

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN EE/EC/IT/CM
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: CH202E
COURSE TITLE	: APPLIED CHEMISTRY
PREREQUISITE	: NIL
TEACHING SCHEME	: TH:04; TU:00;PR:02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)
TH. TEE EXAM.	: 03 HRs
PR. TEE EXAM	: 02 HRs (Internal)
PT. EXAM	: 01 HR

❖ RATIONALE:

Chemistry is the basic science which is essential to all engineering courses. For an engineer, the usage of equipments and instruments would require knowledge of chemical substances, their composition and properties. Chemistry subject knowledge also aims to bridge the theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in the field of engineering.

Study of different polymers, insulators or dielectrics, adhesives and their chemical behavior will be useful in their applications in electrical appliances and electronics industries. This will be gateway for development of reasoning capacity of students and understanding new technology as well and capabilities in solving challenging problems at various level of working in the electronic and computer industry.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use principles and basic laws of chemistry in engineering field.
2. Select and apply knowledge of metal and nonmetallic materials in field of engineering and Technology.
3. Select proper cells and batteries on the basis of properties and construction.
4. Record readings of experiments.
5. Conclude result of practical on the basis of ultimate stakeholders or society.
6. Safely handle chemicals and equipments which are correlate with safety of others and environmental protection

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Chemical Bonding	1. Define terms related to Atomic structure. 2. State postulates of Bohr's Theory. 3. Draw schematic diagram of atom. 4. Write all steps of formation of molecules. 5. Review the filling up orbital by Aufbau principle and Hunds rule.	Atomic Structure: 1.1 Definition of Atom, Fundamental Particles of Atom – their Mass, Charge, Location. 1.2 Postulates of Bohr's Theory 1.3. Definition, Shape of the orbitals & distinction between Orbits & Orbitals. 1.4 Hund's Rule, Filling Up of the Orbitals by Aufbau's Principle (till Atomic no. 30). Valency: 1.5 Definition & types of valency (Electrovalency & Covalency). 1.6 Octet Rule, Duplet Rule. 1.7 Formation of Electrovalent e.g. NaCl, CaCl ₂ , MgO, AlCl ₃ . 1.8 Formation of Covalent Compounds CO ₂ , H ₂ O, NH ₃ , C ₂ H ₂ . 1.9 Distinction between electrovalent & covalent compounds.	
2. Metallurgy and Alloys	1. Describe the process of extraction of copper and aluminum from its ore. 2. State different properties of copper and aluminum metal. 3. Select proper alloy as per their composition, properties and uses. 4. Write Engineering applications of Al and Cu.	Metallurgy 2.1 Metallurgy of Copper Definitions of metallurgy. 2.2 Extraction process: Ores of copper, extraction of copper from copper pyrite by physical concentration by Froth floatation process and chemical concentration by roasting. 2.3 smelting, bessemerisation, electrolytic refining. 2.4 Engineering Applications of copper. Metallurgy of Aluminum 2.5 Extraction process : ores of Aluminum, extraction of aluminum, purification of bauxite by Hall's process, electrolytic reduction of alumina, 2.6 electrolytic refining of aluminum. 2.7 Engineering applications of aluminum Alloy 2.8 Brass ,Bronze, duralumin, Alnico composition ,properties and applications 2.9 Solders -Composition, properties and applications of ,rose metal and wood's metal	
3. Non-Metallic Engineering	1. Distinguish between thermo softening and thermosetting plastics.	Polymers (Plastics, Rubber) 3.1 Definition of Plastic, Formation of Plastic by Addition & Condensation	

Materials	<ol style="list-style-type: none"> List the properties of Rubber. State the applications of thermal insulators, and Adhesive. Describe applications of Phenol formaldehyde resin, urea formaldehyde resin and epoxy resin. 	<ol style="list-style-type: none"> Polymerization, types of polymerization, thermosetting and thermosetting plastic. Definitions, examples and applications of conducting polymers, photoconductive polymers, electrically insulating polymers, liquid crystal polymer(LCP) Rubber: Types of Rubber. Natural Rubber: Its Processing, Drawbacks of Natural Rubber, Vulcanisation of Rubber with Chemical Reaction. Synthetic Rubber: Definition, difference between natural and synthetic rubber, Properties of synthetic rubber such as elasticity, tack, abrasion resistant, their definition and related applications. Insulating material and Adhesives Definition & Characteristics of Thermal insulators. Preparation, Properties & Applications of Thermocole & glasswool. Definition, characteristics, advantages of adhesive, Properties and application of Phenol formaldehyde resin, urea formaldehyde resin and epoxy resin. 	
4. Electro chemistry	<ol style="list-style-type: none"> Describe the mechanism of electrolysis. Identify the role of electrodes in application of electrolysis. Define terms involved in electrochemistry. Calculate the problems based on Faradays I, Faradays II law and PH. Apply the knowledge of electrolysis in Electroplating and Electro refining. 	<p>Basic concepts of electrolysis:</p> <ol style="list-style-type: none"> Electrolyte, type of electrolyte- strong and weak electrolyte, their difference. Ionization and electrolytic dissociation, Arrhenius theory of electrolytic dissociation, degree of ionization, factors affecting degree of ionization. Definitions of electrolytic cell, electrodes- cathode, anode, electrode potential- oxidation potential and Reduction potential. <p>Electrolysis</p> <ol style="list-style-type: none"> Mechanism of electrolysis- Electrolysis, electrochemical series for cations and anions. Mechanism of electrolysis of CuSO_4 solution by using Platinum electrode and Copper electrode. Applications of electrolysis- Electroplating of Silver, Electro refining of Blister copper. Faraday's laws of electrolysis: Faraday's First and Second law, relation between electrochemical equivalent and chemical equivalent, numerical. <p>P^{H} and P^{OH}:</p> <ol style="list-style-type: none"> Definition of P^{H}, P^{OH}, P^{H} scale, numerical. 	

5. Cells and batteries	<ol style="list-style-type: none"> 1. Define basis terms involved in electrochemical cell and battery. 2. Write construction and working of different types of cells. 3. Differentiate Primary and Secondary cells. 4. describe the engineering applications of Lead-acid 5. Storage cell, Ni-Cd Cell, Hydrogen- oxygen fuel cell. 	Electrochemical cells/ batteries: 5.1 Basic concepts: Definition of electrolyte, conductivity of electrolytes, cell, battery, electrolytic cell, electrochemical cell, charging, discharging. 5.2 Classification of electrochemical cells: Primary and secondary cells. 5.3 Primary cells: construction, working and applications of - Dry Cell, Daniel cell, 5.4 Secondary cells: construction, working and applications of - Lead-acid storage cell, Ni-Cd Cell 5.5 Fuel cell : Definition, construction, working, advantages, limitations and 5.6 applications of Hydrogen- oxygen fuel cell.	
6. Corrosion	<ol style="list-style-type: none"> 1. Write mechanism of atmospheric corrosion and immersed corrosion. 2. Describe different methods of protection of metal from corrosion. 3. Select proper protection method for different types of material from corrosion. 	6.1 Definition, Types, Atmospheric or Chemical Corrosion, Mechanism, Factors Affecting Atmospheric Corrosion] 6.2 Definition, Types, Atmospheric or Chemical Corrosion, Mechanism, Factors Affecting Atmospheric Corrosion 6.3 Immersed Corrosion or Electrochemical Corrosion, mechanism of electrochemical corrosion absorption of oxygen gas, Evolution of Hydrogen gas. 6.4 Factors Affecting Electrochemical Corrosion, 6.5 Application of Protective Coatings like metal coating by -Galvanizing, Tinning, Sherardizing Metal Spraying, Metal Cladding, Cementation or Diffusion Method. 6.6 Application of non metallic coatings: paint-definition, characteristics, constituents of paint and their functions.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Pract-icals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Explore the chemistry laboratory.	Chemical Bonding	2
2	Determine the percentage of copper in the given brass alloy or copper ore.	Metallurgy and Alloys	2
3	Find the relation between loss in weight of aluminium strip in acidic and alkaline medium and rate of corrosion.	Corrosion	2
4	Determine the strength of given hydrochloric acid solution by titrating it against Sodium hydroxide solution.	Corrosion	2
5	Determine thinner content in oil paint.	Corrosion	2
6	Prepare urea formaldehyde resin used in manufacturing of sun mica Plastic.	Electrochemistry	2
7	Determination of P^H value of given solution by using P^H paper, universal indicator and P^H meter.	Electrochemistry	2
8	Find the Electrochemical equivalent (ECE) of copper.	Cells and Battery	2
9	Perform electro refining process of copper metal.	Electrochemistry	2
10	Prepare Phenol formaldehyde resin used in manufacturing of Bakelite Plastic.	Non-Metallic Engg. Materials	2
11	Analyse basic and Acidic Radicals of known salt solution-1 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	2
12	Analyse basic and Acidic Radicals of known salt solution-2 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	2
13	Analyse basic and Acidic Radicals of known salt solution-3 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	2
14	Analyse basic and Acidic Radicals of known salt solution-4 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	2
Skill Assessment			4
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Chemical Bonding:	06(04)	04(04)	00(00)	10(08)
2	Metallurgy and Alloys	02(00)	04(06)	06(00)	12(06)
3	Non-Metallic Engineering Materials	06(00)	04(04)	00(00)	10(04)
4	Electrochemistry	02(04)	10(02)	06(04)	18(10)
5	Cells and Battery	02(00)	08(00)	00(06)	10(06)
6	Corrosion	00(02)	04(04)	06(00)	10(06)
	Total	18(10)	34(20)	18(10)	70(40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	4	U	2	5/7
	6	R	2																
02	1	R	4	1	U	4	2	U	4	1	R	4	1	U	4				3/5
03	3	R	4	3	U	4	4	U	4	3	U	4	4	R	4				3/5
04	5	U	4	5	U	4	6	U	4	4	A	4	6	U	4				3/5
05	2	A	6	4	A	6	2	U	6										2/3
06	4	U	6	6	A	6	5	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Writing chemical reactions, handling the equipment, writing procedure etc.	10
2	Performance	20
3	Calculation, result, drawing graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	-	-	-	-	-	-	-	-	-	-
2	3	2	-	-	-	-	-	-	-	-	-	-
3	3	2	-	-	-	-	-	-	-	-	-	-
4	3	-	3	-	-	-	-	3	-	3	-	-
5	3	-	2	-	-	-	-	2	-	2	-	-
6	3	-	1	-	-	2	-	1	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Engineering Chemistry	Jain and Jain , Dhanpat Rai publishing company(P) ltd.15 edition	10092
2	Engineering Chemistry	S. S. Dara , S. Chand Publication,15 edition	
3	Engineering Chemistry	R. Sivakumar N. Sivakumar and Tata McGraw-Hill, edition10.	9780745-328896
4	Polytechnic Chemistry	Vedprakash Mehta ,Jain brothers,edition6	13-9788183600134
5	Industrial chemistry	Goel Publication,edition-8	81877224002

❖ **E-REFERENCES:**

http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_polymers- ,
assessed on 2 Feb. 2016
http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_fluids- ,
assessed on 2 Feb. 2016
<http://www.asetute.com.au/corrosion.html> , assessed on 4 Feb. 2016
http://www.sherardizing.com/resources/files/9_Sherardizing_Corrosion.pdf , assessed on
4 Feb. 2016
<http://www.galvanizeit.org/aga/animation> , assessed on 6 Feb. 2016
http://www.ehow.com/list_6725219_different-types-metal-cladding.html , assessed on 8
Feb 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Electronic balance (measure up to 0.001 mg)
2. Battery 12 volt
3. Digital multi-meter
4. Rheostat assorted sizes
5. Voltmeter MI 0-150-300 V
6. Ammeter MI 0-5-10 A
7. Electrolytic cell set up
8. Digital PH meter

❖ **LIST OF EXPERS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

Sr. No	Name	Designation	Institute/Industry
1.	Dr. P.J. Sondawale	I/C chemistry Department	Government Polytechnic, Nagpur
2.	Dr. Mudrika I. Ahmed	Lecturer in chemistry	Government Polytechnic, Nagpur
3.	Dr. M. S. Rathod	Lecturer in chemistry	Government Polytechnic, Nagpur
4.	Dr. S. A. Petkar	Lecturer in chemistry	Government Polytechnic, Nagpur
5.	Mr. S.R. Gaidhar	Lecturer in chemistry	Government Polytechnic, Gadchiroli
6.	Dr. S. Z. Jadhav	Professor in chemistry	Institute of Science, Nagpur
7.	Dr. K. A. Nandekar	Lecturer in chemistry	G.H.Raisoni Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)