

SCHEME OF STUDIES
DIPLOMA IN POLYMER TECHNOLOGY (C-20)

CURRICULUM STRUCTURE

V Semester Scheme of Studies - Diploma in Polymer Technology [C-20]

Pathway	Course Category / Teaching Department	Course Code	Pathway Title	Hours per Semester			Total contact hrs /Semester	Credits	CIE Marks		SEE-1 Marks (Theory)		SEE-2 Mark (Practical)		Total Marks	Min Marks for Passing CIE (including CIE marks)	Assigned Grade	Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min	Max	Min					
Programme Specialization Pathway																			
1	ES/PO Specialization pathways in emerging areas Student may select any one of the specializations	20P051I	1. Polymer Product Manufacturing	104	52	312	468	24	240	96	60	24	100	40	400	160			
		20P052I	2. Testing of Polymer Products	104	52	312	468	24	240	96	60	24	100	40	400	160			
		20P053I	3. Specialized Polymer	104	52	312	468	24	240	96	60	24	100	40	400	160			
Science and Research Pathway				L	T	P	Total	Credits	CIE Marks		SEE Marks								Both SGPA & CGPA
									Max	Min	Max	Min							
2	BS/SC/PO Specialization pathway in Science and Research (Student need to take all four papers in this pathway)	20SC51T	Paper 1-Applied Mathematics	52	26	0	78	6	50	20	50	20	100	40					
		20SC52T	Paper 2 - Applied Science	52	0	52	104	6	50	20	50	20	100	40					
		2ORM53T	Paper 3 - Research Methodology	52	0	52	104	6	50	20	50	20	100	40					
		2OTW54P	Paper 4 - Technical Writing	39	13	52	104	6	60	24	40	16	100	40					
			Total	195	39	156	390	24	210	84	190	76	400	160					
Entrepreneurship Pathway																			
3	ES/PO	20ET51I	Entrepreneurship and Start up	104	52	312	468	24	240	96	160	64	400	160					

L:- Lecture T:- Tutorial P:- Practical BS- Basic Science:: ES-Engineering Science:: SC: Science , I: Integrated

Note : In 5th Semester student need to select any one of the pathways consisting of 24 credits

Students can continue their higher education irrespective of the pathways selected

VI Semester Scheme of Studies - Diploma in Polymer Technology [C-20]

Pathway	Course Category / Teaching Department	Course Code	Pathway	Course		Total contact	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing	Assigned Grade	Grade	SGPA and CGPA
								Max	Min	Max	Min					
Internship	ES/PO	20PO61S	Specialisation pathway	Internship/ project	40 Hours / week Total 16 Weeks	640	16	240	96	160	64	400	160			
		20PO61R	Science and Research Pathway	Research project	40 Hours / week Total 16 Weeks	640	16	240	96	160	64	400	160			
		20PO61E	Entrepreneurship and Start up pathway	Minimum Viable Product - MVP/ Incubation/ Startup proposal	40 Hours / week Total 16 Weeks	640	16	240	96	160	64	400	160			

Note: Student shall undergo Internship/Project/research project/MVP/Incubation/Startup proposal in the same area as opted in 5th semester pathway



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Program	Polymer Technology	Semester	5
Course Code	20PO511	Type of Course L:T:P	104:52:312
Specialization	Polymer Product Manufacturing Technology	Credits	24
CIE Marks	240	SEE Marks	160

Introduction:

Polymers can be separated into plastics and rubbers. As engineering materials, they are relatively new compared to metals and ceramics, dating only from around the mid-1800s, for our purposes in covering polymers as a technical subject, it is appropriate to divide them into the following three categories, (1) Thermoplastic polymers, (2) Thermosetting polymers, (3) Elastomer.

Because of the properties of polymers, it is possible to mould them and change their shape using a number of different repetitious manufacturing processes. The most important of these are extrusion, injection moulding, blow moulding, vacuum forming, extrusion blow moulding, rotational moulding, calendaring, foaming and compression moulding.

There are many kinds of rubber products, The basic process of rubber products using general solid rubber-raw rubber as raw materials includes six basic processes of mastication, mixing, calendaring, extrusion, moulding and vulcanization. In addition, it also includes basic processes such as raw material preparation, finished product finishing, and inspection and packaging.

Composite materials are formed by combining two or more materials that have quite different properties, and they do not dissolve or blend into each other. The different materials in the composite work together to give the composite unique properties. Humans have been using composite materials for thousands of years in different areas. The first uses of composites date back to the 1500 BC, when early Egyptians and Mesopotamian settlers used a mixture of mud and straw to create strong and durable buildings.

Depending on the material we want to bind, we can use a wide range of adhesives, which can be divided into different categories, taking into account appearance, adhesion, strength, and chemical structure. For the production of glue, various additives can be used to improve its adhesive properties, accelerate curing or reduce viscosity. Adhesive substances are usually in liquid form. However, you can also find a solid form, e.g. powder, pearls, sticks or cartridges, forming a weld after melting. Its strength depends on several factors: cohesion, adhesion, shape and thickness of the adhesive layer, as well as on the so-called depth of penetration of the material by an adhesive substance. The most important is the adhesion and cohesion that affect the type and strength of the chemical interaction of the adhesive with the bonded surfaces, as well as the mechanical strength of the adhesive layer itself. Adequate selection of glue for the type and size of materials that are to be bonded makes it relatively easy to glue them together.

Course Cohort Owner

A Course Cohort Owner is a faculty from the core discipline, who is fully responsible for one specialised field of study and the cohort of students who have chosen to study that specialised field of study.

Guidelines for Cohort Owner

1. Each Specialized field of study is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. One faculty from the Core Discipline shall be the Cohort Owner, who for teaching and learning in allied disciplines can work with faculty from other disciplines or industry experts.
3. The course shall be delivered in boot camp mode spanning over 12 weeks of study, weekly developmental assessments and culminating in a mini capstone.
4. The industry session shall be addressed by industry subject experts (in contact mode/online / recorded video mode) in the discipline only.
5. The cohort owner shall be responsible to identify experts from the relevant field and organize industry session as per schedule.
6. Cohort owner shall plan and accompany the cohort for any industrial visits.
7. Cohort owner shall maintain and document industrial assignments, weekly assessments, practices and mini project.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table
9. The cohort owner along with classroom sessions can augment or use supplementally teaching and learning opportunities including good quality online courses available on platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM, etc.
10. Cohort owner shall guide the cohorts for the selection and execution of mini project.

Course outcome: A student should be able to

CO-01	Manufacture a molded Rubber product, Extruded product, dipped latex product .etc.
CO-02	Manufacture a plastic Products using injection molding, Extrusion molding, Blow molding and Rotational molding etc.
CO-03	Manufacture a FRP products and adhesive product.
CO-04	Analyze the properties of finished products by using specified testing methods under ASTM/ISO etc.

CO-05	Troubleshoot the processing difficulties and its remedies.
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Detailed course plan

Week	C O	P O	Days	1 st session (9am to 1 pm)	L	T	P	2 ND session (1.30pm to 4.30pm)	L	T	P
	Learning outcomes										
1	01,04,05	1, 2, 3, 4, 7	1	Present an over view of Polymer Products and manufacturing.	2	1	1	Present an over view of Polymer Products and manufacturing and scope of different polymer products.	0	0	3
	01,04,05	1, 2, 3, 4, 7	2	Formulate a formula to manufacture a rubber bush to meet the given specification,	2	1	1	According to the formula weigh the required materials and arrange it accordingly.	0	0	3
	01,04,05	1, 2, 3, 4, 7	3	Discuss on materials taken according to formula , and discuss the sequence of mixing	2	1	1	Start the mixing process according to the sequence using the weighed materials	0	0	3
	01,04,05	1, 2, 3, 4, 7	4	Discuss on vulcanizing materials, importance of mature time for mixed compound, Importance of reho graph, importance of mold fill factor calculation, importance of finishing and testing of finished products.	2	1	1	Mix the vulcanizing materials, Calculate the mold fill factor, produce the rubber bush, finish the end product test the product according to the specified test standards. Different types of Test methods followed in rubber industries, importance of testing the product according to the specified test standards.	0	0	3
	01,04,05	1, 2, 3, 4, 7	5	Developmental Assessment -Assessment	0	0	3	Review and corrective action. 1. Draw a neat layout diagram of the bush manufacturing process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	01,04,05	1, 2, 3, 4, 7	6.	Industry class-On molded products and its application	0	2	2				
	Learning outcomes										

2	01,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a rubber sheet to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3
	01,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula , and discuss the sequence of mixing.	2	1	1	Start the mixing process according to the sequence using the weighed materials	0	0	3
	01,04,05	1, 2, 3, 4, 7	3	Discuss on vulcanizing materials, importance of mature time for mixed compound, Importance of rheo graph, importance of mold fill factor calculation, importance of finishing and testing of finished products.	2	1	1	Mix the vulcanizing materials, Calculate the mold fill factor, produce the rubber bush, finish the end product test the product according to the specified test standards.	0	0	3
	01,04,05	1, 2, 3, 4, 7	4	Different types of Test methods followed in rubber industries, importance of testing, test standards followed in rubber industries.	2	1	1	Conduct test on the product Manufactured- Tensile test, Abrasion test, compression test, hardness, etc.	0	0	3
	01,04,05	1, 2, 3, 4, 6, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action 1. Draw a neat layout diagram of the bush manufacturing process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	01,04,05	1, 2, 3, 4, 7	6	Industry Class-Importance of testing and quality inspection in rubber industries.	0	2	2	Weekly Assignment(1PM-2PM)			
Learning outcomes											
3	01,04,05	1, 2, 3, 4, 7	1	Peer review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a rubber tube to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3

	01,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula , and discuss the sequence of mixing.	2	1	1	Start the mixing process according to the sequence using the weighed materials	0	0	3
	01,04,05	1, 2, 3, 4, 7	3	Discuss on vulcanizing materials, importance of mature time for mixed compound, Importance of rheo graph study, importance of L/D ration in extrusion process.	2	1	1	Mix the vulcanizing materials, produce the rubber tube, finish the end product test the product according to the specified test standards	0	0	3
	01,04,05	1, 2, 3, 4, 7	4	Different types of Test methods followed in rubber industries, importance of testing, test standards followed in rubber industries.	2	1	1	Conduct test on the product Manufactured- Tensile test, compression test, hardness, etc.	0	0	3
	01,04,05	1, 2, 3, 4, 7	5	CIE 1 - Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	01,04,05	1, 2, 3, 4, 7	6	Industry Class-Extrusion process and its important application.	0	2	2	Weekly Assignment(1PM-2PM)			
Learning outcomes											
4	01,04,05	1, 2, 3, 4, 7	1	Peer Review- - First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a rubber glove to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3
	01,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the sequence of mixing followed in latex compounding.	2	1	1	Start the compounding of latex, mix the compound according to the sequence using the weighed materials	0	0	3
	01,04,05	1, 2, 3, 4, 7	3	Discuss on vulcanizing materials used in latex products, importance of mature time in latex compound, important steps to be	2	1	1	Mix the vulcanizing materials, produce the rubber gloves, finish the end product test	0	0	3

				followed to gain a good compounded latex.				the product according to the specified test standards			
	01,04,05	1, 2, 3, 4, 7	4	Different types of Test methods followed in latex industries, importance of testing, test standards followed in latex industries.	2	1	1	Conduct test on the product Manufactured-, TSR, VFA, DRC, visual, Viscosity Test, MST inspection, etc.	0	0	3
	01,04,05	1, 2, 3, 4, 7	5	Developmental Assessment -Assessment Review and corrective action.	0	0	3	-Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	02,04,05	1,2	6	Industry Class-Latex products and its application.	0	2	2	Weekly Assignment(1PM-2PM)			
Learning outcomes											
5	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic soap box, using injection moulding machine to meet the given specification.	0	0	3
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic soap box, importance of process cycle.	2	1	1	Manufacture a product using injection moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Test the plastic materials –Melting point test, Tensile test, HDT-VST, DENSITY Test	0	0	3

	02,04,05	1, 2, 3, 4, 7	4	Different test procedures followed for different plastic material, Discuss and analyze the test results, trouble shooting in injection molding process.	2	1	1	Test the plastic materials – Tensile test, Melting point test, HDT-VST, DENSITY Test	0	0	3
	02,04,05	1, 2, 3, 4, 7	5	CIE 2 – Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	02,04,05	1, 2, 3, 4,6, 7	6	Industry Class- Injection molding process and its application. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
6	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic hollow product, using rotational moulding machine to meet the given specification.	0	0	3
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic hollow product by rotational moulding process. , importance of process cycle.	2	1	1	Manufacture a hallow product using rotational moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Test the plastic materials- ECSR test, Izod impact test, MFI test.	0	0	3
	02,04,05	1, 2, 3, 4, 7	4	Test procedure followed - ECSR test, Izod impact test, MFA test.	2	1	1	Test the plastic materials- ECSR test, Izod impact test, MFI test.	0	0	3

								Troubleshooting followed in rotational molding technique, finishing operations followed in rotational molding			
	02,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
		1, 2, 3, 4, 6, 7	6	Industry Class: -Rotational molding products and its application. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
7	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic extruded product, using extrusion machine to meet the given specification.	0	0	3
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic extruded product by extrusion process. , importance of process cycle.	2	1	1	Manufacture an extruded product using extrusion machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Test the plastic materials- Falling dart impact tester, Burst pressure test, Arc test.	0	0	3
	02,04,05	1, 2, 3, 4, 7	4	Test procedure followed - Falling dart impact tester, Burst pressure test, Arc test	2	1	1	Test the plastic materials- Falling dart impact tester, Burst pressure test, Arc test.	0	0	3

	02,04,05	1, 2, 3, 4, 7	5	CIE 3 – Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	6	Industry Class: -Plastic extruded products and application. Weekly Assignment(1PM-2PM)	0	2	2				
Learning outcomes											
8	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic bottle, using Blow moulding machine to meet the given specification.	0	0	3
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic bottle by blow moulding process. , importance of process cycle.	2	1	1	Manufacture a plastic bottle using blow moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	- Test the plastic materials- Opacity test, Colour identification index, Tensile test. test.	0	0	3
				4	Test procedure followed Opacity test, Colour identification index, Tensile test.	2	1	1	Test the plastic materials- Opacity test, Colour identification index, Tensile test. Troubleshooting followed in extrusion technique, finishing operations followed in extrusion process.	0	0

	02,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	6	Industry Class: -Blow molding trends and advancements. Weekly Assignment(1PM-2PM)	0	2	2				
Learning outcomes											
9	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a composite sheet, using Hand layup process to meet the given specification.	0	0	3
	03,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a composite sheet by hand layup process, importance of gel time.	2	1	1	Manufacture a composite sheet by hand layup process, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3
	03,04,05	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 1. Determine the tex value. 2. Determine the moisture content and binder content of glass rooving. 3. Determine the surface weight/density of glass tissue. 4. Determine the binder content of glass tissue.	2	1	1	Test the composite materials: 1. Determine the tex value. 2. Determine the moisture content and binder content of glass rooving.	0	0	3
	03,04,05	1, 2, 3, 4, 7	4	Importance of finishing operations followed in composite industries, Importance of	2	1	1	Test the composite materials:	0	0	3

				testing in composite industries, importance of quality inspection in composite industries.				3. Determine the surface weight/density of glass tissue. 4. Determine the binder content of glass tissue			
	03,04,05	1, 2, 3, 4, 7	5	CIE 4 - Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	03,04,05	1, 2, 3, 4, 6, 7	6	Industry Class: - Advancement in Polymer Industries. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
10	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a composite model, using VARTM process to meet the given specification.	0	0	3
			2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a composite model by VARTM process, importance of gel time.	2	1	1	Manufacture a composite model by VARTM process, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3
	03,04,05	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 1. Determine the viscosity of polyester resin measured by Brookfield viscometer. 2. Determine the reactivity of unsaturated polyester resin. 3. Determine the gel time of unsaturated polyester resin at room temperature.	2	1	1	Test the composite materials: 1. Determine the viscosity of polyester resin measured by Brookfield viscometer. 2. Determine the reactivity of unsaturated polyester resin. 3. Determine the gel time of unsaturated polyester resin at room temperature.	0	0	3

				4. Determine water content in Methyl ethyl ketone peroxide.				4. Determine water content in Methyl ethyl ketone peroxide.			
	03,04,05	1, 2, 3, 4, 7	4	Troubleshooting followed in composite industries, finishing operations followed in composite industries Test the composite materials: 1. Determine the viscosity of polyester resin measured by Brookfield viscometer. 2. Determine the reactivity of unsaturated polyester resin.	2	1	1	Test the composite materials: 1. Determine the gel time of unsaturated polyester resin at room temperature. 2. Determine water content in Methyl ethyl ketone peroxide.	0	0	3
	03,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
			6	Industry Class: - Advancement in Polymer Industries. Weekly Assignment(1PM-2PM)	0	2	2				
Learning outcomes											
11	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a Water proofing compound, to meet the given specification.	0	0	3
	03,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a Water proofing compound,	2	1	1	Manufacture a Water proofing compound, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3

03,04,05	1, 2, 3, 4, 7	3	<p>Briefing of following Test procedure:</p> <ol style="list-style-type: none"> 1. Determination of water beading property of grouts. 2. Method of water Absorption-Carsten tube. 3. Determine the viscosity test of given adhesive material. 4. Determine the solid content in given adhesive material. 5. Determine the ash content in given adhesive material. 6. 	2	1	1	<p>Test on Adhesive materials:</p> <ol style="list-style-type: none"> 1. Determination of water beading property of grouts. 2. Method of water Absorption-Carsten tube 	0	0	3
03,04,05	1, 2, 3, 4, 7	4	<p>Troubleshooting followed in Adhesive industries, safety and quality operations followed in adhesive industries</p>	2	1	1	<p>Test on Adhesive materials:</p> <ol style="list-style-type: none"> 1. Determine the viscosity test of given adhesive material. 2. Determine the solid content in given adhesive material. 3. Determine the ash content in given adhesive material. 	0	0	3
03,04,05	1, 2, 3, 4, 7	5	<p>CIE 5- Written and practice test</p>	0	0	3	<p>Developmental Assessment -Assessment Review and corrective action.</p> <ol style="list-style-type: none"> 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process. <ol style="list-style-type: none"> 1. 	0	0	3

	03,04,05	1, 2, 3, 4, 6, 7	6	Industry Class: - Advancement in Adhesive Industries. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
12	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a Tile and stone fixing adhesive, to meet the given specification.	0	0	3
	03,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a Tile and stone fixing adhesive.	2	1	1	Manufacture a Tile and stone fixing adhesive, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3
	03,04,05	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 1. Determine adjustment time/Open time 2. To determine the time duration, it takes a mortar to reach a constant state of cure or hydration. (IS & FS Gilmore apparatus.) 3. To determine the particle distribution of the sand and other aggregate and to check the cement content of finished products. 4. To determine the shear adhesion strength of our products, raw materials, packing materials, competitor's products.	2	1	1	Test on Adhesive materials: 1. Determine adjustment time/Open time 2. To determine the time duration, it takes a mortar to reach a constant state of cure or hydration. (IS & FS Gilmore apparatus.)	0	0	3
	03,04,05	1, 2, 3, 4, 7	4	Troubleshooting followed in Adhesive industries, safety and quality operations followed in adhesive industries. Test on Adhesive materials: 1. To determine the particle distribution of the sand and other aggregate and to	2	1	1	Procedure/Test on Adhesive materials: 1. Determine the compression test of a given sample. 2. Determine Flexural strength of a given sample.	0	0	3

				check the cement content of finished products. 2. To determine the shear adhesion strength of our products, raw materials, packing materials, competitor's products.							
	03,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
		1, 2, 3, 4, 7	6	Industry Class: - Importance of adhesive materials.	0	2	2	Weekly Assignment(1PM-2PM)			
	Learning outcomes										
13	03,04,05	1, 2, 3, 4, 6, 7	1	Internship a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship. b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies. c) Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence - including the areas of				Project a) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective. b) Design and develop the project solution or methodology to be used to solve at least one of the problems identified. c) Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to			
	03,04,05	1, 2, 3, 4, 6, 7									
	03,04,05	1, 2, 3, 4, 6, 7									
	03,04,05	1, 2, 3, 4, 6, 7									
	03,04,05	1, 2, 3, 4, 6, 7									

				learning you expect to learn during internship.		ensure the project achieves the desired outcome.	
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CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1- Written and practice test	4	30
Week 5	CIE 2- Written and practice test	4	30
Week 7	CIE 3- Written and practice test	4	30
Week 9	CIE 4- Written and practice test	4	30
Week 11	CIE 5- Written and practice test	4	30
	On line Course work (Minimum 10 hours online course with certification from (SWAYAM/NPTEL/Infosys Springboard)		40
	Profile building for Internship / Submission of Synopsys for project work		20
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			240
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hrs duration reduced to 60 marks		3	60
SEE 2 - Practical		3	100
TOTAL SEE MARKS (B)			160
TOTAL MARKS (A+B)			400

*The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Assessment framework for CIE (1 to 5)

Note: Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Programme	Polymer Technology	Semester	V
Course	Polymer product manufacturing.	Max Marks	30
Course Code	20PO51I	Duration	4 hours
Name of the course coordinator			

Note: Answer one full question from each section.

Q. No	Question	CL L3/L4	CO	PO	Marks
Section-1 (Theory) - 10 marks					
1.a)	Explain vulcanization materials in rubber production.	L3	01, 04, 05	1, 2, 3, 4, 7	5
b)	Illustrate the importance of fill factor in rubber industries.	L4	01, 04, 05	1, 2, 3, 4, 7	5
2.a)	List natural and synthetic rubber with its structure.	L3	01, 04, 05	1, 2, 3, 4, 7	2
b)	Prepare a formula to manufacture a rubber bush with 70 hardness.	L3	01, 04, 05	1, 2, 3, 4, 7	3
c)	Outline the manufacturing of rubber sheet and explain.	L4	01, 04, 05	1, 2, 3, 4, 7	5
Section-2 (Practical) - 20 marks					
3)	Prepare the rubber bush according to the given formula and test the rubber bush and report.	L3	01, 04, 05	1, 2, 3, 4, 7	10
4)	Outline the manufacturing of rubber sheet and get the tensile result of manufactured sheet.	L4	01, 04, 05	1, 2, 3, 4, 7	10

Note : Theory questions shall be aligned to practical questions

Assessment framework for SEE 1 (Theory)

Programme :	POLYMER TECHNOLOGY	Max Marks :	100
Semester :	V	Duration :	3 Hrs
Course :	POLYMER PRODUCTS MANUFACTURING.		
Course Code :	20PO51I		

Instruction to the Candidate: Answer one full question from each section.

Q. No	Question	CL	CO	Marks
Section-1				
1.a)	Explain the manufacturing process of Rubber sheet using compression moulding technique, with layout diagram.	L3	1, 4, 5	10
b)	Illustrate the test method on rubber sheet a. Tensile Strength b, Hardness test.	L4		10
2.a)	Explain the manufacturing process of Rubber bush using compression moulding technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Compression Strength b, Abrasion resistance	L4		10
Section-2				
3.a)	Explain the manufacturing process of Rubber tube using extrusion process technique.	L3	1, 4, 5	10
b)	Illustrate the test method on rubber tube a. Splice strength b, Chemical resistance.	L4		10
4.a)	Explain the manufacturing process of Latex gloves.	L3		10
b)	Illustrate the test method on gloves a. DRC b, MST	L4		10
Section-3				
5.a)	Explain the manufacturing process of plastic box using injection moulding technique, with layout diagram.	L3	2, 4, 5.	10
b)	Illustrate the test method on rubber sheet a. Tensile Strength b, Hardness test.	L4		10
6.a)	Explain the manufacturing process of hollow product using rotational moulding technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Compression Strength b, Burst strength.	L4		10
Section-4				
7.a)	Explain the manufacturing process of plastic bottle using blow moulding technique, with layout diagram.	L3	2, 4, 5.	10
b)	Illustrate the test method on rubber sheet a. Destructive test b. Opacity test	L4		10
8.a)	Explain the manufacturing process of plastic sheet using extrusion technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Bulk density b. MFI	L4		10
Section-5				
9.a)	Explain the manufacturing process of composite sheet using VARTM process, with layout diagram.	L3	3, 4, 5.	10

b)	Illustrate the test method on composite sheet a. Viscosity by Brook field viscometer b. Determine the gel time of resin.	L4	10
10.a)	Explain the manufacturing process water proofing compound with layout diagram.	L3	10
b)	Illustrate the test method on Adhesive material a. Determination on water beading property of grouts b. Determination of solid content in adhesive material.	L4	10

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
1	Case submission	20
2	Case presentation	20
3	Case innovation	20
4	Result	20
5	Viva voce	20
Total		100

References

Sl. No	
1	Rubber Products Manufacturing Technology Ed. By Anil K Bhowmick, Malcolm M. Hall and Henry A. Benarey, Marcel Dekker Inc., New York, 1994.
2	The Language of Rubber – Elastomers – Chemicals department, 1963, E.I. Dupont de Nemours & Co., Delaware, U.S.A.
3	Physical testing of rubber – R.P. Brown, 1979, Applied Science Publishers Ltd. London
4	Rubber Technology (3rd Edn.), Maurice Morton (Ed.), Van Nostrand Reinhold Co., N.Y. 1987
5	Rubber Tech., and Manufacture by C.M. Blow-Plastic and Rubber Institute Butter Worths- 1982
6	Plastics Materials and Product Testing Vol. I & II CIPET, Chennai
7	Rubber Engineering - Indian Rubber Institute - Tata McGraw Hill Publishing Co. Ltd.
8	PVC Technology – Penn
9	Plastics Testing Technology Hand book - Vishu Shah, John Wiley and sons, NY.
10	Hand book of Plastics Test methods - R.P. Brown, John Wiley, NY
11	C.B. Bucknall and D. R. Paul, “Polymer Blends: Volumes I and II”, John Wiley and Sons, New York, 2000
12	D R. Paul and C.B. Newman, “Polymer Blends Vol. I & II”, Academic Press Inc, 1978.
13	Polymer Blends and Alloys, “Gabriel O. Shonaike and George P. Simon”, editors. Marcel Dekker, 1999.
14	Experiment in Polymer Science by DG Hundiwale, VD Aathawale, UR Kapadi
15	ACE bond adhesive company manual.

Required Course Facilities:**Lab equipment's list with appropriate specifications (Batch size:20)****Sl. No. Name of Equipment and Specification Quantity Required**

Sl no	Machine details	Qty
1	Universal testing machine (utm) 01 nos.	01 nos.
2	Izod and charpy	01 nos.
3	Falling dart machine	01 nos.
4	Rockwell and durometer.	01 nos.
5	Flexometer	01 nos.
6	Vicat softening point apparatus	01 nos.
7	Heat distortion temperature	01 nos.
8	Dielectric apparatus	01 nos.
9	Volume and surface resistivity setup	01 nos.
10	Opacity tester	01 nos.
11	Environmental stress cracking resistance	01 nos.
12	Chemical resistance setup	01 nos.
13	Flammability test setup	01 nos.
14	Semiautomatic blow molding machine for small bottle	01 nos.
15	Semi automatic injection molding machine	01 nos.
16	Lab type rotational molding machine	01 nos.
17	Extruder machine for blowing film	01 nos.
18	Lab type dispersion kneader	01 nos.
19	Rheometr	01 nos.
20	Fully automatically injection molding machine	01 nos.
21	Fully automatical blow molding machine	01 nos.
22	Extruder pipe manufacturing machine	01 nos.
23	Two roll mixing mill	01 nos.
24	Hydraulic press	01 nos.
25	Auto clave/ vulcanizer	01 nos.
26	(mfi)-melt flow index	01 nos.
27	Weighing balance	01 nos.

28	Density tester	01 nos.
29	Extrusion of strands and pelletization	01 nos.
30		01 nos.
31	Glove manufacturing setup	01 nos.
32	Brookfield viscometer	01 nos.
33	Vartm setup	01 nos.
34	Hand lay-up setup	01 nos.
35	Oven	01 nos.
36	Muffel furnace	01 nos.
37	Desiccator	01 nos.

Appropriate Virtual practice links:

- www.youtube.com/watch?v=B06aa41muSE
- https://www.youtube.com/watch?v=zcBv_jvFDBI
- <https://www.youtube.com/watch?v=N5AV-lWpIxY>
- <https://www.youtube.com/watch?v=h-sLHYvqT7I>
- https://www.youtube.com/watch?v=A9PMs_N33fU
- <https://www.youtube.com/watch?v=uwFvGZcjQME>
- <https://www.youtube.com/watch?v=30A6sL5dISA>
- <https://www.youtube.com/watch?v=rJVbpXRT8ww>
- <https://www.youtube.com/watch?v=N5AV-lWpIxY>
- https://www.youtube.com/watch?v=wqw4bu_IShI
- <https://www.youtube.com/watch?v=BuSWAMxdcHg>
- <https://www.youtube.com/watch?v=NXLDoATXoh4>
- <https://www.youtube.com/watch?v=780DsKqsHP0>
- <https://www.youtube.com/watch?v=ydpOvLqcAWA>
- <https://www.youtube.com/watch?v=GDdUi24g20o>
- <https://www.youtube.com/watch?v=UAlAyQz5vVQ>
- <https://www.youtube.com/watch?v=QLiQLGPXg5k>

- <https://www.youtube.com/watch?v=xnqoVoW0zd0>
- https://www.youtube.com/watch?v=MTKPGEHq_ak
- <https://www.youtube.com/watch?v=Sb4DA2uNZ68>
- <https://www.youtube.com/watch?v=y8oWkx1PhUY>
- <https://www.youtube.com/watch?v=3YrsqS8xhzg>
- <https://www.youtube.com/watch?v=noxZ2D4Zcjo>
- <https://www.youtube.com/watch?v=ChJj6kyKsJw>
- <https://www.youtube.com/watch?v=dztweAfXQv0>
- <https://www.youtube.com/watch?v=V54awR2lHRg>
- <https://www.youtube.com/watch?v=ypCcKJS0fx0>
- <https://www.youtube.com/watch?v=MMTgHlsgVLE>
- <https://www.youtube.com/watch?v=SeqDm9l3yEM>
- <https://www.youtube.com/watch?v=sDJpf6pKyuE>
- <https://www.youtube.com/watch?v=a8bUVHLt8d4>
- <https://www.youtube.com/watch?v=T9gF3l5YRKA>
- <https://www.youtube.com/watch?v=1Mqvuhku4P8>
- <https://www.youtube.com/watch?v=xim1m2Bhvzc>
- <https://www.youtube.com/watch?v=ZfyPCujUPms>
- <https://www.youtube.com/watch?v=5IlrOxRPy0U>
- <https://www.youtube.com/watch?v=3oKT6sv-e1k>
- <https://www.youtube.com/watch?v=O8rmvNLAMsc>
- <https://www.youtube.com/watch?v=F153DNul8xs>
- <https://www.youtube.com/watch?v=O8rmvNLAMsc>
- <https://www.youtube.com/watch?v=rHxxLYzJ8Sw>
- <https://www.youtube.com/watch?v=jV0ICySwhLE>
- <https://www.youtube.com/watch?v=0gUKG88mE0M>
- <https://www.youtube.com/watch?v=Qw7eBWnYZIc>
- <https://www.youtube.com/watch?v=ZW0y3WUd4qo>
- <https://www.youtube.com/watch?v=WYqCnEvTRUQ>
- <https://www.youtube.com/watch?v=02SAIPKKYn4>
- <https://www.youtube.com/watch?v=P-tg52VRzZU>
- <https://www.youtube.com/watch?v=XvXrD4iuF5g>

- <https://www.youtube.com/watch?v=VMH6qbED7pg>
- <https://www.youtube.com/watch?v=dbywZ4PJ3QA>
- <https://www.youtube.com/watch?v=IXYKKDiCroM>
- <https://www.youtube.com/watch?v=FTUw0OwwMLU>
- <https://www.youtube.com/watch?v=tP8JCX87DzI>
- <https://www.youtube.com/watch?v=yTsXKGUdtCE>



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Program	Polymer Technology	Semester	5
Course Code	20P052I	Type of Course L:T:P	104:52:312
Specialization	Testing of Polymer Products.	Credits	24
CIE Marks	240	SEE Marks	160

Introduction:

Polymers have become a crucial part of our lives and most of the things around us are made up of polymers. Due to the increased usage of polymers, they need to be tested for quality as the toxicity caused by polymer materials can be hazardous. Physical and mechanical testing of polymers targets on the testing, analysis and characterization of polymer materials, including both synthetic and natural polymers.

Polymer Testing ensures that material complies with industry specifications applicable to industries such as aerospace, automotive, consumer, medical and defence amongst others. Identifying the capabilities and limitations of a material is of high priority to suppliers, manufacturers and product developers on every level of the polymer industry supply chain. Polymer testing helps to perceive product efficiency to withstand different environmental conditions, resistance against rough handling and also to determine shelf life of the product.

WHY IS POLYMER TESTING IMPORTANT?

- Helps raw material suppliers and product developers to understand the properties of their products
- Supports the companies to comply with product performance specifications
- Allows the developers to introduce stronger quality control system
- Provides valuable data when conducting failure analysis investigation and supports in potential litigation

Course Cohort Owner

A Course Cohort Owner is a faculty from the core discipline, who is fully responsible for one specialised field of study and the cohort of students who have chosen to study that specialised field of study.

Guidelines for Cohort Owner

1. Each Specialized field of study is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. One faculty from the Core Discipline shall be the Cohort Owner, who for teaching and learning in allied disciplines can work with faculty from other disciplines or industry experts.
3. The course shall be delivered in boot camp mode spanning over 12 weeks of study, weekly developmental assessments and culminating in a mini capstone.
4. The industry session shall be addressed by industry subject experts (in contact mode/online / recorded video mode) in the discipline only.
5. The cohort owner shall be responsible to identify experts from the relevant field and organize industry session as per schedule.
6. Cohort owner shall plan and accompany the cohort for any industrial visits.
7. Cohort owner shall maintain and document industrial assignments, weekly assessments, practices and mini project.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table
9. The cohort owner along with classroom sessions can augment or use supplemental teaching and learning opportunities including good quality online courses available on platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM, etc.
10. Cohort owner shall guide the cohorts for the selection and execution of mini project.

Course outcome: A student should be able to

CO-01	Test and analyzing the Manufactured Rubber products.
CO-02	Test and analyzing the Manufactured Plastic products.
CO-03	Test and analyzing the Manufactured composite products.

CO-04	Test and analyzing the Manufactured Adhesive products.
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Detailed course plan

Week	C O	P O	Days	1 st session (9am to 1 pm)	L	T	P	2 ND session (1.30pm to 4.30pm)	L	T	P
	Learning outcomes										
1	01	1, 2, 3, 4, 7	1	Present an over view of course- Testing of Polymer Products.	2	1	1	Present an over view of Testing of Polymer Products. and scope of different polymer products.	0	0	3
	01	1, 2, 3, 4, 7	2	Formulate a formula to manufacture a rubber sheet/flap to meet the given specification.	2	1	1	According to the formula weigh the required materials and arrange it accordingly.	0	0	3
	01	1, 2, 3, 4, 7	3	Discuss on materials taken according to formula, and discuss the sequence of mixing Discuss on vulcanizing materials, importance of mature time for mixed compound, Importance of rheo graph, importance of mold fill factor calculation, importance of finishing and testing of finished products.	2	1	1	Start the mixing process according to the sequence using the weighed materials. Disperse the vulcanizing materials, Calculate the mold fill factor, produce the rubber sheet, finish the end product test the product according to the specified test standards.	0	0	3
	01	1, 2, 3, 4, 7	4	Different types of Test methods followed in rubber industries, importance of testing the product according to the specified test standards. <u>Test Procedures: ASTM D 412</u> 1.Tensile, Elongation, Modulus	2	1	1	<u>Conduct the Test: ASTM D 412</u> 1.Tensile, Elongation, Modulus	0	0	3
	01	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Review and corrective action 1. Draw a neat layout diagram of the process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	01	1, 2, 3, 4, 7	6.	Industry class-On molded products and its application.	0	2	2				

				Weekly Assignment(1PM-2PM)								
Learning outcomes												
2	01	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a rubber tube to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3	
	01	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the sequence of mixing. Discuss on vulcanizing materials, importance of mature time for mixed compound, Importance of rheo graph, importance of finishing and testing of finished products.	2	1	1	Start the mixing process according to the sequence using the weighed materials. Mix the vulcanizing materials, produce the rubber tube, finish the end product test the product according to the specified test standards.	0	0	3	
	01	1, 2, 3, 4, 7	3	Different types of Test methods followed in rubber industries, importance of testing, test standards followed in rubber industries. 1.	2	1	1	Test Procedures: 1. Chemical Resistance (ASTM D- 471) 2. Splice strength	0	0	3	
	01	1, 2, 3, 4, 7	4	Conduct the Test: 1. Chemical Resistance (ASTM D- 471) 2. Splice strength	2	1	1	Conduct test on the product Manufactured- Tensile test, compression test, hardness, etc.	0	0	3	
	01	1, 2, 3, 4, 6, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3	
	01	1, 2, 3, 4, 7	6	Industry Class-Importance of testing and quality inspection in rubber industries.	0	2	2					

				Weekly Assignment(1PM-2PM)								
Learning outcomes												
3	01	1, 2, 3, 4, 7	1	Peer review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a rubber pad to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3	
	01	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula , and discuss the sequence of mixing.	2	1	1	Start the mixing process according to the sequence using the weighed materials. Mix the vulcanizing materials, produce the rubber tube, finish the end product test the product according to the specified test standards	0	0	3	
	01	1, 2, 3, 4, 7	3	Different types of Test methods followed in rubber industries, importance of testing, test standards followed in rubber industries.	2	1	1	Conduct the following Test: 1. Compression set method B (ASTN D 395-03) 2. Hardness (Durometer) (ASTM D2240-05) 3. Abrasion resistance (ASTM D5963-04)	0	0	3	
	01	1, 2, 3, 4, 7	4	Test procedure: 1. Compression set method B (ASTN D 395-03) 2. Hardness (Durometer) (ASTM D2240-05) 3. Abrasion resistance (ASTM D5963-04)	2	1	1	Test procedure: 1. Compression set method B (ASTN D 395-03) 2. Hardness (Durometer) (ASTM D2240-05) 3. Abrasion resistance (ASTM D5963-04)	0	0	3	
	01	1, 2, 3, 4, 7	5	CIE 1 - Written and Practice Test	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3	

	01	1, 2, 3, 4, 7	6	Industry Class-Extrusion process and its important application. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
4	01	1, 2, 3, 4, 7	1	Peer Review- - First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a rubber glove to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3
	01	1, 2, 3, 4, 7	2	Formulate materials taken according to formula, and discuss the sequence of mixing followed in latex compounding.	2	1	1	Start the compounding of latex, mix the compound according to the sequence using the weighed materials	0	0	3
	01	1, 2, 3, 4, 7	3	Discuss on vulcanizing materials used in latex products, importance of mature time in latex compound, important steps to be followed to gain a good compounded latex.	2	1	1	Mix the vulcanizing materials, produce the rubber gloves, finish the end product test the product according to the specified test standards. Different types of Test methods followed in latex industries, importance of testing, test standards followed in latex industries.	0	0	3
	01	1, 2, 3, 4, 7	4	Conduct the following Test: 1. Volatile fatty acid number 2. Dry rubber Content 3. Total Solid content 4. MST	2	1	1	Test the following: 1. Volatile fatty acid number 2. Dry rubber Content 3. Total Solid content 4. MST	0	0	3
	01	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3

	01	1,2	6	Industry Class-Latex products and its application. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
5	02	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic soap box, using injection moulding machine to meet the given specification.	0	0	3
	02	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic soap box, importance of process cycle.	2	1	1	Manufacture a product using injection moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Different test procedures followed for different plastic material, Discuss and analyse the test results, trouble shooting in injection moulding process.	0	0	3
	02	1, 2, 3, 4, 7	4	Conduct the following Test: 1. Density Gradient Technique (ASTM D-792-00) 2. Water Absorption of plastics (ASTM D 570-98) 3. Bulk Density 4. Melting point test	2	1	1	Conduct the following Test: 1. Density Gradient Technique (ASTM D-792-00) 2. Water Absorption of plastics (ASTM D 570-98) 3. Bulk Density 4. Melting point test	0	0	3
	02	1, 2, 3, 4, 7	5	CIE 2 - Written and Practice Test	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product.	0	0	3

							3. Note down different types of materials and machinery used during the process.				
	02	1, 2, 3, 4, 6, 7	6	Industry Class- injection molding process and its application. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
6	02	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture using rotational moulding machine to meet the given specification.	0	0	3
	02	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic hollow product by rotational moulding process. , importance of process cycle.	2	1	1	Manufacture a hallow product using rotational moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Troubleshooting followed in rotational molding technique, finishing operations followed in rotational molding	0	0	3
	02	1, 2, 3, 4, 7	4	Conduct the following Test: 1. Melt flow Index 2. Heat distortion Temperature 3. Vicat softening Temperature.	2	1	1	Conduct the following Test: 1. Melt flow Index 2. Heat distortion Temperature 3. Viscat softening Temperature.	0	0	3
	02	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
			1, 2, 3, 4, 6, 7	6	Industry Class: -Advancements in extrusion molding of plastic.	0	2	2			

				Weekly Assignment(1PM-2PM)							
Learning outcomes											
7	02	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic bottle, using blow moulding machine to meet the given specification.	0	0	3
	02	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic bottle, using blow moulding machine, importance of process cycle.	2	1	1	Manufacture a plastic bottle, using blow moulding machine identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Conduct the following Test: 1. Burst Strength 2. Visual strength 3. Destructive test	0	0	3
	02	1, 2, 3, 4, 7	4	Conduct the following Test: 1. Burst Strength 2. Visual strength 3. Destructive test	2	1	1	Conduct the following Test: 1. Burst Strength 2. Visual strength 3. Destructive test	0	0	3
	02	1, 2, 3, 4, 7	5	CIE 3 – Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action Troubleshooting followed in extrusion technique, finishing operations followed in extrusion process. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	02	1, 2, 3, 4, 7	6	Industry Class: -Advancement in Blow molding.	0	2	2				

				Weekly Assignment(1PM-2PM)							
Learning outcomes											
8	02	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic sheet, using Extrusion moulding machine to meet the given specification.	0	0	3
	02	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce Extrusion moulding machine, importance of process cycle.	2	1	1	Manufacture a plastic sheet using extrusion moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Troubleshooting followed in extrusion technique, finishing operations followed in extrusion process. .	0	0	3
			4	Conduct the following Test: 1. Tensile Properties (ASTMT D 638-03) 2. Tear Resistance (ASTM D 1004-03) 3. Non-destructive test	2	1	1	Conduct the following Test: 1. Tensile Properties (ASTMT D 638-03) 2. Tear Resistance (ASTM D 1004-03) 3. Non-destructive test	0	0	3
	02	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	-Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	02	1, 2, 3, 4, 7	6	Industry Class: -Extrusion molding trends and advancements. Weekly Assignment(1PM-2PM)	0	2	2				

				Learning outcomes								
9	03	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a composite sheet, using Hand layup process to meet the given specification.	0	0	3	
	03	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a composite sheet by hand layup process, importance of gel time.	2	1	1	Manufacture a composite sheet by hand layup process, identify different process troubleshooting followed during the process, parallel plot a process flow diagram according to the process.	0	0	3	
	03	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 1. Determine the tex value. 2. Determine the moisture content and binder content of glass rooving. 3. Determine the surface weight/density of glass tissue. 4. Determine the binder content of glass tissue.	2	1	1	Test the composite materials: 1. Determine the tex value. 2. Determine the moisture content and binder content of glass rooving.	0	0	3	
	03	1, 2, 3, 4, 7	4	Importance of finishing operations followed in composite industries, Importance of testing in composite industries, importance of quality inspection in composite industries.	2	1	1	Test the composite materials: 1. Determine the surface weight/density of glass tissue. 2. Determine the binder content of glass tissue	0	0	3	
	03	1, 2, 3, 4, 7	5	CIE 4 - Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action, troubleshooting followed in extrusion technique, finishing operations followed in extrusion process.	0	0	3	
	03	1, 2, 3, 4, 6, 7	6	Industry Class: - Testing standards in Polymer Composite Industries. Weekly Assignment(1PM-2PM)	0	2	2					
				Learning outcomes								

10	03	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a composite model, using VARTM process to meet the given specification.	0	0	3
			2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a composite model by VARTM process, importance of gel time.	2	1	1	Manufacture a composite model by VARTM process, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3
	04	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 5. Determine the viscosity of polyester resin measured by Brookfield viscometer. 6. Determine the reactivity of unsaturated polyester resin. 7. Determine the gel time of unsaturated polyester resin at room temperature. 8. Determine water content in Methyl ethyl ketone peroxide.	2	1	1	Test the composite materials: 5. Determine the viscosity of polyester resin measured by Brookfield viscometer. 6. Determine the reactivity of unsaturated polyester resin. 7. Determine the gel time of unsaturated polyester resin at room temperature. 8. Determine water content in Methyl ethyl ketone peroxide.	0	0	3
	04	1, 2, 3, 4, 7	4	Troubleshooting followed in composite industries, finishing operations followed in composite industries Test the composite materials: 1. Determine the gel time of unsaturated polyester resin at room temperature. 2. Determine water content in Methyl ethyl ketone peroxide.	2	1	1	Test the composite materials: 3. Determine the viscosity of polyester resin measured by Brookfield viscometer. 4. Determine the reactivity of unsaturated polyester resin.	0	0	3
	04	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week.	0	0	3

								2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.			
			6	Industry Class: - Advancement in Composite Industries. Weekly Assignment(1PM-2PM)	0	2	2				
Learning outcomes											
11	04	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a Water proofing compound, to meet the given specification.	0	0	3
	04	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a Water proofing compound,	2	1	1	Manufacture a Water proofing compound, identify different process troubleshooting followed during the process, parallel plot a process flow diagram according to the process.	0	0	3
	04	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 7. Determination of water beading property of grouts. 8. Method of water Absorption-Carsten tube. 9. Determine the viscosity test of given adhesive material. 10. Determine the solid content in given adhesive material. 11. Determine the ash content in given adhesive material.	2	1	1	Test on Adhesive materials: 3. Determination of water beading property of grouts. 4. Method of water Absorption-Carsten tube	0	0	3
	04	1, 2, 3, 4, 7	4	Troubleshooting followed in Adhesive industries, safety and quality operations followed in adhesive industries. Test on Adhesive materials:	2	1	1	Test on Adhesive materials: 4. Determine the viscosity test of given adhesive material. 5. Determine the solid content in given adhesive material.	0	0	3

				2. Determine the ash content in given adhesive material.							
	04	1, 2, 3, 4, 7	5	CIE 5- Written and practice test	0	0	3	Developmental Assessment -Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	04	1, 2, 3, 4, 6, 7	6	Industry Class: - Advancement in Adhesive Industries.	0	2	2	Weekly Assignment(1PM-2PM)			
Learning outcomes											
12	04	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a Tile and stone fixing adhesive, to meet the given specification.	0	0	3
	04	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a Tile and stone fixing adhesive.	2	1	1	Manufacture a Tile and stone fixing adhesive, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3
	04	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 1. Determine adjustment time/Open time 2. To determine the time duration, it takes a mortar to reach a constant state of cure or hydration. (IS & FS Gilmore apparatus.) 3. To determine the particle distribution of the sand and other aggregate and to	2	1	1	Test on Adhesive materials: 1. Determine adjustment time/Open time 2. To determine the time duration, it takes a mortar to reach a constant state of cure or hydration. (IS & FS Gilmore apparatus.)	0	0	3

			check the cement content of finished products. 4. To determine the shear adhesion strength of our products, raw materials, packing materials, competitor's products.							
04	1, 2, 3, 4, 7	4	Troubleshooting followed in Adhesive industries, safety and quality operations followed in adhesive industries. Procedure/Test on Adhesive materials: 3. Determine the compression test of a given sample. 4. Determine Flexural strength of a given sample. 5. Determine the compression test of a given sample.	2	1	1	Test on Adhesive materials: 1. To determine the particle distribution of the sand and other aggregate and to check the cement content of finished products. 2. To determine the shear adhesion strength of our products, raw materials, packing materials, competitor's products. 3. Determine Flexural strength of a given sample.	0	0	3
04	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	-Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	1, 2, 3, 4, 7	6	Industry Class: - Importance of adhesive materials.	0	2	2	Weekly Assignment(1PM-2PM)			

13		1	Internship a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship. b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies. c) Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.	Project a) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective. b) Design and develop the project solution or methodology to be used to solve at least one of the problems identified. c) Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.

CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1- Written and practice test	4	30
Week 5	CIE 2- Written and practice test	4	30
Week 7	CIE 3- Written and practice test	4	30
Week 9	CIE 4- Written and practice test	4	30
Week 11	CIE 5- Written and practice test	4	30
	On line Course work (Minimum 10 hours online course with certification from (SWAYAM/NPTEL/Infosys Springboard)		40
	Profile building for Internship / Submission of Synopsys for project work		20
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			240

SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hrs duration reduced to 60 marks	3	60
SEE 2 - Practical	3	100
TOTAL SEE MARKS (B)		160
TOTAL MARKS (A+B)		400

*The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Assessment framework for CIE (1 to 5)

Note: Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam - 4 hours

Programme	Polymer Technology	Semester	V		
Course	Testing of Polymer Products.	Max Marks	30		
Course Code	20P052I	Duration	4 hours		
Name of the course coordinator					
Note: Answer one full question from each section.					
Qn.No	Question	CL L3/L4	CO	PO	Marks
Section-1 (Theory) - 10 marks					
1.a)	Illustrate the importance of testing in polymer industries.	L3	1	1,2,3,4,7	5
b)	Explain the manufacturing process of rubber sheet with its formula.	L4	2	1,2,3,4,7	5
2.a)	List few standard test methods followed in rubber and plastic industries.	L3	1	1,2,3,4,7	2
b)	Explain the importance of mixing in rubber and plastic industries.	L3	1	1,2,3,4,7	3
c)	Outline the manufacturing process of rubber pad.	L4	1	1,2,3,4,7	5
Section-2 (Practical) - 20 marks					
3)	Determine the testing of rubbers a. Hardness b. Tensile properties	L3	1	1,2,3,4,7	10
4)	Outline the manufacturing process of rubber pad and execute it practically.	L4	2	1,2,3,4,7	10

Note : Theory questions shall be aligned to practical questions

Assessment framework for SEE 1 (Theory)

Programme :	POLYMER TECHNOLOGY			
Semester :	V			
Course :	TESTING OF POLYMER PRODUCTS.		Max Marks :	100
Course Code :	20P052I	Duration :	3 Hrs	

Instruction to the Candidate: Answer one full question from each section.

Q. No	Question	CL	CO	Marks
Section-1				
1.a)	Explain the manufacturing process of Rubber sheet using compression moulding technique, with layout diagram.	L3	1, 4, 5	10
b)	Illustrate the test method on rubber sheet a. Tensile Strength b, Hardness test.	L4		10
2.a)	Explain the manufacturing process of Rubber bush using compression moulding technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Compression Strength b, Abrasion resistance	L4		10
Section-2				
3.a)	Explain the manufacturing process of Rubber tube using extrusion process technique.	L3	1, 4, 5	10
b)	Illustrate the test method on rubber tube a. Splice strength b, Chemical resistance.	L4		10
4.a)	Explain the manufacturing process of Latex gloves.	L3		10
b)	Illustrate the test method on gloves a. DRC b, MST	L4		10
Section-3				
5.a)	Explain the manufacturing process of plastic box using injection moulding technique, with layout diagram.	L3	2, 4, 5.	10
b)	Illustrate the test method on rubber sheet a. Tensile Strength b, Hardness test.	L4		10
6.a)	Explain the manufacturing process of hollow product using rotational moulding technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Compression Strength b, Burst strength.	L4		10
Section-4				
7.a)	Explain the manufacturing process of plastic bottle using blow moulding technique, with layout diagram.	L3	2, 4, 5.	10
b)	Illustrate the test method on rubber sheet a. Destructive test b. Opacity test	L4		10
8.a)	Explain the manufacturing process of plastic sheet using extrusion technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Bulk density b. MFI	L4		10
Section-5				
9.a)	Explain the manufacturing process of composite sheet using VARTM process, with layout diagram.	L3	3, 4, 5.	10

b)	Illustrate the test method on composite sheet a. Viscosity by Brook field viscometer b. Determine the gel time of resin.	L4	10
10.a)	Explain the manufacturing process water proofing compound with layout diagram.	L3	10
b)	Illustrate the test method on Adhesive material a. Determination on water beading property of grouts b. Determination of solid content in adhesive material.	L4	10

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
1	Case submission	20
2	Case presentation	20
3	Case innovation	20
4	Result	20
5	Viva voce	20
Total		100

References

Sl. No	
1	Rubber Products Manufacturing Technology Ed. By Anil K Bhowmick, Malcolm M. Hall and Henry A. Benarey, Marcel Dekker Inc., New York, 1994.
2	The Language of Rubber – Elastomers – Chemicals department, 1963, E.I. Dupont de Nemours & Co., Delaware, U.S.A.
3	Physical testing of rubber – R.P. Brown, 1979, Applied Science Publishers Ltd. London
4	Rubber Technology (3rd Edn.), Maurice Morton (Ed.), Van Nostrand Reinhold Co., N.Y. 1987
5	Rubber Tech., and Manufacture by C.M. Blow-Plastic and Rubber Institute Butter Worths- 1982
6	Plastics Materials and Product Testing Vol. I & II CIPET, Chennai
7	Rubber Engineering - Indian Rubber Institute - Tata McGraw Hill Publishing Co. Ltd.
8	PVC Technology – Penn
9	Plastics Testing Technology Hand book - Vishu Shah, John Wiley and sons, NY.
10	Hand book of Plastics Test methods - R.P. Brown, John Wiley, NY
11	C.B. Bucknall and D. R. Paul, “Polymer Blends: Volumes I and II”, John Wiley and Sons, New York, 2000
12	D R. Paul and C.B. Newman, “Polymer Blends Vol. I & II”, Academic Press Inc, 1978.
13	Polymer Blends and Alloys, “Gabriel O. Shonaike and George P. Simon”, editors. Marcel Dekker, 1999.
14	Experiment in Polymer Science by DG Hundiwale, VD Aathawale, UR Kapadi
15	ACE bond adhesive company manual.

Required Course Facilities:**Lab equipment's list with appropriate specifications (Batch size:20)****Sl. No. Name of Equipment and Specification Quantity Required**

Sl No	Machine Details	Qty
1	Universal Testing Machine (Utm) 01 Nos.	01 Nos.
2	Izod And Charpy	01 Nos.
3	Falling Dart Machine	01 Nos.
4	Rockwell And Durometer.	01 Nos.
5	Flexometer	01 Nos.
6	Vicat Softening Point Apparatus	01 Nos.
7	Heat Distortion Temperature	01 Nos.
8	Dielectric Apparatus	01 Nos.
9	Volume And Surface Resistivity Setup	01 Nos.
10	Opacity Tester	01 Nos.
11	Environmental Stress Cracking Resistance	01 Nos.
12	Chemical Resistance Setup	01 Nos.
13	Flammability Test Setup	01 Nos.
14	Semiautomatic Blow Molding Machine For Small Bottle	01 Nos.
15	Semi Automatic Injection Molding Machine	01 Nos.
16	Lab Type Rotational Molding Machine	01 Nos.
17	Extruder Machine For Blowing Film	01 Nos.
18	Lab Type Dispersion Kneader	01 Nos.
19	Rheometer	01 Nos.
20	Fully Automatically Injection Molding Machine	01 Nos.
21	Fully Automatic Blow Molding Machine	01 Nos.
22	Extruder Pipe Manufacturing Machine	01 Nos.
23	Two Roll Mixing Mill	01 Nos.
24	Hydraulic Press	01 Nos.
25	Auto Clave/ Vulcanizer	01 Nos.
26	(Mfi)-Melt Flow Index	01 Nos.
27	Weighing Balance	01 Nos.

28	Density Tester	01 Nos.
29	Extrusion Of Strands And Pelletization	01 Nos.
30		01 Nos.
31	Glove Manufacturing Setup	01 Nos.
32	Brookfield Viscometer	01 Nos.
33	Vartm Setup	01 Nos.
34	Hand Lay-Up Setup	01 Nos.
35	Oven	01 Nos.
36	Muffel Furnace	01 Nos.
37	Desiccator	01 Nos.

Appropriate Virtual practice links:

www.youtube.com/watch?v=B06aa41muSE

https://www.youtube.com/watch?v=zcBv_jvFDBI

<https://www.youtube.com/watch?v=N5AV-lWpIxY>

<https://www.youtube.com/watch?v=h-sLHYvqT7I>

https://www.youtube.com/watch?v=A9PMs_N33fU

<https://www.youtube.com/watch?v=uwFvGZcjQME>

<https://www.youtube.com/watch?v=30A6sL5dISA>

<https://www.youtube.com/watch?v=rJVbpXRT8ww>

<https://www.youtube.com/watch?v=N5AV-lWpIxY>

https://www.youtube.com/watch?v=wqw4bu_IShI

<https://www.youtube.com/watch?v=BuSWAMxdcHg>

<https://www.youtube.com/watch?v=NXLD0ATXoh4>

<https://www.youtube.com/watch?v=780DsKqsHP0>

<https://www.youtube.com/watch?v=ydp0vLqcAWA>

<https://www.youtube.com/watch?v=GDdUi24g20o>

<https://www.youtube.com/watch?v=UAlAyQz5vVQ>

<https://www.youtube.com/watch?v=QLiQLGPXg5k>

<https://www.youtube.com/watch?v=xnqoVoW0zd0>
https://www.youtube.com/watch?v=MTKPGEHq_ak
<https://www.youtube.com/watch?v=Sb4DA2uNZ68>
<https://www.youtube.com/watch?v=y8oWkx1PhUY>
<https://www.youtube.com/watch?v=3YrsqS8xhzg>
<https://www.youtube.com/watch?v=noxZ2D4Zcjo>
<https://www.youtube.com/watch?v=ChJj6kyKsJw>
<https://www.youtube.com/watch?v=dztweAfXQv0>
<https://www.youtube.com/watch?v=V54awR2lHRg>
<https://www.youtube.com/watch?v=ypCckJS0fx0>
<https://www.youtube.com/watch?v=MMTgHlsgVLE>
<https://www.youtube.com/watch?v=SeqDm9l3yEM>
<https://www.youtube.com/watch?v=sDJpf6pKyuE>
<https://www.youtube.com/watch?v=a8bUVHLt8d4>
<https://www.youtube.com/watch?v=T9gF3l5YRKA>
<https://www.youtube.com/watch?v=1Mqvuhku4P8>
<https://www.youtube.com/watch?v=xim1m2Bhvzc>
<https://www.youtube.com/watch?v=ZfyPCujUPms>
<https://www.youtube.com/watch?v=5lIrOxRPy0U>
<https://www.youtube.com/watch?v=3oKT6sv-e1k>
<https://www.youtube.com/watch?v=O8rmvNLAMsc>
<https://www.youtube.com/watch?v=F153DNul8xs>
<https://www.youtube.com/watch?v=O8rmvNLAMsc>
<https://www.youtube.com/watch?v=rHxxLYzJ8Sw>
<https://www.youtube.com/watch?v=jV0ICySwhlE>
<https://www.youtube.com/watch?v=0gUKG88mE0M>
<https://www.youtube.com/watch?v=Qw7eBWnYZIc>
<https://www.youtube.com/watch?v=ZW0y3WUd4qo>
<https://www.youtube.com/watch?v=WYqCnEvTRUQ>
<https://www.youtube.com/watch?v=02SAIPKKYn4>
<https://www.youtube.com/watch?v=P-tg52VRzZU>
<https://www.youtube.com/watch?v=XvXrD4iuF5g>
<https://www.youtube.com/watch?v=VMH6qbED7pg>
<https://www.youtube.com/watch?v=dbywZ4PJ3QA>

<https://www.youtube.com/watch?v=IXYKKDiCroM>
<https://www.youtube.com/watch?v=FTUw00WWMLU>
<https://www.youtube.com/watch?v=tP8JcX87DzI>
<https://www.youtube.com/watch?v=yTsXKGUdtCE>



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Program	Polymer Technology	Semester	V
Course Code	20P053I	Type of Course L:T:P	104:52:312
Specialization	Specialized Polymer Products.	Credits	24
CIE Marks	240	SEE Marks	160

Introduction:

Polymers can be separated into plastics and rubbers. As engineering materials, they are relatively new compared to metals and ceramics, dating only from around the mid-1800s, for our purposes in covering polymers as a technical subject, it is appropriate to divide them into the following three categories, (1) Thermoplastic polymers, (2) Thermosetting polymers, (3) Elastomer.

Because of the properties of polymers, it is possible to mould them and change their shape using a number of different repetitious manufacturing processes. The most important of these are extrusion, injection moulding, blow moulding, vacuum forming, extrusion blow moulding, rotational moulding, calendaring, foaming and compression moulding.

There are many kinds of rubber products, The basic process of rubber products using general solid rubber-raw rubber as raw materials includes six basic processes of mastication, mixing, calendaring, extrusion, moulding and vulcanization. In addition, it also includes basic processes such as raw material preparation, finished product finishing, and inspection and packaging.

Composite materials are formed by combining two or more materials that have quite different properties, and they do not dissolve or blend into each other. The different materials in the composite work together to give the composite unique properties. Humans have been using composite materials for thousands of years in different areas. The first uses of composites date back to the 1500 BC, when early Egyptians and Mesopotamian settlers used a mixture of mud and straw to create strong and durable buildings.

Depending on the material we want to bind, we can use a wide range of adhesives, which can be divided into different categories, taking into account appearance, adhesion, strength, and chemical structure. For the production of glue, various additives can be used to improve its adhesive properties, accelerate curing or reduce viscosity. Adhesive substances are usually in liquid form. However, you can also find a solid form, e.g. powder, pearls, sticks or cartridges, forming a weld after melting. Its strength depends on several factors: cohesion, adhesion, shape and thickness of the adhesive layer, as well as on the so-called depth of penetration of the material by an adhesive substance. The most important is the adhesion and cohesion that affect the type and strength of the chemical interaction of the adhesive with the bonded surfaces, as well as the mechanical strength of the adhesive layer itself. Adequate selection of glue for the type and size of materials that are to be bonded makes it relatively easy to glue them together.

Course Cohort Owner

A Course Cohort Owner is a faculty from the core discipline, who is fully responsible for one specialised field of study and the cohort of students who have chosen to study that specialised field of study.

Guidelines for Cohort Owner

1. Each Specialized field of study is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. One faculty from the Core Discipline shall be the Cohort Owner, who for teaching and learning in allied disciplines can work with faculty from other disciplines or industry experts.
3. The course shall be delivered in boot camp mode spanning over 12 weeks of study, weekly developmental assessments and culminating in a mini capstone.
4. The industry session shall be addressed by industry subject experts (in contact mode/online / recorded video mode) in the discipline only.
5. The cohort owner shall be responsible to identify experts from the relevant field and organize industry session as per schedule.
6. Cohort owner shall plan and accompany the cohort for any industrial visits.
7. Cohort owner shall maintain and document industrial assignments, weekly assessments, practices and mini project.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table
9. The cohort owner along with classroom sessions can augment or use supplemental teaching and learning opportunities including good quality online courses available on platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM, etc.
10. Cohort owner shall guide the cohorts for the selection and execution of mini project.

Course outcome: A student should be able to

CO-01	Manufacture a molded Specialized rubber product, Extruded product, dipped latex product .etc.
CO-02	Manufacture a Specialized plastic products using injection molding, Extrusion molding, Blow molding and Rotational molding etc.
CO-03	Manufacture a Specialized FRP products and adhesive product.
CO-04	Analyze the properties of finished products by using specified testing methods under ASTM/ISO etc.

CO-05	Troubleshoot the processing difficulties and remedies.
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Detailed course plan

Week	C O	P O	Days	1 st session (9am to 1 pm)	L	T	P	2 ND session (1.30pm to 4.30pm)	L	T	P
	Learning outcomes										
1	01,04,05	1, 2, 3, 4, 7	1	Present an over view of course Specialized Polymer Products	2	1	1	Present an over view of Specialized Polymer Products. and scope of different polymer products.	0	0	3
	01,04,05	1, 2, 3, 4, 7	2	Determine a formula to manufacture a silicon rubber sheet/flap to meet the given specification.	2	1	1	According to the formula weigh the required materials and arrange it accordingly.	0	0	3
	01,04,05	1, 2, 3, 4, 7	3	Discuss on materials taken according to formula, and discuss the sequence of mixing Discuss on vulcanizing materials, importance of mature time for mixed compound, Importance of rheo graph, importance of mold fill factor calculation, importance of finishing and testing of finished products.	2	1	1	Start the mixing process according to the sequence using the weighed materials. Disperse the vulcanizing materials, Calculate the mold fill factor, produce the rubber sheet, finish the end product test the product according to the specified test standards.	0	0	3
	01,04,05	1, 2, 3, 4, 7	4	Different types of Test methods followed in rubber industries, importance of testing the product according to the specified test standards. <u>Test Procedures: ASTM D 412</u> 1.Tensile, Elongation, Modulus	2	1	1	<u>Conduct the Test: ASTM D 412</u> 1.Tensile, Elongation, Modulus	0	0	3
	01,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Review and corrective action 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	01,04,05	1, 2, 3, 4, 7	6.	Industry class-On molded products and its application.	0	2	2				

				Weekly Assignment(1PM-2PM)								
Learning outcomes												
2	01,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a silicon rubber tube to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3	
	01,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the sequence of mixing. Discuss on vulcanizing materials, importance of mature time for mixed compound, Importance of rheo graph, , importance of finishing and testing of finished products.	2	1	1	Start the mixing process according to the sequence using the weighed materials. Mix the vulcanizing materials, finish the end product test the product according to the specified test standards.	0	0	3	
	01,04,05	1, 2, 3, 4, 7	3	Different types of Test methods followed in rubber industries, importance of testing, test standards followed in rubber industries. 2.	2	1	1	Test Procedures: 3. Tear resistance (ASTM D- 624-001) 4. Chemical Resistance (ASTM D- 471)	0	0	3	
	01,04,05	1, 2, 3, 4, 7	4	Conduct the Test: 3. Tear resistance (ASTM D- 624-001) 4. Chemical Resistance (ASTM D- 471)	2	1	1	Conduct test on the product Manufactured- Tensile test, Abrasion test, compression test, hardness, etc.	0	0	3	
	01,04,05	1, 2, 3, 4, 6, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3	
	01,04,05	1, 2, 3, 4, 7	6	Industry Class-Importance of testing and quality inspection in rubber industries.	0	2	2					

				Weekly Assignment(1PM-2PM)								
Learning outcomes												
3	01,04,05	1, 2, 3, 4, 7	1	Peer review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a metal to rubber bonded product to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3	
	01,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula , and discuss the sequence of mixing.	2	1	1	Start the mixing process according to the sequence using the weighed materials. Mix the vulcanizing materials, produce the rubber tube, finish the end product test the product according to the specified test standards	0	0	3	
	01,04,05	1, 2, 3, 4, 7	3	Different types of Test methods followed in rubber industries, importance of testing, test standards followed in rubber industries.	2	1	1	Conduct the following Test: 4. Compression set method B (ASTN D 395-03) 5. Hardness (Durometer) (ASTM D2240-05) 6. Abrasion resistance 7. Bonding strength	0	0	3	
	01,04,05	1, 2, 3, 4, 7	4	Test procedure: 4. Compression set method B (ASTN D 395-03) 5. Hardness (Durometer) (ASTM D2240-05) 6. Abrasion resistance 7. Bonding strength	2	1	1	Test procedure: 4. Compression set method B (ASTN D 395-03) 5. Hardness (Durometer) (ASTM D2240-05) 6. Abrasion resistance 7. Bonding strength	0	0	3	
	01,04,05	1, 2, 3, 4, 7	5	CIE 1 - Written and Practice Test	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3	

	01,04,05	1, 2, 3, 4, 7	6	Industry Class-Metal to rubber bonding and its important application. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
4	01,04,05	1, 2, 3, 4, 7	1	Peer Review- - First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Formulate a formula to manufacture a rubber glove to meet the given specification, According to the formula weigh the required materials and arrange it accordingly.	0	0	3
	01,04,05	1, 2, 3, 4, 7	2	Formulate materials taken according to formula, and discuss the sequence of mixing followed in latex compounding.	2	1	1	Start the compounding of latex, mix the compound according to the sequence using the weighed materials	0	0	3
	01,04,05	1, 2, 3, 4, 7	3	Discuss on vulcanizing materials used in latex products, importance of mature time in latex compound, important steps to be followed to gain a good compounded latex.	2	1	1	Mix the vulcanizing materials, produce the rubber gloves, finish the end product test the product according to the specified test standards. Different types of Test methods followed in latex industries, importance of testing, test standards followed in latex industries.	0	0	3
	01,04,05	1, 2, 3, 4, 7	4	Conduct the following Test: 5. Volatile fatty acid number 6. Dry rubber Content 7. Total Solid content 8. MST 9. Visual Test	2	1	1	Test the following: 5. Volatile fatty acid number 6. Dry rubber Content 7. Total Solid content 8. MST 9. Visual Test	0	0	3
	01,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product.	0	0	3

								3. Note down different types of materials and machinery used during the process.			
	02,04,05	1,2	6	Industry Class-Latex products and its application. Weekly Assignment(1PM-2PM)	0	2	2				
Learning outcomes											
5	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a reinforced plastic box, using injection moulding machine to meet the given specification.	0	0	3
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic box, importance of process cycle.	2	1	1	Manufacture a product using injection moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Different test procedures followed for different plastic material, Discuss and analyse the test results, trouble shooting in injection moulding process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	4	Conduct the following Test: 5. Density Gradient Technique (ASTM D-792-00) 6. Water Absorption of plastics (ASTM D 570-98) 7. Bulk factor	2	1	1	Conduct the following Test: 5. Density Gradient Technique (ASTM D-792-00) 6. Water Absorption of plastics (ASTM D 570-98) 7. Bulk factor	0	0	3
	02,04,05	1, 2, 3, 4, 7	5	CIE 2 - Written and Practice Test	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3

	02,04,05	1, 2, 3, 4,6, 7	6	Industry Class- Injection molding process and its application. Weekly Assignment(1PM-2PM)	0	2	2				
	Learning outcomes										
6	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a PVC hollow product. to meet the given specification.	0	0	3
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a plastic hollow product by rotational moulding process. , importance of process cycle.	2	1	1	Manufacture a hallow product using rotational moulding machine, identify different process troubleshooting followed during the process, parallel plot a process cycle diagram according to the process.	0	0	3
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Troubleshooting followed in rotational molding technique, finishing operations followed in rotational molding	0	0	3
	02,04,05	1, 2, 3, 4, 7	4	Conduct the following Test: 4. Melt flow Index 5. Heat distortion Temperature 6. Vicat softening Temperature.	2	1	1	Conduct the following Test: 4. Melt flow Index 5. Heat distortion Temperature 6. Vicat softening Temperature.	0	0	3
	02,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action: 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
		1, 2, 3, 4, 6, 7	6	Industry Class: -Advancements in Rotational molding of plastic. Weekly Assignment(1PM-2PM)	0	2	2				

		Learning outcomes										
7	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a coloured plastic bottle, using blow moulding machine to meet the given specification.	0	0	3	
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce using blow moulding machine. , importance of process cycle.	2	1	1	Manufacture an extruded product using blow moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3	
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Conduct the following Test: 4. Bursting test 5. Destructive test 6. Non-Destructive test	0	0	3	
	02,04,05	1, 2, 3, 4, 7	4	Conduct the following Test: 1. Bursting test 2. Destructive test 3. Non-Destructive test	2	1	1	Conduct the following Test: 4. Bursting test 5. Destructive test 6. Non-Destructive test	0	0	3	
	02,04,05	1, 2, 3, 4, 7	5	CIE 3 – Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action Troubleshooting followed in extrusion technique, finishing operations followed in extrusion process. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3	
	02,04,05	1, 2, 3, 4, 7	6	Industry Class: -Advancement in Blow molding. Weekly Assignment(1PM-2PM)	0	2	2					

		Learning outcomes										
8	02,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a plastic sheet, using Extrusion moulding machine to meet the given specification.	0	0	3	
	02,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce Extrusion moulding machine, importance of process cycle.	2	1	1	Manufacture a plastic sheet using extrusion moulding machine, identify different process troubleshooting followed during the process, and plot a process cycle diagram according to the process.	0	0	3	
	02,04,05	1, 2, 3, 4, 7	3	Importance of finishing operations followed in plastic industries, Importance of testing in plastic industries, importance of quality inspection in plastic industries.	2	1	1	Troubleshooting followed in extrusion technique, finishing operations followed in extrusion process.	0	0	3	
			4	Conduct the following Test: 4. Tensile Properties (ASTMT D 638-03) 5. Tear Resistance (ASTM D 1004-03) 6. Compression test (ASTM D 695-02a)	2	1	1	Conduct the following Test: 4. Tensile Properties (ASTMT D 638-03) 5. Tear Resistance (ASTM D 1004-03) 6. Compression test (ASTM D 695-02a)	0	0	3	
	02,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	-Assessment Review and corrective action: Troubleshooting followed in extrusion technique, finishing operations followed in extrusion process. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3	
	02,04,05	1, 2, 3, 4, 7	6	Industry Class: -Extrusion molding trends and advancements. Weekly Assignment(1PM-2PM)	0	2	2					

				Learning outcomes								
9	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a reinforced composite sheet, using Hand layup process to meet the given specification.	0	0	3	
	03,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a composite sheet by hand layup process, importance of gel time.	2	1	1	Manufacture a composite sheet by hand layup process, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3	
	03,04,05	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 1. Determine the tex value. 2. Determine the moisture content and binder content of glass rooving. 3. Determine the surface weight/density of glass tissue. 4. Determine the binder content of glass tissue.	2	1	1	Test the composite materials: 1. Determine the tex value. 2. Determine the moisture content and binder content of glass rooving.	0	0	3	
	03,04,05	1, 2, 3, 4, 7	4	Importance of finishing operations followed in composite industries, Importance of testing in composite industries, importance of quality inspection in composite industries.	2	1	1	Test the composite materials: 1. Determine the surface weight/density of glass tissue. 2. Determine the binder content of glass tissue	0	0	3	
	03,04,05	1, 2, 3, 4, 7	5	CIE 4 - Written and Practice Test	0	0	3	Developmental Assessment -Assessment Review and corrective action, troubleshooting followed in extrusion technique, finishing operations followed in extrusion process.	0	0	3	
	03,04,05	1, 2, 3, 4, 6, 7	6	Industry Class: - Advancement in composite polymer Industries. Weekly Assignment(1PM-2PM)	0	2	2					
				Learning outcomes								

10	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a reinforced composite model, using VARTM process to meet the given specification.	0	0	3
			2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a composite model by VARTM process, importance of gel time.	2	1	1	Manufacture a composite model by VARTM process, identify different process troubleshooting followed during the process, parallel plot a process flow diagram according to the process.	0	0	3
	03,04,05	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 9. Determine the viscosity of polyester resin measured by Brookfield viscometer. 10. Determine the reactivity of unsaturated polyester resin. 11. Determine the gel time of unsaturated polyester resin at room temperature. 12. Determine water content in Methyl ethyl ketone peroxide.	2	1	1	Test the composite materials: 9. Determine the viscosity of polyester resin measured by Brookfield viscometer. 10. Determine the reactivity of unsaturated polyester resin. 11. Determine the gel time of unsaturated polyester resin at room temperature. 12. Determine water content in Methyl ethyl ketone peroxide.	0	0	3
	03,04,05	1, 2, 3, 4, 7	4	Troubleshooting followed in composite industries, finishing operations followed in composite industries Test the composite materials: 3. Determine the gel time of unsaturated polyester resin at room temperature. 4. Determine water content in Methyl ethyl ketone peroxide.	2	1	1	Test the composite materials: 5. Determine the viscosity of polyester resin measured by Brookfield viscometer. 6. Determine the reactivity of unsaturated polyester resin.	0	0	3
	03,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week.	0	0	3

								2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.			
		6	Industry Class: - Composite materials and testing. Weekly Assignment(1PM-2PM)	0	2	2					
Learning outcomes											
11	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a Water proofing compound, to meet the given specification.	0	0	3
	03,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a Water proofing compound,	2	1	1	Manufacture a Water proofing compound, identify different process troubleshooting followed during the process, parallel plot a process flow diagram according to the process.	0	0	3
	03,04,05	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 12. Determination of water beading property of grouts. 13. Method of water Absorption-Carsten tube. 14. Determine the viscosity test of given adhesive material. 15. Determine the solid content in given adhesive material. 16. Determine the ash content in given adhesive material. 17.	2	1	1	Test on Adhesive materials: 5. Determination of water beading property of grouts. 6. Method of water Absorption-Carsten tube	0	0	3
	03,04,05	1, 2, 3, 4, 7	4	Troubleshooting followed in Adhesive industries, safety and quality operations followed in adhesive industries. Test on Adhesive materials:	2	1	1	Test on Adhesive materials: 6. Determine the viscosity test of given adhesive material.	0	0	3

				3. Determine the ash content in given adhesive material.				7. Determine the solid content in given adhesive material.			
	03,04,05	1, 2, 3, 4, 7	5	CIE 5- Written and practice test	0	0	3	Developmental Assessment -Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	03,04,05	1, 2, 3, 4, 6, 7	6	Industry Class: - Advancement in Adhesive Industries.	0	2	2	Weekly Assignment(1PM-2PM)			
Learning outcomes											
12	03,04,05	1, 2, 3, 4, 7	1	Peer Review- First half of the session will be on summarization of previous week's activities, and second of the morning session will be on planning for the coming week.	2	1	1	Determine a formula to manufacture a Tile and stone fixing adhesive, to meet the given specification.	0	0	3
	03,04,05	1, 2, 3, 4, 7	2	Discuss on materials taken according to formula, and discuss the important steps followed to produce a Tile and stone fixing adhesive.	2	1	1	Manufacture a Tile and stone fixing adhesive, identify different process troubleshooting followed during the process, and plot a process flow diagram according to the process.	0	0	3
	03,04,05	1, 2, 3, 4, 7	3	Briefing of following Test procedure: 5. Determine adjustment time/Open time 6. To determine the time duration, it takes a mortar to reach a constant state of cure or hydration. (IS & FS Gilmore apparatus.) 7. To determine the particle distribution of the sand and other aggregate and to	2	1	1	Test on Adhesive materials: 3. Determine adjustment time/Open time 4. To determine the time duration, it takes a mortar to reach a constant state of cure or hydration. (IS & FS Gilmore apparatus.)	0	0	3

			check the cement content of finished products. 8. To determine the shear adhesion strength of our products, raw materials, packing materials, competitor's products.							
03,04,05	1, 2, 3, 4, 7	4	Troubleshooting followed in Adhesive industries, safety and quality operations followed in adhesive industries. Procedure/Test on Adhesive materials: 6. Determine the compression test of a given sample. 7. Determine Flexural strength of a given sample. 8. Determine the compression test of a given sample.	2	1	1	Test on Adhesive materials: 4. To determine the particle distribution of the sand and other aggregate and to check the cement content of finished products. 5. To determine the shear adhesion strength of our products, raw materials, packing materials, competitor's products. 6. Determine Flexural strength of a given sample.	0	0	3
03,04,05	1, 2, 3, 4, 7	5	Developmental Assessment	0	0	3	-Assessment Review and corrective action. 1. Draw a neat layout diagram of the entire process carried out during the week. 2. Note down all the troubleshooting methods followed during the Processing of material to become a final product. 3. Note down different types of materials and machinery used during the process.	0	0	3
	1, 2, 3, 4, 7	6	Industry Class: - Adhesive materials and its importance . Weekly Assignment(1PM-2PM)	0	2	2				
Learning outcomes										

13			1 Internship a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship. b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies. c) Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.		Project a) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective. b) Design and develop the project solution or methodology to be used to solve at least one of the problems identified. c) Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.
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CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1- Written and practice test	4	30
Week 5	CIE 2- Written and practice test	4	30
Week 7	CIE 3- Written and practice test	4	30
Week 9	CIE 4- Written and practice test	4	30
Week 11	CIE 5- Written and practice test	4	30
	On line Course work (Minimum 10 hours online course with certification from (SWAYAM/NPTEL/Infosys Springboard)		40
	Profile building for Internship / Submission of Synopsys for project work		20
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			240
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hrs duration reduced to 60 marks		3	60
SEE 2 - Practical		3	100
TOTAL SEE MARKS (B)			160
TOTAL MARKS (A+B)			400

*The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Assessment framework for CIE (1 to 5)

Note : Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam - 4 hours

Programme	Polymer Technology	Semester	V
Course	Specialized Polymer products.	Max Marks	30
Course Code	20PO53I	Duration	4 hours
Name of the course coordinator			

Note: Answer one full question from each section.

Qn.No	Question	CL L3/L4	CO	PO	Marks
Section-1 (Theory) - 10 marks					
1.a)	Explain vulcanization materials in rubber production.	L3	01, 04, 05	1, 2, 3, 4, 7	5
b)	Illustrate the importance of fill factor in rubber industries.	L4	01, 04, 05	1, 2, 3, 4, 7	5
2.a)	List natural and synthetic rubber with its structure.	L3	01, 04, 05	1, 2, 3, 4, 7	2
b)	Prepare a formula to manufacture a rubber bush with 70 hardness.	L3	01, 04, 05	1, 2, 3, 4, 7	3
c)	Outline the manufacturing of rubber sheet and explain.	L4	01, 04, 05	1, 2, 3, 4, 7	5
Section-2 (Practical) - 20 marks					
3)	Prepare the rubber bush according to the given formula and test the rubber bush and report.	L3/L4	01, 04, 05	1, 2, 3, 4, 7	10
4)	Outline the manufacturing of rubber sheet and get the tensile result of manufactured sheet.	L3/L4	01, 04, 05	1, 2, 3, 4, 7	10

Note : Theory questions shall be aligned to practical questions

Assessment framework for SEE 1 (Theory)

Programme : POLYMER TECHNOLOGY	Max Marks : 100
Semester : V	Duration : 3 Hrs
Course : Specialized Polymer Products.	
Course Code : 20P053I	

Instruction to the Candidate: Answer one full question from each section.

Q. No	Question	CL	CO	Marks
Section-1				
1.a)	Explain the manufacturing process of Rubber sheet using compression moulding technique, with layout diagram.	L3	1, 4, 5	10
b)	Illustrate the test method on rubber sheet a. Tensile Strength b, Hardness test.	L4		10
2.a)	Explain the manufacturing process of Rubber bush using compression moulding technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Compression Strength b, Abrasion resistance	L4		10
Section-2				
3.a)	Explain the manufacturing process of Rubber tube using extrusion process technique.	L3	1, 4, 5	10
b)	Illustrate the test method on rubber tube a. Splice strength b, Chemical resistance.	L4		10
4.a)	Explain the manufacturing process of Latex gloves.	L3		10
b)	Illustrate the test method on gloves a. DRC b, MST	L4		10
Section-3				
5.a)	Explain the manufacturing process of plastic box using injection moulding technique, with layout diagram.	L3	2, 4, 5.	10
b)	Illustrate the test method on rubber sheet a. Tensile Strength b, Hardness test.	L4		10
6.a)	Explain the manufacturing process of hollow product using rotational moulding technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Compression Strength b, Burst strength.	L4		10
Section-4				
7.a)	Explain the manufacturing process of plastic bottle using blow moulding technique, with layout diagram.	L3	2, 4, 5.	10
b)	Illustrate the test method on rubber sheet a. Destructive test b. Opacity test	L4		10
8.a)	Explain the manufacturing process of plastic sheet using extrusion technique, with layout diagram.	L3		10
b)	Illustrate the test method on rubber bush a. Bulk density b. MFI	L4		10
Section-5				
9.a)	Explain the manufacturing process of composite sheet using VARTM process, with layout diagram.	L3	3, 4, 5.	10

b)	Illustrate the test method on composite sheet a. Viscosity by Brook field viscometer b. Determine the gel time of resin.	L4	10
10.a)	Explain the manufacturing process water proofing compound with layout diagram.	L3	10
b)	Illustrate the test method on Adhesive material a. Determination on water beading property of grouts b. Determination of solid content in adhesive material.	L4	10

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
1	Case submission	20
2	Case presentation	20
3	Case innovation	20
4	Result	20
5	Viva voce	20
Total		100

References

Sl. No	
1	Rubber Products Manufacturing Technology Ed. By Anil K Bhowmick, Malcolm M. Hall and Henry A. Benarey, Marcel Dekker Inc., New York, 1994.
2	The Language of Rubber – Elastomers – Chemicals department, 1963, E.I. Dupont de Nemours & Co., Delaware, U.S.A.
3	Physical testing of rubber – R.P. Brown, 1979, Applied Science Publishers Ltd. London
4	Rubber Technology (3rd Edn.), Maurice Morton (Ed.), Van Nostrand Reinhold Co., N.Y. 1987
5	Rubber Tech., and Manufacture by C.M. Blow-Plastic and Rubber Institute Butter Worths- 1982
6	Plastics Materials and Product Testing Vol. I & II CIPET, Chennai
7	Rubber Engineering - Indian Rubber Institute - Tata McGraw Hill Publishing Co. Ltd.
8	PVC Technology – Penn
9	Plastics Testing Technology Hand book - Vishu Shah, John Wiley and sons, NY.
10	Hand book of Plastics Test methods - R.P. Brown, John Wiley, NY
11	C.B. Bucknall and D. R. Paul, “Polymer Blends: Volumes I and II”, John Wiley and Sons, New York, 2000
12	D R. Paul and C.B. Newman, “Polymer Blends Vol. I & II”, Academic Press Inc, 1978.
13	Polymer Blends and Alloys, “Gabriel O. Shonaike and George P. Simon”, editors. Marcel Dekker, 1999.
14	Experiment in Polymer Science by DG Hundiwale, VD Aathawale, UR Kapadi
15	ACE bond adhesive company manual.

Required Course Facilities:**Lab equipment's list with appropriate specifications (Batch size:20)****Sl. No. Name of Equipment and Specification Quantity Required**

Sl No	Machine Details	Qty
1	Universal Testing Machine (Utm) 01 Nos.	01 Nos.
2	Izod And Charpy	01 Nos.
3	Falling Dart Machine	01 Nos.
4	Rockwell And Durometer.	01 Nos.
5	Flexometer	01 Nos.
6	Vicat Softening Point Apparatus	01 Nos.
7	Heat Distortion Temperature	01 Nos.
8	Dielectric Apparatus	01 Nos.
9	Volume And Surface Resistivity Setup	01 Nos.
10	Opacity Tester	01 Nos.
11	Environmental Stress Cracking Resistance	01 Nos.
12	Chemical Resistance Setup	01 Nos.
13	Flammability Test Setup	01 Nos.
14	Semiautomatic Blow Molding Machine For Small Bottle	01 Nos.
15	Semi Automatic Injection Molding Machine	01 Nos.
16	Lab Type Rotational Molding Machine	01 Nos.
17	Extruder Machine For Blowing Film	01 Nos.
18	Lab Type Dispersion Kneader	01 Nos.
19	Rheometer	01 Nos.
20	Fully Automatically Injection Molding Machine	01 Nos.
21	Fully Automatic Blow Molding Machine	01 Nos.
22	Extruder Pipe Manufacturing Machine	01 Nos.
23	Two Roll Mixing Mill	01 Nos.
24	Hydraulic Press	01 Nos.
25	Auto Clave/ Vulcanizer	01 Nos.
26	(Mfi)-Melt Flow Index	01 Nos.
27	Weighing Balance	01 Nos.

28	Density Tester	01 Nos.
29	Extrusion Of Strands And Pelletization	01 Nos.
30		01 Nos.
31	Glove Manufacturing Setup	01 Nos.
32	Brookfield Viscometer	01 Nos.
33	Vartm Setup	01 Nos.
34	Hand Lay-Up Setup	01 Nos.
35	Oven	01 Nos.
36	Muffel Furnace	01 Nos.
37	Desiccator	01 Nos.

3. Appropriate Virtual practice links:

www.youtube.com/watch?v=B06aa41muSE
https://www.youtube.com/watch?v=zcBv_jvFDBI
<https://www.youtube.com/watch?v=N5AV-lWpIxY>
<https://www.youtube.com/watch?v=h-sLHYvqT7I>
https://www.youtube.com/watch?v=A9PMs_N33fU
<https://www.youtube.com/watch?v=uwFvGZcjQME>
<https://www.youtube.com/watch?v=30A6sL5dISA>
<https://www.youtube.com/watch?v=rJVbpXRT8ww>
<https://www.youtube.com/watch?v=N5AV-lWpIxY>
https://www.youtube.com/watch?v=wqw4bu_IShI
<https://www.youtube.com/watch?v=BuSWAMxdcHg>
<https://www.youtube.com/watch?v=NXLD0ATXoh4>
<https://www.youtube.com/watch?v=780DsKqsHP0>
<https://www.youtube.com/watch?v=ydp0vLqcAWA>
<https://www.youtube.com/watch?v=GDdUi24g20o>
<https://www.youtube.com/watch?v=UAlAyQz5vVQ>
<https://www.youtube.com/watch?v=QLiQLGPXg5k>

<https://www.youtube.com/watch?v=xnqoVoW0zd0>
https://www.youtube.com/watch?v=MTKPGEHq_ak
<https://www.youtube.com/watch?v=Sb4DA2uNZ68>
<https://www.youtube.com/watch?v=y8oWkx1PhUY>
<https://www.youtube.com/watch?v=3YrsqS8xhzg>
<https://www.youtube.com/watch?v=noxZ2D4Zcjo>
<https://www.youtube.com/watch?v=ChJj6kyKsJw>
<https://www.youtube.com/watch?v=dztweAfXQv0>
<https://www.youtube.com/watch?v=V54awR2lHRg>
<https://www.youtube.com/watch?v=ypCckJS0fx0>
<https://www.youtube.com/watch?v=MMTgHlsgVLE>
<https://www.youtube.com/watch?v=SeqDm9l3yEM>
<https://www.youtube.com/watch?v=sDJpf6pKyuE>
<https://www.youtube.com/watch?v=a8bUVHLt8d4>
<https://www.youtube.com/watch?v=T9gF3l5YRKA>
<https://www.youtube.com/watch?v=1Mqvuhku4P8>
<https://www.youtube.com/watch?v=xim1m2Bhvzc>
<https://www.youtube.com/watch?v=ZfyPCujUPms>
<https://www.youtube.com/watch?v=5IlrOxRPy0U>
<https://www.youtube.com/watch?v=3oKT6sv-e1k>
<https://www.youtube.com/watch?v=O8rmvNLAMsc>
<https://www.youtube.com/watch?v=F153DNul8xs>
<https://www.youtube.com/watch?v=O8rmvNLAMsc>
<https://www.youtube.com/watch?v=rHxxLYzJ8Sw>
<https://www.youtube.com/watch?v=jV0ICySwhlE>
<https://www.youtube.com/watch?v=0gUKG88mE0M>
<https://www.youtube.com/watch?v=Qw7eBWnYZIc>
<https://www.youtube.com/watch?v=ZW0y3WUd4qo>
<https://www.youtube.com/watch?v=WYqCnEvTRUQ>
<https://www.youtube.com/watch?v=02SAIPKKYn4>
<https://www.youtube.com/watch?v=P-tg52VRzZU>
<https://www.youtube.com/watch?v=XvXrD4iuF5g>
<https://www.youtube.com/watch?v=VMH6qbED7pg>
<https://www.youtube.com/watch?v=dbywZ4PJ3QA>

<https://www.youtube.com/watch?v=IXYKKDiCroM>
<https://www.youtube.com/watch?v=FTUw00WWMLU>
<https://www.youtube.com/watch?v=tP8JcX87DzI>
<https://www.youtube.com/watch?v=yTsXKGUdtCE>