GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE/ ME/ MT
PROGRAMME CODE	01/04/05
COURSE TITLE	ENGINEERING CHEMISTRY
COURSE CODE	SC11201
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
SC11201	ENGINEERING CHEMISTRY	DSC	03	-	02	01	06	03	02	30	70*#	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 2 Hrs

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment, **SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @-Internal Assessment, # - External Assessment,*# - Online Examination,@$ - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Applications of Material Science and Chemical Principles have resulted in the development of new materials used in modern medicines and automobiles, synthetic fibers, polymers, alloys, new energy sources and many other important products and processes. Steels, alloys, plastic and elastomers are included considering their present extensive use in automobiles, chemicals and heavy engineering industries.

Corrosion and methods of prevention will make students realize the importance of care and maintenance of machines and equipment. The study of impurities and hardness in water and methods for water softening will help the students make proper use of water.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Distinguish materials based on atomic structure.
CO2: Select metals and non-metals for given applications
CO3: Use corrosion preventive measures in the industry.
CO4: Use relevant water treatment processes to solve industrial problems.
CO5: Select relevant fuel and lubricant in relevant applications.
CO6: Use the appropriate engineering material in various applications.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I ATOMIC STRUCTURE (CL Hrs-05, Marks-10)			
1.	TLO 1.1 Explain the characteristics of fundamental particles TLO 1.2 Distinguish between orbit and orbital. TLO 1.3 Draw orbital electronic configurations (s, p, d, f) of elements. TLO 1.4 Explain the formation of molecules TLO 1.5 Explain the Covalent compounds. *	1.1 Indian Chemistry:-Philosophy of an atom by Acharya Kanad. 1.2 Orbits: Bohr's energy levels, sub-energy levels, s, p, d, f orbital, shapes and description of s and p orbital. 1.3Aufbau's principle, Hund's rule, orbital electronic configurations (s, p, d, f) of elements having atomic numbers 1 to 30 1.4. Definitions of valence electrons, valency, types of valencies, Definition of electrovalency positive and negative electrovalency. 1.5. Formation of Electrovalent compounds-Nacl, $AlCl_3$ Definition of covalency, single, double and triple covalent bonds, formation of Covalent compounds H_2O, CO_2, N_2.	Chalk and board Improved lecture, Tutorial Assignment, and Demonstration	CO1
	UNIT-II METALS AND ALLOYS (CL Hrs-08, Marks-12)			
2	TLO 2.1 Draw the flow chart showing different processes in metallurgy. TLO 2.2 Classify carbon steel giving properties and application of each type. TLO 2.3 Define heat treatment and state the purposes of the hardening method. TLO 2.4 Describe the purposes of making alloys. TLO 2.5 State the composition, properties and uses of a given alloy.	2.1 Occurrence of metals, definitions of mineral, ore, flux, matrix, slag and metallurgy, mechanical properties of metal. 2.2 Flow chart showing different processes in metallurgy, classification, properties and application of carbon steel, 2.3 Heat treatment (definition, purposes and methods) 2.4 Definition of alloy, purposes of making alloys with examples, classification of alloys (ferrous and non-ferrous), 2.5 Composition, properties and uses of Heat resisting steel, Magnetic steel, Shock resistance steel, Stainless steel, High-speed steel, Spring steel, Tool steel, Duralumin, Woods metal, Brass and Monel metal	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-III CORROSION (CL Hrs-08, Marks-12)			
3	TLO 3.1 Explain different types of oxide films. TLO 3.2 Explain the mechanism of electrochemical corrosion. TLO 3.3 Explain the factors affecting the rate of atmospheric corrosion and electrochemical corrosion. TLO 3.4 Describe the galvanization process of protection of metal from corrosion. TLO 3.5 Distinguish between galvanization and tinning.	3.1 Definition, causes of corrosion types of corrosion- definition (atmospheric and electrochemical) Types of oxide films 3.2 Mechanism of atmospheric and electrochemical corrosion (evolution of hydrogen, absorption of oxygen). 3.3 Factors affecting the rate of atmospheric corrosion and electrochemical corrosion. 3.4 Protection Methods- Galvanization and Tinning Processes, 3.5 Sherardizing Metal spraying, Metal cladding.	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	**CO3**
	UNIT- IV WATER (CL Hrs-08, Marks-12)			
4	TLO 4.1. Explain the bad effects of hard water in the paper and textile industries. TLO 4.2. Describe the method of removal of hardness by the zeolite process. TLO 4.3. Explain the reverse osmosis process of water. TLO 4.4. Explain sewage treatment of water. TLO 4.5 Calculate the pH and pOH for a given solution	4.1 Definition of hard water and soft water causes of hardness, types of hardness. 4.2 Bad effect of hard water in industries (paper, textile, dye, sugar) 4.3 Removal of hardness by lime soda method, zeolite, Ion exchange method. 4.4 Reverse osmosis, sewage treatment 4.5 pH scale, applications of pH in engineering. Numerical based on pH.	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	**CO4**
	UNIT –V LUBRICANTS & FUELS (CL Hrs-08, Marks-12)			
5	TLO 5.1 Classify lubricant and list the examples of each type. TLO 5.2 Select the proper lubricant for given machines, (I.C.E., gears, cutting tools, high pressure.) TLO 5.3 Describe the characteristics of good fuel. TLO 5.4 Compare solid, liquid and gaseous fuel TLO 5.5 Draw the diagram of refining of crude petroleum	5.1 Lubricants: Classification of lubricant, properties of lubricating oils (physical and chemical) 5.2 Selection of lubricant for light machines, I.C.E., gears, cutting tools, high-pressure and low-speed machines, transformers, and spindles in the textile industry for refrigeration systems. 5.3 Definition, classification of fuels, characteristics of good fuel. 5.4 Comparison between solid, liquid and gaseous fuel, types of coal. Proximate analysis of coal. 5.5 Refining of crude petroleum. Fractions obtained by distillation of	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	**CO5**

		crude oil, gasoline, kerosene, and diesel as a fuel (properties and uses).		
UNIT –VI MATERIALS (CL Hrs-08, Marks-12)				
6	TLO6.1 Describe the different constituents of paint. TLO 6.2 Distinguish between varnish and paint. TLO 6.3 Describe the preparation and properties of a given insulator. TLO 6.4 Describe the polymerization process of the given polymer, TLO 6.5 Explain the properties and uses of the given polymer, elastomer. TLO 6.6 Explain the function of different constituents of cement.	6.1Paints: Definition, the purpose of applying paints, characteristics of paint, constituents of paint, function and examples of each constituent. 6.2 Varnish: Definition, types, and difference between varnish and paint. 6.3 Insulators: Definition, characteristics, preparation, properties and application of Glass wool and Thermocole. 6.4 Plastic: Definition, Classification based on Molecular structure, Monomers (homo polymer and copolymer), & Thermal behaviour (Thermoplastics and Thermosetting). 6.5 Types Polymerization Reaction, Addition &condensation, properties and application of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde. 6.6 Cement: Definition, classification of cement, chemical composition of Portland cement, functions of constituents in cement.	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	**CO6**

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1 Write the electronic configuration of atoms from Z=1 to Z=30	Write the electronic configuration of atoms from Z=1 to Z=30	2	CO1
2	LLO 2 Write the formation of compounds NaCl, $AlCl_3$, H_2O, CO_2, N_2	Write the formation of compounds NaCl, $AlCl_3$, H_2O, CO_2, N_2	2	CO1
3	LLO 3 Determine basic radical-given ionicsolutions by performing the selective test	Determination of basic radical from given ionic solution	2	CO1
4	LLO 4 Determine acidic radical given ionicsolutions by performing the selective test	Determination of acidic radical from given ionic solution.	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	xperiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
5	LLO 5 Determine the percentage of iron in a given steel sample by redox titration.	Determination of the percentage of iron in a given steel sample by redox titration.	2	CO2
6	LLO 6 Prepare phenol formaldehyde resin.	Preparation of phenol formaldehyde resin.	2	CO6
7	LLO 7 Determine the rate of corrosion of Aluminium in an acidic medium	Determination of the rate of corrosion of Aluminium in an acidic medium.	2	CO3
8	LLO 8 Determine the hardness of the given water sample by the EDTA method.	Determination of hardness of given water sample by EDTA method.	2	CO4
9	LLO 9 Determine the coefficient of viscosity using Ostwald's viscometer	Determination of the coefficient of viscosity using Ostwald's viscometer.	2	CO5
10	LLO 10 Determine moisture content from a given coal sample.	Determination of moisture content from a given coal sample.	2	CO5
11	LLO 11 Determine thinner content in oil paint.	Determination of thinner content in oil paint.	2	CO6
12	LLO 12 Preparation of corrosive medium for Aluminium at different temperature	Preparation of corrosive medium for Aluminium at different temperatures	2	CO3

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

- Types of bonds: Prepare a chart and models displaying different types of bonds with examples.
- Metals and Alloys: Prepare a chart showing the Composition, properties application of Ferrous Alloys.
- Insulating materials: Prepare a chart including different synthetic Plastic and Rubber and list their uses.
- Lubricants: Prepare a chart including the Selection of lubricants for different machines.
- Water: Collect and analyse different water samples from different sources.
- Corrosion: Prepare a Chart displaying images of observed corrosion processes in the surrounding
- Materials: Collect information by library survey regarding engineering materials used in various industries.
- Engineering material: Collect information by library survey regarding engineering materials used in various industries.
- Fuels: Prepare a chart of Fractions obtained by distillation of crude oil.

Assignment:

- Explain covalent bonds and ionic bonds with examples
- Distinguish between paints and varnishes.
- Write the electronic configuration of atoms
- Write the formation of compounds NaCl, $AlCl_3$, H_2O, CO_2, N_2
- Compare Thermoplastics and Thermosetting
- State properties and applications thermocol and glass wool
- Explain types of alloys with examples.
- Demonstrate the Mechanism of the Hydrogen Evolution process.
- Write properties and applications of solid, semisolid and liquid lubricant.
- Write properties and applications of solid, liquid and gaseous fuels.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital Hot Air Oven GR Lab temperature ranges from 100 to 250 ^{0} c	10,11
2.	Electronic balance with the scale range of 0.001 gm to 500 gm	All

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Atomic structure	CO 1	05	02	08	00	10
2	II	Metals and alloys	CO 2	08	02	04	06	12
3	III	Corrosion	CO 3	08	02	04	06	12
4	IV	Water	CO 4	08	02	04	06	12
5	V	Lubricants & Fuels	CO 5	08	04	02	06	12
6	VI	Materials	CO 6	08	02	04	06	12
			Grand Total	**45**	**14**	**26**	**30**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Midterm Exam 5. Self-Learning 6. Term Work 7. Seminar/Presentation	1. End Term Exam 2. Micro-project

X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	-	2	-	1			
CO2	3	2	-	-	2	1	1			
CO3	3	-	-	2	-	-	1			
CO4	3	2	-	2	2	1	1			
CO5	3	2	-	2	1	1	1			
CO6	3	2	-	3	1	1	-			

Legends:- High:03, **Medium:**02, **Low:**01, **NoMapping:** -
*PSOs are to be formulated at the institute level

XI.SUGGESTED LEARNING MATERIALS/BOOKS

12	Author	Title	Publisher
1	Dara S.S. Umare S.S.	Engineering Chemistry	S. Chand and Co publication, New Delhi, 201, ISBN: 8121997658
2	Jain and Jain	Engineering Chemistry	Dhanpat Rai and Sons, New Delhi,2015, ISBN: 9352160002
3	Vairam. S	Engineering Chemistry	Wiley Indian Pvt. Ltd, New Delhi, 2013 ISBN: 9788126543342
4	Agnihotri, Rajesh	Chemistry for Engineers	Wiley Indian Ptd.Ltd, New Delhi, 2014, ISBN: 9788126550784
5	Agrawal Shikha	Engineering Chemistry	Cambridge University Press, New Delhi, 2015 ISBN: 97811074764
6	George E.Totten, R J Shah SR Westbrook	Fuels and Lubricants Handbook	Published by ASTM with a product code of B-ASTM-002 ISBN of 978-0-8031-4551-1, and 1086 pages.

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	www.chemistryteaching.com	Physical, inorganic and organic chemistry.
2.	www.chemcollective.org	Virtual Labs, simulation
3.	www.chem1.com	Chemistry instruction and education
4.	www.onlinelibrary.wiley.com	Materials and corrosion
5.	www.rsc.org	Catalysis

Sr.No	Link/Portal	Description
6	www.chemcollective.org	Collection of virtual labs, scenario-based learning activities
7	www.wqa.org	Water Quality.
8	https://www.ancient-origins.net/history-famous-people/indian- sage-acharya-kanad-001399	IKS Philosophy of atom by AcharyaKanad.

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