

**School of Chemistry
Faculty of Sciences
University of the Punjab, Lahore
Course Outline**



Semester-VIII

Programme	BS Chemistry	Course Code	Chem-468	Credit Hours	2
Course Title	Polymers and its Applications	Course Type		Major (Elective)	
Course Introduction					
<p>This course content will increase the understanding of student about Polymerization techniques, basic theory, mechanisms, chemistry, processing and applications.</p> <p>Polymerization mechanisms Introduction, characteristics and significance, Classification including, synthetic and natural, thermoplastic and thermosets, Concept of homo and co-polymers, polyblends, Tacticity and its importance, Glass transition temperature, Molecular weight of Polymers, Polymerization types involving various mechanisms including addition and condensation polymerization, Ionic polymerization including anionic and cationic, Co-ordination polymerization.</p> <p>Polymers processing Polymerization techniques – Bulk, Solution, Emulsion and Suspension techniques, Polymer Fabrication – extrusion, injection, modeling and blow molding of plastics., Detailed description and uses of the following polymers: Polyethylene, Polystyrene, Epoxy resins, Polyethylene tetraphthalate, Elastomers, Conducting polymers and Biopolymers.</p>					
Learning Outcomes					
<p>On the completion of the course:</p> <ul style="list-style-type: none"> • Students are expected to become familiarized with the concepts of macro molecules • This will enable them to understand the chemistry of polymers and polymerization mechanism • They obtained knowledge of fabrication and applications of polymers in real life • Students are able to understand the concept of GLP and GMP 					
Course Content				Assignments/Readings	
Week 1	Polymerization Mechanisms - Introduction, characteristics and significance, Classification including synthetic and natural, thermoplastic and thermosetting			Class Based learning/tests	
Week 2	Polymerization Mechanisms - Classification including, synthetic and natural, thermoplastic and thermosetting			Class Based learning/tests	
Week 3	Polymerization Mechanisms - Concept of homo and co-polymers, polyblends, Tacticity and its importance, Glass transition temperature			Class Based learning/tests	
Week 4	Polymerization Mechanisms - Concept of homo and co-polymers, polyblends, Tacticity and its importance, Glass transition temperature, Molecular weight of Polymers			Class Based learning/tests	

Week 5	Polymerization Mechanisms – addition polymerization, Free radical.	Class Based learning/tests
Week 6	Polymerization Mechanisms – addition polymerization Ionic polymerization including anionic polymerization	Class Based learning/tests
Week 7	Polymerization Mechanisms – addition polymerization Ionic polymerization including cationic polymerization	Written Assignment
Week 8	Polymerization Mechanisms – addition polymerization Ionic polymerization including cationic polymerization	Class Based learning/tests
Week 9	Midterm Assessment	----
Week 10	Polymerization Mechanisms – addition polymerization Ionic polymerization including coordinate polymerization.	Class Based learning/tests
Week 11	Polymers Processing - Polymerization techniques Bulk, Solution, Emulsion and Suspension techniques	Class Based learning/tests
Week 12	Polymers Processing - Polymer Fabrication extrusion, injection, modeling and blow molding of plastics	Class Based learning/tests
Week 13	Synthesis and application of following polymers - Polyethylene, Polystyrene, Epoxy resins	Class Based learning/tests
Week 14	Synthesis and application of following polymers - Polyethylene tetraphthalate, Elastomers	Class Based learning/tests
Week 15	Synthesis and application of following polymers - conducting polymers and Biopolymers	Quiz
Week 16	Synthesis and application of the following polymers – Biopolymers	Class Based learning/tests

Textbooks and Reading Material

1. Applied Chemistry, Haq Nawaz Bhatti and Muhammad Salman, 2017, Caravan Book Publisher, Pakistan.
2. Pulp and Paper Technology, Testing and Applications, K.P. Rao (2003), CBS Publishers.
3. Chemistry of Pulp and Paper making, Edwin Sutermeister, Ed-3rd (1946)
4. Fertilizers and Soil Fertility, U.S.Jones, Reston Publishing Co. Virginia, 1979.
5. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
6. Shereve's Chemical Process Industries, 5th Ed.1975, by G.T.Austin, McGraw Hill Book Co. New York.

Teaching Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Assignments: Types and Number with Calendar

1. Written 7th week
2. Quiz 15th week

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes - Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Semester VIII					
Programme	BS Chemistry	Course Code	Chem-469	Credit Hour	1
Course Title	Applied Chemistry Lab – I	Course Type	Major (Elective)		
Course Introduction					
<p>Students will apply their knowledge to synthesize and depolymerize the important polymers. They will also learn about the characterization of Oils and Fats. Depolymerization of PET and Polyethene, Determination of Acid Value, Saponification Value, Ester value and iodine value of oils. Preparation of Urea Formaldehyde, Phenol formaldehyde resins.</p>					
Learning Outcomes					
<p>On the completion of the course:</p> <ul style="list-style-type: none"> • Students are expected to become familiarized with the concepts of macro molecules. • This will enable them to understand the chemistry of polymers and polymerization mechanism. • They obtained knowledge of fabrication and applications of polymers in real life. • Students are able to understand the concept of GLP and GMP 					
Course Content				Assignments/Readings	
Week 1	Depolymerization of PET			Lab work / Notebook	
Week 2	Depolymerization of Polyethene			Lab work / Notebook	
Week 3	Determination of Acid Value of oils.			Lab work / Notebook	
Week 4	Determination of Saponification Value and Ester value of oils.			Lab work / Notebook	
Week 5	Determination of Ester value of oils.			Lab work / Notebook	
Week 6	Determination of iodine value of oils.			Lab work / Notebook	
Week 7	Determination of iodine value of oils.			Lab work / Notebook	
Week 8	Preparation of Urea Formaldehyde resin.			Lab work / Notebook	
Week 9	Midterm Assessment			----	
Week 10	Study of the properties of Urea Formaldehyde resin.			Lab work / Notebook	
Week 11	Preparation of Phenol Formaldehyde resin.			Lab work / Notebook	
Week 12	Study of the properties of Phenol Formaldehyde resin.			Lab work / Notebook	
Week 13	Preparation of Melamine Formaldehyde resin.			Lab work / Notebook	
Week 14	Study of the properties of Melamine Formaldehyde resin.			Lab work / Notebook	
Week 15	Preparation of polyblends			Quiz	
Week 16	Review and Viva Voce			Lab work / Notebook	

Textbooks and Reading Material

1. Applied Chemistry, Haq Nawaz Bhatti and Muhammad Salman, 2017, Caravan Book Publisher, Pakistan.
2. Pulp and Paper Technology, Testing and Applications, K.P. Rao (2003), CBS Publishers.
3. Chemistry of Pulp and Paper making, Edwin Sutermeister, Ed-3rd (1946)
4. Fertilizers and Soil Fertility, U.S.Jones, Reston Publishing Co. Virginia, 1979.
5. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
6. Shereve's Chemical Process Industries, 5th Ed.1975, by G.T.Austin, McGraw Hill Book Co. New York.

Teaching Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Assignments: Types and Number with Calendar

1. Written 7th week
2. Quiz 15th week

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes - Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Semester-VIII					
Programme	BS Chemistry	Course Code	Chem-470	Credit Hours	2
Course Title	Agro-industries		Course Type	Major (Elective)	
Course Introduction					
<p>This course content will increase the knowledge of the with regards to the processes involved in Agro-based industries especially Fertilizers and Sugar.</p> <p>Sugar and fermentation industries</p> <p>Sugar - Importance of sugar industry, chemistry and sources of sucrose, manufacture of raw and refined sugar with flow sheet, estimation of sugar (physical and chemical methods)</p> <p>Fermentation - importance of various fermentation industries, basic requirements for fermentation, steps in fermentation process. Manufacture of alcohol from molasses, Vinegar preparation of absolute alcohol, proof spirit, and denatured spirit.</p> <p>Fertilizers</p> <p>Need of Fertilizers; Classification of Fertilizers, Importance of Macro- and Micro-nutrients; Raw materials along with their sources, manufacturing procedure, flowsheet(s) and assimilation in soil for important fertilizers include Ammonia, Urea, Calcium ammonium Nitrate, Calcium Cyanamide, diammonium hydrogen phosphate, Calcium superphosphate, Calcium triple superphosphate, potash fertilizers, Organic Compost.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ul style="list-style-type: none"> • Students are expected to become familiarized with the concepts of basic steps involved in manufacturing of sugar industry • This will enable them to understand the basics of the fermentation process • This will enable them to understand the basic concept of the importance of fertilizers and common fertilizers 					
Course Content			Assignments/Readings		
Week 1	Sugar - Importance of sugar industry, chemistry and sources of sucrose.		Class Based learning/tests		
Week 2	Sugar - manufacture of raw sugar with flow sheet.		Class Based learning/tests		
Week 3	Sugar - manufacture of raw sugar with flow sheet.		Class Based learning/tests		
Week 4	Sugar - Refining of raw sugar.		Class Based learning/tests		
Week 5	Sugar - Refining of raw sugar.		Class Based learning/tests		
Week 6	Sugar – Estimation of sugar (physical and chemical methods)		Class Based learning/tests		

Week 7	Fermentation - importance of various fermentation industries, basic requirements for fermentation, steps in fermentation process.	Written Assignment
Week 8	Fermentation - Manufacture of alcohol from molasses, preparation of absolute alcohol, proof spirit, and denatured spirit	Class Based learning/tests
Week 9	Midterm Assessment	----
Week 10	Fermentation - Manufacturing of Vinegar	Class Based learning/tests
Week 11	Fertilizers - Need of Fertilizers; Classification of Fertilizers, Importance of Macro- and Micro-nutrients.	Class Based learning/tests
Week 12	Fertilizers - Raw materials along with their sources, manufacturing procedure, flowsheet(s) and assimilation in soil of Ammonia, Urea, Calcium Ammonium Nitrate.	Class Based learning/tests
Week 13	Fertilizers - Raw materials along with their sources, manufacturing procedure, flowsheet(s) and assimilation in soil of Calcium Cyanamide, diammonium hydrogen phosphate	Class Based learning/tests
Week 14	Fertilizers - Raw materials along with their sources, manufacturing procedure, flowsheet(s) and assimilation in soil of Calcium superphosphate, Calcium triple superphosphate.	Class Based learning/tests
Week 15	Fertilizers - Raw materials along with their sources, manufacturing procedure, flowsheet(s) and assimilation in soil of potash fertilizers.	Quiz
Week 16	Fertilizers - Raw materials along with their sources, manufacturing procedure, flowsheet(s) and assimilation in soil of organic Compost	Class Based learning/tests

Textbooks and Reading Material

1. Applied Chemistry, Haq Nawaz Bhatti and Muhammad Salman, 2017, Caravan Book Publisher, Pakistan.
2. Pulp and Paper Technology, Testing and Applications, K.P. Rao (2003), CBS Publishers.
3. Chemistry of Pulp and Paper making, Edwin Sutermeister, Ed-3rd (1946)

4. Fertilizers and Soil Fertility, U.S.Jones, Reston Publishing Co. Virginia, 1979.
5. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
6. Shereve's Chemical Process Industries, 5th Ed.1975, by G.T.Austin, McGraw Hill Book Co. New York.

Teaching Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Assignments: Types and Number with Calendar

1. Written 7th week
2. Quiz 15th week

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes - Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Semester-VIII					
Programme	BS Chemistry	Course Code	Chem-471	Credit Hours	1
Course Title	Applied Chemistry Lab - II	Course Type	Major (Elective)		
Course Introduction					
<p>It will increase the practical handling of the students regarding analysis of sugar cane juice and liquid effluents from the sugar industry.</p> <p>Determination of Sucrose content in sugar cane juice by polarimetry and refractive index, Determination of reducing sugars, Determination of BOD, COD and DO in water bodies and industrial effluents, Determination of pH of soil, Determination of calcium in agricultural effluents.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ul style="list-style-type: none"> • Students are expected to get familiarized with the concepts of basic Analytical Techniques • This will enable them qualify for basic to moderate level jobs involving general knowledge of Chemistry • The obtained knowledge shall also enable the students to enter into various entrepreneurial activities involving general introduction to chemistry • Students are able to understand the concept of GLP and GMP 					
Course Content				Assignments/Readings	
Week 1	Determination of Sucrose content by polarimetry and refractive index in synthesized samples.			Lab work / Notebook	
Week 2	Determination of sucrose content in sugar cane juice by polarimetry and refractive index.			Lab work / Notebook	
Week 3	Determination of reducing sugars in urine sample.			Lab work / Notebook	
Week 4	Determination of reducing sugars in blood sample.			Lab work / Notebook	
Week 5	Determination of DO in water bodies and industrial effluents.			Lab work / Notebook	
Week 6	Determination of BOD in water bodies and industrial effluents.			Lab work / Notebook	
Week 7	Determination of BOD in water bodies and industrial effluents.			Lab work / Notebook	
Week 8	Determination of COD in water bodies and industrial effluents.			Lab work / Notebook	

Week 9	Midterm Assessment	----
Week 10	Determination of COD in water bodies and industrial effluents.	Lab work / Notebook
Week 11	Determination of pH of soil.	Lab work / Notebook
Week 12	Determination of macro and micronutrients of soil.	Lab work / Notebook
Week 13	Determination of macro and micronutrients of soil.	Lab work / Notebook
Week 14	Determination of calcium in agricultural effluents.	Lab work / Notebook
Week 15	Determination of sodium and calcium in agricultural effluents.	Quiz
Week 16	Review and Viva Voce	Lab work / Notebook
Textbooks and Reading Material		
<ol style="list-style-type: none"> 1. Applied Chemistry, Haq Nawaz Bhatti and Muhammad Salman, 2017, Caravan Book Publisher, Pakistan. 2. Pulp and Paper Technology, Testing and Applications, K.P. Rao (2003), CBS Publishers. 3. Chemistry of Pulp and Paper making, Edwin Sutermeister, Ed-3rd (1946) 4. Fertilizers and Soil Fertility, U.S.Jones, Reston Publishing Co. Virginia, 1979. 5. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006). 6. Shereve's Chemical Process Industries, 5th Ed.1975, by G.T.Austin, McGraw Hill Book Co. New York. 		
Teaching Learning Strategies		
<ol style="list-style-type: none"> 5. Lectures 6. Group Discussion 7. Laboratory work 8. Seminar/ Workshop 		
Assignments: Types and Number with Calendar		
<ol style="list-style-type: none"> 1. Written 7th week 2. Quiz 15th week 		

Assessment			
Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes - Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Semester-VIII					
Programme	BS Chemistry	Course Code	Chem-472	Credit Hours	2
Course Title	Textile Industries		Course Type	Major (Elective)	
Course Introduction					
<p>Students will learn about the Textile processing; Synthesis of Fibers, finishing of fibers and dyeing of fibers. They will also learn about the synthesis to textile dyes.</p> <p>Textile fibers Classification of textile fibres, sources and properties of natural fibres, chemistry and manufacturing of Viscose rayon, Cellulose Acetate, Nylons and Polyesters and conversion to fibres, Finishing processes for 100% cotton fabrics such as singeing, desizing, scouring, mercerizing and bleaching</p> <p>Textile dyeing Color and chemical constitution, Important classes of chromogens, Classification and nomenclature of dyes, manufacturing of dye intermediates and dyes, Selection of dyes for wool, cellulosic and synthetic fibers, Application methods of dyes to wool and cellulosic fibers.</p>					
Learning Outcomes					
<p>On the completion of the course:</p> <ul style="list-style-type: none"> • Students are expected to become familiarized with the concepts of textile processing processes. • This will enable students to understand textile dyes and different finishing processes before dyeing of textiles. 					
Course Content			Assignments/Readings		
Week 1	Textile fibers - Classification of textile fibres, sources and properties of natural fibres.		Class Based learning/tests		
Week 2	Textile fibers - Chemistry and manufacturing of Viscose rayon.		Class Based learning/tests		
Week 3	Textile fibers - Chemistry and manufacturing of Cellulose Acetate.		Class Based learning/tests		
Week 4	Textile fibers - Chemistry and manufacturing of Nylons.		Class Based learning/tests		
Week 5	Textile fibers - Chemistry and manufacturing of Nylons.		Class Based learning/tests		
Week 6	Textile fibers - Chemistry and manufacturing of Polyesters and conversion to fibers.		Class Based learning/tests		
Week 7	Finishing processes for 100% cotton fabrics such as singeing, desizing, scouring.		Written Assignment		

Week 8	Finishing processes for 100% cotton fabrics such as mercerizing and bleaching.	Class Based learning/tests
Week 9	Midterm Assessment	----
Week 10	Textile dyeing - Color and chemical constitution.	Class Based learning/tests
Week 11	Textile dyeing - Color and chemical constitution.	Class Based learning/tests
Week 12	Textile dyeing - Important classes of chromogens, Classification and nomenclature of dyes.	Class Based learning/tests
Week 13	Textile dyeing - manufacturing of dye intermediates and dyes.	Class Based learning/tests
Week 14	Textile dyeing - manufacturing of dye intermediates and dyes.	Class Based learning/tests
Week 15	Textile dyeing - Selection of dyes for wool, cellulosic and synthetic fibers.	Quiz
Week 16	Textile dyeing - Application methods of dyes to wool and cellulosic fibers.	Class Based learning/tests

Textbooks and Reading Material

1. Applied Chemistry, Haq Nawaz Bhatti and Muhammad Salman, 2017, Caravan Book Publisher, Pakistan.
2. Pulp and Paper Technology, Testing and Applications, K.P. Rao (2003), CBS Publishers.
3. Chemistry of Pulp and Paper making, Edwin Sutermeister, Ed-3rd (1946)
4. Fertilizers and Soil Fertility, U.S.Jones, Reston Publishing Co. Virginia, 1979.
5. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
6. Shereve's Chemical Process Industries, 5th Ed.1975, by G.T.Austin, McGraw Hill Book Co. New York.

Teaching Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Assignments: Types and Number with Calendar

1. Written 7th week
2. Quiz 15th week

Assessment			
Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes - Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Semester-VIII					
Programme	BS Chemistry	Course Code	Chem-473	Credit Hour	1
Course Title	Applied Chemistry Lab - III	Course Type	Major (Elective)		
Course Introduction					
<p>Students will understand about the Applications of Analytical techniques in chemical characterization of dyes. Also, they will learn how to apply dyes to fabrics.</p> <p>Dyeing of clothes in different shades using Acid dyes, Determination of pK value of indicators (methyl orange and methyl red). Catalytic / photolytic degradation of Dyes. Removal of dyes from industrial effluents. Estimation of dyes by spectrophotometry.</p>					
Learning Outcomes					
<p>On the completion of the course:</p> <ul style="list-style-type: none"> • Students are expected to become familiarized with the concepts of basic Analytical Techniques • This will enable them qualify for basic to moderate level jobs involving general knowledge of chemistry • The obtained knowledge shall also enable the students to enter into various entrepreneurial activities involving general introduction to chemistry • Students are able to understand the concept of GLP and GMP 					
Course Content				Assignments/Readings	
Week 1	Dyeing of clothes in different shades using Acid dyes.			Lab work / Notebook	
Week 2	Dyeing of clothes in different shades using Acid dyes.			Lab work / Notebook	
Week 3	Dyeing of clothes in different shades using Acid dyes.			Lab work / Notebook	
Week 4	Determination of pK value of indicators (methyl orange and methyl red).			Lab work / Notebook	
Week 5	Determination of pK value of indicators (methyl orange and methyl red).			Lab work / Notebook	
Week 6	Determination of pK value of indicators (methyl orange and methyl red).			Lab work / Notebook	
Week 7	Determination of pK value of indicators (methyl orange and methyl red).			Lab work / Notebook	
Week 8	Estimation of dyes by spectrophotometry.			Lab work / Notebook	

Week 9	Midterm Assessment	----
Week 10	Catalytic / photolytic degradation of Dyes.	Lab work / Notebook
Week 11	Catalytic / photolytic degradation of Dyes.	Lab work / Notebook
Week 12	Removal of dyes from industrial effluents.	Lab work / Notebook
Week 13	Removal of dyes from industrial effluents.	Lab work / Notebook
Week 14	Removal of dyes from industrial effluents.	Lab work / Notebook
Week 15	Estimation of dyes by spectrophotometry.	Quiz
Week 16	Review and Viva Voce	Lab work / Notebook

Textbooks and Reading Material

1. Applied Chemistry, Haq Nawaz Bhatti and Muhammad Salman, 2017, Caravan Book Publisher, Pakistan.
2. Pulp and Paper Technology, Testing and Applications, K.P. Rao (2003), CBS Publishers.
3. Chemistry of Pulp and Paper making, Edwin Sutermeister, Ed-3rd (1946)
4. Fertilizers and Soil Fertility, U.S.Jones, Reston Publishing Co. Virginia, 1979.
5. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
6. Shereve's Chemical Process Industries, 5th Ed.1975, by G.T.Austin, McGraw Hill Book Co. New York.

Teaching Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Assignments: Types and Number with Calendar

1. Written 7th week
2. Quiz 15th week

Assessment			
Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes - Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Semester-VIII					
Programme	BS Chemistry	Course Code	Chem-474	Credit Hours	3
Course Title	Industries and Environment	Course Type	Major (Elective)		
Course Introduction					
<p>The student will learn about the basic concepts of Environmental Chemistry. They will also learn how industrial activities contribute to Water and Air Pollution.</p> <p>History and significance of environmental degradation, impact of the modern life-style on environmental quality, resource depletion, environmental pollution and its types, environmental education, Environmental management systems, institutions for the protection of environment, inter-disc nature of environmental studies, environmental segments and their interrelation ships, Environmental quality standards (air, drinking water and wastewater).</p> <p>Air and Water Environment:</p> <p>Composition of atmosphere, temperature and pressure profile of different layers of the atmosphere, common air pollutants and their sources, greenhouse effect and global warming, stratospheric ozone depletion, Importance of water, BOD and COD, sources of water pollution (industrial, agricultural, municipal and natural), primary, secondary and advanced treatment of water.</p>					
Learning Outcomes					
<p>On the completion of the course:</p> <ul style="list-style-type: none"> • Students are expected to become familiarized with the concepts of environment, environmental standards and effect of industries on environment • This will enable them to understand the importance of environmental protection • This will also enable the students to understand the importance of practice of green processes in chemistry 					
Course Content				Assignments/Readings	
Week 1	Environment - Environmental degradation, impact of the modern lifestyle on environmental quality.			Class Based learning/tests	
Week 2	Environment - Resource depletion, environmental pollution and its types, environmental education.			Class Based learning/tests	
Week 3	Environment - Environmental management systems, institutions for the protection of environment, inter-disciplinary nature of environmental studies.			Class Based learning/tests	
Week 4	Environment - environmental segments and their inter-relationships.			Class Based learning/tests	
Week 5	Environment - Environmental quality standards (air, drinking water and wastewater).			Class Based learning/tests	

Week 6	Environment - Environmental quality standards (air, drinking water and wastewater).	Class Based learning/tests
Week 7	Environment - Composition of atmosphere, temperature and pressure profile of different layers of the atmosphere.	Written Assignment
Week 8	Environment - common air pollutants and their sources.	Class Based learning/tests
Week 9	Midterm Assessment	----
Week 10	Environment - greenhouse effect and global warming, stratospheric ozone depletion.	Class Based learning/tests
Week 11	Environment - Importance of water, BOD and COD.	Class Based learning/tests
Week 12	Environment - sources of water pollution (industrial, agricultural, municipal and natural).	Class Based learning/tests
Week 13	Environment - sources of water pollution (industrial, agricultural, municipal and natural).	Class Based learning/tests
Week 14	Environment - primary, secondary and advanced treatment of water.	Class Based learning/tests
Week 15	Environment - primary, secondary and advanced treatment of water.	Quiz
Week 16	Environment - primary, secondary and advanced treatment of water.	Class Based learning/tests

Textbooks and Reading Material

1. Applied Chemistry, Haq Nawaz Bhatti and Muhammad Salman, 2017, Caravan Book Publisher, Pakistan.
2. Pulp and Paper Technology, Testing and Applications, K.P. Rao (2003), CBS Publishers.
3. Chemistry of Pulp and Paper making, Edwin Sutermeister, Ed-3rd (1946)
4. Fertilizers and Soil Fertility, U.S.Jones, Reston Publishing Co. Virginia, 1979.
5. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
6. Shereve's Chemical Process Industries, 5th Ed.1975, by G.T.Austin, McGraw Hill Book Co. New York.

Teaching Learning Strategies			
1. Lectures 2. Group Discussion 3. Laboratory work 4. Seminar/ Workshop			
Assignments: Types and Number with Calendar			
1. Written 7 th week 2. Quiz 15 th week			
Assessment			
Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes - Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.