

# **SHIVAJI UNIVERSITY KOLHAPUR**



Accredited By NAAC with 'A' Grade

**Faculty of Interdisciplinary Studies  
Structure, Scheme and Syllabus for  
Bachelor of Vocation (B. Voc.)**

**Chemical & Petrochemicals / Chemical Technology**

**Part - I,II,III**

**Syllabus to be implemented from June 2020**

**SHIVAJI UNIVERSITY, KOLHAPUR**

**STRUCTURE AND SYLLABUS OF B.VOC.**

**Bachelor of Vocation (B.Voc.) – Chemical & Petrochemicals / Chemical Technology**

**TITLE** : B.Voc.( Chemical and Petrochemicals / Chemical Technology)  
Syllabus (Semester Pattern)  
Under Faculty of Interdisciplinary Studies

**YEAR OF IMPLEMENTATION** : Syllabus will be implemented from June 2020

**DURATION** : B. Voc. Part I, II and III ( Three Years)  
B. Voc. Part I - Diploma ( One Year )  
B. Voc. Part II - Advanced Diploma (Second Year)  
B. Voc. Part III – Degree (Third Year)

**PATTERN OF EXAMINATION** : Semester Pattern

- **Theory Examination**–At the end of semester as per Shivaji University Rules
- **Practical Examination**– i) In the 1<sup>st</sup>, 3<sup>rd</sup> and 5<sup>th</sup> semester of B.Voc. there will be internal assessment of practical record, related report submission and project reports at the end of semester.  
ii) In the second semester of B. Voc. I, there will be internal practical examination at the end of semester.  
iii) In the 4<sup>th</sup> and 6<sup>th</sup> semester of B. Voc. there will be external practical examination at the end of semester.

**MEDIUM OF INSTRUCTION** : English

**STRUCTURE OF COURSE** : B. Voc. Part – I, II and III  
Two Semester Per Year  
Two General Papers per year / semester  
Three Vocational Papers per Year / Semester  
Three Practical papers per Year / Semester  
One Project / Industry Visit/ Study Tour / Survey

**SCHEME OF EXAMINATION**

**A) THEORY**

- The theory examination shall be at the end of the each semester.
  - All the general theory papers shall carry 40 marks and all vocational theory papers shall carry 50 marks.
  - Evaluation of the performance of the students in theory shall be on the basis of semester examination as mentioned above.
  - Question paper will be set in the view of entire syllabus preferably covering each unit of the syllabus.
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- **Nature of question paper for Theory examination** (Excluding Business Communication Paper)–

There will be seven questions carrying equal marks.

i. Students will have to solve any five questions.

Q. No. 1 : Multiple Choice Question ( Ten Question )

Q. No. 2 : Short answer type question with internal choice (Five out of Seven )

Q. No. 3 : Long answer type questions (Five out of Seven )

Q. No. 4 : Short Notes with internal choice (Two out of Three

## **PRACTICAL**

Evaluation of the performance of the students in practical shall be on the basis of semester examination ( Internal assessment at the end of Semester I, II and III and V and external examination at the end of Semester IV and VI as mentioned separately in each paper.

### **Standard of Passing :**

As per the guidelines and rules for B. Voc. (Attached Separately – Annexure I)

Eligibility Criteria:

1. The Eligibility for admission is 10+02 or equivalent, in any stream (Arts/ Commerce/ Science) from any recognized board or University.
2. The candidates after with 10+02 year ITI course/ in any branch / trade also eligible for course.
3. The candidates graduate from any faculty or engineering degree / diploma holders are also eligible.

## Structure of the Course

### B. Voc. – I (Diploma) Semester – I

Sr. No	Paper No.	Title	Theory /Practical /Project	Marks	Distribution of Marks		Credits	
					Theory	Practical	Theory	Practical
1		<b>General Education Components</b>						
2	<b>I</b>	Business Communication (I)	Theory /Practical	50	40	10	3	
3		<b>Skill Development Components</b>						
4	<b>II</b>	Fundamental Chemistry (I)	Theory	50	50	--	3	
5	<b>III</b>	Fundamental Industrial Chemistry (I)	Theory	50	50	--	3	
6	<b>IV</b>	Elementary Physics & Mathematics	Theory	50	50	--	3	
7	<b>III</b>	<b>Laboratory Work</b>						
8	<b>V</b>	General Practical of Chemistry	Practical	50	--	50		4
9	<b>VI</b>	Laboratory Work : Fundamental Chemistry (I)	Practical	50	--	50		4
10	<b>VII</b>	Laboratory Work: Fundamental Industrial Chemistry (I)	Practical	50	--	50		4
11	<b>VIII</b>	Laboratory Work : Elementary Physics	Practical	50		50		4
12		<b>Field Work</b>						
13	<b>IX</b>	Project / Seminar	-	50	--	50		2
14		<b>Non Credit Courses</b>						
15		Democracy, Elections and Good Governance	Theory	50	50	--	--	--
		Total Marks and Credit for Semester-I		450				30

**General Education Components:** The subject (Department/Discipline) in which a student takes admission.

**Skill Development Components:** The subject closely related to a student's major subject

**Non Credit Courses:** Six courses are of general nature and are compulsory

**Structure of the Course**  
**B. Voc. – I (Diploma) Semester – II**

Sr. No.	Paper No.	Title	Theory /Practical /Project	Marks	Distribution of Marks		Credits	
					Theory	Practical	Theory	Practical
1		<b>General Education Components</b>						
2	<b>X</b>	Business Communication (II)	Theory /Practical	50	50		3	
3		<b>Skill Development Components</b>						
4	<b>XI</b>	Analytical and Electrochemistry	Theory	50	50	--	3	
5	<b>XII</b>	Chemistry of Surfactants	Theory	50	50	--	3	
6	<b>XIII</b>	Surface Coating Techniques	Theory	50	50	--	3	
7		<b>Laboratory Work</b>						
8	<b>XIV</b>	Laboratory Work : Analytical Chemistry	Practical		--	50		4
9	<b>XV</b>	Laboratory Work: Electrochemistry	Practical		--	50		4
10	<b>XVI</b>	Laboratory Work : Chemistry of Surfactants	Practical		--	50		4
11	<b>XVII</b>	Laboratory Work : Surface Coating Techniques	Practical		--	50		4
12	<b>XVIII</b>	<b>Industrial Visit</b>	-		--	50		2
13		<b>Non Credit Courses</b>						
14		E-Banking and Financial Services	Theory	50	50	--	--	--
15		<b>Total Marks and Credit for Semester-II</b>			450			30

**General Education Components:** The subject (Department/Discipline) in which a student takes admission.

**Skill Development Components:** The subject closely related to a student's major subject

**Non Credit Courses:** Six courses are of general nature and are compulsory

**Theory and Practical Workload of the Course**  
**B. Voc. – I (Diploma) Semester – I**

**Scheme of Teaching:**

**B. Voc. – Part I (Diploma) Semester – I**

Sr. No.	Paper No.	Title	Distribution of Workload (Per Week)		
			Theory	Practical	Total
1	<b>I</b>	Business Communication (I)	3	--	3
2	<b>II</b>	Fundamental Chemistry (I)	3	-	3
3	<b>III</b>	Fundamental Industrial Chemistry (I)	3	-	3
4	<b>IV</b>	Elementary Physics and Mathematics	3	--	3
5	<b>V</b>	Laboratory Work : General Practical in Chemistry		5	5
6	<b>VI</b>	Laboratory Work : Fundamental Chemistry (I)	-	5	5
7	<b>VII</b>	Laboratory Work: Fundamental Industrial Chemistry (I)	-	5	5
8	<b>VIII</b>	Laboratory Work : Elementary Physics and Mathematics	-	5	5
9	<b>IX</b>	Project	-	-	-
		<b>Total --</b>	<b>12</b>	<b>20</b>	<b>32</b>

**Scheme of Teaching:**

**B. Voc. – Part I (Diploma) Semester – II**

Sr. No.	Paper No.	Title	Distribution of Workload (Per Week)		
			Theory	Practical	Total
1	<b>X</b>	Business Communication-(II)	3	-	3
2	<b>XI</b>	Analytical & Electrochemistry	3	-	3
3	<b>XII</b>	Chemistry of Surfactants	3	-	3
4	<b>XIII</b>	Surface Coating Techniques	3	-	3
5	<b>XIV</b>	Laboratory Work : Analytical Chemistry	-	5	5
6	<b>XV</b>	Laboratory Work: Electrochemistry	-	5	5
7	<b>XVI</b>	Laboratory Work : Chemistry of Surfactants	-	5	5
8	<b>XVII</b>	Laboratory Work : Surface Coating Techniques		5	
9	<b>XVIII</b>	Study Tour	-	-	-
		<b>Total-</b>	<b>12</b>	<b>20</b>	<b>32</b>

## Structure of the Course

### B. Voc. – II (Advanced Diploma) Semester – III

Sr. No.	Paper No.	Title	Theory /Practical /Project	Marks	Distribution of Marks		Credits	
					Theory	Practical	Theory	Practical
		<b>Theory Workload</b>						
1	<b>XIX</b>	Fundamental Chemistry-II	Theory /Practical	50	50	--	3	
2	<b>XX</b>	Fundamental Industrial Chemistry-II	Theory	50	50	--	3	
3	<b>XXI</b>	Industrial Unit Process & Operations	Theory	50	50	--	3	
4	<b>XXII</b>	Water Analysis	Theory	50	50	--	3	
		<b>Laboratory Work</b>						
5	<b>XXIII</b>	Laboratory Work : Fundamental Chemistry-II	Practical		--	50		4
6	<b>XXIV</b>	Laboratory Work: Fundamental Industrial Chemistry-II	Practical		--	50		4
7	<b>XXV</b>	Laboratory Work : Industrial Unit Process & Operations	Practical		--	50		4
8	<b>XXVI</b>	Laboratory Work : Water Analysis	Practical		--	50		4
	<b>XXVII</b>	Project / Seminar	-		--	50		2
		<b>Total Marks and Credit for Semester-III</b>		<b>450</b>			<b>30</b>	

## Structure of the Course

### B. Voc. – II (Advanced Diploma) Semester – IV

Sr. No.	Paper No.	Title	Theory /Practical /Project	Marks	Distribution of Marks		Credits	
					Theory	Practical	Theory	Practical
		<b>Theory Workload</b>						
1	<b>XXVIII</b>	Petroleum & Petrochemicals	Theory /Practical	50	50		3	
2	<b>XXIX</b>	Chemistry of Polymer & Composite materials	Theory	50	50	--	3	
3	<b>XXX</b>	Polymer Technology	Theory	50	50	--	3	
4	<b>XXXI</b>	Petroleum Analysis	Theory	50	50	--	3	
		<b>Laboratory Work</b>						
5	<b>XXXII</b>	Laboratory Work : Petroleum & Petrochemicals	Practical		--	50		4
6	<b>XXXIII</b>	Laboratory Work: Chemistry of Polymer & Composite materials	Practical		--	50		4
7	<b>XXXIV</b>	Laboratory Work : Polymer Technology	Practical		--	50		4
8	<b>XXXV</b>	Laboratory Work : Petroleum Analysis	Practical		--	50		4
	<b>XXXVI</b>	Industrial Visit	-		--	50		2
		<b>Total Marks and Credit for Semester-IV</b>		<b>450</b>			<b>30</b>	



**Scheme of Teaching: B. Voc. – Part II (Advanced Diploma) Semester – III**

Sr. No.	Paper No.	Title	Distribution of Workload (Per Week)		
			Theory	Practical	Total
1	<b>XIX</b>	Fundamental Chemistry-II	3	--	3
2	<b>XX</b>	Fundamental Industrial Chemistry-II	3	-	3
3	<b>XXI</b>	Industrial Unit Process & Operations	3	-	3
4	<b>XXII</b>	Water Analysis	3	--	3
5	<b>XXIII</b>	Laboratory Work : Fundamental Chemistry-II		5	5
6	<b>XXIV</b>	Laboratory Work: Fundamental Industrial Chemistry-II	-	5	5
7	<b>XXV</b>	Laboratory Work : Industrial Unit Process & Operations	-	5	5
8	<b>XXVI</b>	Laboratory Work : Water Analysis	-	5	5
9	<b>XXVII</b>	Project	-	-	-
		<b>Total --</b>	<b>12</b>	<b>20</b>	<b>32</b>

**Scheme of Teaching: B. Voc. – Part II (Advanced Diploma) Semester – IV**

Sr. No.	Paper No.	Title	Distribution of Workload (Per Week)		
			Theory	Practical	Total
1	<b>XXVIII</b>	Petroleum & Petrochemicals	3	-	3
2	<b>XXIX</b>	Chemistry of Polymer & Composite materials	3	-	3
3	<b>XXX</b>	Polymer Technology	3	-	3
4	<b>XXXI</b>	Petroleum Analysis	3	-	3
5	<b>XXXII</b>	Laboratory Work : Petroleum & Petrochemicals	-	5	5
6	<b>XXXIII</b>	Laboratory Work: Chemistry of Polymer & Composite materials	-	5	5
7	<b>XXXIV</b>	Laboratory Work : Polymer Technology	-	5	5
8	<b>XXXV</b>	Laboratory Work : Petroleum Analysis		5	
9	<b>XXXVI</b>	Study Tour	-	-	-
		<b>Total-</b>	<b>12</b>	<b>20</b>	<b>32</b>

## Structure of the Course

### B. Voc. – III (Degree) Semester – V

Sr. No.	Paper No.	Title	Theory /Practical /Project	Marks	Distribution of Marks		Credits	
					Theory	Practical	Theory	Practical
		<b>Theory Workload</b>						
1	XXXVII	Stereo Chemistry & Organic reaction Mechanism	Theory /Practical	50	50		3	
2	XXXVIII	Biochemistry	Theory	50	50	--	3	
3	XXXIX	MAT- Advanced Analytical Techniques	Theory	50	50	--	3	
4	XXXX	Pharmaceutical (Medicinal) Chemistry	Theory	50	50	--	3	
		<b>Laboratory Work</b>						
5	XXXXI	Laboratory Work : Stereo Chemistry & Organic reaction Mechanism	Practical		--	50		4
6	XXXXII	Laboratory Work: Biochemistry	Practical		--	50		4
7	XXXXIII	Laboratory Work : Modern Analytical Techniques	Practical		--	50		4
8	XXXXIV	Laboratory Work : Pharmaceutical (Medicinal) Chemistry	Practical		--	50		4
	XXXXV	Mini Project	-		--	50		2
<b>Total Marks and Credit for Semester-V</b>					<b>450</b>			<b>30</b>

## Structure of the Course

### B. Voc. – III (Degree) Semester – VI

Sr. No.	Paper No.	Title	Theory /Practical /Project	Marks	Distribution of Marks		Credits	
					Theory	Practical	Theory	Practical
		<b>Theory Workload</b>						
1	XXXXVI	Pharmaceutical Engineering	Theory /Practical	50	40	10	3	
2	XXXXVII	Pharmaceutical Technology	Theory	50	50	--	3	
3	XXXXVIII	Industrial Applications of Organometallic Compounds	Theory	50	50	--	3	
4	XXXXIX	Nanotechnology and its applications	Theory	50	50	--	3	
		<b>Laboratory Work</b>						
5	XXXXX	Laboratory Work : Pharmaceutical Engineering	Practical		--	50		4
6	XXXXXI	Laboratory Work: Pharmaceutical Technology	Practical		--	50		4
7	XXXXXII	Laboratory Work : Applications of Organometallic Compounds	Practical		--	50		4
8	XXXXXIII	Laboratory Work : Nanotechnology and its applications	Practical		--	50		4
	XXXXXIV	Project/ IE	-		--	50		2
		<b>Total Marks and Credit for Semester-VI</b>		<b>450</b>			<b>30</b>	

**Scheme of Teaching:****B. Voc. – Part III (Degree) Semester – V**

Sr. No.	Paper No.	Title	Distribution of Workload (Per Week)		
			Theory	Practical	Total
1	XXXVII	Stereo Chemistry & Organic reaction Mechanism	3	--	3
2	XXXVIII	Biochemistry	3	-	3
3	XXXIX	MAT- Advanced Analytical Techniques	3	-	3
4	XXXX	Pharmaceutical (Medicinal) Chemistry	3	--	3
5	XXXXI	Laboratory Work : Stereo Chemistry & Organic reaction Mechanism		5	5
6	XXXXII	Laboratory Work: Biochemistry	-	5	5
7	XXXXIII	Laboratory Work : Modern Analytical Techniques	-	5	5
8	XXXXIV	Laboratory Work : Pharmaceutical (Medicinal) Chemistry	-	5	5
9	XXXXV	Project	-	-	-
		<b>Total --</b>	<b>12</b>	<b>20</b>	<b>32</b>

**Scheme of Teaching: B. Voc. – Part III (Degree) Semester –VI**

Sr. No.	Paper No.	Title	Distribution of Workload (Per Week)		
			Theory	Practical	Total
1	XXXXVI	Pharmaceutical Engineering	3	-	3
2	XXXXVII	Pharmaceutical Technology	3	-	3
3	XXXXVIII	Industrial Formulation & GLP	3	-	3
4	XXXXIX	Pharmaceutical (Medicinal) Chemistry	3	-	3
5	XXXXX	Laboratory Work : Pharmaceutical Engineering	-	5	5
6	XXXXXI	Laboratory Work: Pharmaceutical Technology	-	5	5
7	XXXXXII	Laboratory Work : Industrial Formulation & GLP	-	5	5
8	XXXXXIII	Laboratory Work : Pharmaceutical (Medicinal) Chemistry		5	
9	XXXXXIV	Study Tour	-	-	-
		<b>Total-</b>	<b>12</b>	<b>20</b>	<b>32</b>

**Eligibility for Admission** : 10 + 2 from any faculty or equivalent Diploma /Advanced Diploma in any related stream.

**Eligibility for Faculty** : 1) M. Sc. / M. Tech Chemistry/ Chemical Technology with NET / SET/Ph.D.  
2) M. A (English) with NET/SET for Functional English & Office Automation Tools

**Eligibility for Laboratory Assistant** : B.Sc.(Chemistry) / Diploma in Chemical Technology

**Staffing Pattern:  
Teaching:**

In 1<sup>st</sup> Year of B. Voc. - 1 Full Time and 1 Part Time Lecturer and 1 CHB Lecturer for Business Communication

In 2<sup>nd</sup> Year of B. Voc.–Total requirement of faculty (Inclusive of 1<sup>st</sup> Year) will be 3 Full time and 1CHB Lecturer for Financial Accounting 1 CHB Lecturer for Business Communication

In 3<sup>rd</sup> Year of B.Voc.–Total requirement of faculty (Inclusive of 1<sup>st</sup> & 2<sup>nd</sup> Year ) will be 4 Full time and 1 part time and 1 CHB Lecturer for Business Communication

**Lab Assistant: For 1<sup>st</sup> Year of B. Voc. - 1 Part time**

For 2<sup>nd</sup> and 3<sup>rd</sup> Year (Inclusive of 1<sup>st</sup> Year) of B. Voc. – 1 Full Time

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**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B. Voc. Part - I, (Diploma), Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – I : Business Communication-I**

**Units Prescribed for Theory:**

**50 Marks.**

**Unit1: Use of English in Business Environment Topics:**

Business Vocabulary: Vocabulary for banking, marketing and for maintaining public relations  
What is a sentence?  
Elements of a sentence  
Types of sentence: Simple, compound, complex

**Unit 2: Writing a Letter of Application and CV/Resume**

**Topics:**

Structure of a letter of application for various posts  
CV/ Resume and its essentials

**Unit 3: Presenting Information/Data**

**Topics:**

Presenting information / data using graphics like tables, pie charts, tree diagrams, bar diagrams, graphs, flow charts

**Unit 4: Interview Technique**

**Topics:**

Dos and don'ts of an interview  
preparing for an interview  
Presenting documents  
Language used in an interview

**Reference Books:**

1. Sethi, Anjane & Bhavana Adhikari. Business Communication. New Delhi: Tata Mc Graw Hill Tickoo, Champa & Jaya Sasikumar. Writing with a Purpose. New York: OUP, 1979.
2. Sonie, Subhash C. Mastering the Art of Effective Business Communication. New Delhi: Student Aid Publication, 2008.
3. Herekar, Praksh. Business Communication. Pune: Mehta Publications, 2007.
4. Herekar, Praksh. Principals of Business Communication. Pune: Mehta Publications, 2003.
5. Rai, Urmila & S.M. Rai. Business Communication. Himalaya Publishing House, 2007.

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**B. Voc. Part - I, (Diploma), Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – II : Fundamental Chemistry (I)**

**Objectives:**

**50 Marks**

To study fundamentals of various branches of Chemistry.

**Unit I:** IUPAC Nomenclature of organic compounds, Chemistry of alkanes, alkenes and alkynes, Haloalkanes, Alcohols, Aldehydes and ketones, Carbon acids, Carboxylic acids and derivatives

**Unit II:** Chemical kinetics, Thermodynamics of surfaces, Liquid- liquid and solid liquid interfaces, Surfactants, Disperse systems

**Unit III:** Ionic, Covalent and Polar Bonds, Functional groups, Inductive effect, resonance and hyper conjugation. Bronsted-Lowry acid and bases, strengths of acid and bases, buffer solution, PH, Indicators, Lewis acid and bases, acidic and basic oxides.

**Unit IV:** Theory of Qualitative organic analysis: Preliminary test, element determination test, functional group test, derivation Mole concept, composition relationship and Stoichiometry.

**Reference Books:**

1. Organic Chemistry, L.G. Wade Jr, Pearson Education
2. Organic Chemistry, T.W.G. Solomons, C.B. Fryhle, John Wiley and Sons Inc
3. Organic Chemistry, J. McMurry, Brooks/Cole
4. Organic Chemistry, Paula Y. Bruice, Pearson Education
5. Introduction to colloid and surface chemistry – D.J.shaw, Butterworth publications
6. Surfaces interfaces and colloids- Drew Myers- Wiley VCH
7. Surfactants and interfacial phenomena- Milton J Rosen – Wiley Interscience
8. Industrial utilization of surfactants principles and applications – M.J. Rosen and M Dahanayake,
9. AOCS Press
10. Foundations of Colloid science – Robert J Hunter – Oxford university Press
11. Chemical Process Principles, Hougen O.A., Watson K. M.
12. Basic Principles and Calculations in Chemical Engineering, Himmelblau,
13. Stoichiometry, Bhatt B.I. and Vora S.M

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**B. Voc. Part - I, (Diploma), Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – III : Fundamental Industrial Chemistry (I)**

**Objectives:**

**50 Marks**

To study fundamentals of Industrial Chemistry.

**Unit I:** Overview of Indian chemical industry, raw material and energy sources, role of catalysis, inorganic products, organic intermediates and final products,

**Unit II:** Petroleum refining and cracking operation , Organic chemicals based on methanol and ethanol, Petrochemicals, Polymers, analysis, and selection of coal

**Unit III:** Carbonization , Hydrogenation, Complete gasification of coal, Fuel oil specifications, Combustion of solid, liquid, and gaseous fuels.

**Unit IV:** Classification of solvent, Characteristics properties of solvents, Liquid ammonia, Chemical reaction in liquid ammonia. Hybridization, Salient features of phenomenon of hybridization.

**Reference Books:**

1. Encyclopedia of Chemical Technology, Kirk-Othmer
2. Ulmann's Encyclopedia of Industrial Chemistry
3. Industrial Organic Chemistry, Weissmerl&Arpe
4. Chemical Process Industries, Shreve B. Austin
5. Chemical Process Technology, Moulijn, M. and van Dippen
6. Dryden's Outlines of Chemical Technology
7. Elements of Fuels, Furnaces and Refractories, O.P. Gupta
8. Fuels handbook, Johnson



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**B. Voc. Part - I, (Diploma), Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper –IV : Elementary Physics and Mathematics**

**Objectives:**

**50 Marks**

To study Elementary Physics.

**Unit I:** Introduction to different elastic constant, Practical applications of elasticity, Fluid Mechanics, Optics and Fiber Optics. Lasers, Ultrasound

**Unit II:** Ohm's Law and Concept of Resistance, Series and Parallel Connections of Resistance, e.m.f., Introduction to PN Junction Diode, LED and Photo Diode.

**Unit III:** Taylor's theorem for multivariable functions and its application to error calculations, Maxima/Minima, Integral Calculus: Beta and Gamma functions.

**Unit IV:** Differentiation under the integral sign, surface integrals, volume integrals.

**Reference Books:**

1. Physics: Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern.
2. Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa.
3. Concepts of Modern Physics – A. Beiser, Mc Graw-Hill.
4. Introduction to Modern Optics – G. R. Fowles, Dover Publications.
5. A Course of Experiments with LASERS – R. S. Sirohi, Wiley Eastern.
6. Optical Fibre Communication – G. Keiser, McGraw-Hill.
7. Optoelectronics – J. Wilson and J. F. B. Hawkes, 2nd ed, Prentice-Hall India.
8. Ultrasonics: Methods and Applications – J. Blitz, Butterworth.
9. Applied Sonochemistry – T. J. Mason and J. P. Lorimer, Wiley VCH.
10. Optics – by Ajay Ghatak
11. Lasers- by Svelto
12. University physics – I & II
13. Advanced Engineering Mathematics, Erwin Kreyszig, John-Wiely.
14. Introductory Methods Of Numerical Analysis, S. S. Sastry, PHI.
15. A First Course in Probability, Sheldon Ross, Pearson Prentice Hall
16. Probability and Statistics in Engineering, W.W. Hines, D. C. Montgomery, D.M. Goldsman.

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**B. Voc. Part - I, (Diploma) Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – V : Laboratory Work : General Practical in Chemistry**

**Objectives:  
Marks**

**Total Marks: 50**

To study the basic instrumentation in chemistry.

**Practical :**

1. Conductometry
2. Potentiometry
3. pH-Metry
4. Spectrophotometry
5. Find out the amount / percentage of **Iron** per gram of soap sample colorimetrically
6. Find out the percentage of '**Magnesium**' in a given sample of Talcum powder complexometrically.
7. Determine the concentration in mg/lit of sulphate ion in the given sample of water nephelometrically.

**Reference Books:**

1. F A Henglein: Chemical Technology (Pergamon)
2. R.W. Thomas and P. Farago: Industrial Chemistry (HEB)
3. R.N. Shreve: Chemical processes Industrial, McGraw Hill Book Company Inc, New York 1956.
4. K. Bhogavathi Somdavi: Applied Chemistry, MJP Publications, 2006
5. Riegels: Industrial Chemistry (Reinhold)
6. B. K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut, 2011

**Scheme of practical evaluation**

Internal practical evaluation	50 Marks
1. Practical	25 Marks
2. submission Practical record book & project report	15 Marks
3. viva-voce	10 Marks

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**B. Voc. Part - I, (Diploma) Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – VI : Laboratory Work : Fundamental Chemistry (I)**

**Objectives:**

**Total Marks: 50 Marks**

To identify the organic compound  
To estimate organic compound.

**Practicals:**

1. Identification of an organic compound through elemental analysis, group detection, physical constants (m.p and b.p.) .
2. Estimation of selected organic compounds like: aniline/phenol, formaldehyde/acetone, glucose, glycerol. Neutral equivalents of acids and bases, SAP value of an oil.
3. Volumetric Analysis : Preparation and Standardization of Volumetric solutions. Acid base reactions, titrations of a mixture of (a) hydrochloric and acetic acid (b) Sulfuric and phosphoric acid (c) carbonate and bicarbonate.
4. To determine normality of each acid in given mixture of strong acid (A) and weak acid (B)
5. To determine relative strength of chloroacetic acid ( $\text{CH}_2\text{ClCOOH}$ ) and acetic acid ( $\text{CH}_3\text{COOH}$ ) conductometry.

**Reference Books:**

1. Organic Chemistry, L.G. Wade Jr, Pearson Education
2. Organic Chemistry, T.W.G. Solomons, C.B. Fryhle, John Wiley and Sons Inc
3. Organic Chemistry, J. McMurry, Brooks/Cole
4. Organic Chemistry, Paula Y. Bruice, Pearson Education
5. Introduction to colloid and surface chemistry – D.J.shaw, Butterworth publications
6. Surfaces interfaces and colloids- Drew Myers- Wiley VCH
7. Surfactants and interfacial phenomena- Milton J Rosen – Wiley Interscience
8. Industrial utilization of surfactants principles and applications – M.J. Rosen and M Dahanayake,

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**B. Voc. Part - I, (Diploma) Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – VII: Laboratory Work : Fundamental Industrial Chemistry (I)**

**Objectives:**

**Total Marks: 50 Marks**

**To learn Industrial chemistry.**

**Practicals:**

1. Oxidation - reduction titrations involving permanganate, dichromate, ceric sulfate, iodine (tri-iodide) potassium bromate. Precipitation titration :Mohr's and Volhard's titrations. Complexometric titrations involving EDTA :
2. Determination of hardness of water. Determination of Manganese in pyrolusite. Gravimetric analysis :
3. Gravimetric determination of Fe, Ni, SO<sub>4</sub> and Cl. Analysis of a Fe-Ni alloy. Suitable number of experiments from the above list will be performed. Ore analysis.
4. Prepare Copper Ferrite (CuFe<sub>2</sub>O<sub>4</sub>) & Find out percentage practical yield of the Copper Ferrite (CuFe<sub>2</sub>O<sub>4</sub>)
5. Prepare zinc ferrite & Find out percentage practical yield of the zinc ferrite.

**Reference Books:**

1. Encyclopedia of Chemical Technology, Kirk-Othmer
2. Ulmann's Encyclopedia of Industrial Chemistry
3. Industrial Organic Chemistry, Weissmerl&Arpe
4. Chemical Process Industries, Shreve B. Austin
5. Chemical Process Technology, Moulijn, M. and van Dippen
6. Dryden's Outlines of Chemical Technology
7. Elements of Fuels, Furnaces and Refractories, O.P. Gupta
8. Fuels handbook, Johnson

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**Chemical and Petrochemicals / Chemical Technology**

**Paper – VIII : Laboratory Work : Elementary Physics**

**Practicals:**

**Total Marks: 50 Marks**

1. Viscosity
2. Thermal conductivity (Mention the actual solid-liquid pairs)
3. Laser for determination of molecular activities.
4. Design of regulated power supply
5. Basic Logic Gates
6. Solar Cell

**Reference Books:**

1. Physics: Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern.
2. Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa.
3. Concepts of Modern Physics – A. Beiser, Mc Graw-Hill.
4. Introduction to Modern Optics – G. R. Fowles , Dover Publications.
5. A Course of Experiments with LASERS – R. S. Sirohi, Wiley Eastern.
6. Optical Fibre Communication – G. Keiser, McGraw-Hill.
7. Optoelectronics – J. Wilson and J. F. B. Hawkes, 2nd ed, Prentice-Hall India.
8. Ultrasonics: Methods and Applications – J. Blitz, Butterworth.
9. Applied Sonochemistry – T. J. Mason and J. P. Lorimer, Wiley VCH.
10. Optics – by Ajay Ghatak
11. Lasersb- by Svelto
12. University physics – I & II
13. Advanced Engineering Mathematics, Erwin Kreyszig, John-Wiely.
14. Introductory Methods Of Numerical Analysis, S. S. Sastry, PHI.
15. A First Course in Probability, Sheldon Ross, Pearson Prentice Hall
16. Probability and Statistics in Engineering , W.W. Hines, D. C. Montgomery, D.M. Goldsman, John-

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**B. Voc. Part - I, (Diploma), Semester - I**  
**Chemical and Petrochemicals / Chemical Technology**  
**Paper-IX**

**Project**

**Total Marks: 50 Marks**

**Objectives: To inculcate research mind in students**

**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – X : Business Communication-II**

**Total Marks:**

**50 Marks**

**Objectives:**

To understand Marketing, Negotiation & Group Discussion.

**Unit I : Group Discussion:**

Preparing for a Group Discussion, Initiating a Discussion, Eliciting Opinions, Views etc. Expressing Agreement/ Disagreement  
Making Suggestions; Accepting and Declining Suggestions Summing up.

**Unit II : Business Correspondence:**

Writing Memos, e- mails, complaints, inquiries, etc. Inviting Quotations  
Placing Orders, Tenders, etc.

**Unit III : English for Negotiation Topics:**

Business Negotiations Agenda for Negotiation Stages of Negotiation

**Unit IV : English for Marketing Topics:**

Describing/ Explaining a Product/Service Promotion of a Product Dealing/  
bargaining with Customers. Marketing a Product / Service: Using  
Pamphlets, Hoardings, Advertisement, Public Function/Festival.

**Reference Books:**

1. Herekar, Praksh. *Business Communication*. Pune: Mehta Publications, 2007.
2. Herekar, Praksh. *Principals of Business Communication*. Pune: Mehta Publications, 2003. John,
3. David. *Group Discussions*. New Delhi: Arihant Publications.
4. Kumar, Varinder. *Business Communication*. New Delhi: Kalyani Publishers, 2000.
5. Pardeshi, P. C. *Managerial Communication*. Pune: Nirali Prakashan, 2008.
6. Pradhan, N. S. *Business Communication*. Mumbai: Himalaya Publishing House, 2005 Rai,
7. Urmila & S. M. Rai. *Business Communication*. Mumbai: Himalaya Publishing House, 2007.
8. Sethi, Anjane & Bhavana Adhikari. *Business Communication*. New Delhi: Tata Mc Graw Hill.
9. Sonie, Subhash C. *Mastering the Art of Effective Business Communication*. New Delhi: Student Aid Publication, 2008.
10. Tickoo, Champa & Jaya Sasikumar. *Writing with a Purpose*. New York: OUP, 1979.

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**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical & Petrochemicals / Chemical Technology**

**Paper – XI : Analytical and Electrochemistry**

**Total Marks:**

**50 Marks**

**Objectives:**

To inculcate Analytical approach in students.

**Unit I:** Introduction , Volumetric &, Gravimetric analysis: Introduction, types, theory, indicators and applications, Aspects of analysis, Applied analysis, Chemistry and electricity, Electrochemical cells, Prediction and significance of cell potentials Nernst equation, Batteries and fuel cells  
Electrochemical Corrosion, Electrolytic cells

**Unit II:** Instrumental methods, Balancing chemical equations, Avogadro's number and the mole concept, Stoichiometric Calculations, yields of chemical reactions, Preparation and standardization of Solutions, Equivalent weight of acid and base.

**Unit III:** Thermal methods , Chromatographic and other separation methods. Conductometry: Introduction, Arrhenius ionic theory, conductivity of electrolytes, Conductance, factors affecting conductance, Kohlrausch law, conductivity cells, applications & advantages of conductometric titration

**Unit IV:** , Equivalent weight of acid salt, anion, Concept of Normality, Molarity, Molality. Molecular spectral methods, Atomic spectral methods, . Potentiometric and pH metric methods: introduction, acid – base neutralization titration, redox titration, precipitation titration.

**Reference Books:**

1. *D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry*
2. *J.G. Dick, Analytical Chemistry, R.E. Krieger Pub*
3. *Environmental Chemistry, A. K. De, Wiley*
4. *Chromatography*
5. *Thermal Methods Electrochemical Engineering by Allen J. Bard, Digby Macdonald, Patrik Schmuki, Martin Stratman*
6. *Electrochemical Methods: Fundamentals and Applications by Allen J. Bard, Larry R. Faulkner.*
7. *Modern Electro chemistry series by Bockris and Reddy.*
8. *Electrochemistry by Samuel Glasstone.*



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**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical & Petrochemicals / Chemical Technology**

**Paper – XII: Chemistry of Surfactants**

**Objectives:**

**Total Marks: 50 Marks**

To study surfactant.

**Unit I:** Surface chemistry and catalysis

**Unit II:** Adsorption-frendlich adsorption isotherm, langmuir adsorption isotherm. Industrial applications of adsorption

**Unit III:** Catalysis, enzyme catalysis, michaelis-menton equation. industrial applications of catalysts. Polymer chemistry.

**Unit IV:** Surface active substances or surfactants are amphiphilic compounds having a lyophilic, in particular hydrophilic, part (polar group) and a lyophobic, in particular hydrophobic, part (often hydrocarbon chain).

**Reference Books:**

1. Surfactants and polymers in aqueous solution by Krister Holmberg, Bo Jonsson, Bengt Kronberg
2. Surface Chemistry of Surfactants and Polymers By Bengt Kronberg , Krister Holmberg , Björn Lindman.
3. Surface Chemistry Essentials By K. S. Birdi
4. Surfactants and Interfacial Phenomena by M. J. Rosen, Wiley, New York, NY, 2nd edn.
5. Surfactants in Solution, ed. K. L. Mittal and B. Lindman, Plenum, New York, 1984, vol. 1–3.
6. Surfactants in Solution, ed. K. L. Mittal and P. Bothorel, Plenum, New York, 1987, vol. 4–6

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**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical & Petrochemicals / Chemical Technology**

**Paper –XIII: Surface Coating Techniques**

**Objectives:**

To understand Surface Coating Techniques.

**Total marks 50**

**Unit I:** Surface engineering

**Unit II:** Chemical Conversion Coating, Metallic coating, Coating from Vapour Phase

**Unit III:** Different methods for surface modification, Thermal spray coatings, Diffusion Coating.

**Unit IV:** Case studies based on coatings and surface modification of important engineering components.

**Reference Books:**

1. ASM Handbook: Surface Engineering, by Faith Reidenback, ASM-International, Metals Park, OH
2. Surface Engineering: Fundamentals of Coatings by P. K. Datta and J. S. Gray, Royal Society of Chemistry
3. Chemical Vapor Deposition (Surface Engineering Series, V. 2) by J.-H. Park and T. S. Sudarshan, ASM-International, Metals Park OH.
4. Advanced Surface Coatings: A Handbook of Surface Engineering, by D. S. Rickerby, A. Mathews, Blackie Academic and Professional Publ. .
5. Handbook of Hard Coatings, by R. F. Bunshah, William Andrew Publishing/Noyes.

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**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical & Petrochemicals / Chemical Technology**

**Paper – XIV: Laboratory Work : Analytical Chemistry**

**Objectives:**

**Total Marks: 50 Marks**

To develop Analytical practical knowledge of students

**Practicals:**

1. Determination of Redwood / Saybolt numbers, kinematic viscosity and viscosity index of Lubricating oils
2. Determination of flash point, fire point, cloud and pour point of oils
3. Determination of acid value and iodine value of oils
4. Determination of COD of water samples
5. Cement Analysis

**Reference Books:**

1. Herekar, Praksh. *Business Communication*. Pune: Mehta Publications, 2007.
2. Herekar, Praksh. *Principals of Business Communication*. Pune: Mehta Publications, 2003. John,
3. David. *Group Discussions*. New Delhi: Arihant Publications.
4. Kumar, Varinder. *Business Communication*. New Delhi: Kalyani Publishers, 2000.
5. Pardeshi, P. C. *Managerial Communication*. Pune: Nirali Prakashan, 2008.
6. Pradhan, N. S. *Business Communication*. Mumbai: Himalaya Publishing House, 2005 Rai,
7. Urmila & S. M. Rai. *Business Communication*. Mumbai: Himalaya Publishing House, 2007.
8. Sethi, Anjane & Bhavana Adhikari. *Business Communication*. New Delhi: Tata Mc Graw Hill.
9. Sonie, Subhash C. *Mastering the Art of Effective Business Communication*. New Delhi: Student Aid Publication, 2008.
10. Tickoo, Champa & Jaya Sasikumar. *Writing with a Purpose*. New York: OUP, 1979.

**Scheme of practical evaluation**

Internal practical evaluation	50 Marks
1. Practical	25 Marks
2. submission Practical record book & Study Tour	15 Marks
3. viva-voce	10 Marks

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**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical & Petrochemicals / Chemical Technology**

**Paper – XV : Laboratory Work : Electrochemistry**

**Objectives:**

**Total Marks: 50 Marks**

To understand basic Electrochemistry practically.

**Practicals:**

1. The Electrochemical Series
2. Standard Electrode Potentials and the Mean Activity Coefficient
3. pH Measurements and Potentiometrically Indicated Titrations
4. Redox Titrations (Cerimetry)
5. Differential Potentiometric Titration
6. Potentiometric Measurement of the Kinetics of the Oxidation of Oxalic Acid
7. A Simple Relative Hydrogen Electrode

**Reference Books:**

1. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry
2. J.G. Dick, Analytical Chemistry, R.E. Krieger Pub
3. Environmental Chemistry, A. K. De, Wiley
4. Chromatography
- 5 Thermal Methods Electrochemical Engineering by Allen J. Bard, Digby Macdonald, Patrik Schmuki, Martin Stratman
6. Electrochemical Methods: Fundamentals and Applications by Allen J. Bard, Larry R. Faulkner.
7. Modern Electro chemistry series by Bockris and Reddy.
8. Electrochemistry by Samuel Glasstone.

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**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – XVI : Laboratory Work : Chemistry of Surfactants**

**Objectives:**

To develop surfactant knowledge of students

**Total marks: 50**

**Practicals:**

1. Density measurements
2. conductance measurements
3. partial volume measurements
4. Viscosity measurements
5. Specific heat measurements

**Reference Books:**

1. Surfactants and polymers in aqueous solution by Krister Holmberg, Bo Jonsson, Bengt Kronberg
2. Surface Chemistry of Surfactants and Polymers By Bengt Kronberg , Krister Holmberg , Björn Lindman.
3. Surface Chemistry Essentials By K. S. Birdi
4. Surfactants and Interfacial Phenomena by M. J. Rosen, Wiley, New York, NY, 2nd edn.
5. Surfactants in Solution, ed. K. L. Mittal and B. Lindman, Plenum, New York, 1984, vol. 1–3.
6. Surfactants in Solution, ed. K. L. Mittal and P. Bothorel, Plenum, New York, 1987, vol. 4–6

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**B. Voc. Part - I, (Diploma), Semester - II**  
**Chemical & Petrochemicals / Chemical Technology**

**Paper – XVII : Laboratory Work : Surface Coating Technique**

**Objectives:**

**Total Marks: 50 Marks**

To develop Analytical practical knowledge of students

**Practicals:**

1. To study Metallic coating, Coating from, Vapour Phase
2. To study Different methods for surface modification, Thermal spray coatings, Diffusion Coating.
3. To study Case studies based on coatings and surface modification of important engineering components.

**Reference Books:**

1. ASM Handbook: Surface Engineering, by Faith Reidenback, ASM-International, Metals Park, OH
2. Surface Engineering: Fundamentals of Coatings by P. K. Datta and J. S. Gray, Royal Society of Chemistry
3. Chemical Vapor Deposition (Surface Engineering Series, V. 2) by J.-H. Park and T. S. Sudarshan, ASM-International, Metals Park OH.
4. Advanced Surface Coatings: A Handbook of Surface Engineering, by D. S. Rickerby, A. Mathews, Blackie Academic and Professional Publ. .
5. Handbook of Hard Coatings, by R. F. Bunshah, William Andrew Publishing/Noyes.

**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B. Voc. Part - II, Semester - III**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper – XIX    Fundamental Chemistry-II**

**Units Prescribed for Theory**

**Unit I**-Basic principles of catalysis: adsorption isotherms, surface area pore size and acid strength measurement. Enthalpy and entropy of adsorption: interpretation of chemisorptions based on the structure and the nature of the solid – solid state theories – role of defects in catalysis. Kinetic of surface reactions: rate determining step, various type of reaction, simple, parallel and consecutive reactions.

**Unit II**-Importance of Organometallic compounds as catalysts, Conditions to be satisfied by a metal to act as catalysts, Hydrogenation of Olefins, Importance of Wilkinson's catalyst, Preparation of the Catalyst,  $[\text{RhCl}(\text{PPh}_3)_3]$ , Role of Rhodium Metal in the Catalytic Process, Mechanism of Hydrogenation of Olefins using Wilkinson's Catalyst.

**Unit III**-Modification over the original catalyst, Hydroformylation of olefins-The Oxo process, Mechanism of Hydroformylation of Olefins using the original catalyst,  $\text{HCo}(\text{CO})_4$ , Modification the original catalyst, Mechanism of the Modified catalysis, Isomerisation of Olefins, Mechanism of Olefin Isomerisation, Oxidation of Olefins- Wacker's Process, Step involved Wacker's Process.

**Practical: - Based on theory units**

**Paper - XX    Fundamental Industrial Chemistry-II**

**Units Prescribed for Theory**

**Unit I**-Methods of reduction to give amino compounds, Aminating Agents, Manufacture of amino compounds by reduction as well as by Ammonolysis. Catalytic hydrogenation and hydrogenolysis, Different types of catalysts, Hydrogenation equipment, Industrial hydrogenation processes

**Unit II**-Definition and Scope, Kinetics and mechanism, Manufacture of soap, fatty acids, furfural Dextrose, Ethanol, ethylene glycol, glycerol and phenol. Alkylation and acylation at carbon, oxygen and nitrogen, Friedel-Crafts reaction, Applications of active methylene compounds like diethyl malonate, ethyl acetoacetate etc. Industrial processes

**Unit III**-Methods of polymerization, Kinetics, Relationship between structure and properties. Industrially important polymerization and polymers: Phenolic, urea, melamine and alkyl

resins, Linear condensation polymers, Polycaprolactum, Nylon6,6 Polyesters, epoxy resins, silicone and isocyanate polymers, polyethylene and polypropylene, Vinyl polymers, polystyrene, acrylate and methacrylate polymers

**Practical: - Based on theory units**

### **Paper -XXI Industrial Unit Process & Operations**

#### **Units Prescribed for Theory**

**Unit I**-Survey of Indian chemical industries, Indian mineral resources, ferrous metallurgy, heavy Chemical industries, nonferrous metals

**Unit II**-Fine chemicals and pharmaceuticals, natural products and agro-based chemicals, contribution of fertilizers and pesticide industries, Growth in export, Fermentation and sugar based industries. Growth of petrochemicals

**Unit III**-Role, Government standards like ISI, MINAS, Agmark, I. P., D. P., U.S. P., concepts of quality and quality control, the nature of variabilities, preparation of control charts, charts for moving averages, defects and defectives. Specification and tolerances, sampling inspection, cost reduction and quality improvement experiments.

**Practical: - Based on theory units**

### **Paper- XXII Water Analysis**

#### **Units Prescribed for Theory**

**Unit I**-Water pollution: Water quality criteria for domestic and industrial uses. Analysis of water and wastewater. Principles of water and wastewater treatments.

**Unit II**-Organic trace chemicals in waste water, volatile carcinogenic matter in waste water, recovery and recycling techniques, biological methods of waste water treatment.

**Unit III**-Removal of organics and harmful inorganic from water and wastewater. Biological treatment of wastewater: Theory and practice. Sludge treatment and disposal

**Practical: - Based on theory units**



**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B. Voc. Part - II, Semester - IV**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper-XXVIII Petroleum & Petrochemicals**

**Units Prescribed for Theory**

**Unit I**-Petrochemical industry – reforming and refining – value added chemicals environment protection auto exhaust catalyst Novel catalytic material clusters, zeolites, mesoporous materials. Hydrocarbons in petroleum, Asphaltenes and Resins, classification of petroleum, evaluation of crude oil, Bench mark crudes.

**Unit II**-Global/Indian petroleum and petrochemical industry. Petroleum refining, outline of chemicals derived from ethylene, xylene and naphthalene

**Unit III**-Traffic management, Fire and safety rules. Indian and Global supply scenario of petroleum and petroleum products. Transportation of petroleum & Petroleum products. Indian and Global supply scenario of petroleum and petroleum products

**Practical: - Based on theory units**

**Paper- XXIX Chemistry of Polymer & Composite materials**

**Units Prescribed for Theory**

**Unit I**-Basic Concepts, classification, importance of polymers, monomers, initiators, inhibitors, retarders, techniques of polymerisation: mass, solution, suspension, emulsion and gas phase; control of molecular weight and their determination, step polymerisation, radical/chain polymerisation, living and non-living chain polymerisation, co-ordination polymerisation, co-polymerisation, ionic polymerisation, ring opening polymerisation

**Unit II**-General Properties of Fibres, Production technique, Melt Spinning, dry Spinning, Solution spinning. Production and uses of – Polyester Ribbon, Nylon 6.6, Nylon 6, Acrylic Fibres, Synthetic paper. Production and uses of – Synthetic Isoprene, Butadiene Rubber, styrene Butadiene Rubber, Butyl Rubber.

**Unit III**-Compounding of plastics and rubber, type, nature and role of additives, pre-compounding operations, mixing of polymers and additives, compression molding, transfer, injection and blow molding, extrusion, calendaring, thermoforming, rotomolding, casting, sintering and compaction, deep coating, mold design, analysis of defects in molded products

**Practical: - Based on theory units**

## **Paper- XXX Polymer Technology**

### **Units Prescribed for Theory**

**Unit I-**Mechanism of polymerization, study of polysters, polyamides, PVC, Polystyrene, Polyvinyl acetate, and polyvinyl chloride, polyethylene, viscose rayon, synthesis of polyethylene, synthetic rubbers, styrene – butadiene, butylisopropene, phenol formation, formldehyderesion, plasticizers and oxidants for polymers, natural polymers, starch and cellulose

**Unit II-**Moleculrshape,structure and configuration,crystallinity,stress-strain behaviour,thermalbehaviour,polymer types and their applications,conducting and ferroelectric polymers

**Unit III-** Processing Technology introduction to polymer processing Types Injection unit & Elements of plasticizing process Non ConventionalInjectionBlowmoulding Thermoforming Extrusion Compression moulding Rotational moulding Calendaring Special guidelines for machining of polymers LASER machining

**Practical: - Based on theory units**

## **Paper- XXXI Petroleum Analysis**

### **Units Prescribed for Theory**

**Unit I-**Petroleum refining: Crude oil distillation process – thermal conversion processes. Conventional thermal cracking – vis-breaking and design variables of vis-breaking – coking: Fluid coking, flexi coking, delayed coking and hardware considerations – catalytic conversion processes -fluid catalytic cracking with special reference to catalyst and reactor design configurations – hydro-treating, hydrodesulphurization and hydro-cracking

**Unit II-**hydrocarbon intermediates and their production, non-hydrocarbon intermediates, olefin production, processing of olefins C4& C5 cut from steam cracking and fluid cracking.– Reforming: process, catalyst, reactor design configuration – alkylolation – isomerization – lube oil manufacturing process, solvent – de-asphalting, solvent de-waxing and hydro finishing – production of PET, waxes and bitumen.

**Unit III-**Aromatics production, second generation petrochemicals from: methane and synthesis gas derivatives, ethylene and ethylene derivatives, propylene and propylene derivatives, C4 and C5 derivatives, aromatics – benzene, toluene and xylene derivatives – third generation petrochemicals – polymers, elastomers, polyurethanes and synthetic fiber

**Practical: - Based on theory units**

**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B. Voc. Part - III, Semester - V**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper-XXXVII Stereo Chemistry & Organic reaction Mechanism**

**Units Prescribed for Theory**

**Unit I**-Concept of Chirality and molecular dissymmetry, Recognition of symmetry elements and chiral centers, Prochiral relationship, homotopic, enantiotopic and diastereotopic groups and faces. Racemic modifications and their resolution, R and S nomenclature. Geometrical isomerism E and Z. Nomenclature. Conformational analysis: cyclohexane derivatives, stability and reactivity, Conformational analysis of disubstituted cyclohexanes.

**Unit II**-Types of reactions, strength of acids and bases. Generation, structure, stability and reactivity of carbocations and carbanions, free radicals, carbenes, arynes, nitrenes and ylids. Effect of structure on reactivity, resonance and field, steric, effects.

**Unit III**-Name reactions, Aldol, Knoevenagel, Claisen, Perkin, Reimer-Tiemann reaction, Mannich, Michael, Wittig, Diels-Alder, Grignard, Stobbe condensation, Reformatsky reaction, Dieckmann reaction, Robinson annulation, Benzoin condensation, Chichibabin reaction

**Practical: - Based on theory units**

**Paper- XXXVIII Biochemistry**

**Units Prescribed for Theory**

**Unit I**-Scope and significance of Biochemistry. Important discoveries in Biochemistry. An overview of elements, chemical reactions and biomolecules in living organisms.

**Unit II**-Carbohydrate – Glucose, Fructose, Lactose, Maltose and Sucrose. Proteins – Precipitation reactions of proteins, Colour reactions of proteins, Colour reactions of amino acids like tryptophan, tyrosine, cysteine, methionine, arginine, proline and histidine. Lipids– solubility, acrolein test, Salkowski test, Lieberman-Burchard test. Qualitative tests for nucleic acid

**Unit III**-Configuration relationship of D-aldoses, D-ketoses. General properties of aldoses and ketoses. Oxidation, reduction, reducing property, formation of glycosides, acylation, methylation, condensation – phenyl hydrazine, addition –HCN. Interconversion of aldoses and ketoses by chemical method. Ascending and descending the series by chemical methods. Stereochemistry of monosaccharides, (+) and (-), D and L, epimers.

**Practical: - Based on theory units**

## **Paper- XXXIX Advanced Analytical Techniques**

### **Units Prescribed for Theory**

**Unit I-**Basic theory, Instrumentation, Laboratory technique and Applications of following methods

**Unit II-X** – ray Methods, Introduction and Instrumentation of various Techniques. Diffraction, Fluorescence, absorption, & emission spectroscopy.

**Unit III-**Thermoanalytical Methods, Basic theory,Therogravimetric AnalysisDifferential Thermal Analysis, Differential scanning calorimetry

**Practical: - Based on theory units**

## **Paper- XXXX Pharmaceutical (Medicinal) Chemistry**

### **Units Prescribed for Theory**

**Unit I-** Introduction of Pharmaceutical Chemistry, Difference between Pharmaceutical Chemistry and Medicinal Chemistry Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structureactivity relationship (SAR), factors affecting bioactivity, resonance, inductive effect,isosterism, non-isosterism, special considerations.

**Unit II-**Theories of drug activity, Introduction, occupancytheory, rate theory, induced fit theory. Quantitative structure activity relationship.Historyand development of QSAR. Concepts of drug receptors. Elementary treatment of drugreceptor ionization constants, steric, Shelton and surface activity parameters and redoxpotentials

**Unit III-** Classification of drugs based on activity. Synthetic procedure for the present commonly used drugs of each type, Manufacturing of few important drugs. Semi synthetic penicillins, Vitamins: type of vitamins, synthesis of Vit – A and Vit – E, Vitamin – II of Niacinamide, Use of NMR in structure determination of drugs and pharmaceuticals: Instrumentation and Applications.

**Practical: - Based on theory units**

**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B. Voc. Part - III, Semester - VI**  
**Chemical and Petrochemicals / Chemical Technology**

**Paper- XXXXVI Pharmaceutical Engineering**

**Units Prescribed for Theory**

**Unit I-Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

**Unit II-Materials of pharmaceutical plant construction:** Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals.

**Unit III-Distillation:** Objectives, applications & types of distillation. principles, construction, working, uses, merits and demerits of (lab scale and industrial scale) Simple distillation, preparation of purified water and water for injection BP by distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

**Practical: - Based on theory units**

**Paper-XXXXVII Pharmaceutical Technology**

**Units Prescribed for Theory**

**Unit I-Prescription:** Parts of prescription, handling of prescription, Posology.  
**Solution:** Formulation, aqueous and non aqueous vehicles, factors affecting rate of solubilization and solubility, methods to improve aqueous solubility, formulation additives; Elixirs; Linctus; Mouthwashes and Gargles; Nasal and Ear drops; Lotions; Stability of solution; Syrups.

**Unit II-Powder:** Classification, advantages of powder formulation, milling, mixing and dividing of powders, factors influencing blending of powders, powders containing liquids, eutexia

**Unit III-Introduction to drug absorption, disposition, elimination using pharmacokinetics,** important pharmacokinetic parameters in defining drug disposition and in therapeutics.  
Mention of uses of pharmacokinetics in drug development process

**Practical: - Based on theory units**

## **Paper-XXXXVIII Industrial Applications of Organometallic Compounds**

### **Units Prescribed for Theory**

**Unit I**-Importance of Organometallic compounds as catalysts, Conditions to be satisfied by a metal to act as catalysts, Hydrogenation of Olefins, Importance of Wilkinson's catalyst, Preparation of the Catalyst,  $[\text{RhCl}(\text{PPh}_3)_3]$ ,

**Unit II**-Role of Rhodium Metal in the Catalytic Process, Mechanism of Hydrogenation of Olefins using Wilkinson's Catalyst, Modification over the original catalyst, Hydroformylation of olefins-The Oxo process, Mechanism of Hydroformylation of Olefins using the original catalyst,  $\text{HCo}(\text{CO})_4$ , Modification the original catalyst, Mechanism of the Modified catalysis

**Unit III**-Factors retarding the  $\beta$ - elimination process, Role of palladium in Catalysing the oxidation of Ethene to Ethanal, Polymerisation of olefins Ziegler-Natta Catalysis, Heterogenous Catalysis, Homogeneous Catalysis, Importance of Ziegler-Natta Catalysis, Mechanism of Ziegler-Natta Catalysis

**Practical: - Based on theory units**

## **Paper-XXXXIX Nanotechnology and its applications**

### **Units Prescribed for Theory**

**Unit I**- Introduction of nanotechnology, Introduction to nanoscale, potential applications, Challenges and opportunities Growth of nanocrystalline materials,

**Unit II**-Nanocrystals in inorganic matrices, glass matrices, dilution controlled growth. Nanocrystals in porous glasses, Semiconductor nanocrystals in zeolites.

**Unit III**- Composite - semiconductor glass films inorganics in organics. Semiconductor nanocrystals in organic solutions and in polymers. Nanocrystals on crystal substrates. Self organized growth. Synopsis of nanocrystals fabricated by various techniques. Special properties and applications of nanocrystalline solids

**Practical: - Based on theory units**

### **REFERENCE BOOKS:**

1. J. E. Huheey : Inorganic Chemistry ( Harper & Row)
2. J. D. Lee: New Concise INORGANIC Chemistry (ELBS).
3. F. A. Cotton and J. Wilkinson: Inorganic Chemistry (JW).
4. J. Mukhlyonov : Catalyst Technology (MIR).
5. N. B. Hannay : Solid State Chemistry ( PH).
6. Z. Wife, R. Speights :Ultrapurity ( MDI).

7. J. M. Thomas and W.J. Thomas: Introduction to Principles of Heterogeneous Catalysis (A.P.)
8. F.A. Kroger: Chemistry of Imperfect Crystals.
9. C. Sateefield: Heterogeneous Catalysis in Practice (MGH).
10. F. Basolo and R. G. Pearson: Inorganic Reaction Mechanism (JW).
11. M. L. Tobe: Inorganic Reaction Mechanism (Nelson, London).
12. H. Taube: Electron Transfer Reaction of Complex Ions in Solution (AP).
13. Benson: Inorganic Reaction Mechanism in Solution (MGH).
14. H. Gopalan: Optical and Electronic Properties of Nanocrystalline Materials.
15. A. Arora: Industrial Management of Toxic and Hazardous Chemicals.
16. R. Gopalan and V. Ramalingam: Concise Co-ordination Chemistry: Vikas Publishing House, Pvt. Ltd.
17. D. Banerjee: Co-ordination Chemistry, 2<sup>nd</sup> Edition, Asian Books Private Limited.
18. Daniel Minoli: Nanotechnology Applications to Telecommunication Networking.
19. T. Pradeep: Nano: The Essentials of Understanding, Nanosciences & Nanotechnology, McGraw-Hill Education.
20. H J Arnkar: Essential of Nuclear Chemistry
21. R.D. Braum, Introduction to Instrumental Analysis.
22. Willard, DeRitt, Dean and Settle, Instrumental methods of Analysis
23. G.W. Ewing, Instrumental Methods of Analysis 4<sup>th</sup> and 5<sup>th</sup> editions.
24. Chatawal and Anand, Instrumental Methods of Analysis.
- Burger : Medicinal Chemistry (I.W.)
25. W.O. Foye: Principles of Medicinal chemistry (I.E)
26. Lendieer and Mitscher: The organic chemistry of drug synthesis (I.W)
27. N.N. Melnikow: Chemistry of Pesticides (Springer)
28. M.B. Green, G.S. Hartley West: Chemicals for crop protection and pest managements (Pergamon)
29. R. Cremllyn: Pesticides
30. K.H. Buchel: Chemistry of Pesticides.
31. H.B. Scher: Advances in pesticides formulation Technology (ACS)
32. Kirk and other: Encyclopedia of chemical Technology
33. S.D. Shukla and G.N. Pandey: Text Book of Chemical technology. Vol. II
34. Introduction to medicinal chemistry, A Gringuage, Wiley- VCH.
35. Wilson Gisvold's Text book of organic Medicinal and pharmaceutical Chemistry, Ed. Robert F. Dorge.
36. An introduction to drug design, S. S. Pandeya and J. R. Dimmock, New age International.
37. Burger's Medicinal Chemistry and Drug Discovery Volume 1 (Chap. 9 and Chap. 14), Ed. M.E. Wolff, John Wiley.
38. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw-Hill.
39. The organic Chemistry of Drug Design and drug action, R.B. Silverman, Academic press.
40. Strategies for Organic Drug synthesis and Design, D. Lednicer, John Wiley.

**B. Voc. Chemical Technology**  
**SEMESTER END UNIVERSITY EXAMINATION**

**THEORY QUESTION PAPER STYLE- Semester I, II, III, IV, V& VI**

**Time: 2.00 hrs**

**Theory- Total Marks-50**

**Que.:1 Multiple Choice Type Question** **- 10 Marks**  
1 MCQs 10 1 mark 10

**Que.:2 Short Answer Type Q & A** **- 10 marks**  
Any **Five** out of **Seven** Questions - Each carrying **2 marks**

**Que.:3 Short Note type Q & A** **- 10 marks**  
Any **Two** out of **Three** Questions - Each carrying **4 marks**

**Que.:4 Long Answer type Q & A** **- 20 marks**  
Any **Five** out of **Seven** Questions - Each carrying **4 marks**

<b>PRACTICAL - Semester I</b>	<b>PRACTICAL - Semester II</b>
Days: 02 Time: 6 hrs/day	Days: 03 Time: 6 hrs/day
Practical - 200 Marks Project - 50 Marks Total Practical - 250 Marks	Practical - 200 Marks Project - 50 Marks Total Practical - 250 Marks



