DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

CIRCULAR NO.SU/ Faculty of Science & Technology./B.VOC./ 94 /2022.

It is hereby informed to all concerned that, on the recommendation of Ad-hoc Board in Vocational Studies and Dean, Faculty of Science & Technology the Hon'ble Vice-Chancellor has **accepted the curriculum of following B.Voc. Courses under Choice Based Credit and Grading System in** his emergency powers under Section-12 [7] of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith:

Sr.No.	Course Name	Semester
1.	B.Voc in Electronic Manufacturing Services	III & VI
2.	B.Voc in Polymer Science and Chemical Technology	III & VI

This is effective from the **Academic Year 2020-21 and 2021-22** and onwards. This curriculum is also available on the University website www.bamu.ac.in.

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Aurangabad-431 004.
Ref. No.SU/B.voc./Curri./2021-22 123-134
Date: 04.06.2022

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Deputy Registrar,
Academic [Syllabus]
Section.

Copy forwarded with compliments to :-

1] **The Principal All Affiliated Concerned Colleges, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.**
2] **The Director,** University Network & Information Centre, UNIC, with **a request to upload the curriculum along with this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.BAMU, A'bad
2] The Concerned Section, Examination Branch,
3] The Section Officer, [Eligibility Unit],
4] The Programmer [Computer Unit-1] Examinations, section, Dr. BAMU, A'bad
5] The Programmer [Computer Unit-2] Examinations, section, Dr. BAMU, A'bad
6] The In-charge, [E- Suvidha Kendra],
7] The B.Voc Section, Dr. BAMU, A'bad
8] The Public Relation Officer,
9] The Record Keeper,

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY AURANGABAD

SYLLABUS OF BACHELOR OF VOCATIONAL

IN

B.Voc in Polymer Science and Chemical Technology

SEMESTER- III & VI

Choice Based Credit System

Effective form the Academic Year

2020-21 and 2021-22 & Onwards

Dr BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD (M.S.)

Bharat Shikshan Sanstha's

SHRI CHHATRAPATI SHIVAJI COLLEGE,OMERGA

DIST OSMANABAD 413 606 (M.S.)

Syllabus as per Semester

Course Structure and Syllabus for

Semester III and IV

Polymer Science and Chemical Technology

UGC, New Delhi approved under the Scheme National Skills Qualifications Framework (NSQF)

(3 years - Six Semester Full Time Course)

2020-21& onwards

23/06/22

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Uniform Curriculum Structure of Bachelor of Vocation (B.Voc.) Sem.III & IV

Second Year: Semester –III

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester III		**General Academic Components**					
1	VOC 301	Second Language-Hindi	04	0	20	80	4
2	VOC 302	Professional Ethics	04	0	20	80	4
3	VOC 303	**Generic Skill-IV** Chemical Reaction Engineering	04	0	20	80	4
Semester III		**Skill Development Components**					
4	VOC 311	**Skill Specific Course-VII** Unit Operations-II	04	0	20	80	4
5	VOC 312	**Skill Specific Course-VIII** Physical Chemistry	04	0	20	80	4
6	VOC 313	**Skill Specific Course-IX** Polymer material and Physico-chemical aspects of polymer-I	04	0	20	80	4
7	VOC 321	**Lab Course 7:** Practical's based on Unit Operations-II	0	04	25	25	2
8	VOC 322	**Lab Course 8:** Physical and Inorganic Chemistry practical's	0	04	25	25	2
9	VOC 323	**Lab Course 9:** Preparation, Identification and analysis of Polymers	0	04	25	25	2
Total			24	12	195	555	30

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Second Year: Semester –IV

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester IV		**General Academic Components**					
1	VOC 401	Business Communication	04	0	20	80	4
2	VOC 402	Financial Managements and Accounts	04	0	20	80	4
3	VOC 403	Industrial Management	04	0	20	80	4
Semester IV		**Skill Development Components**					
4	VOC 411	Specific Skill Course-X Unit Operation-II	04	0	20	80	4
5	VOC 412	Specific Skill Course-XI Chemical Reaction Engineering	04	0	20	80	4
6	VOC 413	Specific Skill Course-XII Polymer Material and Physico-chemical aspects of Polymer-II	04	0	20	80	4
7	VOC 421	Lab Course -10 Practical's based on Unit Operations-II	0	04	25	25	2
8	VOC 422	Lab Course -11 Practical's based on Chemical Reaction Engineering	0	04	25	25	2
9	VOC 423	Lab Course -12 Synthesis, Estimation and analysis of Polymers	0	04	25	25	2
10	VOC 431	In-Plant Training-II*	0	120	50	50	4
Total			**24**	**12**	**225**	**605**	**34**

#Students have to undertake 120 contact hours internship in respective industry during summer vacation at the end of each academic year. This is off campus activity.

#Students should submit report of the in-plant training within seven (07) days after completion of training.

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

General Academic Components

Polymer Science and Chemical Technology

Semester-III

Uniform pattern 2019

Second Year: Semester-III

General Academic Components

VOC 301- Second Language –Hindi (सामान्य हिंदी)

(04 Credits: 100 Marks)

उद्देश्य:

1) साहित्य आस्वादन अभिरूची का परिसंस्कार
2) जीवन मूल्यों के प्रति आस्था
3) अत्याधुनिक इलेक्ट्रानिक माध्यमों का परिचय

अध्ययन-अध्यापन प्रक्रिया :

1) व्याख्यान पद्धति
2) लेखन एवं पठन कौशल वृद्धि के लिए अभ्यास
3) दृक-श्रव्य माध्यम का प्रयोग

पाठयपुस्तक:

अ.) गय के विविध आयाम, संपा., प्रो. जयमोहन एम.एस., वाणी प्रकाशन, नई दिल्ली

पाठयक्रम में समाविष्ठ रचनाएँ

1) आत्मवृत्त: मेरा जीवन
2) रेखाचित्र-पीलकंठ मोर
3) संस्मरण -कमला
4) निबंध-शिरीष के पुल
5) यात्रावृत्त-चीडो पर चाँदनी

आ.) प्रयोजनमूलक हिंदी :

1) प्रयोजनमूलक भाषा

अ) भाषा का स्वरूप एक महत्व
आ) भाषा की परिभाषा , विशेषताएँ एवं प्रकार्य
इ) वैश्वीकरण के परिप्रेक्ष्य में हिंदी भाषा का महत्त्व

2) भाषा शिक्षण : स्वरूप एवं प्रक्रिया

अ) भाषा शिक्षण की प्रक्रिया,
आ) भाषा कौशल

1.श्रवण कौशल	2.भाषण कौशल
3.वाचन कौशल	4.लेखन कौशल

3) व्यावसायिक हिन्दी

अ) वाणिज्य व्यापार : तात्पर्य एवं स्वरूप

आ) वाणिज्य व्यापार के साधन

इ (वाणिज्य व्यापार और भाषीक प्रकार्य

ई (वाणिज्य -व्यावसायिक भाषा : संरचनात्मक विशेषताएं

उ) व्यावसायिक पत्र लेखन

4) निबंध लेखन

अ) निबंध : तात्पर्य एवं स्वरूप

आ) निबंध लेखन : साहित्यिक / सामाजिक/ समसामायिक समस्या। वैज्ञानिक विषय

संदर्भ ग्रंथ:

1) साहित्य विधाओं की प्रकृतिः देवी शंकर अवस्थी

2) हिंदी गद्य । विन्यास और विकास : डॉ. रामस्वरूप चतुर्वेदी

3) हिंदी का गद्य पर्व: डॉ. नामवर सिंह

4) हिंदी के अध्यतन अनुप्रयोग: डॉ .माधव सोनटक्के

5) प्रयोजनमूलक तथा व्यावहारिक हिन्दी : डॉ. सुकुमार भंडारे

Second Year: Semester-III

General Academic Components

VOC 302- Professional Ethics

(04 Credits: 100 Marks)

Learning Objective:

1. To create an awareness on Engineering Ethics and Human Values.
2. To install Moral and Social Values and Loyalty
3. To appreciate the rights of others.
4. To create awareness on assessment of safety and risk

Course Outcomes: By the end of the semester, the student will be able to:

1. Identify and analyse an ethical issue in the subject matter under investigation or in a relevant field.
2. Identify the multiple ethical interests at stake in a real-world situation or practice.
3. Assess their own ethical values and the social context of problems.
4. Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human.
5. Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

Course Contents:

Unit I: Introduction to Professional Ethics **(15 Hrs)**

Defination of Profession; Engineering and Professionalism; Two module of professionalism, Defination of Ethics, types of ethics/morality, negative force of engineering ethics-preventive ethics; positive force of engineering ethics- aspirational ethice, Good works, Ordinary positive engineering; case studies based on unit I.

Unit II: Ethics in the World of Business **(15 Hrs)**

Introduction; ethics and Entrepreneurship; Economics and law: Ethics and Management; Business ethic and ethical theory; introduction to welfare, right and justice; introduction to equality, liberty and virtue; introduction to whistle blowing. Case studies based on unit II.

Unit III: The Social and Value Dimension of Technology (15 Hrs)

Technology and society: Technology optimism and pessimism; computer technology- primary and social interaction of technology and society; trust and reliability- Honesty, form of dishonesty, confidentiality; intellectual prperty; expert witnessing; informing the public; conflict of interest; Case studies based on unit III.

Unit IV: Corporate Social Responsibility (15 Hrs)

Introduction, Debate over CSR, business case for CSR, Implementing CSR. Corporate Governance and accountability. Introduction to international Business ethics, Case studies based on unit IV.

Text and Reference Books:

1. Engineering Ethics: Concepts and Cases- C. E. Harris Jr., Michael S. Pritchard, M. J. Rabins: Cengage Learning India Pvt. Ltd. ISBN-8131517292
2. Ehtics and conduct of Business- J. R. Boatright, B. P. Patra; Pearson, ISBN: 9788131759622.
3. Professional Ethics and Human Values- M. Govindrajan, S. Natarjan, V. S. Senthilkumar: prentice hall india learning pvt. Ltd. ISBN-8120348168
4. Ngineering Ethics includes human values- M. Govindrajan, S. Natarjan, V. S. Senthilkumar: prentice hall india learning pvt. Ltd. ISBN-9788120325784.

Second Year: Semester-III

General Academic Components

VOC 303- Generic Skill-IV

Chemical Reaction Engineering

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide students with a thorough understanding and knowledge of Chemical reaction Engimneering.
2. To provide students with various applications related to chemical reactions.
3. To make student competent for getting future jobs in Industry.
4. To develop skill among the students in studing the different typed of reactors.

Course Outcomes: On completion of the course, students should be able to-

1. Understand and interpret the basic concepts of chemical reaction enginnering.
2. Able to explain the different types of reactions and its kinetics.
3. Able to solve problems related to Chemical kinetics.
4. Able to distinguish the product distribution in parallel and series reactions.
5. Acquire Knowledge of Chemical reaction kinetics in different types of reactions.

Course Contents:

Unit-I: Overview of Chemical Reaction Engineering: (10 Hrs)

Typical Chemical Process, Classification of reactions,Variable Affecting the Rate of Reaction.DefinitionofReactionRate.

Unit-II: Kinetics of Homogeneous Reactions: (25 Hrs)

The rate equation, Concentration-Dependent Term of a rate equation, Single& multiple Reactions, Elementary & Non elementary reactions, Molecularity & Order of Reaction, Rate Constant (K). Representation of an Elementary Reaction, Representation of Non elementary Reaction, Kinetic Models for Non elementary Reactions-free radicals, ions & polar substances, Molecules, Transition Complex, Non Chain Reactions, Chain Reactions-Free radicals, Chain reaction mechanism, Molecular intermediates, nonchain mechanism, Transition Complex, non chain mechanism.Temperature-Dependent Term of

a Rate Equation-Temperature Dependency from Arrhenius Law.Comparison of Theories with Arrhenius law, Activation Energy and Temperature Dependency.

Unit-III: Interpretation of Batch Reactor Data: **(25 Hrs)**

Introduction of Batch Reactor.Constant-Volume,Batch Reactor, Analysis of Total Pressure data obtained in a Constant-Volume System, Integral Methods of Analysis of Data, Irreversible Unimolecular-I type First Order Reactions, Irreversible Bimolecular-Type Second Order Reactions, Zero Order Reactions, Overall Order of Irreversible Reactions from the half life tl/2, Irreversible reactions in Parallel, Homogeneous Catalyzed Reactions, Autocatalytic Reactions, Irreversible Reactions in Series. First Order Reversible Reactions, Second Order Reversible Reactions, Reactions of Shifting Order, Differential Method of Analysis of Data, Varying- Volume Batch Reactor, Differential Method of Analysis, Integral Method of Analysis, Zero Order Reactions. First Order Reaction, Second Order Reactions, The Search for a Rate Equation.

Reference Books:

1. Chemical Reaction Engineering- Octave Levenspiel-Wiley India Pvt. Ltd.
2. Chemical Reaction Engineering- K.A.Gavane-Nirali Prakashan,Pune
3. Principles of Reaction Engineering-S.D.Dawande-Central Techno Publications.

Skill Development Components

Polymer Science and Chemical Technology

Semester-III

Uniform pattern 2019

Second Year: Semester-III

Skill Development Components

VOC 311- Skill Specific Course -VII

Unit Operations-II

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide students with a thorough understanding and knowledge of various unit operation carried out in the industry.
2. To provide students with various applications related to distillation,evaporation,condensation etc.unit operations.
3. To make student competent for getting future jobs in Industry.
4. To develop skill among the students in studing the different unit operations using during the manufacturing of product.

Course Outcomes: On completion of the course, students should be able to-

1. Understand and interpret the basic concepts of Unit operations.
2. Able to explain the different types of unit operations viz. Distillation,evaporation,drying,size reduction etc..
3. Able to solve problems related to various unit operations.
4. Able to distinguish the different type of study of operations.
5. Acquire Knowledge of various unit operations applicable in industry.

Course Contents:

Unit-I:Overview of Mass Transfer Operations **(08 Hrs)**

General Overview - Introduction to Mass Transfer operations, Benefits, General Principles of Mass Transfer, Various types of Mass Transfer Operations their importance.

Unit-II: Equilibrium Stage Operations **(07 Hrs)**

Introduction, Typical distillation equipment, Principles of Stage Processes, Terminology for Stage Contact Plants, Material Balances, Enthalpy balances, Graphical method for two component system, Operating line diagram, Ideal contact stages, Determining the number of ideal stages.

Unit-III: Distillation **(15 Hrs)**

Introduction, Flash Distillation, Simple Distillation, Steam Distillation, Rectification, Material

Balances in Plate Columns,Number of Ideal Plates, MoCabe Thiele Method, constant molal overflow,Reflux Ratio, Condenser and Top Plate, Bottom Plate and Reboiler, Feed Plate, Minimum Reflux, Optimum Reflux Ratio, Plate Efficiency, Types.Relations, Factors influencing plate efficiency, Rectification in packed towers,Batch Distillation.

Unit-IV: Liquid Extraction **(20 Hrs)**

Terminology. Introduction to liquid-liquid extraction, Applications of Liquid-Liquid Extraction, Principles of liquid-liquid equillibria, Triangular diagrams, Types of extraction system, I & II.Temperature offects on systems types, Solvent selection Commercial extraction system. Typical extraction system. Extraction calculations-SingleStage Operations, Multi Stage Cross Current Operation. Continuous multistage counter current operations, Design considerations for packed beds.Extraction Equipments-Mixer Settlers, Spray & Packed extraction lowers,Perforated plate towers, Baille towers, Agilated Tower extractor,Centrifugal Extractors.

Unit-V:Size Reduction **(10 Hrs)**

Introduction, Principles of Comminution, Criteria for comminution, Characteristics of comminuted products, Energy & Power requircntents in comminution, Crushing efticiency, Empirical relationship-Rittingers & Kicks Law, Bond Crushing Law & Work Index, Size reduction equipments.

Reference Books

1. Unit operations in Chemical Engineering –W.L.McCabe, J.C.Smith,Peter Harriott.
2. Unit operations-II -K.A.Gavane
3. Mass Transfer Operations- Robert E.Treybal

Second Year: Semester-III

Skill Development Components

VOC 312- Skill Specific Course -VIII

Physical Chemistry

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide students with a thorough understanding and knowledge of Physical Chemistry.
2. To provide students with various applications of Physical chemistry
3. To make student competent to seek the admission of Physical chemistry.
4. To make student competent in presentation of Physical Chemistry.

Course Outcomes: On completion of the course, students should be able to-

1. Understand and interpret the basic concepts of Thermodynamics.
2. Able to write various derivations related to thermodynamics.
3. Able to solve problems related to thermodynamics.
4. Able to write and justify the reasons of process occurs due to thermodynamic parameters.
5. Acquire Knowledge of Chemical Equilibrium in various reaction pathways.

Course Contents:

Unit I: Thermodynamics-I **(22 Hrs)**

Definition: of Thermodynamic Terms: System, Surrounding types of system intensive and extensive properties. Thermodynamic Process, Concept of heat and work.Work done in reversible and irreversible process, concept of maximum work (Wmax), Numerical Problems. First law of Thermodynamics: Statement, Definition of Internal energy and Enthalpy. Heat capacity, heat capacities at constant volume pressure and their relationship. Calculation of W,q, du and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Numerical problems, Hess's law of heat Summation and its application

Unit II: Thermodynamic-II **(25 Hrs)**

Second Law of Thermodynamics: Need for the law, different statement of the law Carnot Cycle and its efficiency, Numerical Problems. Carnot's theorem. Concept of Entropy: Definition, Physical significance, Entropy as a State Function, Entropy change in Physical change, Entropy as criteria of Spontaneity & Equilibrium Entropy Change in Ideal Gases. Gibbs and Helmholtz Functions: Gibbs Function (G) and Helmoltz Function (A) as

Thermodynamic Quantities. A and G as criteria for Thermodynamic Equilibrium and Spontaneity, their Advantage over Entropy change.Variation A with P, V and T.

Unit III: Chemical Equilibrium **(13 Hrs)**

Equilibrium Constant and Free Energy. Thermodynamic Derivation of Law of Mass Action. Le Chatelier's Principle. Reaction Isotherm and Reaction Isochore. Clapeyron Equation, Clausius-Clapeyron Equation and its Application.

Reference Bookss

1) Principles of Physical Chemistry: Puri, Sharma and Pathania

2) Physical Chemistry 4thEdn.: Prutton and Maron

3) Advanced Physical Chemistry: Gurdeep Raj

4) Thermodynamics: Basic and Applied :V. Ganesan

5) Basic and Applied Thermodynamics: P.K.Nag

6) An Introduction To Chemical Thermodynamics: R.P.Rastogi and R.R.Misra

7) A Textbook of Physical Chemistry, Thermodynamics and Chemical Equilibrium (SI Units) - Vol. 2, 6th Edition: K. L. Kapoor

Second Year: Semester-III

Skill Development Components

VOC 313- Skill Specific Course -IX

Polymer materials and Physico-chemical aspects of polymer-I

(04 Credits: 100 Marks)

Learning Objectives:

1. To impart understanding of the necessity and methodology of different polymer testing processes to evaluate polymer properties.
2. To predict major characteristics of a polymer from its chemical structure and molecular architecture.
3. To understand the working principles /experimental methods of various unit operations required in Plastic and Polymer Chemistry.
4. To provide general overview of synthesis, properties and applications of Polymers.

Course Outcomes: On completion of the course, students should be able to-

1. Understand the knowledge of polymer solution and factors associated with it.
2. Able to learn and apply various experimental methods for purification, isolation and chromatographic techniques.
3. Will acquire knowledge of morphology and crystallinity of polymers.
4. Able to write and understand the various methods of synthesis, properties and applications of industrially useful Polymers.
5. Will apply the knowledge of synthesis of polymers to synthesize other polymeric material.

Course Contents:

Unit I: Polymer Solution (20 Hrs)

The process of polymer dissolution, thermodynamics of polymer dissolution, theories of polymer solution, nature of polymer molecules in solution, size and shape of polymer molecules in solution, solubility of crystalline and amorphous polymer, effect of molecular weight on solubility, viscosity of dilute and concentrated polymer solution.

Unit II: Experimental methods (10 Hrs)

Monomer purification, isolation and purification by polymer fractionation, fractionation technique, methods of fractionation, gel permeation chromatography, gradient elution technique, partial dissolution technique.

Unit III: Morphology and Crystallinity (15 Hrs)

Introduction, Development of Crystallinity, morphology and order of Crystalline polymer, factors affecting Crystallinity, relation of morphology with structure and chemical properties, morphology of single crystal, crystallization from melt, during flow and from dilute solution.

Chemistry of polymer materials

Unit IV:Poly Urethanes (07 Hrs)

Raw material and their preparation, polymerization reaction, PU foam, elastomer and fibers, properties and application.

Unit V: Poly Carbonates (08 Hrs)

Raw material and their preparation, polymerization reaction, preparation by direct phosgenation, ester interchange method, properties and applications.

Reference Books

1) Introductory polymer chemistry – G. S. Misra
2) Text book of polymer science – P. L. Nayak and S. Lenka
3) Polymer chemistry – M. G. Arora and M. Singh
4) Polymer science and Technology – J. R. Fried
5) Text book of polymer sciences – F. W. Billmeyer
6) Polymer science – V. R. Gowarikar and N. V. Vishwanathan.
7) Polymer science and technology – A. Ghosh

Second Year: Semester-III

Skill Development Components

VOC 321- Lab Course: 7

Practical's based on Unit Operations-II

(02 Credits: 50 Marks)

Learning Objectives:

1. To acquaint students with practical knowledge of unit processes.
2. To provide students with skill to perform practicals on unit operations.
3. To improve the hands on skill of presentation related to practicals.
4. To provide necessary knowledge with different devices related to unit process.

Course Outcomes: On completion of the course, students should be able to-

1. Learn skillfully distillation using binary mixture
2. Perform practicals of rate of drying of solid substances 3.
4. Discuss and demonstrate the experiment of purification the sample of naphthalene.
5. Able to perform and discuss the experiment of crystallization of the given sample of phthalic acid from hot water.

Course Contents:

1. To perform simple distillation using binary mixture (Methanol + water or Ethanol + water)
2. To study the rate of drying of solid substances (Saw dust).
3. To study the liquid –liquid equillibria for three componenet system (Glacial acetic acid + Chloroform + Distilled water)
4. To study the rate of drying in tray dryer.
5. To purify the given sample of naphthalene or camphor by simple sublimation method.
6. To crystallise the given sample of phthalic acid from hot water using fluted paper and steamless funnel.

Record book

Viva-voce

Reference Books:

1. Systematic experimental Physical Chemistry- S.W. Rajbhoj and T.K.Chondhekar
2. Unit Operation-II –K.A.Gavane

Second Year: Semester-III

Skill Development Components

VOC 322- Lab Course: 8

Physical and Inorganic Chemistry Practical's

(02 Credits: 50 Marks)

Learning Objectives:

1. To acquaint students with practical's of Physical and Inorganic Chemistry.
2. To provide students with skillful performance of various Physical Chemistry experiments based on Thermodynamics, reaction kinetics and gravimetric estimations.
3. To understand and estimate the amount of various metals by Complexometric Titration.

Course Outcomes: On completion of the course, students should be able to-

1. Able to prepare various standard solutions for requirement of practical.
2. Able to perform various experiments and to calculate various thermodynamic factor/values for different chemical reactions.
3. To understand the principle of viscometer and able to calculate Mol.Wt. of given polymer.
4. Skillful in performing experiments based on gravimetric estimations.
5. Able to perform with skill the various practical's based on complexometric titration.

Course Contents:

Non Instrumental (Any Five)

1. To determine critical solution temperature of Phenol-water system.
2. To determine solubility of benzoic acid at different Temperature and determine Heat of dissolution process.
3. To determine heat of neutralization (Hn) of NaOH and HCl
4. To determine heat of neutralization (Hn) of NaOH and Acetic acid.
5. Partition coefficient of Benzene-water system using benzoic acid.
6. To determine the equilibrium constant for the reaction: $KI + I_2 \text{ --- > } KI_3$.
7. Determine the molecular mass of polymer from viscometry measurements.
8. To investigate the Kinetics of iodination of Acetone.

Gravimetric Estimation: (Any Three)

1. Estimation of Zinc gravimetrically as Zinc ammonium phosphate ($ZnNH_4PO_4$)
2. Estimation of Mn gravimetrically as Manganese Ammonium Phosphate ($MnNH_4PO_4$)
3. Estimation of Nickel gravimetrically as Ni-DMG

4. Estimation of Barium gravimetrically as Ba-Chromate ($BaCrO_4$)

5. Estimation of Aluminum as Aluminum Oxinate.

6. To determine the equilibrium constant for the reaction: $KI + I_2$-KI_3

7. Determine the molecular mass of polymer from viscometry measurements.

8. To investigate the Kinetics of Iodination of acetone.

Complexometric Titration: (Any Two)

1. Estimation of Zinc by EDTA solution using EBT indicator.

2. Estimation of Nickel by EDTA using Murexide indicator

3. Estimation of copper by EDTA using fast sulphon black F indication

4. Estimation of Lead by EDTA using Xylenol Orange indicator

Record book

Viva-voce

Reference Books:

1. Experimental Physical Chemistry- V .D. Athawale

2. Practical Physical Chemistry- Dr. M. Satish Kumar

3. Advanced Practical Inorganic Chemistry- Gurdeep Raj

4. Practical Physical Chemistry- Gupta, Renu, New Age International (P) Ltd Publishers.

5. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar (Anjali Publication, Aurangabad)

6. College Practical Chemistry- V K Ahluwalia and Sunita Dhingra,

7. A Text-book of Quantitative Inorganic Analysis- Arthur Israel Vogel

8. Quantitative Chemical Analysis- Na Li and John J Hefferren

Second Year: Semester-III

Skill Development Components

VOC 323- Lab Course: 9

Preparation, Identification and analysis of Polymers

(02 Credits: 50 Marks)

Learning Objectives:

1. To impart understanding of the necessity and methodology of different polymer testing processes to evaluate polymer properties.
2. To identify and analyse the various properties of polymer materials
3. To provide students with skillful performance of various Polymer Chemistry experiments.
3. To understand and perform various unit operations like distillation, steam distillation and fractional distillation.
4. To make skillful in identification for engineering plastic and cellulose and to analyze polymer plasticizers and fillers.

Course Outcomes: On completion of the course, students should be able to-

1. Able to perform various unit operations like distillation, steam distillation and fractional distillation.
2. Able to perform various experiments based on identification and analyses of Polymers.
3. To understand the principle of unit operations involved in distillation.
4. Skillful in performing experiments based on synthesis of phenoplasts and Aminoplasts.
5. Able to analyze monomers like styrene, methyl metacrylate and vinyl chloride.

Course Contents:

1. Fractional distillation. 2 Experiments
Distillation of phenol, benzene, toluene.
2. Preparation of phenoplasts. 2 Experiments
3. Preparation of Aminoplasts. 2 Experiments
4. Analysis of monomers styrene, methylmetacrylate, vinyl chloride, Malamine. 2 Experiments
5. Identification of engineering plastic. 2 Experiments
6. Identification of cellulose polymer. 2 Experiments.

7. Analysis of plasticizers and fillers. 2 Experiments

Record book

Viva-voce

Reference Books:

1. Identification and Testing of Plastics- A. S. Athalye, Multi-Tech Publishing.
2. Testing & Evaluation of Plastics- Mathur and Bhardwaj- Allied publisher Pvt Ltd.
3. Handbook of Industrial Polyethylene and Technology Definitive Guide to Manufacturing, Properties, Processing, Applications and Markets. Mark A. Spalding and Ananda M.Chatterjee - Scrivener Publishing.
4. Practical's in Polymer Science-Siddaramaiah
5. Experiments in Polymer Science -D.G.Hundaiwale, V.D.Athawale, U.R.Kapadi and V.V.Gite.

Second Year: Semester –IV

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester IV		**General Academic Components**					
1	VOC 401	Business Communication	04	0	20	80	4
2	VOC 402	Financial Managements and Accounts	04	0	20	80	4
3	VOC 403	Industrial Management	04	0	20	80	4
Semester IV		**Skill Development Components**					
4	VOC 411	Specific Skill Course-X Unit Operation-II	04	0	20	80	4
5	VOC 412	Specific Skill Course-XI Chemical Reaction Engineering.	04	0	20	80	4
6	VOC 413	Specific Skill Course-XII Polymer Material and Physico-chemical aspects of Polymer-II	04	0	20	80	4
7	VOC 421	Lab Course -10 Practical's based on Unit Operations-II	0	04	25	25	2
8	VOC 422	Lab Course -11 Practical's based on Chemical Reaction Engineering	0	04	25	25	2
9	VOC 423	Lab Course -12 Synthesis, Estimation and Analysis of Polymers	0	04	25	25	2
10	VOC 431	In-Plant Training-II#	0	120	50	50	4
Total			**24**	**12**	**225**	**605**	**34**

#Students have to undertake 120 contact hours internship in respective industry during summer vacation at the end of each academic year. This is off campus activity.

#Students should submit report of the in-plant training within seven (07) days after completion of training.

General Academic Components

Polymer Science and Chemical Technology

Semester-IV

Uniform pattern 2019

Second Year: Semester-IV

General Academic Components

VOC 401- Business Communication

(04 Credits: 100 Marks)

Learning Objectives:

1. To acquaint students with linguistic practices in business communication.
2. To provide students with effective business writing skills.
3. To improve situational analysis capacity in students.

Course Outcomes:

On completion of the course, students should be able to-

1. State and use principals of effective writing.
2. Apply communication as a tool to resolute conflicts.
3. Analyze a case study.
4. Categorize communication areas to construct monologues/ dialogues for effective situational communication.

Course Contents:

Unit I: Introduction to Communication (12 Hrs)

Definition of Communication, Classification, Role; Characteristics of successful communication-Importance of communication in business Communication structure in organization Communication in conflict resolution; Case Studies.

Unit II: Writing Skills (12 Hrs)

Principles of effective writing -Approaching the writing process systematically: The 3X3 writing process for business communication; Writing routine and persuasive letters-Positive and Negative messages Writing Reports, Writing memos, Case Studies

Unit III: Case Analysis (12 Hrs)

Different types of cases-Difficulties and overcoming the difficulties of the case metho- Reading a case properly (previewing, skimming, reading, scanning) -Case analysis approaches (Systems, Behavioral, Decision, Strategy)-Analyzing the case-Dos and don'ts for case preparation -Discussing and Presenting of Case Studies.

Unit IV: Employment Communication (12 Hrs)

Introduction-Composing Application Messages-Writing CVs-Group discussions-Interview skills Impact of Technological Advancement on Business Communication-Technology-enabled Communication-Communication networks-Intranet-Internet-emails-SMS ,tele conferencing-video conferencing; Case Studies.

Unit V: Meetings (12 Hrs)

Meetings-Planning meetings-objectives-participants-timing-venue of meetings-leading meetings, Meeting Documentation: Notice, Agenda, Resolution & Minutes; Case Studies.

Reference books

Text:

1. Business Communication: Concepts, Cases And Applications -Chaturvedi P. D, & Mukesh Chaturvedi ,2/e, Pearson Education,201 1

2. Business Communication: Process And Product -Mary Ellen Guffey,3/e, Cengage Learning, 2002.

3. Communication -Rayudu C. S, Himalaya Publishing House

4. Business Communication -Lesikar, Flatley, Rentz & Pande, 11/e, TMH, 2010

5. Basic Business Communication -Raj Kumar, Excel Books, 2010

Suggested Reading:

1. Advanced Business Communication -Penrose, Rasberry, Myers, *She,* Cengage Learning, 2004

2. BCOM -Lehman, DuFrene, Sinha, Cengage Learning, 2/e2012

3. Business Communication - Madhukar R. K, 2/e, Vikas Publishing House.

4. Effective Technical Communication - Ashraf Rizvi M, TMH, 2005.

5. Business Communication - Sehgal M. K & Khetrapal V, Excel Books.

6. Business Communication -Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012.

Second Year: Semester-IV

General Academic Components

VOC 402- Financial Management and Accounts

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide students with primary aspects of financial management
2. To acquaint students with basic terminologies of finance and accounting
3. To introduce students to the basic rules of accounting and journal
4. To provide necessary tools so that students can prepare Trading and Profit and Loss A/c and Balance Sheet

Course Outcomes:

On completion of the course, students should be able to

1. Explain concepts, terminologies and functioning of financial accounting
2. Elaborate accounting terms, equation and journal
3. Apply Voucher approach in accounting
4. Prepare trading, profit/loss account and balance sheet

Course Contents:

Unit I: Financial Management- I (12 Hrs)

Concept and Definition, Purpose of Investment, Types of Capital, Working Capital, Sources of Finance, Reserve, Surplus, Financial Accounting, Boo-eeping, Terms used in Boo Keeping, Assets, Liabilities, The Journal and the Ledger, Trial Balance, Trading Account

Unit II: Financial Management- II (12 Hrs)

Financial Statements, Financial Ratios, Sources of Finance, Capital, Working Capital, Capitalization, Capital Structure, Difference between Capital, Capitalisation and Capital Structure, Capital Gearing, Factors affecting Requirements for working capital, Return on Investment, International Financial Management

Unit III: Introduction to Financial Accounting (12 Hrs)

Accounting-An Introduction: Business transactions, Book-keeping, Accounting and its branches. Nature, functions and objectives of Financial Accounting.

Accounting Assumptions-Accounting Concepts: Meaning, concepts: Matching, Accrual, Realization and Dual Aspect Concept.

Unit IV: Accounting Terms, Accounting Equation and Journal (12 Hrs)

Accounting Terms-Accounting Equation Need of Accounting equation, Meaning and preparation of accounting equation. Rules of Accounting -Journal Meaning, classification of journal into General journal and special journals (with examples). Incorporation of journal entries involving different accounts. Cash Book Meaning, types-Simple Cash Book, Two columns Cash Book and Three columns Cash Book.

Unit V:Voucher Approach in Accounting and Financial Statements (12 Hrs)

Vouchers and their preparation - Day Book and Subsidiary Day Books - Recording the vouchers into Day Books -Recording the Vouchers into Subsidiary Day Books Ledger Posting of Day Book-Posting of Subsidiary Day -Trial Balance -Errors and their Rectification. Capital and Revenue - Preparation of Trading and Profit and Loss Account and Balance Sheet - Preparation of Trading and Profit and Loss A/c and Balance Sheet (with adjustments).

References:

Text:

1. Accounting Principles -Anthony, R.N., and J.S. Reece, , Richard D.,Irwin, Inc.

2. Financial Accounting: Concepts and Applications -Monga, J.R., Mayoor Paper Backs, New Delhi.

3. Advanced Accounts-Shukla, M.C., T.S. Grewal and S.C.Gupta, Vol-I, S.Chand & Co., New Delhi.

Suggested Reading:

1. Advanced Accountancy Vol-1 - Gupta, R.L. and M. Radhaswamy, Sultan Chand & Sons, New Delhi.

2.Financial Accounting- Maheshwari, S.N. and. S. K. Maheshwari, Vikas Publishing House, New Delhi.

3. Advanced Accounting-Tulsian, P.C.;Tata Mc GrawHill, New Delhi.

4. Compendium of Statements and Standards of Accounting- The Institute of Chartered Accountants of India, New Delhi.

Second Year: Semester-IV

General Academic Components

VOC 403- Industrial Management

(04 Credits: 100 Marks)

Learning Objectives:

1. To make students understand the role of industrial management in organizations
2. To enable students to differentiate between strategic and tactical operations/ decisions
3. To introduce students with typical managerial decisions under specific situations
4. To provide students with basic concepts of JIT and Lean Operations

Course Outcomes:

On completion of the course, students should be able to

1. Explain key terminologies of Industrial Management
2. Describe concept and process of organization
3. Discuss basic aspects of product development process
4. Emphasize of quality of product and process
5. Implement JIT practices in operation realm

Course Contents:

Unit I: Industrial Engineering and Management Science: (12 Hours)

Concept of Industrial engineering, Roles of Industrial Engineer, Production Management Versus Industrial Engineering, Operation Management, Managerial Economics, Managerial Accounting.

Unit II: Organization (12 Hours)

Concept of organization, importance of organization, the process of organization, principles of organization organizational structure, types of organization. Departmentation, authority, Delegation of authority, group dynamics, organizational change, organizational development, organizational conflict, managerial leadership, communication system, committees, project organization.

Unit III: Product Design, Planning and Development (12 Hours)

Introduction to product design, effect of design on cost, requirements of a good

product design, factors affecting product design, design by imitation, design of specification and drawings, product planning, product classification, product development, standardization, simplification, specialization, diversification, interchangeability, Process Selection, Process Design, Process analysis.

Unit IV: Inspection and Quality Control (12 Hours)

Definition and concept, purposes or objectives of inspection, inspection of incoming materials, raw or received material, In process inspection, inspection of finished goods, statistical quality control, Probability concept, normal distribution, measures of central tendency, sampling inspection, sampling plans, the zero defect concept, quality circle.

Unit V: JIT and Lean Operations (12 Hours)

Introduction, The Toyota Approach, Case Studies; Developing the JIT Philosophy, Transitioning to JIT System, JIT in Services, Operations Strategy, Wastes in an Industrial scenario, Concepts of Lean Operations, Case Studies.

References

Text:

1. Industrial Engineering and Management - O. P. Khanna- Dhanpat Rai Publications.

2. Operations Management -W. J. Stevenson- McGraw Hill Companies.

Suggested Readings:

1. General Industrial Management-Henri Fayol

2. Industrial Management-Bagad V.S.- Technical Publication.

Skill Development Components

Polymer Science and Chemical Technology

Semester-IV

Uniform pattern 2019

Second Year: Semester-IV

Skill Development Components

VOC 411- Unit Operations-II

(04 Credits: 100 Marks)

Learning Objectives:

1. To make students understand the role of unit operations in Industry.
2. To enable students to differentiate between unit process and unit operations.
3. To introduce students with different unit processes in chemical Industry.

Course Outcomes: On completion of the course, students should be able to-

1. Discuss and write all operations of gas absorption.
2. Learn and apply the concepts of Evaporation to different evaporation methods.
3. Duscuss and apply method of crystallization for purification and separation.
4. Apply and discuss about drying of solids.
5. Discuss and will apply methods and applictions of mechanical separations.

Course Contents:

Unit-I: Gas Absorption **(10 Hrs)**

Introduction. Design of Packed Towers, Contact between Liquid & Gas, Pressure drop & limiting flow rates, Principles of absorption material balances, Limiting gas-liquid ratio, Temperature Hivariations in packed towers. Rate of absorption, Calculation of tower leight, Number of Transfer units.

Unit-II: Evaporation **(12 Hrs)**

Introduction, Liquid Characteristics Types of Evaporators, Performance of Tubular Fivaporatars, Evaporator Capacity, Boiling Point Elevation and Duhring Rule, Effect of liquid head & friction on temperature drop, Heat Transfer Coefficient, Overall Coefficient, Evaporator economy. Enthalpy balance for single effect evaporator,Enthalpy balance with negligible heat of dilution, Single effect calculations, Multiple effect evaporators. Methods of feeding,Capacity and economy of multiple effect evaporator, Effect of liquid head and boiling point elevation.

Unit-III: Crystallization **(13 Hrs)**

Importance of Crystal Size,Crystal Geography,Crystallographic systems, Invariant Crystals,

Principles of Crystallization, Purity of Product, Equillibria & its yields, Enthalpy Balances, Super Saturation, Units of Super Saturation, Temperature differential as a potential, Nucleation-Origins of Crystals in crystallizers, Primary nucleation, Homogeneous nucleation,Equilibrium, Kelvin Equation, Rate of nucleation, Heterogeneous nucleation, Secondary nucleation, Contact nucleation, Crystal Growth- Individual & overall Growth Coefficients. Growth Rate, Mass Transfer Coefficient, Surface Growth Coefficient, AL law of crystal growth,Crystallization Equipment-variations in crystallizers. Vacuum Crystallizers, Draft Tube Baffle Crystallizer, Yield of Vacuum Crystallizer.

Unit-IV: Drying of Solids **(13 Hrs)**

Introduction, Classification of Dryers. Solid handling in dryers. Principles of Drying-Temperature Pattern in dryers, Hear Transfer in dryers. Heat duty, Heat Transfer Coefficient, Heat Transfer Units, Mass Transfer in Dryers, Phase Equillibra-equillibrim moisture and free moisture, Bound & unbound water, Cross circulating drying-constant drying conditions, Rate of drying, Constant rate period, Critical Moisture Content & Falling Rate Period, Calculation of Drying Time under constant drying conditions, Drying Equipments- Dryers for Solids & Pastes, Dryers for Solutions & Slurries.

Unit-V: Mechanical Separations **(12 Hrs)**

Screening, Screening Equipment Comparison of Ideal & Actual Screens, Material Balances over Screens, Screen Effectiveness,Capacity & Effectiveness of Screens, Effect of Mesh Size on capacity of Screen, Capacitics of Actual Screens, Filtration, Cake Filters, Filter Media. Filter aids. Principles of Cake Filtration, Pressure drop through filter cake, Principles of Centrifugal Filtration.

Reference Books:

1. Unit Operations of Chemical Engineering –WL Mecabe, JC. Smith,Peter Harriott
2. Mass Transfer Operations- Robbert E. Treybal
3. Chemical Engineering Vol.2 – J.M. Coulson & J.P. Richardson
4. Principles of Mass Transfer Operations- Kiran D. Patil Nirali Prakashan, Pune)
5.Unit Operations-II - K.A.Gavhane (Nirali Prakashian, Pune)

Second Year: Semester-IV

Skill Development Components

VOC 412- Chemical Reaction Engineering

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide advanced knowledge of Chemical reaction Engineering.
2. To enable the students to understand for various reactor and its design used during the organic process.
3. To update the students with design part of the rector used in reaction engineering.

Course Outcomes: On completion of the course, students should be able to-

1. Learn and write concepts of reactor design
2. Discuss and apply ideal reactor for single reaction.
3. Discuss and apply various designs for Single Reactions
4. Discuss and apply various designs for parallel Reactions
5. Understand and apply concepts of nonideal flow.

Course Contents:

Unit-I: Introduction to Reactor Design **(10 Hrs)**

Broad Classification of Reactor Types, Material balance lor an element of Volume of the reactor, Energy balance for an element of Volume.

Unit-II: Ideal Reactors for a Single Reaction **(20 Hrs)**

Three types ofIdeal Reactors, Ideal Batch Reactor, Space Time & Space Velocity, Steady State Mixed Flow Reactor, (Example 5.1, Example 5.3),Steady State Plug Flow Reactor, (Example 5.5), Holding Time & Space Time for flow reactors.

Unit-III: Design for Single Reactions **(20Hrs)**

Size Comparison of Single Reactors, Batch Reactor, Mixed versus Plug flow Reactors, First & Second Order Reactions. Multiple- Reactor Systems-Plug flow reactors in series and or in parallel, (Example 6.I), Equal size Mixed Flow Reactors in Series, First Order Reaction, Mixed Flow Reactors of Different sizes in Series, finding the conversion in a

given system, Determining the Best System for a given conversion, Maximization of Rectangles, Reactors of types in series, Recycle Reactor & its performance equation.

Unit-IV: Design for Parallel Reactions **(05 Hrs)**

Introduction to Multiple Reactions-Qualitative Discussions about Product Distribution to Multiple Reactions-Qualitative Discussions about Product Distribution.

Unit-V: Basics of Non-Ideal Flow. **(05 Hrs)**

The Residence Time Distriblllion(RTD), E,The Age Distribution of Fluid, Relation among F, C and E curve and 'mean time' for closed vessel.

Reference Books:

1. Chemical Reaction Engineering - Octave Levenspiel (Wiley India Pvt. Ltd. Third Edn.)
2. Chemical Reaction Engineering - K.A.Gavhane Nirali Prakashan, Pune)
3. Principles of Reaction Engineering S.D.Dawandi: (Central Techno Publication)

Second Year: Semester-IV

Skill Development Components

VOC 413- Polymer Material and Physico-chemical Aspects of polymer - II

(04 Credits: 100 Marks)

Learning Objectives:

1. To impart understanding of the necessity and methodology of different polymer testing processes to evaluate polymer properties.
2. To predict major characteristics of a polymer from its chemical structure and molecular architecture.
3. To understand the working principles /experimental methods of various unit operations required in Plastic and Polymer Chemistry.
4. To provide general overview of synthesis, properties,Kinetics and applications of Polymers.

Course Outcomes: On completion of the course, students should be able to-

1. Will be able to discuss kinetics of polymerization.
2. Able to discuss about compound ingredients and cost of plasticizers, stabilizers, fillers, colorants, Additives.
3. Will be able to discuss and understand transitions in Polymers.
4. Able to discuss synthesis, properties and applications of Poly Methacrylate
5. Will acquire knowledge of synthesis, properties and applications of Bisphenol A epoxide.

Course Contents:

Unit-I: Kinetics of polymerization (20 Hrs)

Basic Concepts of theory of polymer solution, deviation of polymer solution from ideal solution, true solution. Cohesive energy density, Headle brand theory-Flory Huggins theory and its modifications. Kinetics of free radical chain, cationic, anionic polymerization.

Unit-II: Compounding ingredients (15 Hrs)

Introduction to compounding ingredients, plasticizers, stabilizers, fillers, colorants, Additives, their effects on processing and cost.

Unit-III: Transitions in polymers (10 Hrs)

Glass transition temperature, determination of glass transition temperature and factors affecting glass transition temperature, glassy solids.

Unit-IV: Chemistry of polymer material (15 Hrs)

1. Poly Methacrylate: Introduction, monomer preparation, polymerization by bulk and suspension polymerization, properties and application.

2. Bisphenol A epoxide: Raw material and their preparation, types of polymerization reaction, resin preparation liquid and solid epoxides their properties and application.

Reference Books

1. Text book of polymer sciences – F. W. Billmeyer
2. Polymer science – V. R. Gowarikar and N. V. Vishwanathan.
3. Polymer science and technology – A. Ghosh
4. Organic polymer chemistry – K J Saunders
5. Physical chemistry of polymer – A Tager
6. Principles of polymerization – George Odian
7. Physical chemistry of macromolecules – D D Deshpande
8. Polymer technology – D C Miles and J H Briston
9. Introduction to plastic technology – Vishu Shah
10. Principles of polymer chemistry – P J Floory
11. Principles of Polymerization- George Odian- Wiley Inter science
12. Polymer Science and Technology: Plastics, Rubber, Blends and Composites- Premamoy Ghosh- Tata McGraw Hill
13. Polymer Science and Technology- Joel R. Fried- Prentice Hall of India Pvt. Ltd.

Second Year: Semester-IV

Skill Development Components

VOC 421- Lab Course: 10

Practical's based on Unit operation-II

(02 Credits: 50 Marks)

Learning Objectives:

1. To make students understand for experiments related to unit operations in Industry.
2. To enable students practically to differentiate between unit process and unit operations.
3. To introduce students/hands on with different unit operations in chemical Industry.

Course Outcomes: On completion of the course, students should be able to-

1. Perform practical on Steam Distillation using Trpentine or Nitrobenzene
2. To demonstrate experiment of Distillation with total reflux using Binary mixture.
3. Perform skillfully experiment on Liquid-Liquid Extraction by using Mixer Settler System.
4. Determine rate of evaporation of given liquid, Size Reduction by using Jaw Crusher, and efficiency of Sieves using Sieve Analyzer.
5. Discuss and perform experiments of determination of Copper and Nickel in the given solution, Estimation of Manganes , Determination of NaOH and Na_2CO_3.
6. Determine thr amount of iron in a water sample by colorimetry.

Course Contents:

1. To Perform a experiment on Steam Distillation using Trpentine or Nitrobenzene and Calculate Material Balance for Steam Distillation..
2. To Perform a experiment on Distillation with total reflux using Binary mixture (Methanol +water or Ethanol+Water) and Determine theoretical plates by McCabe-Thiele Method.
3. To study the experiment on Liquid-Liquid Extraction by using Mixer Settler System & Calculate Percentage of Extraction of a given liquid.
4. Determine the rate of evaporation of given liquid Sample (thin solution of Sugar + Water or NaCl + water or Sugar Canc Juice)in a open pan evaportor
5. To perform a study experiment on Size Reduction by using Jaw Crusher.

6. To Calculate the efficiency of Sieves using Sieve Analyzer (use Coal or any nontoxic substance)
7. Determinntion of Copper and Nickel in the given solution (Idometric Method)
8. Estimation of Manganes: dioxide hpyrolusitc.
9. Determination of NaOH and Na_2CO_3 in the given alkali mixture.
10. Determination of iron in a water sample by colorimetry.

Record book

Viva-voce

Reference Books:

1 Unit Operations-II - K.A. Gavhane
2. Systematic Experimental Physical Chemistry - S.W.Rajbhoj & T.K.Chondhekar
3. Practical Chemistry - S. Umar, J. Sardar & A. Muley
4. University Practical Chemistry, Vishal Publishing Co. Jalandhar-P.C. Kamboj
5. Experiments and Calculations in Engineering Chemistry- S.S. Dara.

Second Year: Semester-IV

Skill Development Components

VOC 422- Lab Course: 11

Practical's based on Chemical Reaction Engineering

(02 Credits: 50 Marks)

Learning Objectives:

1. To impart understanding of the necessity of different chemical reaction engineering.
2. To provide general overview of reaction Kinetics and its applications industry.

Course Outcomes: On completion of the course, students should be able to-

1. Perform practical of saponification of ethyl acetate and NaOH using batch reactor.
2. Demonstatate experiments of autocatalytic reaction between $KMnO_4$ and Oxalic acid.
3. Performs experiments and calculates energy of activation of reaction between pot.Persulphate and pot.Iodide.
4. Determines the energy of activation of reaction between pot.Persulphate and pot.Iodide.
5. Calculates and discuss on energy of activation of hydrolysis of ethyl acetate in presence of NaOH.

Course Contents:

6. To study the saponification of ethyl acetate and NaOH using batch reactor.Determine order of reaction and rate constant.
7. To study the autocatalytic reaction between $KMnO_4$ and Oxalic acid.
8. To determine the rate constant 'K'between $KMnO_4$ and KI having equal concentration by mixed reactor.
9. To determine the energy of activation of reaction between pot.Persulphate and pot.Iodide.
10. To determine energy of activation of hydrolysis of ethyl acetate in presence of NaOH.
11. To determine rate constant (K) of reaction between bromic acid and hydroiodic acid at equal concentration by batch reactor.

Record book

Viva-voce

Reference Books:

1.Chemical Reaction Engineering K.A.Gavhane 2.Systematic

2.Experimental Physical Chemistry - S.W.Rajbhoj & T.K.Chondhekar

Second Year: Semester-IV

Skill Development Components

VOC 423-Lab Course:12

Synthesis, Estimation and Analysis of Polymers

(02 Credits: 50 Marks)

Learning Objectives:

1. General understanding of structure of polymers and predict polymer properties.
2. To provide the practical exposure of polymer synthesis in the laboratory
3. To impart understanding of the necessity and methodology of different polymer testing processes to evaluate polymer properties.
4. To analyse the various properties of polymer materials.
5. To enable the students learn about various polymer testing procedures.

Course Outcomes: On completion of the course, students should be able to-

1. Will be skilful to analyse the polymers by end group method.
2. Able to synthesize PF resin, mono glyceride and Nylon salt.
3. Will be able to perform experiment of method of de polymerization of PS/ PMMA
4. Skilful in testing compound/ resin and product of polymers.
5. Able to determine formaldehyde, carboxyl and amino content in a sample

Course Contents:

1. End group analysis by conduct metrically.
2. End group analysis by pH metrically.
3. Preparation of PF resin.
4. Preparation of mono glyceride.
5. Preparation of Nylon salt.
6. De polymerization of PS/ PMMA.
7. Pyrolytic degradation of PVC.
8. Testing of compound/ resin and product.
9. Degradation of Nylon 6 and Nylon 66.
10. To determine formaldehyde content in a sample.
11. To determine carboxyl and amino potentiometrically.

Record book

Viva-voce

Reference Books:

1. Polymer technology-D.C.Miles and J.H.Briston
2. Introduction to plastic technology-Vishu Shah
3. Principles of polymer chemistry-P. J. Floory
4. Physical Chemistry of Macromolecules-D.D.Deshpande
5. Practical's in Polymer Science-Siddaramaiah
6. Experiments in Polymer Science -D.G.Hundaiwale, V.D.Athawale, U.R.Kapadi ,V.V.Gite.
7. Material Testing Laboratory Manual- C.B.kukreja, K.Kishore and Ravi Chawla.
8. Practical's in Polymer Chemistry- Dr Neha Sen

Second Year: Semester-IV

Skill Development Components

VOC 431-In Plant Training-II (Summer Training)

(04 Credits: 100 Marks)

Learning Objectives:

1. To expose students to practical skill/real work of environment experience and at the same time, to gain the knowledge through hands on observation and job execution within real job situation.
2. To develop skills in work ethics, communication, management and others.
3. To enhance knowledge, self-confidence (useful for own proficiency) of the students, apply their technical knowledge and provides exposure in order to develop the professional skills.

Course Outcomes: On completion of the course, students should be able to-

1. Pick up the details of the work culture.
2. Apply to acquire and apply knowledge/fundamental principles of Polymer Science and Chemical technology.
3. Perform practical with skill in real infrastructure.
4. Able to communicate efficiently.
5. Able to identify, formulate and model problems and finds solution based knowledge.
6. Aware of the social, cultural, global and environmental responsibility as a Polymer Chemist.

Note:

1. Students have to undertake 120 contact hours internship in respective industry during summer vacation at the end of each academic year. This is off campus activity
2. Students should submit report of the in-plant training within seven (07) days after completion of training.

Structure and Scheme of marking of in plant training (summer training)

1. Industrial visit Submission of in plant training report .....(50 Marks)
   Write brief information about history, Physical and chemical properties, raw materials, Methods of production, Manufacturing process description, flow sheet, Material

balance and uses.

2. Writing of synopsis on industrial visit .....(30 Marks)
3. Viva- Voce and presentation.....(20 Marks)

Reference Book:

1) Industrial Training Guideline book-Moon Remyasa.
https://www.academia.edu/9360059/INDUSTRIAL_TRAINING_GUIDELINE_BOOK?auto=download
2) Report writing skills training course-Dr Margaret Green hall
3) Scientific and Technical Report (How to write and illustrate) -B.C. Sharma, (Alpha Science Publications.
4) The art of scientific writing-Wiley- H.F. Ebel, C.Bliefert and W.E.Russey (VCH publications).

Bharat Shikshan Sanstha's

Shri Chhatrapati Shivaji College, Omerga. Dist.
Osmanabad-413606

(Affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.)

B. VOC. in

(Electronic Manufacturing Services)

Syllabus III & IV Semester

Effective From 2021-22

B. VOC. In Electronic Manufacturing Services

Second Year: Semester III

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester III		General Academic Components					
1	VOC 301	Second Language-Hindi	04	0	20	80	4
2	VOC 302	Professional Ethics	04	0	20	80	4
3	VOC 303	Electronic Instruments - Maintenance and troubleshooting	04	0	20	80	4
Semester III		Skill Development Components					
4	VOC 311	Linear Integrated Circuits	04	0	20	80	4
5	VOC 312	Fundamental of 8085 Microprocessor	04	0	20	80	4
6	VOC 313	Sensor Fundamental	04	0	20	80	4
7	VOC 321	Lab Course 7- Linear Integrated Circuits	0	04	25	25	2
8	VOC 322	Lab Course 8- Fundamental of 8085 Microprocessor	0	04	25	25	2
9	VOC 323	Lab Course 9-Sensor Fundamental	0	04	25	25	2
Total			24	12	195	555	30

B. VOC. In Electronic Manufacturing Services

Second Year: Semester IV

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester IV		General Academic Components					
1	VOC 401	Business Communication	04	0	20	80	4
2	VOC 402	Financial Managements and Accounts	04	0	20	80	4
3	VOC 403	Industrial Management	04	0	20	80	4
Semester IV		Skill Development Components					
4	VOC 411	Analog Communication Systems	04	0	20	80	4
5	VOC 412	8086 Microprocessor and interfacing	04	0	20	80	4
6	VOC 413	Properties of Electronic Materials	04	0	20	80	4
7	VOC 421	Lab Course 10- Analog Communication Systems	0	04	25	25	2
8	VOC 422	Lab Course 11-8086 Microprocessor and interfacing	0	04	25	25	2
9	VOC 423	Lab Course 12- Properties of Electronic Materials	0	04	25	25	2
10	VOC 431	In-Plant Training*	0	120	50	50	4
Total			24	12	225	605	34

*Students have to undertake 120 contact hours internship in respective industry during summer vacation at the end of each academic year. This is off campus activity.

*Students should submit report of the in-plant training within seven (07) days after completion of training.

B. VOC. Second Year: Semester III

General Academic Components

VOC 301- Second Language Hindi

(04 Credits: 100 Marks)

उद्देश्य:

1) साहित्य आस्वादन अभिरूची का परिसंस्कार
2) जीवन मूल्यों के प्रति आस्था
3) अत्याधुनिक इलेक्ट्रानिक माध्यमों का परिचय

अध्ययन-अध्यापन प्रक्रिया :

1) व्याख्यान पद्धति
2) लेखन एवं पठन कौशल वृद्धि के लिए अभ्यास
3) दृक-श्रव्य माध्यम का प्रयोग

पाठयपुस्तक:

अ.) गय के विविध आयाम, संपा., प्रो. जयमोहन एम.एस., वाणी प्रकाशन, नई दिल्ली

पाठयक्रम में समाविष्ठ रचनाएँ

1) आत्मवृत्त: मेरा जीवन
2) रेखाचित्र-पीलकंठ मोर
3) संस्मरण -कमला
4) निबंध-शिरीष के पुल
5) यात्रावृत्त - चीडो पर चाँदनी

आ.) प्रयोजनमूलक हिंदी :

1) प्रयोजनमूलक भाषा

अ) भाषा का स्वरूप एक महत्व

आ) भाषा की परिभाषा , विशेषताएँ एवं प्रकार्य

इ) वैश्वीकरण के परिप्रेक्ष्य में हिंदी भाषा का महत्त्व

2) भाषा शिक्षण : स्वरूप एवं प्रक्रिया

अ) भाषा शिक्षण की प्रक्रिया,

आ) भाषा कौशल

1.श्रवण कौशल 2.भाषण कौशल

3.वाचन कौशल 4.लेखन कौशल

3) व्यावसायिक हिन्दी

अ) वाणिज्य व्यापार : तात्पर्य एवं स्वरूप

आ) वाणिज्य व्यापार के साधन

इ (वाणिज्य व्यापार और भाषीक प्रकार्य

ई (वाणिज्य -व्यावसायिक भाषा : संरचनात्मक विशेषताएं

उ) व्यावसायिक पत्र लेखन

4) निबंध लेखन

अ) निबंध : तात्पर्य एवं स्वरूप

आ) निबंध लेखन : साहित्यिक / सामाजिक/ समसामायिक समस्या। वैज्ञानिक विषय

संदर्भ ग्रंथ:

1) साहित्य विधाओं की प्रकृतिः देवी शंकर अवस्थी

2) हिंदी गद्य । विन्यास और विकास : डॉ. रामस्वरूप चतुर्वेदी

3) हिंदी का गद्य पर्व: डॉ. नामवर सिंह

4) हिंदी के अध्यतन अनुप्रयोग: डॉ .माधव सोनटक्के

5) प्रयोजनमूलक तथा व्यावहारिक हिन्दी : डॉ. सुकुमार भंडारे

B. VOC. Second Year: Semester III

General Academic Components

VOC 302- Professional Ethics

(04 Credits: 100 Marks)

Learning Objective:

- To create an awareness on Engineering Ethics and Human Values.
- To install Moral and Social Values and Loyalty
- To appreciate the rights of others.
- To create awareness on assessment of safety and risk

Course Outcomes: By the end of the semester, the student will be able to:

- Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field.
- Identify the multiple ethical interests at stake in a real-world situation or practice.
- Assess their own ethical values and the social context of problems.
- Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human
- Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

Unit I: Introduction to Professional Ethics **(15 Hrs)**

Defination of Profession; Engineering and Professionalism; Two module of professionalism, Defination of Ethics, types of ethics/morality, negative force of engineering ethics-preventive ethics; positive force of engineering ethics- aspirational ethice, Good works, Ordinary positive engineering; case studies based on unit I.

Unit II: Ethics in the World of Business **(15 Hrs)**

Introduction; ethics and Entrepreneurship; Economics and law: Ethics and Management; Business ethic and ethical theory; introduction to welfare, right and justice; introduction to equality, liberty and virtue; introduction to whistle blowing. Case studies based on unit II.

Unit III: The Social and Value Dimension of Technology **(15Hrs)**

Technology and society: Technology optimism and pessimism; computer technology- primary and social interaction of technology and society; trust and reliability- Honesty, form of dishonesty, confidentiality; intellectual prperty; expert witnessing; informing the public; conflict of interest; Case studies based on unit III.

Unit IV: Corporate Social Responsibility **(15 Hrs)**

Introduction, Debate over CSR, business case for CSR, Implementing CSR. Corporate Governance and accountability. Introduction to international Business ethics, Case studies based on unit IV.

Text and Reference Books:

1. Engineering Ethics: Concepts and Cases- C. E. Harris Jr., Michael S. Pritchard, M. J. Rabins: Cengage Learning India Pvt. Ltd. ISBN-8131517292
2. Ehtics and conduct of Business- J. R. Boatright, B. P. Patra; Pearson, ISBN: 9788131759622.
3. Professional Ethics and Human Values- M. Govindrajan, S. Natarjan, V. S. Senthilkumar: prentice hall india learning pvt. Ltd. ISBN-8120348168
4. Ngineering Ethics includes human values- M. Govindrajan, S. Natarjan, V. S. Senthilkumar: prentice hall india learning pvt. Ltd. ISBN-9788120325784.

B. VOC. Second Year: Semester III

General Academic Components

(Generic Skill-IV)

VOC 303- Electronic Instruments - Maintenance and troubleshooting

(04 Credits: 100 Marks)

Learning Objectives:

- This course will help the students learn about the Fundamentals of Troubleshooting Electronic Equipment.
- Learn how to use various tools and equipments to find the fault in electronic.
- Learn how to test if a component is working properly or not and find substitute for it.

Course Outcomes:

By the end of the semester, the student will be able to:

- Explores causes of failures components and devices in electronic systems
- Acquires skill of troubleshooting analog and digital circuits
- Gets acquainted with fault diagnosis procedure
- Understands the importance of preventive maintenance

Unit- I : Failures and Testing of Semiconductor Devices (15 Hrs)

Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure, Test procedures for Diodes, special types of Diodes, Bipolar Junction Transistors, Field Effect Transistors, Thyristors, Operational Amplifiers, Fault diagnosis in op-amp circuits

Unit- II: Troubleshooting Digital Circuits (15 Hrs)

Logic IC families, Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, Digital troubleshooting methods – typical faults, testing digital ICs with pulse generators Logic clip, Logic Probe, Logic Pulser, Logic Current Tracer, Logic Comparator Special consideration for fault diagnosis in digital circuits Handling precautions for ICs sensitive to static electricity Testing flip-flops, counters, registers, multiplexers and de-multiplexers, encoders and decoders; Tri-state logic.

Unit-III: Troubleshooting - Case studies (15 Hrs)

Power supply circuits- Types of Regulators, Power Supply Troubleshooting, SMPS, High Voltage DC Power supplies; Multimeters, signal generators, Oscilloscope – Fault Diagnosis chart, CRT replacement.

Unit- IV: Preventive maintenance (15 Hrs)

Indications for preventive maintenance actions, preventive maintenance of Electronic circuits, mechanical systems, General guideline for cleaning and lubricating.

Books Recommended:

1. Troubleshooting Electronic Equipment, R. S. Khandpur, Tata Mc Graw Hill Publishing Ltd (2007)
2. Electronic Instruments and systems: Principles, maintenance and troubleshooting, R. G. Gupta, Tata Mc Graw Hill Publishing Ltd (2004)
3. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F.M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi (2003)

B. VOC. Second Year: Semester III

Skill Development Components

(Specific Skill Course-VII)

VOC- 311: Linear Integrated Circuits

(04 credits: 100 marks)

Learning Objective:

- To understand the basic concepts of operational amplifier and its various applications.
- To understand the basics of oscillators and its practical applications.
- To study IC 555 timer and its use in different applications.

Course Outcomes:

At the end of the course the student should be able to:

- Understand and analyze the IC 741 operational amplifier and its characteristics.
- Design the solution for linear & non-linear applications using IC741.
- Explain the principles of oscillation and design various oscillator circuits.
- Understand and analyze the IC 555 and its use in various applications.

Unit -I: Operational Amplifier **(15 Hrs)**

Differential amplifier-Dual input balanced output differential amplifier, block diagram of typical Op-Amp, schematic symbol, interpreting data sheet, the ideal Op-Amp, equivalent circuit of an Op-Amp, Op-Amp Parameters-Input-Impedance, Output impedance, input offset voltage, Open Loop Voltage gain, input bias current, slew rate, open loop Op-Amp configurations

Unit -II: Operational Amplifier Applications **(15 Hrs)**

Voltage series feedback amplifier, Voltage shunt feedback amplifier, DC and AC amplifiers, summing, scaling and averaging amplifiers, voltage to current converter (Low voltage DC voltmeter and low voltage AC voltmeter only), integrator, differentiator, basic comparator, zero-crossing detector, Schmitt trigger

Unit -III Oscillators: **(15 Hrs)**

Oscillator principle, oscillator types, frequency stability, phase shift oscillator, Wien Bridge oscillator, square wave generator, triangular wave generator, saw tooth wave generator, voltage-controlled oscillator

Unit -IV The 555 Timer: **(15 Hrs)**

Basic block of IC 555 timer and function of each block, IC 555 as monostable multivibrator, monostable multivibrator applications, IC 555 as an astable multivibrator, astable multivibrator applications, Free running ramp generator.

Books Recommended:

1. Op-Amps & Linear Integrated Circuits (Second Edition) [Chapters 1 to 4], Ramakant Gaikwad, Prentice Hall of India.
2. 2.Electronics Principles and Applications (Fifth edition) [Chapters 1and 2.], John D Ryder

3. Linear Integrated Circuits D Roy Choudhry & Shail B Jain, New Age International Publishing
4. Electronic Devices (Sixth Edition) Floyd, Pearson Education
5. Op Amps & Linear Integrated Circuits James M Fiore, Thomson Learning
6. Integrated Circuits, K R Botkar, Khanna Publishers, New Delhi.

B. VOC. Second Year: Semester III

Skill Development Components

(Specific Skill Course-VIII)

VOC- 312: Fundamental of 8085 Microprocessor

(04 credits: 100 marks)

Learning Objective:

- To understand basic architecture of 8085 Microprocessors and its pin diagram and pin function.
- To understand instruction sets and different addressing modes.
- To understand assembly language programming and its logic.

Course Outcomes:

At the end of the course the student should be able to:

- Explain 8085 microprocessor as central device connected to memory and I/O devices.
- Describe basics of microprocessor, microprocessor architecture and programming.
- Explain & perform experiments based on interfacing microprocessor with memory and various I/O (Input/Output) devices.

Unit I: Overview of Digital Circuit Components **(15 Hrs)**

Introduction, tri-states devices-buffer, controlled buffer register, bus organised structure; Latch, Multiplexer, Demultiplexer, decoder, Arithmetic logic unit, memory-classification, pin connections of memory components.

Unit II: 8085 Microprocessor **(15 Hrs)**

The ideal microprocessor, architecture of microprocessor, organisation of microprocessor, features of Intel 8085, 8085 functional pin description, 8085 CPU architecture, arithmetic and logical group, register group, interrupt control, Serial I/O control group, Instruction register, decoder and control group. Demultiplexing AD7 – AD0, generation of control signals, 8085 clock circuit, basic 8085 microprocessor unit, 8085 instruction fetching and execution operation

Unit III: 8085 Instruction Set and Programming: **(15 Hrs)**

Basic instructions: Instruction classification, Instruction formats. How to write and execute a simple program. Instruction Timings and Operation status. Data transfer instruction. Arithmetic operations, Branch operations.

Programming Techniques: Flow chart, Assembly Language Programs; Looping, Arithmetic Operations related to memory, Logical operations; Rotate, Compare.

Unit IV: Timing Diagram Technique: **(15 Hrs)**

Memory Read, Memory write, OPcode - Fetch with and without wait state, T – state calculation of different instruction. Microprocessor interface: Memory interface, I /O Port interface, programmable peripheral interface, Memory mapped I /O, I /O mapped I /O.

Books Recommended:

1. 8 - bit Microprocessors System Design – V J Vibhte & P B Borole, Technova Publications, PUNE
2. Microprocessor Architecture, Programming, and Applications with the **8085,** (5th Edition) –Ramesh S. Gaonkar, Penram International Publishing.
3. Microprocessors –I –A. P. Godse Technical Publications PUNE
4. Fundamentals of Microprocessor & Microcomputer Controller, B. Ram

B. VOC. Second Year: Semester III

Skill Development Components

(Specific Skill Course-IX)

VOC- 313: Sensor Fundamentals

(04 credits: 100 marks)

Learning Objectives:

To facilitate the students to understand

- the concepts of sensor and the concept of different principles of sensors.
- To provide an opportunity to the students to enter into sensor research.
- To create enthusiasm among the students to undertake research in sensors.

Course Outcome:

After completion of program, Students will be able to –

- understand and explain Sensors, characteristics of sensors, optical fiber and optical sensors.
- analyze the system based on sensor and actuators.
- design and develop sensor devices
- Students will be capable to undertake research in Sensors.

Unit - I: Introduction **(15 Hrs.)**

Sensors and Sensor Science, Sensors – Eyes and Ears of Machines, The Term 'Sensor', Optical Sensors, Physical Sensors, Chemical Sensors, elements of chemical sensors, **Sensor Physics**, Solids, Energy Band Model, Lattice Defects, Ionic Conductance, Hopping, Junctions and Potential Barriers, **Primary electronics for sensors :** Amplification by Operational Amplifier, Instruments for electric measurements.

Unit - II: Sensors and Sensor Characteristics **(15 Hrs.)**

Sensors, Signals, and Systems; Ideal sensor curve, ideal sensor requisite, Sensor Classifications; **Sensor Characteristics**: Transfer Function; Span (Full-Scale Input); Full-Scale Output; Accuracy; Calibration; Calibration Error; Hysteresis; Nonlinearity; Saturation; Repeatability; Dead Band; Resolution; **Parameters of sensors**: Sensitivity, detection limit, response and recovery time, selectivity, dynamic range, linearity, stability.

Unit - III: Optical Sensors **(15 Hrs.)**

Introduction of light detectors: Photodiodes, Phototransistor, Photoresistors; photovoltaic cell, Optical waveguides and fibres, types of optical fibers: single mode, multimode and graded index optical fiber, concept of TIR and ATR, Optical fibre sensors: Introduction and classification of sensors with optical fibres, Optical fibre sensors with amplitude modulation, Sensor with wavelength modulation; Optical chemical sensors: Introduction, Optical sensors: Methods of detection, Evanescent wave sensors.

Unit - IV: Physical Sensors **(15 Hrs.)**

Potentiometric Sensors; Gravitational Sensors; LVDT and RVDT, Eddy Current Sensors, Piezoelectric sensors, **Resistive Sensors:** Potentiometers, Strain gauges; Inductive sensors, Capacitive sensors, Bridge circuits, Displacement Measurements, **Blood Pressure Measurements:** Extravascular sensors, Intravascular sensors, Disposable pressure sensors.

References:

1. Chemical Sensors: An Introduction for Scientists and Engineers: Grundler, Peter; Springer Berlin Heidelberg New York **(2007)**, ISBN 978-3-540-45742-8
2. Modern Sensors Handbook, Edited by Pavel Ripka and Alois Tipek; ISTE Ltd, USA **(2007)**, ISBN 978-1-905209-66-8.
3. Handbook of Chemical and Biological Sensors; Edited by Richard F Taylor, Arthur D Little Inc., Jerome S Schultz, University of Pittsburgh; Institute of Physics Publishing Bristol and Philadelphia; **(1996)** ISBN 0 7503 0323 9
4. Hand Book of Modern Sensors: Physics, Designs and Applications by Jacob Fraden
   Third Edition (Springer-Verlag New York, Inc.) **(2004)**, ISBN 0-387-00750-4.
5. Understanding Smart Sensors By Randy Frank; Second Edition; Artech House Boston. London **(2000),** ISBN 1-58053-398-1.
6. Sensors and Transducers, Third Edition by Ian R. Sinclair; Butterworth-Heinemann publication, Woburn **(2001),** ISBN 0 7506 4932 1
7. Principles of Chemical Sensors: Janata, Jiri 2nd Edition; Springer Dordrecht Heidelberg London, New York **(2009),** ISBN 978-0-387-69930-1 e-ISBN 978-0-387-69931-8
8. Optoelectronics Devices and System SECOND EDITION by S. C. Gupta; Prentice Hall International **(2011)** ISBN: 978-81-203-5065-6
9. Optical Fibers and fiber optic communication Systems by Subir Kumar Sarkar; S Chand & Company Ltd **(2000),** ISBN: 9788121914598
10. Lasers and Optical Fiber Communications by P Sarah; I.K. International Publishing House Pvt Ltd, New Delhi **(2008),** ISBN: 9788189866587 / 8189866583
11. Optoelectronics by R. A. Barapate (Tech-Max Publication) **(2003)**

Lab Course 7-Specific Skill Course-VII

VOC -321: Linear Integrated Circuits

List of Experiment: (At least six experiments have to be performed)

1. Study of Op – Amp as a non-inverting amplifier.
2. Study of Op – Amp as an inverting amplifier.
3. Study of Op – Amp as an inverting adder.
4. Study of Op – Amp as an inverting subtractor.
5. Study of Op – Amp as an integrator.
6. Study of Op – Amp as a differentiator.
7. Study of Op – Amp as a Schmitt trigger.
8. Study of Op – Amp as an analog computer to solve simple equation.
9. Study of Op – Amp as Low voltage DC voltmeter
10. Built and study Wien Bridge oscillator using Op – Amp.
11. Built and study phase shift oscillator using Op – Amp.
12. Built and study astable multivibrator using IC 555.
13. Built and study monostable multivibrator using IC 555.

Lab Course 8-Specific Skill Course-VIII

VOC -322: Fundamental of 8085 Microprocessor

List of Experiment: (At least six experiments have to be performed)

1. Assembly language program to find sum of two 8 bit numbers.

2. Assembly language program to find sum of 8 bit numbers in a given array.

3. Assembly language program to find difference of two given numbers.

4. Assembly language program to find largest/smallest number in a block of data containing N numbers.

5. Assembly language program to find ascending/descending order number in a block of data containing N numbers.

6. Assembly language program to move a block of data from one location to other location.

7. Assembly language program to find a factorial of 8-bit number.

8. Assembly language program to find sum of two 16-bit numbers.

9. Assembly language program to perform one byte BCD addition.

10. Assembly language program to multiply two single byte numbers.

Lab Course 9-Specific Skill Course-IX

VOC -323: Sensor Fundamental

List of Experiment: (At least six experiments have to be performed)

1. Determination of Numerical Aperture of PMMA optical fiber
2. Losses in Optical fiber.
3. Study of Optical to Electrical (O-E) characteristics of fiber optic Phototransistor converter.
4. Study of Electrical to Optical (E-O) characteristics of fiber optic 660nm an 850nm converter.
5. Optical fiber chemical sensor.
6. Study of Potentiometric sensor
7. Study of Displacement sensor
8. Gas sensor based on OCP (organic Conducting Polymers)
9. Gas Sensor based on Single Walled carbon nanotubes (SWNTs)
10. Study of LVDT as displacement Sensor
11. Study of Hall Effect sensor as an event counter

Second Year: Semester IV

General Academic Components

VOC- 401: Business Communication

(4 credit: 100 marks)

Learning Objectives:

- To acquaint students with linguistic practices in business communication
- To provide students with effective business writing skills
- To improve situational analysis capacity in students

Course Outcomes:

On completion of this course, the students will be able to-

- State and use principals of effective writing
- Apply communication as a tool to resolute conflicts
- Analyze a case study
- Categorize communication areas to construct monologues/ dialogues for effective situational communication

Course Contents

Unit I: Introduction to Communication **(12 Hrs)**

Definition of Communication, Classification, Role; Characteristics of successful communication — Importance of communication in business — Communication structure in organization Communication in conflict resolution; Case Studies

Unit II: Writing Skill **(12 Hrs)**

Principles of effective writing — Approaching the writing process systematically: The 3X3 writing process for business communication; Writing routine and persuasive letters — Positive and Negative messages Writing Reports, Writing memos, Case Studies

Unit HI: Case Analysis **(12 hrs)**

Different types of cases — Difficulties and overcoming the difficulties of the case method — Reading a case properly (previewing, skimming, reading, scanning) — Case analysis approaches (Systems, Behavioural, Decision, Strategy) — Analyzing the case — Dos and don'ts for case preparation — Discussing and Presenting of Case Studies

Unit IV: Employment Communication **(12 Hrs)**

Introduction — Composing Application Messages - Writing CVs — Group discussions — Interview skills Impact of Technological Advancement on Business Communication — Technology-enabled Communication - Communication networks — Intranet — Internet — e mails — SMS teleconferencing — videoconferencing; Case Studies

Unit V: Meetings **(12 Hrs)**

Meetings — Planning meetings — objectives — particIpants — timing — venue of meetings —

leading meetings. Meeting Documentation: Notice, Agenda, Resolution & Minutes; Case Studies

References:

Text:

1. Business Communication: Concepts, Cases And Applications — Chaturvedi P. D, & Mukesh Chaturvedi ,2/e, Pearson Education,201 1
2. Business Communication: Process and Product — Mary Ellen Guffey,3/e, Cengage Learning, 2002.
3. Communication — Rayudu C. S, Himalaya Publishing House
4. Business Communication — Lesikar, Flatley, Rentz & Pande, 11/e, TMH, 2010
5. Basic Business Communication — Raj Kumar, Excel Books, 2010

Suggested Reading:

1. Advanced Business Communication — Penrose, Rasberry, Myers, *She,* Cengage Learning, 2004.
2. BCOM — Lehman, DuFrene, Sinha, Cengage Learning, 2/e 2012
3. Business Communication — Madhukar R. K, 2/e, Vikas Publishing House.
4. Effective Technical Communication - Ashraf Rizvi M, TMH, 2005.
5. Business Communication - Sehgal M. K & Khetrapal V, Excel Books.
6. Business Communication — Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012.

Second Year: Semester IV

General Academic Components

VOC 402: Financial Managements and Accounts

(4 Credits: 100 Marks)

Learning Objectives:

- To provide students with primary aspects of financial management
- To acquaint students with basic terminologies of finance and accounting
- To introduce students to the basic rules of accounting and journal
- To provide necessary tools so that students can prepare Trading and Profit and Loss A/c and Balance Sheet

Course Outcomes:

On completion of the course, students should be able to

- Explain concepts, terminologies and functioning of financial accounting
- Elaborate accounting terms, equation and journal
- Apply Voucher approach in accounting
- Prepare trading, profit/loss account and balance sheet

Course Content

Unit I: Financial Management- I **(12 Hrs)**

Concept and Definition, Purpose of Investment, Types of Capital, Working Capital, Sources of Finance, Reserve, Surplus, Financial Accounting, Boo-eeping, Terms used in Boo Keeping, Assets, Liabilities, The Journal and the Ledger, Trial Balance, Trading Account

Unit II: Financial Management- II **(12 Hrs)**

Financial Statements, Financial Ratios, Sources of Finance, Capital, Working Capital, Capitalization, Capital Structure, Difference between Capital, Capitalisation and Capital Structure, Capital Gearing, Factors affecting Requirements for working capital, Return on Investment, International Financial Management

Unit III: Introduction to Financial Accounting **(12 Hrs)**

Accounting-An Introduction: Business transactions, Book-keeping, Accounting and its branches. Nature, functions and objectives of Financial Accounting. Accounting Assumptions-Accounting Concepts: Meaning, concepts: Matching, Accrual, Realisation and Dual Aspect Concept.

Unit IV: Accounting Terms, Accounting Equation and Journal **(12 Hrs)**

Accounting Terms-Accounting Equation, Need of Accounting equation, Meaning and

preparation of accounting equation. Rules of Accounting -Journal Meaning, classification of journal into General journal and special journals (with examples). Incorporation of journal entries involving different accounts. Cash Book Meaning, types-Simple Cash Book, Two column Cash Book and Three column Cash Book.

Unit V: Voucher Approach in Accounting and Financial Statements (12 Hrs)

Vouchers and their preparation - Day Book and Subsidiary Day Books -Recording the vvouchers into Day Books -Recording the Vouchers into Subsidiary Day Books Ledger Posting of Day Book -Posting of Subsidiary Day -Trial Balance -Errors and their Rectification. Capital and Revenue - Preparation of Trading and Profit and Loss Account and Balance Sheet - Preparation of Tradingg and Profit and Loss A/c and Balance Sheet (with adjustments).

References:

Text:

1. Accounting Principles -Anthony, R.N., and J.S. Reece, , Richard D. Irwin, Inc.
2. Financial Accounting: Concepts and Applications -Monga, j.R., Mayoor Paper Backs, New Delhi.
3. Advanced Accounts-Shukla, M.C., T.S. Grewal and S. C. Gupta, Vol-I, S. Chand & Co., New De1hi.

Suggested Reading:

1. Advanced Accountancy Vol-1 - Gupta, R.L. and M. Radhaswamy, Sultan Chand & Sons, New Delhi.
2. Financial Accounting- Maheshwari, S.N. and. S. K. Maheshwari, Vikas Publishing House, New Delhi.
3. Advanced Accounting-Tulsian, P.C.; Tata Me Graw Hill, New Delhi.
4. Compendium of Statements and Standards of Accounting- The Institute of Chartered Accountants of India, New Delhi.

Second Year: Semester IV

General Academic Components

VOC -403: Industrial Management

(4 credits: 100 Marks)

Learning Objectives:

- To make students, understand the role of industrial management in organizations
- To enable students to differentiate between strategic and tactical operations/ decisions
- To introduce students with typical managerial decisions under specific situations
- To provide students with basic concepts of JIT and Lean Operations

Course Outcomes:

On completion of the course, students should be able to-

- Explain key terminologies of Industrial Management
- Describe concept and process of organization
- Discuss basic aspects of product development process
- Emphasize of quality of product and process
- Implement JIT practices in operation realm

Course Contents:

Unit I: Industrial Engineering and Management Science **(12 Hours)**

Concept of Industrial engineering, Roles of Industrial Engineer, Production Management Versus Industrial Engineering, Operation Management, Managerial Economics, Managerial Accounting.

Unit II: Organization **(12 Hours)**

Concept of organization, importance of organization, The process of organization, principles of organization, organizational structure, types of organization. Departmentation, authority, Delegation of authority, group dynamics, organizational change, organizational development, organizational conflict, managerial leadership, communication system, committees, project organization.

Unit III: Product Design, Planning and Development **(12 Hours)**

Introduction to product design, effect of design on cost, requirements of a good product design, factors affecting product design, design by imitation, design of specification and drawings, product planning, product classification, product development, standardization, simplification, specialization, diversification, interchangeability, Process Selection, Process Design, Process Analysis.

Unit IV: Inspection and Quality Control **(12 Hours)**

Definition and concept, purposes or objectives of inspection, inspection of incoming materials, raw or received material, In process inspection, inspection of finished goods, statistical quality control, probability concept, normal distribution, measures of central tendency, sampling inspection, sampling plans, the zero efect concept, quality circle.

Unit V: JIT and Lean Operations **(12 Hours)**

Introduction, The Toyota Approach, Case Studies; Developing the JIT Philosophy, Transitioning to JIT System, JIT in Services, Operations Strategy, Wastes in an Industrial scenario, Concepts f Lean Operations, Case Studies.

References:

Text:

1. Industrial Engineering and Management - O. P. Khanna- Dhanpat Rai Publication.
2. Operations Management — W. J. Stevenson- Mc-Graw Hill Companies

Suggested Reading:

1. General Industrial Management- Henri Fayol.
2. Industrial Management- Bagad V. S.- Technical Publication

Second Year: Semester IV

Skill Development Components

(Specific Skill Course X)

VOC 411: Analog Communication Systems

(4 Credits: 100 marks)

Learning Objectives:

- The fundamentals of signals & linear time invariant systems used in communication systems.
- Knowledge of probability, random variables & random processes
- In depth knowledge of different types of analog communication system and different modulation techniques used in these systems.
- Analysis of noise and its impact on different modulation techniques.

Course Outcomes:

On Completion of this course the students will be able to:

- Analyze analog communications in time domain and frequency domain.
- Distinguish between different analog modulation techniques.
- Understand the importance of noise considerations in communication systems.

Unit I: Modulation Techniques **(15 Hrs)**

Modulation Techniques Various frequency bands used for communication, Types of Communication and need of modulation. Introduction to AM, FM, PM, frequency spectrum of AM Waves, Representation of AM, Power relation in AM waves, Need and description of SSB, Suppression of carrier, Suppression of unwanted side-bands, independent sideband system, Vestigial sideband system, Mathematical representation of FM, Frequency spectrum of AM waves, Phase Modulation, Comparison between analog and digital modulation, wideband and narrow band FM.

Unit II: AM Transmitters and Receivers **(15 Hrs)**

AM Transmitters: Generation of AM, low level and high-level modulation, comparison of levels, AM transmitter block diagram, collector class C modulator, Base Modulator, Transistor Vander Bil modulator, DSB S/C modulator. AM Receiver: Tuned radio frequency (TRF) receiver. Super heterodyne receiver, RF section and characteristics, mixers, frequency changing and tracking, IF rejection and IF amplifiers. Detection and automatic gain control (AGC), AM receiver characteristics.

Unit III: FM Transmitters and Receivers **(12 Hrs)**

FM Transmitters: Basic requirements and generation of FM, FM Modulation methods: Direct methods, Variable capacitor Modulator, Varactor Diode Modulator, FET Reactance Modulator, Transistor Reactance Modulator, Pre-emphasis, Direct FM modulator, AFC in reactance modulator, Disadvantages of direct method, Indirect modulators, RC-phase shift modulators, Armstrong FM systems. FM Receivers: Limiters, single and double-tuned demodulators, balanced slope detector, Foster-Seely or Phase Discriminator, De-emphasis, ratio Detector, Block diagram of FM Receivers, RF Amplifiers, FM Receiver characteristics.

Unit IV: SSB Transmitters and Receivers **(08 Hrs)**

Generator of SSB, balanced modulator circuit, filter method, phase shift method, third method, Phase cancellation method, Demodulation of SSB, product demodulator, Diode detection technique of SSB.

Unit V: Pulse Modulation Techniques **(10 Hrs)**

Pulse amplitude modulation and demodulation, Pulse width modulation and demodulation, Pulse position modulation and demodulation, Sampling theorem, Time Division Multiplexing, Frequency Division Multiplexing.

Text Books:

1. Electronic communication systems by George Kennedy.
2. Principle of communication systems by Taub and schilling.
3. Electronics and Radio Engineering – M L Gupta, Dhanpat Rai & Sons.
4. Electronic Communications [IV Edition] –Dennis Roddy & J Coolen, PHI Private Ltd. New Delhi
5. Advanced Electronic Communication Systems –Wayne Tomasi, PHI publication 2001.
6. Introduction to Telecommunication –A A Gokhale, Thomson Learning.

Second Year: Semester IV

Skill Development Components

(Specific Skill Course XI)

VOC 412: 8086 Microprocessor and interfacing

(4 Credits: 100 marks)

Learning Objective:

Students will be able to-

- Understand outline the history of computing devices.
- Describe the architecture of 8086 microprocessors.
- Develop programs for microprocessor and interface with input and output devices.

Course Outcomes:

At the end of the course, students will develop ability to-

- Define the history of microprocessors.
- Describe the architectures of 8086 microprocessors.
- Draw timing diagram and write programs using 8086
- Distinguish between the different modules of operation of microprocessors.
- Evaluate the appropriateness of a memory expansion interface based on the address reference with particular application.
- Apply the above concepts to real world electrical and electronics problems and applications.

Course Contents

Unit I: The 8086 Microprocessor **(12 Hrs)**

Generation of Microprocessor, registered organization of 8086, features of 8086, Pin diagram (Signal Description), CPU architecture, Physical Memory Organisation, general bus operation, I / O processing capability, special processor activities, minimum mode 8086 system and timing, maximum mode 8086 system and timing

Unit II: The 8086 Microprocessor Instruction set **(12 Hrs)**

Machine language instruction formats, addressing modes of 8086, Data copy / transfer instructions, Arithmetic instructions, logical instruction, Branch instructions, loop instructions, machine control instructions, Flag manipulation instructions, Shift and rotate instructions, String instructions

Unit III: Assembly language programming **(12 Hrs)**

Assembly language programs- addition of two numbers, addition of a series of 8 bit numbers, find the largest number from given array of 8 bit numbers, find out odd and even numbers from the given series of hexadecimal numbers, find out positive numbers and negative numbers from

a given series of signed numbers, move a string of data from one location to other location, arrange given array of 8 bit numbers in ascending order, arrange given array of 8 bit numbers in descending order, one byte BCD addition, factorial of a 8 bit number , average of block of 8 / 16 bit data.

Unit IV: Interface with 8255 and 8251 **(12 Hrs)**

Features of 8255, PIO 8255 pin diagram and architecture, modes of operation of 8255, Interfacing ADC, interfacing of DAC.

Communication Interface-Features of 8251, Methods of data communication, architecture and signal description, operating modes, interfacing and programming of 8251

Unit V: Interface with 8253 and 8257 **(12 Hrs)**

Features of 8253 Pin diagram and architecture, control word, operating modes, programming and interfacing 8253.

DMA 8257- pin description, block diagram, operating modes, programming and interfacing 8257.

Books Recommended:

1. Advanced Microprocessors and Peripherals (Second Edition) – A K Ray & K M Bhurchandi Tata McGraw Hill 2009
2. The INTEL Microprocessors 8086 /8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Processor –Barry B. Brey Printice-Hall INDIA
3. Microprocessors – S. K. Gupta Pragati Prakashan Meerut
4. Microprocessors – II –A. P. Godse Technical Publications PUNE

Second Year: Semester IV

Skill Development Components

(Specific Skill Course XII)

VOC 413: Properties of Electronic Materials

(4 Credits: 100 marks)

Learning Objective:

- To make students to understand basic phenomenon as conductivity, reflection and absorption
- To introduce students to electrical, dielectric, optical and magnetic properties of metal oxides and polymers

Course Outcomes:

After completion of the course students will be able to -

- Understand basic phenomenon as conductivity, reflection and absorption
- Understand electrical, dielectric, optical and magnetic properties of materials
- Analyze the order of magnetic materials
- Screen the wide range of materials for desired application
- Enable to understand the defects in crystals and their effects on various properties

Course Contents:

Unit - I: Electrical Properties of Metals **(10 Hrs.)**

Conductivity, reflection and absorption, Fermi surfaces, superconductivity, thermoelectric phenomena, Conduction in metals oxides, amorphous materials

Unit - II: Dielectric Properties of Materials **(10 Hrs.)**

Macroscopic electric field, local electric field at anatom, dielectric constant and polarizability, ferroelectricity, antiferroelectricity, phase transition, piezoelectricity, ferroelasticity, electrostriction.

Unit - III: Optical Properties of Materials **(15 Hrs.)**

Optical constants and their physical significance, Kramers – Kronig Relations, Electronic inter bond and intra bond transitions, Relations between Optical properties and band structure – colour of material (Frenkel Excitons), Bond Structure determination from optical spectra reflection, refraction, diffraction, scattering, dispersion, photoluminescence, Electroluminiscence.

Unit - IV: Magnetic Properties of Materials **(15 Hrs.)**

Dimagnetism, paramagnetism, various contributions to para and dia magnetism, Adia-batic demagnetization, Paramagnetic susceptibility; Ferromagnetism, ferrimagnetism, ferrites, antiferromagnetism, Curie point, temperature dependence of saturation magnetization, saturation magnetization at absolute zero, magnons and their thermal excitation, dispersion relation, Neutron Magnetic scattering, Ferrimagnetic and antiferrimagnetic order, domains and domain walls, magnetic resonance. Coercive force, hysterisis, methods for parameters measurements

Unit – V: Polymers: **(10 Hrs.)**

Structure of polymers, polymerization mechanism, characterization techniques, optical, electrical, thermal and dielectric properties of polymers. Defects in crystals and their effects on mechanical, electrical and optical properties; Diffusion in materials

References:

1. Electronic Properties of materials, R. E. Hummel Springer New York publication
2. Solid State Physics, Dekkar, Mcgraw Higher Ed publication
3. Introduction to Solid State Physics, C. Kittle, Wiley publication
4. Solid State Physics, Ashcroft, Mermin,Cengage Learning Publication
5. Principles of Electronic materials & dev, S. O. Kasap, Mcgraw Higher Ed Publication
6. Elementary Solid state physics, M. Ali Omar; Pearson Publication.

Second Year: Semester IV

Skill Development Components

Lab Course 10-Specific Skill Course-X

VOC -421: Analog Communication Systems

List of Experiment: (At least six experiments have to be performed)

1. To design and implement Amplitude modulator and Demodulator.
2. To design and implement DSB-SC modulator using Balance modulator.
3. To implement a Phase Lock Loop circuit and calculate it's Specifications.
4. To design and implement Frequency Modulator and Demodulator
5. To design and implement Frequency Division Multiplexer and De-multiplexer
6. To design and implement Pulse Amplitude Modulator (PAM) and Demodulator.
7. To design and implement Pulse Width Modulator (PWM)
8. To design and implement Pulse Position Modulator (PPM)
9. To design and implement sample and hold circuit.
10. To design and obtain the characteristics of a mixer circuit.
11. To design and implement the Pre-emphasis and De-emphasis circuits

Second Year: Semester IV

Skill Development Components

Lab Course 11-Specific Skill Course-XI

VOC -422: 8086 Microprocessor and interfacing

List of Experiment: (At least six experiments have to be performed)

1. Write an ALP for Addition, subtraction, multiplication and division of two 8-bit numbers using 8086 microprocessor.
2. Write an ALP for Data transfer using 8086 microprocessor.
3. Write an ALP for Sum of series using 8086 microprocessor.
4. Write an ALP to find Factorial of a number using 8086 microprocessor.
5. Write an ALP to find Square of a number using 8086 microprocessor.
6. Write an ALP to arrange number of array for Ascending/descending order using 8086 microprocessor.
7. Write an ALP to find square of number using 8086 microprocessor.
8. Interfacing of SPDT switches using 8086 microprocessor.
9. Interfacing of DC motor
10. Interfacing of DAC to generate ramp wave, triangular wave and square wave.

Second Year: Semester IV

Skill Development Components

Lab Course 12-Specific Skill Course-XII

VOC -423: Properties of Electronic Materials

List of Experiment: (At least six experiments have to be performed)

1. Study of band gap of semiconductor using 4 probe method
2. Study the dielectric constant of solids as a function of temperature
3. Study of verification of the Curie law
4. Study of variation of resistivity of given specimen using 4-probe method and determination of its energy bandgap
5. Recording of spectra of given specimen using spectrophotometer
6. Polymerization and study of electrical (I/V) and optical properties of given polymer.
7. Study of reflectance, absorbance and transmission spectra of given specimen.
8. Determination of magnetic susceptibility of diamagnetic and paramagnetic samples using Guoy balance method
9. Study of variation of dielectric constant as a function of temperature and verification of the Curie law and determination of the Curie temperature
10. Study of variation of photoconductivity using polarized light.

Dr BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD (M.S.)

SHRI CHHATRAPATI SHIVAJI COLLEGE, OMERGA

DIST OSMANABAD 413 606 (M.S.)

Course Structure and Syllabus for

Semester V and VI

Polymer Science and Chemical Technology

UGC, New Delhi approved under the Scheme National Skills Qualifications Framework (NSQF)

(3 years - Six Semester Full Time Course)

2020-21& onwards

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Uniform Curriculum Structure of Bachelor of Vocation (B.Voc.) Sem.V & VI

Third Year: Semester-V

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester-V		**General Academic Components**					
1	VOC 501	Personality Development and Stress Management	04	0	20	80	4
2	VOC 502	**Generic Skill-V** Process Equipment Design	04	0	20	80	4
3	VOC 503	**Generic Skill-VI** Advance Polymer Chemistry-I	04	0	20	80	4
Semester-V		**Skill Development Components**					
4	VOC 511	**Skill Specific Course-XIII** Unit Processes in Organic Synthesis	04	0	20	80	4
5	VOC 512	**Skill Specific Course-XIV** Structure and Properties of Polymer-I	04	0	20	80	4
6	VOC 521	**Lab Course 13:** Practical's on Unit Processes in Organic Synthesis	0	04	25	25	2
7	VOC 522	**Lab Course 14:** Practical's on Structure and Properties of Polymer-I	0	04	25	25	2
8	VOC 541	**Major Project-I:**	0	12	75	75	6
Total			**20**	**20**	**225**	**525**	**30**

23/5/22

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University, Aurangabad

Third Year: Semester-VI

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester-VI		**General Academic Components**					
1	VOC 601	Personality Development	04	0	20	80	4
2	VOC 602	**Generic Skill-VII** Unit Operations in Inorganic Synthesis and Industrial Safety.	04	0	20	80	4
3	VOC 603	**Generic Skill-VIII** Process Instrumentation and Plant Utilities.	04	0	20	80	4
Semester-VI		**Skill Development Components**					
4	VOC 611	**Skill Specific Course-XV** Structure and Properties of Polymer-II	04	0	20	80	4
5	VOC 612	**Skill Specific Course-XVI** Advance Polymer Chemistry-II	04	0	20	80	4
6	VOC 621	**Lab-Course 15:** Practical's on Structure and Properties of Polymer-II	0	04	25	25	2
7	VOC 622	**Lab-Course 16:** Practical's on Advance Polymer Chemistry-II	0	04	25	25	2
8	VOC 631	**In-Plant Training-III# (Summer Training)**	0	120	50	50	4
9	VOC 641	**Major Project-II**	0	12	75	75	6
Total			20	20	275	575	34

#Students have to undertake 120 contact hours internship in respective industry during summer vacation at the end of each academic year. This is off campus activity.

#Students should submit report of the in-plant training within seven (07) days after completion of training.

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General Academic Components

Polymer Science and Chemical Technology

Semester-V

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Third Year: Semester-V

General Academic Components

VOC 501-Personality Development and Stress Management

(04 Credits: 100 Marks)

Learning Objectives:

1. To enable the students to understand the necessity of a pleasant personality.
2. Equip students with stress handling practices.
3. Provide effective verbal and non-verbal communication skills to students.
4. Provide effective interview, group discussion and professional skills necessary for global job sector to students.

Course Outcomes:

On completion of the course, students should be able to-

1. Recognize self-management and interpersonal management skills.
2. Identify habits leading to stress.
3. Implement effective verbal and non-verbal communication skills in professional and personal realm.
4. Apply appropriate interview and group discussion skills.

Course Contents:

Unit I: Changed Approach to Learning **(12 Hrs.)**

Introduction, planning and goal setting, understanding people, self-management skills, developing potential and self-actualization, need achievement, conflict resolution skills-seeking Win-Win situation, Interpersonal conflicts, Types of Conflict, Conflict resolution.

Unit II: Stress and Habits **(12 Hrs.)**

Introduction, type of stress-self-awareness about stress, regulating stress- Making the best out of stress, stress coping strategies, Habits-guiding principles, identifying good and bad habits, Habit cycle, breaking bad habits, Zeigarnik effect for productivity and personal growth, forming habit of success.

Unit III: Effective Communication **(12 Hrs.)**

Introduction, Barriers to communication- arising out of sender's/ Receiver personality, Interpersonal transactions, Miscommunication; Non-verbal communication, introduction

Unit-VI: Reaction Vessel **(08 Hrs)**

Introduction, Materials of Construction, Classification of Reaction Vessels. Heating Systems, Design Considerations.

Unit-VII: Corrosion **(08 Hrs)**

Forms of Corrosion, Factors influencing corrosion, Factors preventing corrosion.

Reference Books:

1. Process Equipment Design- M. V.Joshi
2. Process Equipment Design- Mahajani & Joshi
3. Perry's Handbook of Engineering Chemistry

Skill Development Components

Polymer Science and Chemical Technology

Semester-V

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preparation Blocks and graft co-polymers. Technical significance of copolymerization.

Unit-IV: Chemical Properties of Polymer: **(10 Hrs)**

Effects of polymer structure on solubility in different solvents, concept of cohesive energy and solubility parameter, chemical resistance of polymers, diffusion and permeability.

Unit-V: Thermodynamics of Polymer Solutions: **(20 Hrs)**

Laws of thermodynamics, enthalpy, entropy, Gibbs free energy, Helmholtz free energy, Clausius in equality, thermodynamic condition for solubility, Flory-Huggins theory, phase diagrams of binary solution; upper and lower critical solution.

References:

1. Polymer Science and Technology: Plastics, Rubber, Blends and Composites- Premamoy Ghosh **Tata** McGraw Hill

2. Polymer Science and Technology- Joel R. Fried- Prentice Hall of India Pvt. Ltd.

3. Polymer Science- V. R. Gowarikar - New Age International Publishers

4. Introduction to Polymer- Young, R. J., P. A. Lovell- Boca Raton, FL: CRC Press

5. Principles of Polymer Chemistry- P.J. Flory- Cornell Univ. Press, New York

6. Textbook of Polymer Science- Golding- Van Nostrand Reinhold Company

7. Textbook of Polymer Science- P. L. Nayak, S. Lenka and Kalyani

Third Year: Semester-V

Skill Development Components

VOC 511- Skill Specific Course -XIII

Unit Processes in Organic Synthesis

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide advanced knowledge of various unit processes in organic synthesis.
2. To enable the students to understand for various reactions used during the organic process.
3. To update the students with design part of the rector used in organic synthesis.

Course Outcomes:

On completion of the course, students should be able to-

1. Understand and discuss methods of different types of organic reactions used in industry.
2. To understand and apply the scope of design the reactor with respect to organic industrial process.
3. To interpret reaction methods and applications of organic reactions.
4. To explain the organic reactions like nitration, amination, sulphonation, halogenation and polymerization.
5. Understand and explain various terms of unit processes in organic synthesis.

Course Contents:

Unit-I: Nitration -Introduction, Nitrating agent, Aromatic Nitration, Kinetics & Mechanism of aromatic nitration, Nitration of hydrocarbons, Nitrate Esters, N-Nitro Compounds, Process equipment for technical nitration, Batch nitration, Continuous nitration, Mixed acid compositions, DVS calculations, Typical industrial nitration process-Preparation of Nitrobenzene, & m-dinitrobenzene.

Unit-II: Amination by reduction

Introduction, Methods of reduction, Iron & acid reduction, reaction mechanism, Chemical & physical factors, physical condition of iron, Amount of water used, Addition of solvents, yields of aniline, Equipment material of construction, Agitation, Jacketing of reducers, Manufacturing of aniline & Recovery of Aniline, Distillation of Aniline

Unit-III: Halogenation

Introduction, Chlorination, Bromination, Fluorination, Iodination

Unit-IV: Sulfonation & Sulfates

Introduction, Sulfonation, sulfonation agents, sulfonation of aromatic compounds, Benzene & its derivatives, Naphthalene, Anthraquinone derivatives

Unit-V: Polymerization

Introduction, Functionality, Polymeriziation, Polycondensation, Addition, Free radical, Ionic, Bulk, Emulsion, Suspension Polymerisation techniques.

References:

1. Unit Processes in Organic Synthesis- P.H.Groggins
2. Chemical Process – Shreve
3. Industrial Chemistry- B.K.Sharma
4. Polymer Chemistry- Gowarikar
5. Polymer Chemistry- Billmayer

Third Year: Semester-V

Skill Development Components

VOC 512- Skill Specific Course -XIV

Structure and Properties of Polymer-I

(04 Credits: 100 Marks)

Learning Objectives:

1. To enable students for the study of advanced spectroscopic techniques for characterizations.
2. To understand basic necessity for the Inorganic Polymers.
3. To apply spectroscopic concepts for solving the practical problem in synthesis of polymers.
4. General understanding of adhesives, Polymer surface chemistry and chemical processing of Polymers.

Course Outcomes:

On completion of the course, students should be able to-

1. Discuss concept of adhesives like adhesive action, binding process, preparations and applications of adhesives.
2. Understand and discuss recent trends in Inorganic Polymers and biopolymers.
3. Discuss and will solve the problems based on IR, NMR and Mass spectroscopy for determination of structure of polymers.
4. Understand concepts of polymer surface Chemistry.
5. Discuss and apply various techniques of chemical processing useful for polymers.

Course Contents:

Unit-I: Adhesives:

Introduction, classification, adhesive action, development of adhesive action and strength. Factors affecting adhesive action, chemical and physical binding process, Preparative methods of adhesive and comparative applications of adhesives.

Unit-II: Inorganic Polymers:

Introduction to inorganic polymers, history, polyphosphozenes synthesis,properties, structure and applications, Synthesis of silicon fluid, silicon resin, silicon, elastomer, Importance and applications of Inorganic polymers ,Polysiloxanes, types, preparation,properties and

applications,Recent trends of inorganic polymers Introduction to biopolymers.

Unit-III: Spectroscopic studies on polymers:

Infrared spectroscopy of polymer, Sample preparation for IR, measurement qualiative structural analysis with the aid of IR absorption Spectroscopy,NMR and MASS spectroscopic analysis of polymers.

Unit-IV: Polymer Surface Chemistry:

Cohesive energy, surface tension and surface energy, contact angle (definition, theory and application), hydrophilic and hydrophobic polymer surfaces.

Unit-V: Chemical Processing:

General idea about post-synthesis chemical processing of textile fiber, yarn and fabric: desizing, scouring, bleaching (bleaching powder, sodium hypochlorite and hydrogen peroxide), dyeing (types of dyes and their applicability on fibers, dye cycle, Munshell color wheel), mercerization, outline of the types of chemical finishing.

References:

1. Principles of Weaving- R. Marks, A. T. C. Robinson
2. Textile Yarns: Technology, Structure, and Applications- B. C. Goswami, J. G. Martindale, F. L. Scardino John Wiley & Sons Inc.
3. Man-made Fibers (Vol. I & II)- Gordon J. Cook- Woodhead Publishing
4. Dyeing and Chemical Technology of Textile Fibers- E. R. Trotman- John Wiley & Sons Inc.
5. Textile Science: An Explanation of Fiber Properties- E. P. G. Gohl, L.D.Vilensky- Guilford Publications.
6. Textbook of Polymer Science- P. L. Nayak, S. Lenka- Kalyani Publications.
7. Textbook of Polymer Science- Golding- Van Nostrand Reinhold Company
8. Principles of Polymer Chemistry- P.J. Flory - Cornell Univ. Press, New York
9. Polymer Science and Technology: Plastics, Rubber, Blends and Composites- Premamoy Ghosh- Tata McGraw Hill publications.
10. Polymer Science- V. R. Gowarikar - New Age International Publishers
11. Introduction to Polymer- Young, R. J., P. A. Lovell- Boca Raton, FL: CRC Press

Third Year: Semester-V

Skill Development Components

VOC 521- Lab Course-13

Practical's based on Unit processes in Organic Synthesis

(02 Credits: 50 Marks)

Learning Objectives:

1. To enable students for the study of preparative methods for organic reactions.
2. To make skillful techniques which are essential for organic synthesis.
3. To apply the knowledge of synthesis of different reactions like nitration, amination halogenation, sulphonation and polymerization.

Course Outcomes:

On completion of the course, students should be able to-

1. Determine the product by nitration reaction.
2. Calculate percentage yield after preparation.
3. Prepare picric acid, 2,4,6 trinitro benzene.
4. Represent the results after completion of the synthesis.
5. Perform skillfully preparation of the yield by organic synthesis.

Course Contents:

1. To prepare picric acid from phenol and calculate % yield
2. To prepare m-dinitro benzene from nitrobenzene and calculate % yield
3. To prepare p-nitroacetanilide from acetanilide and calculate % yield
4. To prepare 6,6and 6, 10 thread by condensation polymerization.
5. To prepare urea-formaldehyde resin.
6. To prepare poly sulphide rubber.
7. To prepare polystyrene from styrene.

Record Book

Viva-voce

References:

1. Vogel's textbook of practical organic Chemistry- Brain S. Furniss
2. Practical Inorganic Chemistry- Yadav

Third Year: Semester-V

Skill Development Components

VOC 522- Lab Course-14

Practical's based on Structure and Properties of Polymer-I

(02 Credits: 50 Marks)

Learning Objectives:

4. To enable students for the study of methods of analysis of polymers.
5. To make skillful for determination of various analytical methods for polymers
6. To apply the knowledge of synthesis of polymers to different methods of synthesis.

Course Outcomes:

On completion of the course, students should be able to-

6. Determine Molecular weight of polymer by Viscometry.
7. Calculate molecular weight of different polymers by end group analysis method and fractional precipitation.
8. Prepare Laminates and Molding Powder by standard method.
9. Evaluate polymer by standard test method.
10. Perform skillfully purification of vacuum distillation and steam distillation.

Course Contents:

1. Determination of molecular weight by viscometry.
2. Determination of molecular weight by end group analysis.
3. Determination of molecular weight distribution of a polymer sample by fractional precipitation.
4. Preparation of Laminates.
5. Preparation of molding powder.
6. Evaluation of polymer by standard test method.
7. Purification of solvent by vacuum distillation.
8. Steam distillation.

Record Book

Viva-voce

References:

1. Polymer technology-D.C.Miles and J.H.Briston
2. Introduction to plastic technology-Vishu Shah
3. Principles of polymer chemistry-P. J. Floory
4. Physical Chemistry of Macromolecules-D.D.Deshpande
5. Practical's in Polymer Science-Siddaramaiah
6. Experiments in Polymer Science -D.G.Hundaiwale, V.D.Athawale, U.R.Kapadi and V.V.Gite.

Third Year: Semester-V
Skill Development Components
VOC 541- Major Project-I

(06 Credits: 150 Marks)

Learning Objectives:

1. To demonstrate the personal abilities and skills required to produce and present an extended piece of work.
2. To engage in personal inquiry, action and reflection on specific topics and issues. Focus on, and demonstrate an understanding of, the areas of interaction.
3. To develop various activities related to project to learn advanced knowledge in Polymer Science and Chemical Technology with dynamic educational resources and research.
4. To investigate the development of students' ability in Polymer Science and Chemical Technology.

Course Outcomes:

On completion of the course, students should be able to-

1. Demonstrate an understanding of the close relationship between scientific research and the development of new knowledge in a global context.
2. Demonstrate that current scientific knowledge is both contestable and testable by further enquiry;
3. Apply the concepts and theories of a range of advanced topics in chemistry to research in a particular area;
4. Analyze critically, evaluate and transform research findings to complete a range of activities;
5. Practice professional ethics relevant to the chemistry field; well-developed judgment, adaptability and responsibility as a learner.

Guidelines:

1. Every student or group of maximum four students should undertake a project work under the guidance of teacher allotted.
2. The project work could be theoretical on design and development, fabrication of new material, implementing a research paper or application of advanced material.

3. It is essential that the student should concentrate on societal need, feasibility, economy, usefulness, effects on environment and global warming.
4. The students should get their project topic approved by the project in charge/ HOD appointed by Principal.
5. A student has to collect information from hand book, research journals, reference books, proceeding of conference through library or internet.
6. Student should prepare a spiral binding report with detail schedule of activities planned for completion of project and its presentation similar to the seminar report and shall be presented by all the partners dividing presentation among them at the time of examination in presence of guide and external examiner.
7. It is compulsory to continue with same project in next semester and copy of report shall be produced at the time of final dissertation.
8. Student will prepare paper/project to participate in state level/National/International competition. The projects participated shall get additional benefit in final semester based on certificate of participation.
9. It is recommended to follow schedule of activities planned and accordingly have to work for completion of project under the guidance of allotted teacher.
10. Regular monitoring and guidance are expected to complete project in specified duration.
11. Pre-demonstration session shall be arranged at the term end, in order to observe completion of project, corrections, shall be done by guide and committee. Suggestions are to be given for minor improvement in the project/ project report. (If any).
12. Projects / project report must be ready in all respect at the time of final dissertation. Term work marks will be allotted based on pre-demonstration performance, presentation and percentage of theme achieved.
13. Practical examination shall be based on final demonstration / presentation, performance and percentage of theme achieved.

Third Year: Semester-VI

Sr. No.	Course Code	Name of the Course	Contact Hours Per Week		Evaluation Scheme		Credit
			L	P	CIA	SEE	
Semester-VI		**General Academic Components**					
1	VOC 601	Personality Development	04	0	20	80	4
2	VOC 602	**Generic Skill-VII** Unit Operations in Inorganic Synthesis and Industrial Safety	04	0	20	80	4
3	VOC 603	**Generic Skill-VIII** Process Instrumentation and Plant Utilities	04	0	20	80	4
Semester-VI		**Skill Development Components**					
4	VOC 611	**Skill Specific Course-XV** Structure and Properties of Polymer-II	04	0	20	80	4
5	VOC 612	**Skill Specific Course-XVI** Advance Polymer Chemistry-II	04	0	20	80	4
6	VOC 621	**Lab-Course 15:** Practical's on Structure and Properties of Polymer-II	0	04	25	25	2
7	VOC 622	**Lab-Course 16:** Practical's on Advance Polymer Chemistry-II	0	04	25	25	2
8	VOC 631	**In-Plant Training-III# (Summer Training)**	0	120	50	50	4
9	VOC 641	**Major Project-II**	0	12	75	75	6
Total			**20**	**20**	**275**	**575**	**34**

#Students have to undertake 120 contact hours internship in respective industry during summer vacation at the end of each academic year. This is off campus activity.

#Students should submit report of the in-plant training within seven (07) days after completion of training.

General Academic Components

Polymer Science and Chemical Technology

Semester-VI

Uniform pattern 2019

Third Year: Semester-VI

General Academic Components

VOC 601-Entrepreneurship Development

(04 Credits: 100 Marks)

Learning Objectives:

1. To develop and strengthen the entrepreneurial quality,
2. To motivate them for achievement and to enable participants to be independent, capable, promising businessmen.
3. The objective is to make the trainees prepared to start their own enterprise after the completion of the training program.

Course outcomes: After studying this course, you should be able to:

1. Understand the nature of entrepreneurship
2. Understand the function of the entrepreneur in the successful, commercial application of innovations
3. Confirm an entrepreneurial business idea
4. Identify personal attributes that enable best use of entrepreneurial opportunities
5. Explore entrepreneurial leadership and management style.

Unit I: Entrepreneurial Development Perspective **(12 Hrs.)**

Evaluation of the concept of entrepreneur, concepts of Entrepreneurship development, Entrepreneur Vs. Entrepreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager, Attributes and characteristics of a successful entrepreneur, role of entrepreneur in development of Indian Economy.

Unit II: Business Organizations **(12 Hrs.)**

Meaning, types of business organization-sole proprietorship, partnership, Co-operative society, Joint-stock company, selection of an appropriate form of business organization.

Unit III: Creating Entrepreneurial Venture **(12 Hrs.)**

Business planning process, Environmental analysis- search and scanning Identifying problems and opportunities, Defining business Idea.

Unit IV: Project Identification and Report **(12 Hrs.)**

Concept of project, project identification, formulation, appraisal, selection implementation and management, preparation of project report.

Unit V: Tutorial, assignments and presentation based on UNIT I to IV. (12 Hrs.)

Books Recommended:

1) The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, Mumbai, 6th Edition, 2010.
2) Entrepreneurial Development, Khanka S. S., Chand and Company Ltd, New Delhi, Third Revised Edition, 2001.
3) Entrepreneurship Development, Pref. E. Gordon and K. Natarajan.
4) Entrepreneurship Development- Theories and Practices, N. P. Singh
5) Entrepreneurship and Entertainment Development-M. Gangadhar Rao.

Third Year: Semester-VI

General Academic Components

VOC 602-Generic Skill-VII

Unit Processes in Inorganic Synthesis and Industrial Safety

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide a overview of unit processes and its applications.
2. To provide a knowledge of Industrial safety and hazards.
3. To offer knowledge of personal protective equipment's for safety and hazards.

Course Outcomes: On completion of the course, students should be able to-

1. Understand and discuss about unit processes for sulfur and sulphuric acid.
2. Apply and interpret unit processes for ammonia, nitric acid and urea.
3. Discuss Polymer Manufacturing Processes for various polymeric materials
4. Understand basic part of Industrial safety.
5. Discuss and aware about details of fire and explosion in industry.
6. Know and make awareness about personal protective equipment's in industry.

Course Contents:

A) Unit processes in Inorganic Synthesis:

Unit-I : Industrial Process of Sulfur & Sulfuric acid **(04 Hrs)**

Unit-II : Nitrogen Industries: Ammonia, Nitric acid & Urea **(04 Hrs)**

Unit-III : Polymer Manufacturing Process: **(17 Hrs)**

1. Polyethylene & Polypropylene
2. Polyvinyl Chloride
3. Phenol Formaldehyde
4. Epoxy Polymers
5. Butadiene-Styrene Copolymer,

B) Industrial Safety:

Unit-IV : Introduction **(12 Hrs)**

Definition & terms used in context of safety, Accident- Non-reportable & reportable accidents, Hazard, Risk, Acceptance of risk, Responsibilities, Perception of Danger, Job Knowledge. Physical factors for Accidents - Accident ratio, Safety Training-Worker Training,

Role of Supervisor in achieving a high standard of Safety, Supervisory Training Motivation for Safety-Safety Suggestion Scheme, Safety Committee, Safety Competition Safety Contests, Safety Drives, Safety Exhibition & Poster.

Unit-V : Fire & Explosion **(12 Hrs)**

The Chemistry of Fire, Fire triangle, Classification of Fire, Stages of Fire, Causes of Industrial Fire-Electrical Equipment, Smoking, Mechanical Fault, Welding & Gas Cutting, Sparks, Explosives Dusts, Static spark, Runaway Chemical reaction, Fire Detection-Human Observation, Fire Alarm System, Fire Extinguishers-Fixed Firefighting system. Portable fire Extinguishers-Soda acid type, Dry Chemical Powder type, Carbon dioxide type & Foam type Extinguisher.

Unit-VI : Personal Protective Equipment **(11 Hrs)**

Hand Protection, Foot Protection, Head Protection, Eye Protection, Face Protection, Skin & Body Protection, and Protection against fall, Noise Protection, Respiratory Protection-Care & Precaution, External air supply type & Self-Contained Breathing apparatus (SCBA), Selection of Personal protective equipment.

Reference Books

1. Dryden's Outline of Chemical Technology-Gopal rao
2. Introduction to Industrial Safety-K.T.Kulkarni (2002)
Or Concept & Practices in Industrial Safety- K.T.Kulkarni (2007)
3. Handbook of Fire Technology-Gupta R.S. Orient Longman Publication (1993)
4. Hazards in Chemical Units-Pandya C.L. (Oxford ISH -1991)

Third Year: Semester-VI

General Academic Components

VOC 603-Generic Skill-VIII

Process Instrumentation and Plant Utilities

(04 Credits: 100 Marks)

Learning Objectives:

1. To expose students to process instrumentation and its plant utilities.
2. To develop knowledge of various temperature and pressure measurement devices.
3. To enhance knowledge regarding plant utilities and apply their technical knowledge and provides exposure in order to develop the professional skills.

Course Outcomes:

On completion of the course, students should be able to-

1. Understand process for Temperature and pressure measurement instrumentation.
2. Discuss about the utility of water for different processes.
3. Explain role of insulation and its types and properties.
4. Discuss and apply the importance and steam and steam generator.
5. Understand and write about role of air and various compressors in industry.

Course Contents:

A) Process Instrumentation:

Unit-I: Temperature measurement:

a) Glass-Stem Thermometers b) Filled Thermal Systems

c) Liquid-Filled System d) Vapor System

e) Gas-Filled System

2. Bimetallic Thermometers

3. Resistance Temperature Detector (RTD's)

4. Radiation & Pyrometers

Unit-II: Pressure Measurement:

1. Manometers-U tube, Well, Inclined & Micromanoters.

2. Bourdon & Helical pressures Sensors

   a. C-bourdon Pressure Sensors

b. Spiral Bourdon Pressure Sensors c. Helical bourdon Pressure Sensor's

3. Bellows Type Pressure Sensors

a. Motion Balance absolute Pressure b. Force Balance absolute Pressure

3. Diaphragm or Capsule type sensors

4. Pressure Gauges

B) Plant Utilities:

Unit-III: Water

Sources of Water, Hard & Soft water, Causes of Hardness, Disadvantages of hard water, Methods of softening of water, Pre boiling of water-Lime soda Process-Ion Exchange process. Essential characteristics of drinking water, purification of water-Screening Sedimentation, Coagulation, Filtration Treatment to Boiler Feed Water-Formation of Scale, Corrosion, Priming & Foaming, Caustic embrittlement,

Unit-IV: Insulation

Introduction, Insulating Factors, properties of good insulator, Classification-GlassWool Properties & application. Thermocole Properties & application, Cold Insulation, Low Temperature Insulation.

Unit-V: Steam & Steam Generator

Steam-Formation of Steam at constant Pressure, Enthalpy-Enthalpy of water, Enthalpy of Evaporation, Enthalpy of dry saturated steam, Wet Steam, Superheated Steam, Specific Volume of steam. Steam Generator- Classification, Factors for Boiler selection.

Unit-VI: Air

Compressed air, Fan air, Reciprocating Air Compressors, Multistage Compressors. Rotary Compressors.

References:

1. Process Instrumentation-Kirk & Remboy

2. Process Measurement & Analysis (Instrument Engineers' Handbook), Third Edn, (Butterworth Heinemann Publication) - Bela G. Liptak

3. Plant Utilities-D.B.Dhone (Nirali Prakashan)-D.B.Dhone

Skill Development Components

Polymer Science and Chemical Technology

Semester-VI

Uniform pattern 2019

Third Year: Semester-VI

Skill Development Components

VOC 611- Skill Specific Course –XV

Structure and Properties of Polymer-II

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide a general overview of polymers, their types, concept of molecular weight.
2. To provide a general understanding of structure of polymers and predict polymer properties.

Course Outcomes: On completion of the course, students should be able to-

1. Learn and understand Rheology and mechanical properties of polymer.
2. Understand and apply various polymer processing techniques.
3. Able to discuss and apply polymer properties and testing.
4. Learn and discuss fibre technology and electrical and optical technology used for polymer processing.
5. Able to understand and apply various aspects of Mechanical properties for polymers.

Course Contents:

Unit-I: Rheology and mechanical properties (15 Hrs)

Concept of rheology, viscous flow, non-Newtonian fluids. Hooks equation, visco elasticity, Maxwell model, Vioget model, Deformation behavior of polymer material, Relaxation and Retardation. Flexible behavior of polymer in flow.

Unit-II: Plastic processing techniques

Introduction, factors affecting the processing, principles of processing, mixing operation, extruders and extrusion process, compression, injection and transfer moulding and Calendaring

Unit-III: Polymer properties and testing (05 Hrs)

Introduction to mechanical, thermal, electrical and optical properties of polymer.

Unit-IV: Fibre Technology **(15 Hrs)**

Natural and synthetic fibres, fibre properties, tenacity, moisture content and moisture regain crimpt, electrical and mechanical crease, crease resistant and retaining properties fabric stability. Processing of fibre, fibre after treatment, processing properties of polyamides, nylon and PET.

Unit-V: Electrical and Optical Properties **(15 Hrs)**

Effect of polymer structure on dielectric constant, power factor, dissipation factor, loss factor, electrical conductivity, static charges, resistivity and arc resistance of polymers. Effect of polymer structure on optical properties, viz. clarity, transparency, haze, transmittance, absorbance, gloss.

Unit-VI: Mechanical Properties **(10 Hrs)**

Introduction, tensile strength, flexural strength, compressive strength, impact strength, abrasion, fatigue resistance, creep and stress relaxation, hardness, burst strength.

Reference Book

1. Polymer Science and Technology: Plastics, Rubber, Blends and Composites-Premamoy Ghosh- Tata McGraw Hill
2. Plastics Materials- J. Brydson-Butterworth Heinemann
3. Introduction to Polymer Science and Chemistry :A Problem-Solving Approach-Manas Chanda-CRC Press
4. Principles of Polymerization-George Odian-Wiley Interscience
5. Textbook of Polymer Science-F. W. Billmeyer-Wiley Interscience
6. Polymer Science- V. R. Gowarikar-New Age International

Third Year: Semester-VI

Skill Development Components

VOC 612- Skill Specific Course –XVI

Advanced Polymer Chemistry-II

(04 Credits: 100 Marks)

Learning Objectives:

1. To provide knowledge of classification, preparation, properties and applications of advanced polymers.
2. To provide knowledge and make aware about polymer industries and environment.
3. To enable students for study of Stabilizers, Colorants and Processing Aids of polymers.

Course Outcomes: On completion of the course, students should be able to-

1. Discuss the properties and applications of elastomers.
2. Understand and apply the knowledge of polymer composites.
3. Discuss and will aware about polymer industries and its impact on environment.
4. Able to write and discuss on various polymeric materials like foam, adhesive, plastic and rubber.
5. Discuss and apply the processing methods and its aids like Stabilizers, Colorants and Processing Aids.

Course Contents:

Unit-I Elastomers **(10 Hrs)**

Vulcanizations, reinforcement, compounding and elastomeric properties.Preparation, properties and applications of: Styrenebutadine rubber, Nitrile and neoprene rubber and ethylene propylene diene monomer rubber (EPDM).

Unit-II Polymer Composites **(10 Hrs)**

Introduction, classification, type's matrix, particulate fillers, mechanical properties of composites, preparation and applications of composites.

Unit-III Polymer Industries and Environment **(10 Hrs)**

Effluents and their disposal, plastic wastes, sources, disposal wastes, recycling of plastic waste primary and secondary recycling, Biodegradation

Unit-IV: Miscellaneous Materials **(15 Hrs)**

Raw materials and manufacturing of silicones (rubber and plastics) and polyurethanes (foam, adhesive, plastic and rubber)

Introduction and classification of additives, technical requirements of use of additives in polymer compounding, types of additives used in polymers.

Unit-V: Stabilizers, Colorants and Processing Aids **(15 Hrs)**

a) Stabilizers: Photo degradation of polymers, antioxidants, antiozonants, heat stabilizers.

b) Colorants: Pigments and dyes, types of pigments and their role in coloration, master batches, color matching.

c) Plasticizers: Plasticizers and anti-plasticizers, properties, characteristics and applications.

d) Lubricants: Types and effect of lubricants, zinc stearate, waxes.

Reference Book

1. The Additives for Plastics Hand Book- John Murphy- Elsevier Advanced Technology
2. Plastics Additives- R. Gachter and H. Muller- Hanser Publishers
3. Polymer Mixing and Extrusion Technology- Nicholas P. Cheremisionoff - Marcel Decker Inc.
4. Polymer Mixing Technology and Engineering - J. L. White, A. L. Coran and A. Moet
5. Handbook of Industrial Polyethylene and Technology Definitive Guide to Manufacturing, Properties, Processing, applications and Markets- Mark A. Spalding and Ananda M. Chatterjee
6. Practical Guide to Polypropylene- Devesh Tripathi- RAPRA Technology Ltd.
7. Polyurethane and Related Foams- Kaneyoshi Ashida- Taylor and Francis
8. Textbook of Polymer Science-F. W. Billmeyer-Wiley Interscience
9. Polymer Science- V. R. Gowarikar-New Age International
10. Polymer Science and Technology- Joel R. Ried- Prentice Hall

Third Year: Semester-VI

Skill Development Components

VOC 621- Lab-Course 15

Practical's on Structure and Properties of Polymers-II

(02 Credits: 50 Marks)

Learning Objectives:

1. To provide hands on experience of preparation of polymers.
2. To enable students skillful in experiments based on determination of various parameters related to polymer material.

Course Outcomes: On completion of the course, students should be able to-

1. Prepare skillfully PS, PVC and PMMA by bulk, Suspension and solution polymerization.
2. Perform practical's based on determination of Hydroxyl value and iodine value of polymer sample.
3. Determine accurately Total, Temporary and permanent hardness of water.
4. Able to perform and calculate chemical oxygen demand in waste water.
5. Able to synthesize polyvinyl alcohol from polyvinyl acetate.
6. Able to Perform experiment of Softening of water by using ion exchange method.

Course Contents:

1. Preparation of PS, PVC and PMMA by bulk, Suspension and solution polymerization.
2. Preparation of alkyd resin.
3. Determination of Hydroxyl value of polymer sample.
4. Determination of iodine value of polymer sample.
5. Determination of Total, Temporary and permanent hardness of water.
6. Determination of chemical oxygen demand in waste water.
7. Polymer modification: Preparation of polyvinyl alcohol from polyvinyl acetate.
8. Softening of water by using ion exchange method.

Record book

Viva-voce

Reference Book:

1. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar (Anjali Publication, Aurangabad).
2. Practical Physical Chemistry- Dr. M. Satish Kumar
3. Practical's in Polymer Science-Siddaramaiah
4. Experiments in Polymer Science -D.G.Hundaiwale, V.D.Athawale, U.R.Kapadi ,V.V.Gite.
5. A textbook of Engineering Chemistry-S.S.Dara-S.Chand Publications.
6. Practical's in Polymer Chemistry- Dr Neha Sen
7. Text book of Polymer Chemistry- Braja Bandhu Nanda and binita Nanda
8. Material Testing Laboratory Manual- C.B.kukreja, K.Kishore and Ravi Chawla.

Third Year: Semester-VI

Skill Development Components

VOC 622- Lab Course-16

Practical's on Advanced Polymer Chemistry-II

(04 Credits: 100 Marks)

Learning Objectives:

1. To enable the students learn about various polymer testing procedures.
2. To enable the students visualize the test method and machine operations for performing various testing on polymer materials/products.

Course Outcomes: On completion of the course, students should be able to-

1. Understand and perform the practical of molecular weight determination by conductometer.
2. Perform practical based on identification of good/ bad/ theta solvent of polymer.
3. Verify the applicability of a mixture of non-solvents as effective solvent of a polymer
4. Determine and discuss the softening point, swelling parameter, surface energy and refractive index of polymer.
5. Perform with skill the experiments of Melt Flow Index, Hardness of given polymer and Compression strength of given polymer sample.

Course Contents:

1. Determine of molecular weight by conductometric titration.
2. Identification of good/ bad/ theta solvent of polymer.
3. Verify the applicability of a mixture of non-solvents as effective solvent of a polymer.
4. Determination of softening point of polymer.
5. Determination of swelling parameter.
6. Determination of surface energy of polymer.
7. Determination of refractive index of polymer solutions.
8. To determine Melt Flow Index of given polymer sample.
9. To determine the Hardness of given polymer sample.
10. To determine the Compression strength of given polymer sample.

Record Book

Viva Voce

Reference Book:

1. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar (Anjali Publication, Aurangabad).
2. Practical Physical Chemistry- Dr. M. Satish Kumar
3. Practical's in Polymer Science-Siddaramaiah
4. Experiments in Polymer Science -D.G.Hundaiwale, V.D.Athawale, U.R.Kapadi ,V.V.Gite.
5. A textbook of Engineering Chemistry-S.S.Dara-S.Chand Publications.
6. Practical's in Polymer Chemistry- Dr Neha Sen
7. Material Testing Laboratory Manual- C.B.kukreja, K.Kishore and Ravi Chawla.

Third Year: Semester-VI

Skill Development Components

VOC 631- In Plant Training-III (Summer Training)

(04 Credits: 100 Marks)

Learning Objectives:

4. To expose students to practical skill/real work of environment experience and at the same time, to gain the knowledge through hands on observation and job execution within real job situation.
5. To develop skills in work ethics, communication, management and others.
6. To enhance knowledge, self-confidence (useful for own proficiency) of the students, apply their technical knowledge and provides exposure in order to develop the professional skills.

Course Outcomes: On completion of the course, students should be able to-

1. Pick up the details of the work culture.
2. Apply to acquire and apply knowledge/fundamental principles of Polymer Science and Chemical technology.
3. Perform practical with skill in real infrastructure.
4. Able to communicate efficiently.
5. Able to identify, formulate and model problems and finds solution based knowledge.
6. Aware of the social, cultural, global and environmental responsibility as a Polymer Chemist.

Note:

1. Students have to undertake 120 contact hours internship in respective industry during summer vacation at the end of each academic year. This is off campus activity
2. Students should submit report of the in-plant training within seven (07) days after completion of training.

Structure and Scheme of marking of in plant training (summer training)

1. Industrial visit Submission of in plant training report .....(50 Marks)
   Write brief information about history, Physical and chemical properties, raw materials, Methods of production, Manufacturing process description, flow sheet, Material balance and uses.

2. Writing of synopsis on industrial visit .....(30 Marks)
3. Viva- Voce and presentation.....(20 Marks)

Reference Book:

1) Industrial Training Guideline book-Moon Remyasa.
https://www.academia.edu/9360059/INDUSTRIAL_TRAINING_GUIDELINE_BO OK?auto=download
2) Report writing skills training course-Dr Margaret Green hall
3) Scientific and Technical Report (How to write and illustrate) -B.C. Sharma, (Alpha Science Publications.
4) The art of scientific writing-Wiley- H.F. Ebel, C.Bliefert and W.E.Russey (VCH publications).

Third Year: Semester-VI

Skill Development Components

VOC 641- Major Project-II

(06 Credits: 150 Marks)

Learning Objectives:

1 To demonstrate the personal abilities and skills required to produce and present an extended piece of work.

2 To engage in personal inquiry, action and reflection on specific topics and issues. Focus on, and demonstrate an understanding of, the areas of interaction.

3 To develop various activities related to project to learn advanced knowledge in Polymer Science and Chemical Technology with dynamic educational resources and research.

4 To investigate the development of students' ability in Polymer Science and Chemical Technology.

Course Outcomes: On completion of the course, students should be able to-

1 Demonstrate an understanding of the close relationship between scientific research and the development of new knowledge in a global context.

2 Demonstrate that current scientific knowledge is both contestable and testable by further enquiry;

3 Apply the concepts and theories of a range of advanced topics in chemistry to research in a particular area;

4 Analyze critically, evaluate and transform research findings to complete a range of activities;

5 Practice professional ethics relevant to the chemistry field; well-developed judgment, adaptability and responsibility as a learner.

Guidelines:

1 Every student or group of maximum four students should undertake a project work under the guidance of teacher allotted.

2 The project work could be theoretical on design and development, fabrication of new material, implementing a research paper or application of advanced material.

3 It is essential that the student should concentrate on societal need, feasibility, economy, usefulness, effects on environment and global warming.

4 The students should get their project topic approved by the project in charge/ HOD appointed by Principal.

5 A student has to collect information from hand book, research journals, reference books, proceeding of conference through library or internet.

6 Student should prepare a spiral binding report with detail schedule of activities planned for completion of project and its presentation similar to the seminar report and shall be presented by all the partners dividing presentation among them at the time of examination in presence of guide and external examiner.

7 It is compulsory to continue with same project in next semester and copy of report shall be produced at the time of final dissertation.

8 Student will prepare paper/project to participate in state level/National/International competition. The projects participated shall get additional benefit in final semester based on certificate of participation.

9 It is recommended to follow schedule of activities planned and accordingly have to work for completion of project under the guidance of allotted teacher.

10 Regular monitoring and guidance are expected to complete project in specified duration.

11 Pre-demonstration session shall be arranged at the term end, in order to observe completion of project, corrections, shall be done by guide and committee. Suggestions are to be given for minor improvement in the project/ project report. (If any).

12 Projects / project report must be ready in all respect at the time of final dissertation. Term work marks will be allotted based on pre-demonstration performance, presentation and percentage of theme achieved.

13 Practical examination shall be based on final demonstration / presentation, performance and percentage of theme achieved.

Principal
Shri Chhatrapati Shivaji College
OMERGA Dist. Osmanabad

Vice-Principal
Shri Chhatrapati Shivaji College
Omerga Dist. Osmanabad - 41360