Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ Sci./College/NEP-2020/104/2024

It is hereby inform to all concerned that, In continuation circular No.SU./Revised B.Sc./NEP/72/2024/25588-96 dated 29.04.2024, the revised syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technolgy, the Academic Council at its meeting held on 08 April 2024 has accepted **the following Revised B.Sc. Course Structure & Curriculum** as per direction by the State Government dated on 13 March 2024 under the Faculty of Science & Technology (as per National Education Policy – 2020) run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	Physics	Ist and IInd semester
2	Instrumentation Practice	Ist and IInd semester
3	Electronics	Ist and IInd semester
4	Mathematics	Ist and IInd semester
5	Industrial Chemistry	Ist and IInd semester
6	Agrochemical Fertilizer	Ist and IInd semester
7	Horticulture	Ist and IInd semester
8	Biochemistry	Ist and IInd semester
9	Botany	Ist and IInd semester
10	Zoology	Ist and IInd semester
11	Biotechnology	Ist and IInd semester
12	Bioinformatics	Ist and IInd semester
13	Microbiology	Ist and IInd semester
14	Dairy Science & TEchnology	Ist and IInd semester
15	Statistics	Ist and IInd semester
16	computer Science	Ist and IInd semester
17	Geology	Ist and IInd semester
18	Chemistry	Ist and IInd semester
19	Analytical Chemistry	Ist and IInd semester
20.	Polymer Chemistry	Ist and IInd semester
21.	Environmental Science	Ist and IInd semester
22.	Fishery Science	Ist and IInd semester

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This is effective from the Academic Year 2024-25 and onwards.

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

University Campus,
Chhatrapati Sambhajinagar
-431 004.
REF.NO. SU/SCI./2024/27128-35
Date:-27.05.2024.

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Deputy Registrar,
Academic Section.

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar- 431001

B.Sc. Degree Programme

(Three Year / Four Years (Hons) /Four Years (Hons with Research)

Course Structure and Syllabus for B. Sc. First Year

(AS PER NEP-2020)

Subject (Major) : Industrial Chemistry

Effective from 2024-25

PREFACE

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Science (B. Sc.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century.

At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Science (B. Sc.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight.

Furthermore, the curriculum is designed to promote experiential learning, research, and hands-on exploration, recognizing the importance of practical engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in practical settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery.

Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Science (B. Sc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Science (B. Sc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world.

As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Science (B. Sc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.

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PREAMBLE

Dr. Babasahcb Ambedkar Marathwada University proposes to offer a three year a Bachelor Program in Science **B. Sc. (Three / Four Years Honours / Honours with Research Degree) Programme with Multiple Entry and Exit Options** with ***Industrial Chemistry*** as ***Major subjects,*** as per NEP 2020 revised guidelines. Each year is called an academic year and is divided into two semesters. Thus there will be a total of six semesters. The teaching learning process involves theory classes (Periods) of an hour duration and practical classes of four hours duration. The curriculum will be delivered through various methods including chalk and talk, power point presentations (ICT based), audio, video tools, E-learning/ E-content, virtual laboratories, simulations, field trips/ Industry visits, seminars (talks by experts), workshops, projects, models and class discussions. The assessment broadly comprises of Internal Assessment (Continuous Evaluation-CIA) and End Semester Examination (ESS). Each theory paper carries 50 marks with 40% marks for Internal Assessment and 60% for End Semester Examination. The internal assessment will be through MCQ, test, assignment, oral presentation, worksheets and short projects. The learning outcome based curriculum framework is designed around the CBCS and is intended to suit the present day needs of the students in terms of securing their path towards higher studies or employment in industries.

Introduction to B.Sc. Programme with Industrial Chemistry(Major) - The choice based credit system (CBCS) offers flexibility of program structure while ensuring that students gets a strong foundation in the subject and gain in-depth knowledge of all aspects of the field. The new curriculum of ***B.Sc.*** with ***Industrial Chemistry(Major)*** offer courses in the areas of organic, inorganic, physical, materials, analytical and industrial chemistry, Industrial safety. All the courses are having defined learning objectives and Course Outcomes, which will help prospective students in choosing the elective courses to broaden their skills in the field of chemistry and interdisciplinary areas. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. The courses also offers ample skills to pursue research as career in the filed of chemistry and allied areas. The core courses in Industrial Chemistry are designed to familiarize the students with the industrial processes involved in the commercial production of the organic & inorganic industrial products. The program offers wide range of discipline specific major electives M1, M2, M3 with vertical courses like Skill Enhancement Courses (SEC) & Vocational Skill Courses (VSC), Ability Enhancement Courses(AEC), Indian Knowledge System (IKS), Curriulum Courses (CC).

Aim of the Bachelor's Degree Programme in B.Sc.in Industrial Chemistry (Major) - Bachelor course in Industrial Chemistry offers the basic concepts of Chemistry with Industrial applications. The main objective of this degree course is to produce graduates with enhanced skills, knowledge and research aptitude to carry out higher studies or research and development in the various industrial areas. This degree program of Industrial Chemistry prepares the students for immediate entry to the workplace with sound theoretical, experimental knowledge in the area of fuels and energy, environment, health, foods, cosmetics, pharmaceuticals, polymers, petrochemicals and related multidisciplinary fields. Overall, the course offers basic foundation in chemistry which enables the students to understand the concepts in chemical manufacturing processing, engineering and industrial development.

Structure of B. Sc. (Three / Four Years Honours / Honours with Research Degree) Programme with Multiple Entry and Exit Options

Subject(Major): M1: Industrial Chemistry

BSc First Year: 1st Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory **Industrial Chemistry**	DSC-1	**Fluid Mechanics & Lubricants**	2		2		2+2 = 4
	DSC-2	(Practical based on DSC-1) **Lab. Course - 1**		4		2	
Major (Core) M2 Mandatory	DSC-1	-	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Major (Core) M3 Mandatory	DSC-1	-	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	GE/OE-1	To be chosen from the faculty other than that of Major	2		2		2
SEC (Skill Enhancement Courses) (Choose any one from pool of courses)	SEC-1	i) **Introduction to Process Calculations** ii)	1		1		2
	SEC-2	i) **Practicals based on Skills in Process Calculations** ii)		2		1	
AEC, VEC, IKS	AEC-1	**English** (Common for all the faculty)	2		2		2+2 =4
	IKS-1	Choose any one from **pool of courses**	2		2		
OJT/ FP/CEP/CC/RP	CC-1	**Health and Wellness** (Common for all the faculty)		4		2	2
			13	**18**	**13**	**09**	**22**

GE/OE-1 : General Safety Aspects (This course will be available for the students from other faculty)

B. Sc . First Year: 2nd Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) **M1** Mandatory **Industrial Chemistry**	DSC-3	**Heat Transfer , Fuels & Water Analysis**	**2**		2		2+2 = 4
	DSC-4	Practical based on DSC-3 **Lab. Course - 2**		4		2	
Major (Core) **M2** Mandatory	DSC-3	-	2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Major (Core) **M3** Mandatory	DSC-3	-	2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	GE/OE-2	To be chosen from other faculty	2		2		2
VSC (Vocational Skill Courses) (Choose any one from pool of courses)	VSC-1	**i) Some Small Scale Industries ii)**	1		1		2
	VSC-2	**i)** Practicals based on **Some Small Scale Industries ii)**		2		1	
AEC, VEC, IKS	AEC-1	**English** (Common for all the faculty)	2		2		2+2 =4
	VEC-1	**Constitution of India** (Common for all the faculty)	2		2		
OJT/ FP/CEP/CC/RP	CC-2	**Yoga Education /** Sports and Fitness (Common for all the faculty)		4		2	2
			13	**18**	**13**	**09**	**22**
Exit Option : Award of UG Certificate in 3 Majors with 44 credits and an additional 4 credits of core NSQF course / Internship OR continue with Major and Minor							

GE/OE-2 : Industrial Safety Aspects (This course will be available for the students from other faculty)

Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from Basket 1 under the Faculty of Science and Technology.

Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year. Students will have to select / declare choice of major subject either in the first year or second year from / out of such options.

Detailed Illustration of Courses included in 1st and 2nd semester:

1) **Major** (Core) subject are mandatory.

   DSC-1 : This is a 2 credit theory course corresponding to Major (core) subject
   DSC-2 : This is a 2 credit practical course based on DSC-1
   DSC-3 : This is a 2 credit theory course corresponding to Major (core) subject
   DSC-4 : This is a 2 credit practical course based on DSC-3

2) **Generic / Open Elective (GE/OE)**: (Needs to be chosen (any two) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

   GE/OE -1 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.
   GE/OE -2 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

3) **SEC** (Skill Enhancement Courses) : Choose any one from pool of courses. These courses needs to be designed to enhance the technical skills of the students in specific area.
   SEC-1 : This is a 1 credit theory course to enhance the technical skills of the students in specific area.
   SEC-2 : This is a 1 credit practical course based on SEC-1.

4) **VSC** (Vocational Skill Courses) : Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.
   VSC-1 : This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.
   VSC-2 : This is a 1 credit practical course based on VSC-1

5) **AEC** (Ability Enhancement courses): The focus of these courses should be based on linguistic and communication skills. In first semester it will be English and will be common for all the faculty.
   AEC-1 : English
   This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.
   AEC-2 : English
   This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

6) **IKS** (Indian Knowledge System) : The courses related to traditional and ancient culture of India will be included in this section. The respective college will have to choose one of the courses from the pool of courses designed by the University.
   IKS-1 : To be chosen from the pool of courses designed by the University
   This is a 2 credit theory course based on Indian Knowledge System. It will be common for all the faculty

7) **VEC** (Value Education Courses): The courses such as understanding India, Environmental Science / Education, Digital and Technological solutions etc will be part of Value Education Courses.
   VEC-1 : Constitution of India
   This is a 2 credit theory course based on value education. It will be common for all the faculty
8) **CC** (Curricular Courses): The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Preforming Arts.
   CC-1 : Health and Wellness
   This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty
   CC-2 : Yoga education / Sports and Fitness
   This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

General Guidelines for Course Selection

1) The Major subject is the discipline or course of main focus, bachelors degree shall be awarded in that discipline / subject.
2) Students will have to choose any three subjects as a **Major 1, Major 2, Major 3**, from **Basket 1** under the **Faculty of Science and Technology.**
3) Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year.
4) In the beginning of second year, students will have to select / declare choice of **one major subject** and **one minor subject** from three major options M1, M2 and M3 (which were opted in the first year)
5) Once the students finalize their **Major Subject** and **Minor Subject** in the beginning of the second year of the programme, they shall pursue their further education in that particular subject as their **Major and Minor** subjects. Therefore, from second year onwards curriculum of the Major and Minor subjects shall be different.
6) Students are required to select **Minor subject** from other discipline of the same faculty
7) Students are required to select Generic /Open Elective (vertical 3 in the credit framework) compulsorily from the faculty different than that of their Major / Minor subjects.
8) Vocational Skill Courses and Skill Enhancement Courses (VSC and SEC) shall be related to the Major subject

Programme Educational Objectives (PEOs) :

Programme Educational Objectives (PEOs) for the Bachelor of Science Curriculum under the National Education Policy 2020:

1. **Mastery of Discipline-Specific Knowledge**: Graduates of the Bachelor of Science program will demonstrate a deep understanding of fundamental principles, theories, and methodologies in their chosen scientific discipline, enabling them to analyze complex problems, propose innovative solutions, and contribute to advancements in their field.
2. **Interdisciplinary Proficiency**: Graduates will possess the ability to integrate knowledge and skills from multiple scientific disciplines, fostering a holistic approach to problem-solving and innovation. They will be equipped to address multifaceted challenges by drawing upon diverse perspectives and methodologies.
3. **Critical Thinking and Analytical Skills:** Graduates will develop strong critical thinking abilities, enabling them to evaluate information rigorously, analyze data effectively, and make informed decisions based on evidence. They will demonstrate

proficiency in applying logical reasoning and scientific methods to solve problems and generate new knowledge.

4. **Leadership and Innovation:** Graduates will demonstrate leadership qualities and entrepreneurial mindset, capable of initiating and driving positive change in their organizations and communities. They will exhibit creativity, resilience, and adaptability, harnessing innovation to address complex challenges and seize opportunities for growth and advancement.
5. **Global Citizenship and Cultural Sensitivity**: Graduates will possess a global perspective and cultural sensitivity, recognizing the interconnectedness of diverse communities and the importance of collaboration across borders. They will engage in cross-cultural dialogue, embrace diversity, and contribute to the advancement of knowledge and understanding on a global scale.

These Programme Educational Objectives serve as guiding principles for the Bachelor of Science curriculum, reflecting our commitment to nurturing well-rounded graduates who are prepared to excel in their careers, contribute to society, and lead meaningful lives in a rapidly changing world.

Programme Outcomes (POs) :

The National Education Policy (NEP) 2020 for India emphasizes several key aspects for Bachelor of Science (B.Sc.) programs, aiming to produce graduates who are not only well-versed in their respective disciplines but also equipped with skills necessary for holistic development and employability. While specific program outcomes may vary between institutions and disciplines within B.Sc. programs, here are some common outcomes aligned with NEP 2020:

- **PO1.The citizenship and society:** Apply broad understanding of ethical and professional skill in sciencesubjects in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.
- **PO2.Environment and sustainability**: Apply broad understanding of impact of science subjects in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.
- **PO3.Ethics:** Apply ability to develop sustainable practical solutions for science subjectrelated problems within positive professional and ethical boundaries.
- **PO4.Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.
- **PO5.Communication:** Communicate effectively on complex sciencesubject related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO6.Project management and finance**: Demonstrate knowledge and understanding of the first principles of science and apply these to one's own work as a member and leader in a team, to complete project in any environment.
- **PO7.Life-long learning**: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

These program outcomes align with the broader goals of NEP 2020 to transform higher education in India and prepare students for the challenges and opportunities of the 21st

century. Board of Studies designing B.Sc. curricula are encouraged to incorporate these outcomes into their program objectives and learning outcomes.

Programme Specific Outcomes (PSOs):

Programme Specific Outcomes (PSOs)- After successful completion of three-year degree program in Industrial chemistry a student should be able to:

PSO 1 : Understand the fundamental concepts, Aspects of industrial chemistry , principles and processes underlying the academic field of Industrial chemistry, its different streams (*Unit operations I & II, Mass transfer, Heat transfer, Fluid mechanisc, Chemical reaction engineering, Industrial safety , process equioment design, Process instrumentation, Plant utilities, and chemical process prinicples)* and its linkages with related disciplinary areas/subjects.

PSO 2 : Demonstrate the procedural knowledge that creates different types of professionals in the field of Industrial chemistry and related fields such as pharmaceuticals, chemical industry, teaching, research, environmental monitoring, product quality, consumer goods industry, food products, cosmetics industry, polymers & petrochemicals, etc.

PSO 3 : Employ critical thinking and the scientific method to design, carry out, record and analyze the results of Industrial chemistry experiments and get an awareness of the impact of industrial chemistry on the environment and the society.

PSO 4 : Use chemical techniques relevant to academia and industry, generic skills and global competencies, including knowledge and skills that enable students to undertake further studies in the field of industrial chemistry or a related field and work in the chemical and non-chemical industry sectors.

PSO 5: Undertake hands on lab work and practical activities which develop problem solving abilities required for successful and bright career in industry.

PSO 6 : Understand safety aspect of chemicals, transfer and measurement of chemicals, preparation of solution and find out the green route for chemical reaction for sustainable development.

PSO 7 : Create an awareness of the impact ofindustrial chemistry on the environment, society and development outside the scientific community.

Semester –I

DSC-1 : Fluid Mechanics & Lubricants .

Total Credits : 02 Total Contact Hours : 30 Hrs Maximum Marks : 50

Learning Objectives of the Course: The students are expected to learn-

i) Flow of fluids, different types of fluid, types of flow, application of flow,Fluid flow phenomena, Basic equations of fluid flow.

ii) Application of Transportation & metering of fluids,

iii) The liquid lubricants & its composition,applications.

Course Outcomes (COs) : After completion of the course, students will be able to -

i) Understood about different types of flow, types of fluid and its applications.

ii) Acquire knowledge of application of fluid by Orificemeter, Venturimeter.

iii) Understand theliquid lubricants & its composition& applications

Course Content:

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Flow of Fluids:** Definitions of fluids, Classification of fluids, Properties of fluids, Fluid Pressure, Pressure Head, Hydrostatic equilibrium for compressible and incompressible fluids. Application of fluid statics-Manometers, U-tube manometer, Inclined Manometer, Differential Manometer, Continuous gravity decanter, Fluid Flow Phenomena - Types of flow, Laminar flow, Shear Rate and Shear Stress, Turbulence-Reynolds number & Transition from Laminar to Turbulent flow, Reynolds experiment, Boundary layers, Flow in boundary layers, Laminar and Turbulent flow in boundary layers. Basic Equations of fluid flow-Equation of Continuity, Bernoulli's equation, Pump work in Bernoulli's equation and its application.	10 Hrs
II	**Transportation of fluids**: Pipe, Tubing, Fittings & valves. Pumps: Classification of Pump, Developed head, Power requirement, Suction lift and cavitations, Positive- displacement pumps, Reciprocating pumps, Rotary pumps, Centrifugal pumps, Centrifugal pump theory, Ideal pump, Actual pump performance, Power consumption, Efficiency. Air Binding and Pump Priming, Losses in Centrifugal Pump, Centrifugal Pump troubles & Remedies, Pump fails to start pumping, Pump is working but not up to the capacity and pressure, Pump starts and then stop pumping, Pump takes too much power. Metering of fluids: Full bore meters-Principle, Construction and Working, Advantages and Disadvantages of Venturimeter , Orifice meter , Pitot Tube, Rotameter.	10 Hrs
III	**Lubricants** -Classification and properties of lubricants- (viscosity index, cloud point, pore point), lubricating oils (conducting and non-conducting) solid and semisolid lubricants, synthetic lubricants. Oils and Fats: Classification of oils, fat splitting, distillation of completely miscible and non-miscible oils, hydrogenation of oils, rancidity, saponification value, iodine number, acid value, soap and synthetic detergent, preparation of soap and detergent.	10 Hrs

TextBooks: Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000. 2.Unit Operation –Mc Cabe Smith, 3. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997 4. Engineering Chemistry – S.S.Dara

DSC-2 : Laboratory Course –1 (Practicals based on DSC-1)

Total Credits: 02 Total Contact Hours: 60 Hrs

Maximum Marks: 50

Learning Objectives of the Course: The students are expected to learn practically-

i. Flow of fluids, different types of fluid, types of flow, application of flow,Fluid flow phenomena, Basic equations of fluid flow.

ii. Application of Transportation & metering of fluids

iii. the liquid lubricants & its composition,applications.

Course Outcomes (COs) : After completion of the course, students will be able to -

i. Understood about different types of flow, types of fluid and its applications.

ii. Acquire knowledge of application of fluid by Orificemeter, Venturimeter.

iii. Understand theliquid lubricants & its composition& applications

Course Content:

Module No.	Topics / actual contents of the syllabus	Contact Hours
1-14.	1. To Determine the Co-efficient of Venutrimeter. 2. To Determine the Co-efficient of Orifice meter. 3. To Study the Characteristics of Centrifugal Pump. 4. To Verify Hagen-Poisellue's Equation. 5. To Study the Pipe Fittings Test Rig. 6. Determination of Acid Value of Lubricating oil. 8. Determination of Saponification Value of Lubricating oil. 9. Determination of Viscosity of Lubricant by Red Wood Viscometer. 10. Determination of Flash & Fire Point of lubricating oil by Cleveland's Apparatus (Open Cup) 11. Determination of Flash & Fire Point of lubricating oil by Abel's Apparatus (Closed Cup) 12. Determination of Flash & Fire Point of Lubricating oil by Pensky-Marten's Apparatus (Closed Cup). 13. Preparation of Soap. 14. Preparation of Detergent.	60

Text Books:

1. Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000.
2. Unit Operation –Mc Cabe Smith,
3. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997
4. Practical Engineering Chemistry – S.S.Dara

ReferenceBooks:List enclosed.

SEC-1-A : Introduction to Process Calculations

Total Credits : 01 Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course: The students are expected to learn-

i. Units & dimensions, basic quantities, derived quantities.
ii. Basic Chemical Calculations, problems.
iii. Material Balances without Chemical Reaction & Material Balances with Chemical reaction, problem solving

Course Outcomes (COs) : After completion of the course, students will be able to

i. Use different units in process calculations.
ii. The students can explain mole concept, Atomic& Mass weight & physical properties of solid, liquid, & gases.
iii. The students can solve the problems on Material Balances without chemical reaction

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	**Units and Dimensions-**Introduction, Dimensions & Systems of Units, Fundamental Quantities, Derived Quantities, Conversions & Problems. Basic Chemical Calculations-Introduction, Mole, Atomic Mass & Molar Mass, Equivalent Mass, Solids, Liquids & Solutions, Important Physical, Properties of Solutions, Gases & Problems Material balances without chemical reactions - Classification of Material Balance Problems, Material balances without chemical reactions, Outline of Procedure for Material Balance Calculations, Distillation, Evaporation, Absorption, Extraction, Drying, Filtration, Mixing, Crystallization and Problems on Material Balances	15 Hrs

TextBooks:

1. Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000.
2. Unit Operation –Mc Cabe Smith,
3. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997
4. Engineering Chemistry – S.S.Dara

ReferenceBooks: List enclosed.

SEC-1-B : Stoichiometry

Total Credits : 01 Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course: The students are expected to learn-

iv. Units & dimensions, basic quantities, derived quantities.

v. Basic Chemical Calculations, problems.

vi. Material Balances without Chemical Reaction & Material Balances with Chemical reaction, problem solving

Course Outcomes (COs) : After completion of the course, students will be able to

iv. Use different units in process calculations.

v. The students can explain mole concept, Atomic& Mass weight & physical properties of solid, liquid, & gases.

vi. The students can solve the problems on Material Balances without chemical reaction

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	**Material Balances with Chemical Reactions** -Stoichiometry, Stoichiometric Equations, Stoichiometric Coefficients, Stoichometric ratio, Limiting reactant, Excess reactant, Conversion, Yield and Selectivity and Problems on Material Balances with Chemical Reactions. Recycle Operations-Recycling, Recycle stream, Purging Operation, Combined feed ratio, Recycle ratio, Purge ratio, Energy Balances-Forms of energy, first law of thermodynamics, General energy balance procedure, Relationship betwen Cp & Cv, Heat of reaction, Heat of formation, Heat of Combustion , Adiabatic process, Adiabatic reaction, Adiabatic reaction temperature, Heat of solution & mixing.	15 Hrs

TextBooks:

1. Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000.
2. Unit Operation –Mc Cabe Smith,
3. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997
4. Engineering Chemistry – S.S.Dara

ReferenceBooks: List enclosed.

SEC-2 : Lab Course (Based on SEC-1-A)

Total Credits : 01 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: The stuents are expected to learn practical skills , while he performing the experiments in industrial Chemistry.

1. To know the glass wares & apparatus & its calibration, use if it for different experiments.
2. To take mps,bps, of acids, bases,& salts avasilable in the laboratory.
3. Prepration of different concentrations & mixtures of solutions by using Mol./Eqs.wts. of chemical compounds...

Course Outcomes (COs) : After completion of the course, students will be able to –

1. Know easily the different types glass wares & apparatus used for experiments.
2. Acquire knowledge of taking mps/bps of solid , liquid chemical compounds easily.
3. Understand the preparation method of various concentrations , composition & applications.in the lab. Every candidate appearing for the examination must produce a journal ..

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	1. Introduction to Laboratory Equipments & techniques-Glass Apparatus-Flasks, Funnels, Beakers, Stirrers, Std,flasks, Drying apparatus, accessories, thermometers, distillaltion assemblies, etc. 2. Calibration of thermameters, measuring flasks, std, flasks, weights of samples, etc. 3. Preparation of Standard solutions of acids-bases-salts (Oxalic acid-1M, NaOH-1N, NaCl gm/Liter) 4. Preparation of required solutions (0.01M), (0.01N), % composition Solutions from available std. Solution of acids-bases-salts. 5. Determination of mps of Solid copmpunds. 6. Determination of bps of liquid samples in the lab. 7. Use of Mol.Wts/Eq.wts of Chemical compound for perperationn of different strength solutions in gms/lit. 8. To seperate a mixture of Solid +Liquid by filteration technique. 9. To seperate a mixture of liquid + liquid by Saperating funnel by using binary mixture of different density system. 10. To saperate ethanol-water binary mixture by simple distillation technique.	30 Hrs

Text Books: *1.* Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000. 2. Unit Operation –Mc Cabe Smith, 2. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997 4.Engineering Chemistry – S.S.Dara

SEC-2 : Lab Course (Based on SEC-1-B)

Total Credits : 01 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: The stuents are expected to learn practical skills , while he performing the experiments in industrial Chemistry.

4. To know the glass wares & apparatus & its calibration, use if it for different experiments.
5. To take mps,bps, of acids, bases,& salts avasilable in the laboratory.
6. Prepration of different concentrations & mixtures of solutions by using Mol./Eqs.wts. of chemical compounds...

Course Outcomes (COs) : After completion of the course, students will be able to –

1. Know easily the different types glass wares & apparatus used for experiments.
2. Acquire knowledge of taking mps/bps of solid , liquid chemical compounds easily.
3. Understand the preparation method of various concentrations , composition & applications.in the lab. Every candidate appearing for the examination must produce a journal ..

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	1. Use of Mol.Wts/Eq.wts of Chemical compound for perperationn of different strength solutions in gms/lit. 2. To seperate a mixture of Solid +Liquid by filteration technique. 3. To seperate a mixture of liquid + liquid by Saperating funnel by using binary mixture of different density system. 4. To saperate ethanol-water binary mixture by simple distillation technique. 5. To prepare dilute acid solution from concentrate solution by using mole %, Volume % & Weight %. 6. Determination of density, viscosity, & Surface Tension of a sample 7. Handling of fire Extingushers-Safety Aspect.. 8. Preparation of Standard solutions of acids-bases-salts (Oxalic acid-1M, NaOH-1N, NaCl gm/Liter) 9. Preparation of required solutions (0.01M), (0.01N), % composition Solutions from available std. Solution of acids-bases-salts. 10. Determination of mps of Solid copmpunds.	30 Hrs

TextBooks: *1.* Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000. 2. Unit Operation –Mc Cabe Smith, 2. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997 4.Engineering Chemistry – S.S.Dara

This course will be available for the students of other faculty

GE/OE-1 : General Safety Aspects

Total Credits : 01 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: The stuents are expected to learn-

1. General safety guidelines, issuing and returning of Chemicals & Glass wares, Rules for using the instruments
2. Chemical Lab Safety Gudelines-Some common lab instruments like –Centrifuge, Water baths & Heating baths, Shakers,
3. Storage of Chemicals – Flammables,Non Flammable solvents, Acids, Bases, Water Reactive Chemicals,

Course Outcomes (COs) : After completion of the course, students will be able to-

1. Understood about issuing and returning of Chemicals & Glass wares, Rules for using the instruments in keeping in labs.
2. Acquire knowledge of Identification of the Safety equipment, What to be done if a fire occurs, in case ofelectric shock, incase of chemical spill.
3. Acquire knowledge of Storage of Chemicals – Flammables,Non Flammable solvents, Acids, Bases, Water Reactive Chemicals

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction of Safety -** General safety guidelines, issuing and returning of Chemicals & Glass wares, Rules for using the instruments, Protection against common Lab accidents from Fire, Electronic Shock, Explosion, Chemical & Thermal burns, Cuts, Absorption of Chemicals through skin, Inhalation of Chemicals, Ingestion of Chemicals.	10 Hrs
II	**Identification of the Safety equipment** - What to be done if a fire occurs, in case of electric shock, incase of chemical spill, incase of ingenstion or inhalation of chemicals, in case of cuts, in case of burns, electric shock burns, in case of emergencey.	10 Hrs
III	**Chemical Lab Safety Gudelines**-Some common lab instruments like – Centrifuge, Water baths & Heating baths, Shakers, Blenders & Sonicators, Air Ovans, Vaccum Drying Ovan, Viscometer, Handling Glassware, Handling of Gas Cylinder, Special Precautions-Wearing Apron, Using Gloves, Using Goggles, Using Chemical Safety Fume Hoods. Storage of Chemicals – Flammables,Non Flammable solvents, Acids, Bases, Water Reactive Chemicals, Oxidizers, Non Oxidizing gases, Carcinogenic material, Disposal of Chemicals- Solvents, Detergents, Acids & Alkalies, Dry Waste, Carcinogenic material.	10 Hrs

Text Books: . Laboratory Safety Manual-Akanksha Sing, Mahadev Bar, Jyoti, Indian Institute of Technology-Delhi-2011 2. Introduction to Industrial Safety-K.T.Kulkarni

SEMESTER II

DSC-3 : Heat Transfer , Fuels & Water Analysis

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: The students are expected to learn- 1.Conduction ,Convection & Radiation 2.Heat Exchange Equipments 2. Fuels & Water analysis.

Course Outcomes (COs) :

1. Students understood the various forms of heat transfer They knows the various types of heat exchange equipments used in industries & the overall heat transfer coefficients.
2. The students can define solid, liquid & gaseous fuels & refining of Petroleum cracking.
3: The students knows chemical & physical examination of water & its applications.

Course Content:

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Conduction**: Basic law of Conduction, Thermal conductivity, Compound resistances in series, Heat flow through a Cylinder. **Convection**: Classification of Convection. **Radiation**: Absorptivity, Reflectivity and Transmissivity, Krichhoff's law, Laws of black body radiation, Steafan-Boltsmann law, Heat Transfer by radiation. Heat Exchange Equipments:Single pass tubular condenser, Double pipe heat exchanger, Counter Current and Parallel flow, Energy Balances, Enthalpy balances in heat exchangers, Enthalpy balances in total condensers, Overall Heat Transfer Coefficients, LMTD, Individual Heat Transfer Coefficient, Calculation of Overall Coefficients from individual coefficients, fouling factors.	10 Hrs
II	**Fuels-:** Introduction , Calorific Value, Classification & properties of fuels. 1. **Solid Fuels:** Properties , compositiom & Analysis of Coal 2. **Gaseous Fuels:** Classification , Natural gas , LPG 3. **Liquid Fuels:** Petroleum, composition & classification , Defination of Flash point & fire point, knocking , Octane Number, aniline point, refining of petroleum cracking, thermal & catalytic cracking, reforming, thermal & catalytic cracking.	10 Hrs
III	**Water Analysis**: Chemical & physical examination of water, Chemical substances affecting potability, color, Turbidity, odour, taste, temperature, PH conductivity, suspended solid , acidity, alkalinity, free chlorine, calcuium & magnesium, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand and Dissolved solids.	10 Hrs

TextBooks: Unit Operations of Chemical Engineering- McCabe Smith, 2. Unit Operations-I (Fluid Flow & Mechanical Operations)- K. A. Gavhane, 3. Unit Operations-II (Heat & Mass Transfer)- K. A. Gavhane 4. Heat Transfer- K. A. Gavhane, 5. Principles of Heat Transfer & Mass Transfer- S. D. Dawande 6. Industrial Chemistry- B. K. Sharma.

DSC-4 : Lab Course –2 (Practicals based on DSC-3)

Total Credits: 02 Total Contact Hours: 60 Hrs
Maximum Marks: 50

Learning Objectives of the Course: The students are expected to learn- Conduction ,Convection & Radiation 2. Heat Exchange Equipments 3.Fuels & Water analysis.

Course Outcomes (COs) :

1. Students understood the various forms of heat transfer They knows the various types of heat exchange equipments used in industries & the overall heat transfer coefficients.
2. The students can define solid, liquid & gaseous fuels & refining of Petroleum cracking.
3. The students knows chemical & physical examination of water & its applications.

Every candidate appearing for the examination must produce a journal

Course Content:

Module No.	Topics / actual contents of the syllabus	Contact Hours
1-12	1. Determination of hardness of water. 2. Determination of percentage of iron in cement (Volumetrically). 3. Determination of amount of available chlorine in Bleaching powder. 4. Estimation of calcium in limestone. 5. Determination of dissolved oxygen (DO), 6. Determination of chemical oxygen demand (COD) in given wastewater sample. 7. To measure the density of various liquids by pyknometer . 8. To Determine the Chloride Content of water by Mohr's Method. 9. Determination of Alkalinity of Water sample . 10. To determine the thermal conductivity of Bad conductor. 11. To determine the calarific value of coal. 12. To determine Colour, Odour, PH, Conductivity, TDS of water sample..	60

Text Books:

1. Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000.
2. Unit Operation –Mc Cabe Smith,
3. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997
4. Practical Engineering Chemistry – S.S.Dara

ReferenceBooks:List enclosed.

VSC-1-A : Vocational Skill Course

Course Title : Some Small Scale Industries

Total Credits : 01 Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

The students are expected to learn-

2. Small sacale unit of Safety Mathes Industry, Agarbatti, Naphthalene Balls, Wax Candles, Shoe Polish Industries-Other precautions.
3. Small sacale unit of Gum Paste, Writing /Fountain Pen Ink-Permanent inks, Red and green ink, Chalk Crayons, Plaster of Paris, Silicon Carbide Crucibles.
4. Inorganic material industries of Glass, Ceramic, Cement.

Course Outcomes (COs) :

1. The students are learned different small scale manufacturing units.
2. The students can explain how to remove stains- Paan stains, Coalter stains, Hair-dye stains, Tobbacco stains, Iron stains, Sweat stains, Grease stains, Cutter splash stains, Tea & Coffee stains, Gum stains.
3. The students easily explain physical & Chemical Properties , Characteristics, Raw Materials, Chemical Reactions, Uses, Methods of Manufacture of Glass, ceramic, & cement.

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	**Small scale manufacturing units**- Safety Matches Industry, Agarbatti, Naphthalene Balls, Wax Candles, Shoe Polish Industries-Other precautions Gum Paste, Writing /Fountain Pen Ink-Permanent inks, Red and green ink, Chalk Crayons, Plaster of Paris, Silicon Carbide Crucibles. How to remove stains- Paan stains, Coalter stains, Hair-dye stains, Tobbacco stains, Iron stains, Sweat stains, Grease stains, Cutter splash stains, Tea & Coffee stains, Sum stains, Oil stains, some care is needed while you use these remedies to remove stains. Inorganic material unit- Glass: Introduction, physical & Chemical Properties of Glass, Characteristics, Raw Materials, Chemical Reactions, Methods of Manufacture of Glass & Uses.	15 Hrs

TextBooks:

1. Unit Operation –Mc Cabe Smith,
2. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997
3. Engineering Chemistry – S.S.Dara

ReferenceBooks: List enclosed.

VSC-1-B : Vocational Skill Course
Course Title : Small Scale Units

Total Credits : 01 Total Contact Hours : 15 Hrs
Maximum Marks : 50

Learning Objectives of the Course: The students are expected to learn-

i. Units & dimensions, basic quantities, derived quantities.
ii. Basic Chemical Calculations, problems.
iii. Material Balances without Chemical Reaction & Material Balances with Chemical reaction, problem solving

Course Outcomes (COs) : After completion of the course, students will be able to

i. Use different units in process calculations.
ii. The students can explain mole concept, Atomic& Mass weight & physical properties of solid, liquid, & gases.
iii. The students can solve the problems on Material Balances without chemical reaction

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	**Inorganic Material Uits-** **Glass**: Introduction, physical & Chemical Properties of Glass, Characteristics, Raw Materials, Chemical Reactions, Methods of Manufacture of Glass & Uses. **Ceramics:** Introduction, Classification and general properties of ceramics, basic raw material, manufacturing process, manufacture of porcelain and china, Refractories, classification, properties, Manufacture of refractories, manufacture of fire clay brics. **Cement:**Introduction, Composition, Types of Cement, Raw Materials, Manufacture of Cement by Wet & Dry Process, Reactions in the Kiln, Setting of Cement, Testing & Uses of Cement. **Small scale units** - Safety Matches Industry, Agarbatti, Naphthalene Balls, Wax Candles, Shoe Polish Industries-Other precautions.Gum Paste, Writing /Fountain Pen Ink-Permanent inks, Red and green ink, Chalk Crayons, Plaster of Paris, Silicon Carbide Crucibles.	15 Hrs

TextBooks:

1. Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000.
2. Unit Operation –Mc Cabe Smith,
3. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997
4. Engineering Chemistry – S.S.Dara

ReferenceBooks: List enclosed.

VSC-2 : Lab Course (Based on VSC-1-A)

Total Credits : 01 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: To acquire knowledge about various experiment such as preparation of various small scale products like shampoo, mosquito coil, Hand sanitizers to motivate students to develop small scale industrial products.

Course Outcomes (COs) : After completion of the course, students will be able to - preparation of various small scale products like shampoo, mosquito coil, Hand sanitizers Every candidate appearing for the examination must produce a journal showing that he/she has completed the experimnts during the semester/academic year. The journal must be certified at the end of the semester /academic year by the Head of ther department.

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	1. Preparation of Talcum Powder 2. Preparation of Shampoo. 3. Preparation of Hair Removal. 4. Preparation of Enamal. 5. Preparation of Face Creams. 6. Preparation of Asprin/Disprin. 7. Preparation of Nail Polish 8. Preparation of Nail Polish Removal 9. Preparation of Mosquito Coil. 10. Preparation of Magnecium Bisilicate(Antacids) 11. Preparation of Hand Sanitizers 12. Determination of percentage of iron in cement (Volumetrically). 13. Determination of amount of available chlorine in Bleaching powder. 14. Estimation of calcium in limestone.	30 Hrs

Text Books: *1.* Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000. 2. Unit Operation –Mc Cabe Smith, 2. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997

VSC-2 : Lab Course (Based on SEC-1-B)

Total Credits : 01 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: To acquire knowledge about various experiment such as preparation of various small scale products like shampoo,mosquito coil, Hand sanitizers to motivate students to develop small scale industrial products.

Course Outcomes (COs) : After completion of the course, students will be able to - preparation of various small scale products like shampoo, mosquito coil, Hand sanitizers Every candidate appearing for the examination must produce a journal showing that he/she has completed the experimnts during the semester/academic year. The journal must be certified at the end of the semester /academic year by the Head of ther department.

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	1. Preparation of Asprin/Disprin. 2. Preparation of Nail Polish 3. Preparation of Nail Polish Removal 4. Preparation of Mosquito Coil. 5. Preparation of Magnecium Bisilicate(Antacids) 6. Preparation of Hand Sanitizers 7. Preparation of Agarbatties 8. Preparation of Vax Candles 9. Preparation of Shoe Polish 10. Preparation of Gum Paste 11. Determination of percentage of iron in cement (Volumetrically). 12. Determination of amount of available chlorine in Bleaching powder. 13. Estimation of calcium in limestone	30 Hrs

TextBooks: *1.* Unit Operation –I-K.A.Gavhane, Nirali Prakashan, 2000. 2. Unit Operation –Mc Cabe Smith, 2. Industrial Chemistry –B.K.Sharma, Goel publication House, Meerut,1997.

This course will be available for the students of other faculty

GE/OE-2 : Industrial Safety Aspects

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: The stuents are expected to learn-

1. Introduction to Industrial safety: Defination & terms used in context of safety, Accident- Nor reportable & reportable accidents.
2. Fire & Explosion- The chemistry of fire, fire triangle, classification of fire. Stages of fire.
3. Fire Safety Equipments-Fire Extinguishers-Fixed fire fighting system, Portable fire Extingusishers-1) Soda acid type

Course Outcomes (COs) : After completion of the course, students will be able to

1-Understood Defination & terms used in context of safety, Accident-Nor reportable & reportable accidents.

2 -Fire & Explosion- The chemistry of fire, fire triangle, classification of fire. Stages of fire.

3 - Acquire knowledge of Fire Safety Equipments-Fire Extinguishers-Fixed fire fighting system, Portable fire Extingusishers-1) Soda acid type

Course Content:

	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction of Safety** - General safety guidelines, issuing and returning of Chemicals & Glass wares, Rules for using the instruments, Protection against common Lab accidents from Fire, Electronic Shock, Explosion, Chemical & Thermal burns, Cuts, Absorption of Chemicals through skin, Inhalation of Chemicals, Ingestion of Chemicals.	10 Hrs
II	**Identification of the Safety equipment** - What to be done if a fire occurs, in case of electric shock, incase of chemical spill, incase of ingenstion or inhalation of chemicals, in case of cuts, in case of burns, electric shock burns, in case of emergencey.	10 Hrs
III	**Fire Safety Equipments**Fire Extinguishers-Fixed fire fighting system, Portable fire Extingusishers-1) Soda acid type, 2) Dry chemical powder type, 3) Carbon dioxide type 4) Foam type Extinguisher.Personal Protective equipment-Hand protection, Foot protection, Head Protection, Eye protection, Face protection, Skin & Body protection. Protection against Fall, Noise protection, Respiratory protection-Care & Precaution, External air supply type & self contained breathing apparatus, Selection of personal protective equipment.	10 Hrs

Reference Books –Introduction to Industrial safety- K.T.Kulkarni (2002) Or Concept & Practices in Industrial Safety-K.T.Kulkarni(2007), Handbook of fire technology-R.S.Gupta Orient Longman publication(1992), Hazzards in Chemical units-C.I.Pandya (Oxford ISH-1991).

List of Reference Books for Industrial Chemistry:

1. Industrial Chemistry :
   An Introduction:D.A.Skoog,D.M.WestandF.J.Holler,Saunders College publishers, 6th edition.
2. An Introduction to Industrial Chemistry
   ,S.A.Iqbal,M.Satake,Y.MidoandM.S.Shethi.
3. College Industrial Chemistry: Joshi, Baliga and Shetty, Himalaya Publishinghouse.
4. Qualitative analysis: Day andUnderwood.
5. Qualitative inorganic analysis: A. I.Vogel.
6. Principles of Industrial Chemistry: Pandit andSoman.
7. Anayltical chemistry, G. D. Christian, J. Wiley eastern pressLtd.
8. Industrial Chemistry: AlkaGupta.
9. Basic concepts of Industrial Chemistry: S. M.Khopkar.
10. Advanced practical organic chemistry:Vishnoi.
11. Qualitative analysis: A laboratory manual: Day andUnderwood.
12. Fandamentals of Industrial Chemistry: D. A. Skoog, D.M. West and H. J. Holler, 7th edition.
13. Industrial Chemistry principles: J. H. Kennedy, W. B. S. Saunders pub.Ltd.
14. Industrial Chemistry: Principles and Techniques: L. G. Hargis, PrenticeHall.
15. Principles in semi-micro qualitative analysis: G. R. Chatwal edited by M.Arora.
16. Experiments in chemistry: D. V.Jahagirdar.
17. A text book of experimental and calculation in engineering chemistry: S. S.Dara.
18. Industrial Chemistry: Pitrzyk and Frank, secondedition.
19. Modern Industrial Chemistry: W. F. Pickering, Marcel Decker INC. NewYork.
20. Introduction to chromatography: Srivastava andSrivastava.
21. University Practical Chemistry by PC Kamboj, Vishal Publishing Company,Jalandhar.
22. Food Chemistry by L.W. Aurand and A.E. woods the AVI PublisingInc.
23. Food Chemistry by L.H. Meyer, AffliatedEast- West press Ltd, NewDelhi.
24. Foods- Facts and principles by N. Shakuntala Manay, M. ShdaksharaSwamy.
25. Principles of Food Chemistry by John M.deMan.
26. Principles of Food Science, Part I,Food Chemistry edited by Owen R. Fennama , Mareal Dekker, Inc., NewYork.
27. Hand book of Food and Nutrition by M.Swaminathan
28. Practical Chemistry (for B.Sc.I, II & III Year Students of All Indian Universities) Dr.O.P.Panday, D.N. Bajpai & Dr. S. Giri, S.Chand& Company, NewDelhi.
29. Vogel, A.I. A Textbook of Quantitative Inorganic Analysis,ELBS.
30. Khosla,B.D.;Garg,V.C.&Gulati,A.SeniorPracticalPhysicalChemistry,R.Chan d& Co.: New Delhi(2011).
31. Garland,C.W.;Nibler,J.W.&Shoemaker,D.P.ExperimentsinPhysicalChemistr y8th Ed.; McGraw-Hill: New York(2003).
32. Halpern,A.M.&McBane,G.C.ExperimentalPhysicalChemistry3rdEd.;W.H.Fre eman & Co.: New York(2003)
33. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education(2009)
34. Furniss,B.S.;Hannaford,A.J.;Smith,P.W.G.;Tatchell,A.R.PracticalOrganicChe mistry, 5th Ed., Pearson(2012)
35. Khosla,B.D.;Garg,V.C.&Gulati,A.,SeniorPracticalPhysicalChemistry,R.Chan

d& Co.: New Delhi(2011).
36. Athawale, V. D. & Mathur, P. Experimental Physical Chemistry New Age International: New Delhi(2001).
37. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University ofDelhi.
38. Arthur, I. V. Quantitative Organic Analysis,Pearson.
39. Garland,C.W.;Nibler,J.W.&Shoemaker,D.P.ExperimentsinPhysicalChemistry 8th Ed.; McGraw-Hill: New York(2003).

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