Shree Manibhai Virani and Smt. Navalben Virani Science College (Autonomous), Rajkot

Affiliated to Saurashtra University, Rajkot

B. Voc. Pharmaceutical Analysis & Quality Assurance

Scheme of Instruction and Examinations
For Students Admitted from A.Y. 2017-2018 & Onwards

Semester– I							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part - I							
17VLCEN01	Functional English	3	3	40	60	100	3
Part - II							
17VPAGC01	**Core 1 :** Pharmaceutical Inorganic Chemistry	3	3	30	70	100	3
17VPAGC02	**Core 2 :** Unit Operations- I	3	3	30	70	100	3
17VPAGC03	**Core 3:** Fundamental Analytical Chemistry	3	3	30	70	100	3
17VPASC01	**Core Skill 1:** Pharmaceutical Inorganic Chemistry Practical	6	3	40	60	100	6
17VPASC02	**Core Skill 2:** Unit Operations- I Practical	3	3	20	30	50	3
17VPASC03	**Core Skill 3:** Fundamental Analytical Chemistry Practical	6	3	40	60	100	6
17VPASC04	**DSE-Allied Skill 1:** Office Automation Tools Practical	3	3	20	30	50	3
		30				**700**	**30**
Part - III							
17VAEES01	**AECC 1:** Environmental Science	1	-	-	-	-	-
17VAEVE01	**SEC 1:** Value Education –I	1	-	Remarks			1
		32					

Semester – II							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part - I							
16VLCEN02	Business Communicative English	3	3	40	60	100	3
Part - II							
17VPAGC04	**Core 4:** Pharmaceutical Analysis	3	3	30	70	100	3
17VPAGC05	**Core 5:** Pharmaceutical Physical Chemistry	3	3	30	70	100	3
17VPAGC06	**Core 6 :** Industrial Hazards, Safety and GLP	3	3	30	70	100	3
17VPASC05	**Core Skill 5 :** Pharmaceutical Analysis Practical	6	3	40	60	100	6
17VPASC06	**Core Skill 6:** Pharmaceutical Physical Chemistry Practical	6	3	40	60	100	6
17VPASC07	**Core Skill 7:** Skill Training/ IDP (Industry/Institute Defined Project)	6	3	40	60	100	6
		30				**700**	**30**
Part - III							
17VAEES02	**AECC 1 :** Environmental Science	1	-	Remarks			2
17VAEVE02	**SEC 2:** Value Education –II	1	-	Remarks			1
		32					

Semester – III							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part - II							
17VPAGC07	**Core 7:** Industrial Analysis	3	3	30	70	100	3
17VPAGC08	**Core 8:** Fundamental Biochemistry	3	3	30	70	100	3
17VPAGC09	**Core 9:** Pharmaceutical Organic Chemistry- I	3	3	30	70	100	3
17VPAGC10	**Core 10:** Unit Operations- II	3	3	30	70	100	3
17VPASC08	**Core Skill 8:** Industrial Analysis Practical	6	3	40	60	100	6
17VPASC09	**Core Skill 9:** Fundamental Biochemistry Practical	3	3	20	30	50	3
17VPASC10	**Core Skill 10:** Pharmaceutical Organic Chemistry- I Practical	6	3	40	60	100	6
17VPASC11	**Core Skill 11:** Unit Operations- II Practical	3	3	20	30	50	3
	Total	**30**				**700**	**30**

Semester – IV							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part - II							
17VPAGC11	**Core 11:** Pharmaceutical Engineering	3	3	30	70	100	3
17VPAGC12	**Core 12:** Food & Beverages Analysis	3	3	30	70	100	3
17VPAGC13	**Core 13:** Pharmaceutical Organic Chemistry- II	3	3	30	70	100	3
17VPAGC14	**Core 14:** Pharmaceutical Technology-I	3	3	30	70	100	3
17VPASC12	**Core Skill 12:** Food & Beverages Analysis Practical	3	3	20	30	50	3
17VPASC13	**Core Skill 13:** Pharmaceutical Organic Chemistry- II Practical	3	3	20	30	50	3
17VPASC14	**Core Skill 14:** Pharmaceutical Technology-I Practical	6	3	40	60	100	6
17VPASC15	**Core Skill 15:** Skill Training / IDP (Industry/Institute Defined Project)	6	3	40	60	100	6
		30				**700**	**30**

Semester - V							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part - II							
17VPAGC15	**Core 15:** Spectroscopy	3	3	30	70	100	3
17VPAGC16	**Core 16:** Medicinal Chemistry-I	3	3	30	70	100	3
17VPAGC17	**Core 17:** Pharmaceutical Technology -II	3	3	30	70	100	3
17VPAGC18	**Core 18:** Chemistry of Natural Products	3	3	30	70	100	3
17VPASC16	**Core Skill 16:** Spectroscopy	6	3	40	60	100	6
17VPASC17	**Core Skill 17:** Medicinal Chemistry-I Practical	3	3	20	30	50	3
17VPASC18	**Core Skill 18:** Pharmaceutical Technology -II Practical	6	3	40	60	100	6
17VPASC19	**Core Skill 19:** Chemistry of Natural Products Practical	3	3	20	30	50	3
	Total	**30**				**700**	**30**

Semester - VI							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part II							
17VPAGC19	**Core 19 :** Chromatographic Techniques	3	3	30	70	100	3
17VPAGC20	**Core 20:** Medicinal Chemistry-II	3	3	30	70	100	3
17VPAGC21	**Core 21:** QC & QA	3	3	30	70	100	3
17VPAGC22	**Core 22:** Entrepreneurship Development & Soft Skill Training	3	-	Remark			3
17VPASC20	**Core Skill 20:** Chromatographic Techniques Practical	6	3	40	60	100	6
17VPASC21	**Core Skill 21:** Medicinal Chemistry-II Practical	6	3	40	60	100	6
17VPASC22	**Core Skill 22:** In-plant Training / IDP (Industry/Institute Defined Project)	6	3	40	60	100	6
		30				**600**	**30**
Total Marks : **4100**							

Part - III						
Course Code	**Semester**	**Particulars**	**Hrs of instruction/week**	**No. of Courses**	**Credit/Course**	**Total Credits**
Ability Enhancement Compulsory Course (AECC)						
As per common list	I & II	**AECC-I** Environment Science	1	1	2	2
	IV & V	**AECC-II** Communication Skill/Soft Skills	2	2	1	2
					Sub Total	**4**
Skill Enhancement Course (SEC)						
As per common list	I	**SEC-I** Value Education-I	1	1	1	1
	II	Value Education-II	1	1	1	1
	Any Semester between II - V	**SEC-II** *Co-Curricular Course	> 40 hours in total	1	1	1
	Any Semester between II - V	**SEC-III** **Value Added Courses	40 hours in total	1	1	1
					Sub Total	4
					Grand Total	8

***Co-Curricular Courses** - Option to students to choose 1 from a list of courses offered by the college, such as Add on Courses, Gandhian Studies Certificate Course, Women Studies Course, etc.

****Value Added Courses** - Option to student to choose at least 1 from a list of courses offered by UG departments.

- **TOTAL MARKS & CREDIT DISTRIBUTION**

S.N.	PART	Total Marks	Total Credits
1.	PART I: Language Course	200	6
2.	PART II (Core): a) General Education b) Skill Education	3900	174
3.	PART III: AECC-I & II, SEC-I,II&III	Remarks	08
	TOTAL	**4100**	**180 + 8**

PART – I : LANGUAGE COURSE

The following are compulsory courses offered in first and Second semesters.

S. N.	Semester	Course Code	Course
1.	I	17VLCEN01	Functional English
2.	II	16VLCEN02	Business Communicative English

PART – II (General Education, Skill Education) :

- **CORE COURSES [General Education - Theory]**

S. N.	Semester	Course code	Course
1.	I	17VPAGC01	**Core 1 :** Pharmaceutical Inorganic Chemistry
2.		17VPAGC02	**Core 2 :** Unit Operations- I
3.		17VPAGC03	**Core 3:** Fundamental Analytical Chemistry
4.	II	17VPAGC04	**Core 4:** Pharmaceutical Analysis
5.		17VPAGC05	**Core 5:** Pharmaceutical Physical Chemistry
6.		17VPAGC06	**Core 6 :** Industrial Hazards, Safety and GLP
7.	III	17VPAGC07	**Core 7:** Industrial Analysis
8.		17VPAGC08	**Core 8:** Fundamental Biochemistry
9.		17VPAGC09	**Core 9:** Pharmaceutical organic Chemistry- I
10.		17VPAGC10	**Core 10:** Unit Operations- II
11.	IV	17VPAGC11	**Core 11:** Pharmaceutical Engineering
12.		17VPAGC12	**Core 12:** Food & Beverages Analysis
13.		17VPAGC13	**Core 13:** Pharmaceutical organic Chemistry- II
14.		17VPAGC14	**Core 14:** Pharmaceutical Technology-I
15.	V	17VPAGC15	**Core 15:** Spectroscopy
16.		17VPAGC16	**Core 16:** Medicinal Chemistry-I
17.		17VPAGC17	**Core 17:** Pharmaceutical Technology -II
18.		17VPAGC18	**Core 18:** Chemistry of Natural Products
19.	VI	17VPAGC19	**Core 19 :** Chromatographic Techniques
20.		17VPAGC20	**Core 20:** Medicinal Chemistry-II
21.		17VPAGC21	**Core 21:** QC & QA
22.		17VPAGC22	**Core 22:** Entrepreneurship Development & Soft Skill Training

- **DISCIPLINE SPECIFIC ELECTIVE-ALLIED (DSE-Allied) COURSES**

S. N.	Semester	Course Code	Course
1.	II	17VCTSC04	**DSE-Allied Skill 2:** Office Automation Tools

- **CORE COURSES [Skill Education - Practical]**

S. No	Semester	Course code	Course
1.	I	17VPASC01	**Core Skill 1:** Pharmaceutical Inorganic Chemistry Practical
2.		17VPASC02	**Core Skill 2:** Unit Operations- I Practical
3.		17VPASC03	**Core Skill 3:** Fundamental Analytical Chemistry Practical
4.	II	17VPASC05	**Core Skill 5 :** Pharmaceutical Analysis Practical
5.		17VPASC06	**Core Skill 6:** Pharmaceutical Physical Chemistry Practical
6.	III	17VPASC08	**Core Skill 8:** Industrial Analysis Practical
7.		17VPASC09	**Core Skill 9:** Fundamental Biochemistry Practical
8.		17VPASC10	**Core Skill 10:** Pharmaceutical organic Chemistry-I Practical
9.		17VPASC11	**Core Skill 11:** Unit Operations- II Practical
10.	IV	17VPASC12	**Core Skill 12:** Food & Beverages Analysis Practical
11.		17VPASC13	**Core Skill 13:** Pharmaceutical organic Chemistry-II Practical
12.		17VPASC14	**Core Skill 14:** Pharmaceutical Technology-I Practical
13.	V	17VPASC16	**Core Skill 16:** Spectroscopy Practical
14.		17VPASC17	**Core Skill 17:** Medicinal Chemistry-I Practical
15.		17VPASC18	**Core Skill 18:** Pharmaceutical Technology -II Practical
16.		17VPASC19	**Core Skill 19:** Chemistry of Natural Products Practical
17.	VI	17VPASC20	**Core Skill 20:** Chromatographic Techniques Practical
18.		17VPASC21	**Core Skill 21:** Medicinal Chemistry-II Practical

- **OTHER CORE COURSES**

S. No.	Semester	Course Code	Course
1	II	17VPASC07	**Core Skill 7:** Skill Training/ IDP (Industry/Institute Defined Project)
2	IV	17VPASC15	**Core Skill 15:** Skill Training / IDP (Industry/Institute Defined Project)
3	VI	17VPASC22	**Core Skill 22:** In-plant Training / IDP (Industry/Institute Defined Project)

- **PART –III : AECC&SEC**

Part - III						
Course Code	**Semester**	**Particulars**	**Hrs of instruction/week**	**No. of Courses**	**Credit/Course**	**Total Credits**
Ability Enhancement Compulsory Course (AECC)						
As per common list	I & II	**AECC-I** Environment Science	1	1	2	2
	IV & V	**AECC-II** Communication Skill/Soft Skills	2	2	1	2
					Sub Total	**4**
Skill Enhancement Course (SEC)						
As per common list	I	**SEC-I** Value Education-I	1	1	1	1
	II	Value Education-II	1	1	1	1
	Any Semester between II - V	**SEC-II** *Co-Curricular Course	> 40 hours in total	1	1	1
	Any Semester between II - V	**SEC-III** **Value Added Courses	40 hours in total	1	1	1
					Sub Total	4
					Grand Total	8

***Co-Curricular Courses** - Option to students to choose 1 from a list of courses offered by the college, such as Add on Courses, Gandhian Studies Certificate Course, Women Studies Course, etc.

****Value Added Courses** - Option to student to choose at least 1 from a list of courses offered by UG departments.

Enclosure –III-3.2

Shree Manibhai Virani and Smt. Navalben Virani Science College (Autonomous), Rajkot

Affiliated to Saurashtra University, Rajkot

Syllabus – B. Voc. Pharm. Analysis & QA – Semester I-II

For Students Admitted from A.Y. 2017-2018 & Onwards

SEMESTER I

17VLCEN01	**Functional English**	**3 Hrs/Wk**

SEMESTER I

17VPAGC01	Core 1 : Pharmaceutical Inorganic Chemistry	3 Hrs/Wk

Course Outcomes:

On the successful completion of the course, students will be able to:

- Remember and recognize overall working and requirement of analysis in pharmaceutical industries.
- Select pharmacopoeia and find & utilize monographs of simple drug substances for their analysis.
- Understand preparation, uses, and special tests of major inorganic pharmaceuticals listed of Indian Pharmacopoeia.
- Analyse and approve samples for presence of iron, arsenic, lead, heavy metals, chloride, and sulphate through their limit tests.
- Prepare simple inorganic materials of pharmaceutical interest and thereby recognize & identify possible impurities to check for in pharmaceutical substances.
- Prepare solutions of standard concentration and determine concentration of unknown/ industrial samples.

Unit-1: Introduction (8 Hours)

Introduction to Pharmaceutical Chemistry, pharmacopeia, monographs, requirement and process of analysis, departmental (sections) role in pharmaceutical industries.

Unit-2: Impurities in Pharmaceuticals (9 Hours)

Sources of impurities, tests for purity and Identity, limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate.

Unit-3: Gastrointestinal, Topical and Dental Products (10 Hours)

An outline of method of preparation, uses, and special tests of Pharmacopoeial Inorganic pharmaceuticals of following class:

- **Gastrointestinal agents**: Acidifying agents, Antacids, Protective and adsorbents, Cathartics, laxative and purgative
- **Topical agents**: Protective, Astringents and Anti-infectives
- **Dental products**: Dentifrices, Anti-caries agents. Complexing and Chelating agents used in therapy.

Unit-4: Electrolytes and elements (9 Hours)

An outline of method of preparation, uses, and special tests of Pharmacopoeial Inorganic pharmaceuticals of following class:

- **Major cellular electrolytes (Intra and extra)**: Physiological ions, electrolytes used for replacement therapy, acids-base balance and combination therapy
- **Essential and trace elements**: Transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements

Unit-5: Pharmaceutical Aids & Miscellaneous Agents (9 Hours)

An outline of method of preparation, uses, and special tests of Pharmacopoeial Inorganic pharmaceuticals of following class:

- **Gases and Vapours**: Oxygen and Respiratory Stimulants.
- **Pharmaceutical Aids**: Anti-oxidants, preservatives, Filter aids, Adsorbents, Diluents, Waters, Buffers
- **Miscellaneous agents**: Sclerosing agents, Expectorants, Emetics, poisons and Anti-dotes, Sedatives etc.

Books Recommended:

1. Inorganic Medicinal and Pharmaceutical Chemistry : J. H. Block, E. B. Roche, T. O. Soine, C. O. Wilson, Varghese Publishing House, First Indian Reprint, 1986.
2. Bentley and Driver's Textbook of Pharmaceutical Chemistry: Revised by L. M. Atherden, Oxford University Press, 8th Ed. 1969.
3. The Indian Pharmacopoeia, Latest Edition, Controller of Publications, Delhi.
4. Practical Pharmaceutical Chemistry edited by A. H. Beckett, J. B. Stenlake, CBS Publishers, and First Indian edition 1987.
5. Vogel's Qualitative Inorganic Analysis Revised by G. Svehla, Longman Gr. Ltd., 7th Ed.1996.

SEMESTER I

17VPAGC02	Core 2 : Unit Operations- I	3 Hrs/Wk

Course Outcomes:

On the successful completion of the course, students will be able to:

- Understand the concepts, estimation andgeneral applications of sedimentation and humidification; along with working of humidifier/dehumidifier.
- Understand the arrangement, requirement and types heat exchangers & boilers in industries.
- Recognize the need of mass transfer and select mass transfer equipment for particular requirement based on the understanding of their working, construction, applications, and associated hazard parameters.
- Operate simple lab equipments and follow standard procedures to determine physical & chemical properties of water and fuels.

Unit-1: Sedimentation (9 Hours)

Introduction, mechanism of settling, Laboratory batch settling test, the thickener, door thickener, settling zones in continuous thickeners.

Unit-2: Humidification (9 Hours)

Definition-Saturated gas, Relative humidity, Percentage humidity, Humid heat, Humid volume, Dew point, Total enthalpy, Adiabatic saturation temperature, Wet bulb temperature, Measurement of humidity from humidity chart, Constructional details and working of Humidifiers and Dehumidifiers

Unit-3: Heat exchangers & Boilers (10 Hours)

Heat Exchangers: Construction and Working of Shell & tube type heat exchangers, finned tube exchanger, Plate type heat exchangers.

Boilers: Types of boilers and their functioning, Steam generation and uses, Specifications of air and its industrial use, Processing of air

Unit-4: Transport Equipments (8 Hours)

Introduction, Industrial requirements, Fans, Blowers, Compressors, Reciprocating pump, Centrifugal pumps, Gear pumps, selection parameters, benefits, safety & hazard of transport equipments

Unit-5: Utilities in Industry (9 Hours)

Fuel: Types of fuels – advantages and disadvantages. Combustions of fuels, Calorific value, Specifications of fuel oil.

Water: Specifications for Industrial use, various water treatments.

Reference Book:

1. Industrial Chemistry, Regregel, Reinhold Publication.
2. Unit Operations in chemical Engineering, McCabe & Smith, McGraw Hill Book Comp.
3. Unit Operations I & II, D.D. Kale Pune Vidyarthigriha Prakashan-Pune.

4. Chemical Engineer Hand Book, J. H. Perry, McGraw Hill Book Comp.
5. Introduction to Chemical Engineering, Badger Banchero McGraw Hill Comp.
6. Fuels & Combustion by Samir Sarkar
7. Engineering Chemistry by S.S. Dara.

SEMESTER I

17VPASC03	Core Skill 3: Fundamental Analytical Chemistry	3 Hrs/Wk

Course Outcomes:

On the successful completion of the course, students will be able to:

- Understand the importance of analysis, basic terminologies and their significance in pharmaceutical industries.
- Select particular quantitative analysis especially titrimetric analysis technique based on the governing principal of the technique and nature of the sample to be analysed.
- Prepare solutions of required/ standard concentration, select indicator and follow procedures to estimate and analyse concentration of unknown/ industrial samples.
- Understand the detection of presence and amount of Nitrogen and moisture in chemicals by Karl-Fischer titrations and Kjeldahl method.

Unit-1: Basics of pharmaceutical analysis-I (6 Hours)

Weights, balances, importance of analysis, concept and difference between quality control and quality assurance, types of analytical methods (classification, validation parameters), glass-wares' handling techniques.

Unit-2: Acid-base titrations (9 Hours)

Relative strength and its effect on titration, common ion effect, pH, Henderson- Hesselbach equation, buffers, neutralization curve, acid bas indicators, theory of indicators, back titrations, biphasic titrations, pharmacopoeial applications, hydrolysis of salts, ionic products of water and law of mass action.

Unit-3: Redox titrations (9 Hours)

Theory of redox titrations, redox indicators, types of redox titrations, iodometry, cerrimetry, mercury metry, diazotization nitrite titrations, 2,6-dichlorophenol, indophenol titrations, titration curve and calculations of potentials during course of titrations.

Unit-4: Miscellaneous Titrations (9 Hours)

Precipitation (Argentometric) titrations: Mohrs, Fajans and Volhard methods

Nonaqueous titrations: Nonaqueous solvents, titrants and indicators. Differentiating and levelling solvents.

Miscellaneous titrations: Karl-Fischer titrations, Kjeldahl method.

Unit-5: Complexomatric & Gravimetric Analysis (12 Hours)

Complexometric titrations: Theory of the titrations, titrant, indicators and pharmacopoeial applications.

Gravimetric analysis: Stability, solubility products, types of precipitations, precipitation techniques, Pharmacopoeial applications

Reference Book:

1. Pharmacopoeia: USP, B.P., I.P.
2. Practical Pharm. Chemistry, Vol. I – Backett, The athlone Press of University of London.
3. Fundamentals of Analytical Chemistry – Skoog, HarcourtCollege Publishers.
4. Quantitative chemical analysis – Vogel A. I., Pearson Education.
5. Text Book of Pharmaceutical Analsys – K. A. Connor, John Willey&Sons, NY.
6. Quantitative Chemical Analysis – Ayer by Harper & Row, New York.

SEMESTER II

17VPAGC04	Core 4: Pharmaceutical Analysis	3 Hrs/Wk

Course Outcomes:

On the successful completion of the course, students will be able to:

- Understand the fundamental principals underlying in the pharmaceutical and pharmacopoeial analysis.
- Standardize routine laboratory reagents & solution, and calibrate laboratory glass-wares.
- Examine analysis data and perform statistical operation for .
- Understand working principals behind instrumental analysis, especially for the electro-analytical methods of analysis.

Unit-1: Basics of Pharmaceutical Analysis-II (8 Hours)

Primary and secondary standards, standardization of analytical reagents, sampling techniques, sampling error minimization.

Unit-2: Statistical Data Analysis (8 Hours)

Types of errors, Accuracy, precision, Data processing, Confidence limit & interval, Test of significance, t-test & F-test, Rejection of data, Control charts, Least square analysis, related problems

Unit-3: Basics of instrumental analytical methods (9 Hours)

Introduction, types, advantages, limitations, validation, signal to noise ratio, important parameters, and general instrumentation.

Unit-4: Electro-analytical methods (10 Hours)

Basics of electro-analytical methods:

- **Conductometry:** Conductance, factors affecting conductance, Kohlrausch law, conductivity cells, applications
- **Potentio and pH metric methods**: Standard reduction potentials, various electrodes, electrodes and cell potential, applications of potentiometry and pH metry.

Unit-5: Miscellaneous Techniques (10 Hours)

- **Polarography & amperometry:** Basics of current flow in polarography, dropping mercury electrode, diffusion current, half wave potential, modifications like pulsed and differential pulse polarography, amperometric titrations.
- **Polarimetry:** Polarimeter, qualitative and quantitative applications

Reference Books

1. Pharmacopoeia: IP, BP, USP.
2. Practical Pharm. Chemistry, Vol. I – Backett, The athlone Press of University of London.
3. Fundamentals of Analytical Chemistry – Skoog, Harcourt College Publishers.
4. Quantitative chemical analysis – Vogel A. I., Pearson Education.
5. Text Book of Pharmaceutical Analysis – K. A. Connor, John Willey & Sons, New York.

SEMESTER II

17VPAGC05	Core 5: Pharmaceutical Physical Chemistry	3 Hrs/Wk

Course Outcomes:

On the successful completion of the course, students will be able to:

- Understand the fundamental physico-chemical phenomena related with pharmaceutical chemistry.
- Examine multiple physical properties of solutions of pharmaceuticals.
- Understand adsorption and its application in pharmaceuticals.

Unit-1: The liquid state (9 Hours)

Physical properties surface tension, parachor, viscosity, refractive index, optical rotation, dipole moment of chemical constituents.

Unit-2: Solutions (8 Hours)

Ideal and real solutions, solutions of gases in liquids, colligative properties, partition co-efficient, conductance and its measurement, Debye-Huckel theory.

Unit-3: Thermodynamics (10 Hours)

Types and concept of system & surrounding, types of processes, state & path functions, intensive & extensive properties, concept of heat & work, concept of internal energy, enthalpy and entropy, Concept and inferences of first, second and zeroth Law of thermodynamics, Bond Dissociation Energy, Joule-Thomson effect and inversion temperature.

Unit-4: Adsorption (8 Hours)

Basic principles, Freundlich and Gibbs adsorption isotherms, Langmuir theory of adsorption, applications of adsorption.

Unit-5: Chemical kinetics (10 Hours)

Zero, first and second orders reactions, complex reaction, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysts, acid-base enzyme catalysis.

Reference Books

1. Text book of Physical Chemistry: Samuel Glasstone, Macmillan India Limited, 2nd Ed. 1995.
2. Elements of Physical Chemistry; Peter Atkins, Julio de paula, Oxford University Press, 4th Ed. 2007.
3. Essentials of Physical Chemistry: Arun Bahl, B.S. Bahl, G.D. Tuli, S Chand & Co Ltd, 26th Ed. 2009.
4. Schaum's Outline of Theory and Problems of Physical Chemistry: Clyde R. Metz, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 2nd Ed. 2004.
5. Physical Chemistry: Keith J. Laidler, John H. Meiser, CBS Publishers & Distributors, New Delhi. 2nd Ed. 2006.

SEMESTER II

17VPAGC06	Core 6 : Industrial Hazards, Safety and GLP	3 Hrs/Wk

Course Outcomes:

On the successful completion of the course, students will be able to:

- Recognize possible hazards in particular industry or plant associated with chemicals and pharmaceuticals.
- Select and utilize personal protective equipments along with safety procedures for safeguard of himself and organizational property.
- Know and Follow GLP in dry and wet laboratories to ensure quality and availability of experimental data & all related information.
- Locate and understand MSDS for safe and efficient utilization of chemicals.

Unit-1: Introduction – Industrial Hazard & Personal Protection (9 Hours)

Industrial hazards and safety: Introduction, Principles of safety, Importance of Industrial safety, role of safety department, Safety committee and Function.

Personal Protective Equipments: Introduction, Legal Requirements, Selection Guideline, Training of use of PPE, Personal protective devices for head, ear, face, eye, foot, knee and body protection, Respiratory personal protective devices.

Unit-2: Hazards due to harmful chemicals (10 Hours)

Chemical Safety, Dangerous properties of chemicals, major factors to be considered for safety due to chemicals, effect of chemicals on human body, Storage and handling of hazardous substances.

Unit-3: Control of hazards in an industry (8 Hours)

Plant layout for safety considerations, Ventilation, Engineering control of chemical plants hazards, Color codes for a safety, Oxygen booth, Smoking Booth, Water wash shower.

Unit-4: Hazards due to Fire and explosion (8 Hours)

Introduction of fire and explosion hazards, General causes and classification of fire, various types of fire extinguishers, extinguishing methods.

Unit-5: Good Laboratory Practices (GLP) (10 Hours)

History of GLP, What is GLP, Fundamental points of GLP, Quality Assurance, Study Plans, SOPs, Inspection of Instrument, Understanding of receipt, handling, sampling and storage of chemicals, MSDS

Reference Books

1. Industrial Hazards and Plant Safety, By Sanjoy Banerjee, Taylor & Francis Group
2. Industrial Hazard and Safety Handbook: (Revised impression), Ralph W King, John Magid, Butterworth Scientific Publisher.
3. Handbook Good Laboratory Practices, Quality Practices for regulated non-clinical research and development, 2nd Edition.
4. Good Laboratory Practices by Jurg P. Seiler, Springer, ISBN-13:978-3-642-86880-1,
5. Hazardous Chemicals: Safety Management and Global Regulations By T.S.S. Dikshith, CRC Press, Taylor & Francis Group.