

Polymer Engineering and Technology of MDM Courses:

Total MDM Courses: 6

1. SEM III: MDM-I: Polymer science and technology I
2. SEM IV: MDM-II: Introduction to polymer engineering and technology
3. SEM V: MDM-III: Polymer chemistry and technology
4. SEM VI: MDM-IV: Technology of thermoplastic/thermoset
5. SEM VII: MDM-V: Additives and compounding of polymers
6. SEM VIII: MDM-VI: Polymer processing

MDM	Course Code: PST1101	Course Title: <u>MDM-I: Polymer Science & Technology I</u>	Credits = 2		
	Semester: III	Total Contact Hours: 30	L	T	P
List of Prerequisite Courses					
Raw materials Analysis & Characterization for Resin and Polymers, Analysis & Characterization of Resin and Polymers, Technology of Thermoset, Technology of Thermoset Polymers					
Description of relevance of this course in the B. Tech. Program					
To train the students with respect to the basics of polymers, Overview of Polymer and Coating Industry Manufacturing Chemistry, properties applications of monomers for synthetic and natural polymers and their handling hazards.					
Course Contents (Topics and Subtopics)					Required Hours
1	Overview of Polymer and Coating Industry, Historical developments in polymeric materials with introduction and classification of polymers				5
2	Basic concepts & definitions: monomer & functionality, oligomer, polymer, repeating unites, degree of polymerization, molecular weight & molecular weight distribution commodity engineering polymers specialty polymer definitions				15
3	Manufacturing Chemistry, properties applications of raw material for synthetic polymers like Ethylene, propylene, butadiene, vinyl chloride, vinylidene dichloride, styrene etc.				10
Total					30
List of Textbooks/Reference Books					
1	Raw Materials for Industrial Polymers by H Ulrich, Hanser Publication 1989.				
2	Principles of Polymer Science, by Bahadur and Sastry, Narosa Publishing House 2002.				
3	Polymer Science by Gowariker, Johan wiley and Sons 1986.				
4	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965.				
5	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988.				
6	Petrochemicals: The Rise of an Industry by Peter H. Spitz, Johan Wiley and sons 1988.				
7	Polymer Chemistry by Malcolm P. Stevens, Oxford University Press, Inc, 1990				
Course Outcomes (Students will be able to.....)					
CO1	Describe the basic concept of monomer, polymer and repeating units and their properties (K2)				
CO2	Interpret the physical and chemical properties of raw materials (K3)				
CO3	Analyze the manufacturing routes and impurities in monomers and raw materials (K4)				
CO4	Propose plan about evaluation of raw materials and reactants for synthesis & manufacturing of resins and polymers. (K5)				

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+P	K3	K4
CO1	K2	3	3	2	3	3	3	2	1	1	1	1	2	2	2
CO2	K3	3	3	1	1	1	3	3	1	1	2	2	3	3	3
CO3	K4	3	3	3	3	2	3	3	2	2	1	1	3	3	3
CO4	K5	2	3	3	2	3	1	3	3	2	2	3	2	2	1
Course	K5	3	3	3	3	3	3	3	3	2	2	3	3	2	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution
 K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM	Course Code: PET1201	Course Title: MDM-II : Spl 2 - Introduction to polymer engineering and technology	Credits = 2			
	Semester: IV	Total Contact Hours: 30	L	T	P	
List of Prerequisite Courses						
HSC (Science), Polymer science and technology I						
List of Courses where this course will be prerequisite						
Raw materials Analysis & Characterization for Resin and Polymers, Analysis & Characterization of Resin and Polymers, Technology of Thermoset, Technology of Thermoset Polymers						
Description of relevance of this course in the B. Tech. Program						
The course "Introduction to Polymer Engineering and Technology" is highly relevant in today's world due to the widespread use of polymers in various industries. Polymers have become integral materials in everyday life, including packaging, automotive, electronics, medical devices, and many more. Understanding the properties, processing methods, and applications of polymers is crucial for aspiring engineers and technologists to design innovative products, reduce production costs, and address environmental challenges associated with polymer waste and disposal. Additionally, with the growing demand for sustainable materials, this course equips students with knowledge about eco-friendly polymers and their potential in future industries.						
	Course Contents (Topics and Subtopics)					Required Hours
1	Introduction to materials and polymer					6
2	Polymer industry					6
3	Various types of polymers					6
4	Introduction to polymer processing					6
5	Various applications of polymers; Environmental and sustainability aspects related to the use of polymers in industry					6
	Total					30
List of Textbooks/Reference Books						
1	Polymer chemistry- Charles E Carraher Jr., 2003					
2	Introduction to Polymer Science- Robert J. Young, Peter A. Lovell, 2011					
3	Plastic Materials and Processing- A. Brentstrong, 2006					
Course Outcomes (Students will be able to.....)						
CO1	Explain the fundamental principles of polymer engineering and technology, including the molecular structure and properties of various types of polymers, and their applications in different industries. (K2)					
CO2	Illustrate the manufacturing processes involved in the production of polymers, and analyze their impact on the final properties of the materials. (K3)					
CO3	Develop an understanding of the diverse applications of polymers in everyday products and advanced technologies, and evaluate their advantages over traditional materials. (K4)					
CO4	Compare and classify different types of polymers based on their chemical structure, physical properties, and processing techniques to determine their suitability for specific applications. (K5)					
CO5	Discuss the environmental and sustainability aspects related to the use of polymers in industry and evaluate potential solutions for mitigating their impact on the ecosystem. (K6)					

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+P	K3	K4
CO1	K2	3	3	3	2	2	3	3	2	2	2	3	3	3	3
CO2	K3	3	3	2	2	3	3	2	2	1	2	3	3	2	3
CO3	K4	3	3	2	3	3	2	2	3	3	3	3	3	2	3
CO4	K5	2	3	1	3	3	2	3	3	3	2	3	3	3	2
CO5	K6	3	3	2	2	3	3	3	2	2	2	3	3	3	3

Course	K6	3	3	3	3	3	3	3	3	3	3	3	3	3	3
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3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution

K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM	Course Code: PST1303	Course Title: <u>MDM-III : Polymer Chemistry & Technology</u>	Credits = 4		
	Semester: V	Total Contact Hours: 60	L	T	P
List of Prerequisite Courses					
HSC (Science)					
List of Courses where this course will be prerequisite					
High Polymer Chemistry, Structure-Property Relationship, Compounding and Polymer Processing, Technology of Thermoplastics, Technology of Thermosets.					
Description of relevance of this course in the B. Tech. Program					
To teach students basic concepts of Polymer Chemistry & Technology so that they can have good base to learn other subjects					
	Course Contents (Topics and Subtopics)				Required Hours
1	Detailed classification of polymers Addition, condensation, commodity engineering and speciality copolymers, Monomer structure and Polymerizability. Crystalline/amorphous, step growth /chain growth, homochain/heterochain, crystalline/amorphous polymers, confirmation etc.				5
2	Homo& copolymers, graft, block alt, ladder, etc. & nomenclature, configuration: cis/trans; tacticity, branched/ crosslinked, Addition and condensation polymerization mechanism				5
3	Techniques of polymerization: bulk, solution, suspension, emulsion, plasma etc.				5
4	Molecular weight and its distribution determination methods (Mn to Mz+1& MWD, Poly dispersity Index), calculations & problems based on it,				5
5	Carothers equation for condensation polymers & conditions to get high or desired molecular weight, calculations & problems based on it.				5
6	Transition temperatures such as Tg, Tc, Tm, their relevance to properties & processing and factors affecting them				5
7	Solubility parameter, solution properties, temperature, good/ bad solvent.				5
8	Different initiating systems such as free radical polymerization, redox with examples & their use choice of initiator half-life period. Measurement of polymer viscosity by different method				5
	Copolymerization, reactivity ratios & kinetics of copolymerization (copolymer composition equation). Polymerization: Probability and statistics-statistics of polycondensation, chain polymerization, branching and gelation. Copolymer sequence distribution				5
9	Basic Rheological concepts of polymer solutions and melts, Newtonian / non Newtonian, time dependent/ independent				5
10	Mixing operations: Typical agitation system, dissolution, suspension, removal of water condensates high speed (low viscosity) stirring, low speed (high viscosity) stirring selection criterion, power consumption. Heat transfer characteristics, powder mixing times etc				5
11	Commercial applicability of Polymers as Plastics, paints, rubbers, fibres & adhesives				5
	Total				60
List of Textbooks/Reference Books					
1	Principles of Polymer Science, Bahadur and Sastry, Narosa Publishing House 2002				
2	Polymer Science, Gowariker, Johan wiley and Sons 1986				
3	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965				
4	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988				
5	Polymer Chemistry, Malcolm P. Stevens, Oxford University Press, Inc, 1990.				
6	Text book of polymer Science, Billmeyer, John Wiley ans Sons 1984.				
7	Principles of Polymer Systems, Rodriguez, Hemisphere Publishing Corpn, 1982				

8	Introduction to Polymer Science and Technology, H. S. Kaufman and J. J. Falcetta, Wiley – Inter science Publication, 1977
9	Principles of polymerization, G. Odian, Wiley – Inter science (1981)
Course Outcomes (Students will be able to.....)	
CO1	Describe the basics of polymers and various terminologies. (K2)
CO2	Solve the problems regarding Calculation of MW – MWD & its relevance (K4)
CO3	Explain the basics of rheology & its effect on processing & application, mixing operations. (K2)
CO4	Compare various techniques of polymerization & initiating systems (K4)
CO5	Differentiate the various types of copolymerization & their commercial applications. (K4)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+P	K3	K3+A	K2+ A	K3	K6 +A+Psy	K3	K4
CO1	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO2	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO3	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO4	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO5	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Curse	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

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MDM	Course Code: PST1611	Course Title: <u>MDM-IV: Technology of Thermoplastic Polymers</u>			Credits = 2			
	Semester: VI	Total Contact Hours: 30			L	T	P	
List of Prerequisite Courses								
Polymer science and Technology, Polymer chemistry and Technology, Raw material Analysis of resins and polymer, High Polymer Chemistry								
List of Courses where this course will be prerequisite								
Compounding and Polymer Processing, Environment Health and Safety of Polymers and Coating, Evolution and testing of Polymers and Coatings, Technology of Plastic Packaging.								
Description of relevance of this course in the B. Tech. Program								
To give an understanding of industrial manufacturing processes, properties and applications, and processing of various types of thermoplastic polymers. Knowledge of the subject will help students conduct research and development in polymer blends polymer nanocomposites, coating formulation development, Fiber reinforces composites, Polymer processing, Rheology of polymers etc. To make aware of Environmental concerns of Polymer products, Recycling of Polymers, industrially produced different grades trade names of polymers.								
	Course Contents (Topics and Subtopics)						Required Hours	
1	Industrial Manufacturing processes, properties and applications, processing environmental concerns of various types of polymers polyolefins like LDPE HDPE etc.						4	
2	Polypropylene and copolymer of PP Plastomers, The copolymer of polyolefins like EVA LLDPE EAA etc.						5	
3	Polyvinyl chloride & its copolymers Compounding of PVC, Polystyrene, HIPS, SAN						4	
4	ABS, important copolymers of styrene maleic anhydride and styrene acrylic copolymers, toughening mechanism of impact-modified plastics.						5	
5	Saturated Polyesters such as PET, PBT, PTT						3	

6	Polycarbonates, Polyacetals, Polyamide- Nylon 6, Nylon 6,6, Nylon 11 etc., aromatic polyamide such as Kevlar etc.	3
7	Acrylic polymers & copolymers, Polyacrylamide, PMMA, Polyacrylonitrile etc.	3
8	Thermoplastic PU, Polyvinyl acetate, Polyvinyl alcohol, etc.	3
	Total	30
List of Textbooks/Reference Books		
	Plastics Materials, 7th Edition by John Brydson, Elsevier 1999.	
	Text book of polymer Science by Bill Meyer, John Wiley and Sons 1984	
	Principles of Polymer Science, by Bahadur and Sastry, Narosa Publishing House 2002.	
	Polymer Science by Gowarikar, John Wiley and Sons 1986.	
	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc.1965.	
	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc1988.	
	Handbook of Thermoplastics, Second Edition Olagoke Olabisiby CRC Press2015	
	Thermoplastic Materials by Ibeh, Christopher C, Taylor Francis Inc 2013	
	Introduction to Polymer Science and Technology by H. S. Kaufman and J. J. Falcetta, Wiley Inter science Publication, 1977	
	Handbook of Polyethylene, A. J. Peacock, Marcel Dakker Inc,2000	
	PVC Technology, A. S. Athalye and Prakash Trivedi, Multi-Tech Publishing Co, 1994.	
	Engineering Thermoplastics Polycarbonates Polyacetals Cellulose Esters, L. Bottenbruch, Hanser Publishers, 1996.	
	Polymer and Resins; Their Chemistry and Chemical Engg, Brage Golding, D. Van Nostrand Company Inc, 1959.	
	Structures of Cellulose, Atlla, American Chemical society, 2003.	
Course Outcomes (Students will be able to.....)		
CO1	Inspect the industrial manufacturing process, compare the advantages disadvantages of such processes, define the process parameters of the thermoplastics polymers and discuss the environmental concerns of their products (K4)	
CO2	Analyze properties like physical mechanical thermal rheological etc (K4)	
CO3	Describe basic processing methods related to of the thermoplastics polymers. Discuss the practical applications of thermoplastics in real world and structure properties and relationship. (K2)	

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+P	K3	K3+A	K2+ A	K3	K6 +A+Psy	K3	K4
CO1	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO2	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO3	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution
K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM	Course Code: PST1612	Course Title: <u>MDM-IV: Technology of Thermoset Polymers</u>	Credits = 2		
	Semester: VI		L	T	P
		Total Contact Hours: 30	1	1	0
List of Prerequisite Courses					

Polymer science and Technology, Polymer chemistry and Technology, Raw material Analysis of resins and polymers, High Polymer Chemistry		
List of Courses where this course will be prerequisite		
Processing of Paint lab -I, Processing of Paint lab- II, Project I, Project II, Environment Health and Safety of Polymers and Coating, Evolution and testing of Polymers and Coatings, Technology of Plastic Packaging.		
Description of relevance of this course in the B. Tech. Program		
To give understanding of alkyd resins, types, synthesis, properties and modification of alkyd resins. Understanding of polyester resins, raw materials used and various curing systems. Basics of Phenolics, polyurethane, silicone and acrylics resins. Their synthesis, modification, processing, chemistry and applications.		
	Course Contents (Topics and Subtopics)	Required Hours
1	Alkyd resins Basic components like polyfunctional alcohols, poly-basic acids, vegetable oils/fatty acids. Different types of drying oils: drying, semi-drying and non-drying with examples. Influence of all these components in the synthesis and properties of the final alkyds obtained.	5
2	Polyesters Resins – unsaturated polyesters resins: Raw material: poly-basic acids, polyfunctional glycols. Curing of resins through unsaturation of the resin/polymer backbone. Curing systems, catalysts and accelerators. Molding compositions, fibre and film forming compositions	5
3	Phenolics. Basic Components of the polymer. Different kinds of phenols to aldehyde on the nature and the property of the polymer. Theory of resinification and effect of pH on the reaction mechanism and the reaction product. Curing of Phenolics.	5
4	Polyurethanes – Thermoplastic and Thermoset: Basic components diisocyanates and diols, different diisocyanates and diols used Reactions of isocyanates with various other functional groups synthesis of polymers polyurethane foams, polyester and polyether foams.	5
5	Thermosetting acrylics: Synthesis of acrylic polymers and co- polymers, different techniques. Structure property relationship application of thermosetting acrylics, like anaerobic adhesives, laminating resins, etc	5
6	Miscellaneous thermosetting polymers.	5
	Total	30
List of Textbooks/Reference Books		
1	Text book of Polymer Science by Bill Meyer, John Wiley Ans Sons 1984.	
2	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965.	
3	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988.	
4	Polymer Chemistry by Malcolm P. Stevens, Oxford University Press, Inc, 1990.	
5	Introduction to Polymer Science and Technology by H. S. Kaufman and J. J. Falcetta, Wiley – Interscience Publication, 1977	
6	Handbook of Thermoplastics, O. Olabisi, Marcel Dekker, 1997.	
7	Resins for Surface Coatings, Polyurethanes Polyamides Phenoplasts Aminoplasts Maleic Resins (Waterborne & Solvent Based Surface Coatings Resins & Applications) (Volume III) Volume III Edition	
8	Resins for Surface Coatings, Volume 1 2nd Edition, Resins for Surface Coatings: Acrylics and Epoxies 2nd Edition by H. Coyard (Author), P. Deligny (Author), N. Tuck (Author), P. K. T. Oldring (Editor)	
9	Resins for surface coating- Oldring series	
10	Basics of Paint Technology Part I, V. C. Malshe.	
11	Organic coatings science and technology, third edition, Zeno Wicks, 2007	
12	Plastics Materials J. A. Brydson, Butterworth Scientific, 1990.	
13	Polymer chemistry, Seymour and Carraher, Marcel Dekker, 2003.	
14	Polymer and Resins; Their Chemistry and Chemical Engg, Brage Golding, D. Van Nostrand Company Inc, 1959.	
15	Structures of Cellulose, Atlla, American Chemical society, 2003.	
16	Polymer Technology by Miles and Briston Falcetta, Wiley – Interscience Publication, 1977	
17	Polymer Technology by Miles and Briston	
Course Outcomes (Students will be able to.....)		

CO1	Categorize the basics of alkyd resins and differentiate between the various types of alkyds. To understand the chemistry of alkyd resins and provide inputs for modification of alkyds. (K4)
CO2	Illustrate the chemistry of polyurethanes. Compare the various raw materials and their reactivity for polyurethanes and provide inputs for modification (K4)
CO3	Interpret the importance of silicones resins. (K3)
CO4	Identify the role of various types of phenolic resin in polymer and paint industry (K2)
CO5	Distinguish between various chemistries of acrylic and polyester (K4)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+P	K3	K3+A	K2+ A	K3	K6 +A+Psy	K3	K4
CO1	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO2	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO3	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO4	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO5	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution
K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM	Course Code: PET1703	Course Title: MDM-V: Additives and Compounding of polymers	Credits = 2		
	Semester: VII	Total contact hours: 30	L	T	P
			1	1	0

List of Prerequisite Courses

Polymer Chemistry and Technology, Polymer chemistry and Technology, Raw material Analysis of resins and polymers

List of Courses where this course will be prerequisite

Compounding and Polymer Processing, Project I, Environment Health and Safety of Polymers and Coating, Evaluation and testing of Polymers and Coatings, Technology of Plastic Packaging.

Description of relevance of this course

To give understanding of various additives used in polymer. To understand the chemistry and mechanism of additives

Sr. No.	Course Contents (Topics and subtopics)	Required Hours
1	An overview of additives, type of additives, main trends of additives, Fillers, mechanical properties due to fillers	3
2	UV stabilizers, Heat Stabilizers, Flame Retardants	2
3	Conductivity, Antistatic Agent	2
4	Curing & Curing agents	2
5	Coupling agents and Compatibilization agents	1
6	Plasticizer, Blowing Agents, Processing and modifier aid	2
7	Lubricants Mould Release Agents, Antislip and Antiblocking additives	2
8	Additives for rubber and recycling, mixing, compounding, Health and Safety	2

9	Polymer compounding and requirements, Fundamentals of Compounding and processing & Classification and Discussion of Melting Mechanisms, Devolatilization Equipment	3
10	Mechanisms and Theory of mixing, Basic Concepts, Dispersive Mixing of Solid Additives, Distributive Mixing Distribution,	3
11	Blenders, Internal Mixers - Single Screw Extruders - Twin Screw Extruders - Intermeshing Twin Screw Extruders - Reciprocating Screws	4
12	Material Consideration, Properties and Characterization Solid additives (inorganic) - Solid additives (organic) , Compatibilizer (mechanisms, theory)	4
Total		30

List of Text Books/ Reference Books

1	Text book of Polymer Science by Billmeyer, John Wiley and Sons 1984.
2	Additives for plastic by Raymond B. Seymour, Academic Press 1978.
3	Additives for plastic handbook by John Murphy, Elsevier advance technology 1996.
4	Determination of Additives in Polymers and Rubbers by T R. Crompton, Rapra Technology Ltd 2007.
5	Polymer Modifiers and Additives by <u>Richard F. Grossman</u> , John T. Lutz Jr, CRC Press 2000.
6	The Complete Technology Book on Industrial Polymers, Additives, Colourants and Fillers by NIIR Board of Consultants & Engineers. Asia Pacific Business Press Inc. 2006.
7	Additives in Polymers: Industrial Analysis and Applications by Jan C. J. Bart John Wiley and Sons 2005.

Course Outcomes (students will be able to.....)

CO1	Discuss about polymer additives depending upon their requirement and final applications(K2)
CO2	Use proper dosage of additives based on their requirements and chemistries (K3)
CO3	Use of various additive chemistries (K3)
CO4	Solve the problems during processing, end application by selecting proper additives, their dosage, combination based on requirement (K4)
CO5	Solve the requirement of processing for any batch with proper quantity of each and every ingredient such as fillers and additives etc. (K4)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+P	K3	K3+A	K2+ A	K3	K6 +A+Psy	K3	K4
CO1	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO2	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO3	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO4	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO5	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

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MDM	Course Code: PET1816	Course Title: MDM-VI: Polymer Processing			Credits = 2		
	Semester: VIII	Total Contact Hours: 30			L	T	P
List of Prerequisite Courses							
Polymer science and Technology, Polymer chemistry and Technology, Raw material Analysis of resins and polymers, Analysis and characterization of Resins and polymers Lab							
List of Courses where this course will be prerequisite							

Environment Health and Safety of Polymers and Coating, Evaluation and Testing of Polymers and Coatings, and Technology of Plastic Packaging.		
Description of relevance of this course in the B. Tech. Program		
The course gives an insight into the processing techniques of polymers. It will help in troubleshooting the various problems faced during processing. The need for compounding of polymer and techniques involved.		
	Course Contents (Topics and Subtopics)	Required Hours
1	Extruders: single screw and twin screw extruders, Film blowing, Fiber spinning, Pipe extrusion, Co-extrusion of pipes, Extrusion of cable material, extrusion of the sheet, Calendaring, Thermoforming	10
2	Molding: Injection molding,	5
3	Blow molding, Compression molding	5
4	Injection stretch blow molding, Resin transfer molding	5
5	The one-dimensional process is like Coating and Adhesives.	5
	Total	30
List of Textbooks/Reference Books		
1	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1988.	
2	Polymer processing by Mckelvey, J.M, John wiley & sons inc 1962.	
3	Polymer processing fundamentals by T. A. Osswald, Munich hanser publishers 1998.	
4	Polymer reaction engineering by K. H. Reichert and W. Heiseler, VCH publishers, 1989	
5	Plastics Compounding by David Burton Todd, Hanser Publishers 1998.	
6	Principles of Polymer Processing, 2nd Edition by <u>Zehev Tadmor</u> , <u>Costas G. Gogos</u> , John Wiley & Sons, Inc., 2006.	
7	Fundamentals of Modern Manufacturing: Materials, Processes, and Systems by <u>Mikell P. Groover</u> , 2009.	
8	Polymer Extrusion by Chris Rauwendaal, Carl Hanser Verlag GmbH & Co; 3rd Revised edition edition (1 August 1994).	
9	Polymer Processing: Principles and Design, 2nd Edition by <u>Donald G. Baird</u> , <u>Dimitris I. Collias</u> , Wiley-Interscience, 2014.	
10	Polymer Processing and Characterization by Sabu Thomas, Deepalekshmi Ponnamma, Ajesh K. Zachariah. Apple Academic Press 2012.	
Course Outcomes (Students will be able to.....)		
CO1	Process the polymers by various technique and able to solve the problems observed during processing. Ability to understand the degradation/stabilization of polymers and to analyses the respective case studies (K4)	
CO2	Analyze effect of temperature during processing, screw dimensions, the rate of addition as well as the concentration of addition of filler etc. (K4)	
CO3	Formulate the batch for any processing with proper quantity of each and every ingredient such as fillers and additives etc. (K5)	

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+P	K3	K3+A	K2+ A	K3	K6 +A+Psy	K3	K4
CO1	K4	3	3	3	3	2	3	1	3	3	3	3	2	3	3
CO2	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO3	K5	3	3	3	2	3	2	2	3	3	3	3	3	2	3
Course	K5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; – No Contribution
K, knowledge level from cognitive domain; A, Affective domain; S, Psychomotor domain