and basic functions. Functions of pneumatic tyres: load carrying capacity, vibration and noise reduction, tyre function as a spring, contribution to driving control and road holding. Basic functions of pneumatic tyres.

Unit 2. Radial tyres, advantages of radial tyres. Tubed and tubeless tyres. Components of radial tyres. Construction of bicycle tyres, Aircraft tyres. Benefits of filling nitrogen in tyres. Role of Indian Tyre Technical Advisory Committee. Tyre size designation. Winter tyres.

Unit 3. Introduction to the materials used in tyre manufacture–Ingredients of rubber compounds for tyres, tubes and tyre curing bladders. Typical formulations for tyre components. Compounding for radial tyres. Textiles used in tyre manufacture. Treatment of textiles - RFL dipping. Cord-rubber composites and their properties– Failure mechanism of cord reinforced rubber. Mechanics of tyre pavement interaction. Tyre forces on dry and wet road surfaces. Tractive forces on dry surface, wet surface, snow and irregular pavements. Braking and traction of tyres.

Unit 4: Manufacture of tyres: two wheelers, cars, trucks, OTR, farm and aircrafts. Calendering process. Bias cutting. Extrusion of tread, side wall and other components. Dual extrusion of cap and base. Bead construction. Tyre building: machines for bias and radial tyres, components of tyre building machines. Inputs for tyre building : inner liner, plies, bead assemblies, tread, breakers, belts and side walls. Sequence of building. Green tyre preparation. Awling, shaping and curing in Bag-O-matic press. Typical cure cycle. Post cure inflation. Determination of optimum cure time by thermocouple studies. Cured tyre inspection. Tyre finishing. Design and manufacture of bicycle and automobile tubes.

Unit 5. Measurement of tyre properties – Static & loaded dimension and size.Tyre construction analysis, endurance test, wheel and plunger tests, traction and noise measurements. Force and moment characteristics, cornering coefficient, aligning torque coefficient, load sensitivity and load transfer sensitivity. Rolling resistance, non-uniformity, dimensional variations, force variations, radial force variation, lateral force variation, conicity and ply steer. Tyre balancing. Mileage evaluations. Tyre flaws and separations (X- ray, holography, etc.). Tyre maintenance and service practices. Standards (BIS) for tyres, tubes and flaps. Role of Indian Tyre Technical Advisory Committee.

References

1 John F. Purdy, Mathematics Underlying the Design of Pneumatic Tires, University of Michigan (1963 – Digitized on 25 Jul 2011).
2 ITTAC Standards Manual, Indian Tyre Technical Advisory Committee, New Delhi (2018).
3 L. J. K. Setright, AutomobileTyres, Chapman and Hall (1972).
4 Tom French, Tyre Technology, Taylor & Francis (1989).
5 Dr. S.N. Chakravarthy, Introduction to Tyretechnology, Polym Consultants- New Delhi (2012).
6 Samuel Kelly Clark, Mechanics of Pneumatic Tires, U.S. Departmentof Transportation, National Highway Traffic Safety Administration (1981 - Digitized on 17 Dec 2007).

7 F.J. Kovac, Tyre Technology, Goodyear Tyre& Rubber Company (1973).
8 Tyre Condition Guides, Indian Tyre Technical Advisory Committee, New Delhi (2018).

Mapping of course outcomes with program outcomes:
Level - Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	2	2	2	2	2
CO 2	2	2	2	2	2	2
CO 3	2	3	2	2	3	2
CO 4	2	2	2	1	2	2
CO 5	1	1	2	1	2	2

24-511-0111 Advanced Polymer Science

Course Outcome

On successful completion of the course, the students will be able to:

CO1 : Identify the plastics and rubbers used in various unknown polymeric products.

CO2 : Estimate molecular weight of polymers by different techniques.

CO3 : Understand the various synthesis methods for the preparation of polymers

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

1. Identification of rubbers, plastics and thermoplastic elastomers -NR, SBR, PB, IR, IIR, EPDM, Hypalon, Thiokol, Silicone, CR, NBR, PE, PP, PS, PVC, PVA, PF, UF, MF
Polyester, SIS, SBS, SEBS

2. Estimation of polymer molecular weights

) Viscometry

) End group analysis

3. Determination of effect of free radical initiators on molecular weight

4. Preparation of Polymers

a) Preparation of polystyrene/PMMA through various synthesis techniques such as bulk, solution, suspension and emulsion polymerisation techniques

) Grafting of NR

References

1 Rabek, Experimental methods in Polymer Chemistry, John Wilely & sons (1998)

2 D. Braun, H. Cherdron, H. Ritter, Polymer Synthesis: Theory and Practice, Springer Science and Business Media (2001)

3 Stanley R. Sandler, Wolf Karo, Joanne Bonesteel, Eli M. Pearce, Polymer Synthesis and Characterization: A Laboratory Manual, Elsevier (1998)

4 K.J. Saunders , Identification of Plastics and Rubber, Chapman and Hall

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	2	1	2
CO2	2	1	1	2	1	2
CO3	2	2	1	1	1	2