

# University of Mumbai



No. AAMS\_UGS/ICC/2024-25/10

## CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office Circular No. UG/73 of 2018-19 dated 06<sup>th</sup> July, 2018 relating to the revised syllabus as per the (CBCS) for the Chemistry of T.Y.B.Sc. Physical Chemistry, Inorganic Chemistry, Organic Chemistry and Analytical Chemistry (Sem -V & VI) (3 and 6 units) including Applied Component Drugs and Dyes, Heavy Fine Chemicals and Petrochemicals.

They are hereby informed that the recommendations made by the **Board of Studies in Chemistry** at its meeting held on 11<sup>th</sup> May, 2024 and subsequently passed by the Board of Deans at its meeting held on 24<sup>th</sup> May, 2024 vide item No. 6.13 (R) have been accepted by the Academic Council at its meeting held on 24<sup>th</sup> May, 2024 vide item No. 6.13 (R) and that in accordance therewith, the **revised syllabus for T.Y.B.Sc. Applied Component (Petrochemicals) – Sem V & VI (CBCS)** has been brought into force with effect from the academic year 2024-25.

(The said circular is available on the University's website [www.mu.ac.in](http://www.mu.ac.in)).

MUMBAI – 400 032  
25<sup>th</sup> June, 2024

*Baliram*  
(Prof. (Dr.) Baliram Gaikwad)  
I/c. REGISTRAR

To,

The Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.13 (R) /24/05/2024

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies **Chemistry**,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL,
- 7) The Deputy Registrar, Admissions, Enrolment, Eligibility & Migration Department (AEM),
- 8) The Deputy Registrar, Result Unit,
- 9) The Deputy Registrar, College Affiliations Development Department (CAD)

**Copy to :-**

- 1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
- 2. The Deputy Registrar, College Affiliations & Development Department (CAD),**
- 3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
- 4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
- 5. The Deputy Registrar, Executive Authorities Section (EA),**
- 6. The Deputy Registrar, PRO, Fort, (Publication Section),**
- 7. The Deputy Registrar, (Special Cell),**
- 8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
- 9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

**They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.**

- 1. P.A to Hon'ble Vice-Chancellor,**
- 2. P.A Pro-Vice-Chancellor,**
- 3. P.A to Registrar,**
- 4. All Deans of all Faculties,**
- 5. P.A to Finance & Account Officers, (F.& A.O),**
- 6. P.A to Director, Board of Examinations and Evaluation,**
- 7. P.A to Director, Innovation, Incubation and Linkages,**
- 8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
- 9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
- 10. The Director of Board of Student Development,**
- 11. The Director, Department of Students Welfare (DSD),**
- 12. All Deputy Registrar, Examination House,**
- 13. The Deputy Registrars, Finance & Accounts Section,**
- 14. The Assistant Registrar, Administrative sub-Campus Thane,**
- 15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
- 16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
- 17. The Assistant Registrar, Constituent Colleges Unit,**
- 18. BUCTU,**
- 19. The Receptionist,**
- 20. The Telephone Operator,**
- 21. The Secretary MUASA**

**for information.**

# **University of Mumbai**



**Revised Syllabus for**

**T.Y.B.Sc.**

**Applied Component (Petrochemicals)**

**Semester – (Sem V and VI)**

**(Choice Based Credit System)**

**(With effect from the academic year 2024-25)**

# University of Mumbai



## Syllabus for Approval

|                                               |                        |                                                 |
|-----------------------------------------------|------------------------|-------------------------------------------------|
| O: _____                                      | <b>Title of Course</b> | T.Y.B.Sc.<br>Applied Component (Petrochemicals) |
| O: _____                                      | <b>Eligibility</b>     | As per University Ordinance                     |
| R: _____                                      | <b>Passing Marks</b>   | 40%                                             |
| <b>No. of years/Semesters:</b>                |                        | Three                                           |
| <b>Level:</b>                                 |                        | UG                                              |
| <b>Pattern:</b>                               |                        | Semester                                        |
| <b>Status:</b>                                |                        | Revised                                         |
| <b>To be implemented from Academic Year :</b> |                        | From Academic Year: 2024-25                     |

Sign of the BOS  
Coordinator  
Dr. Sunil Patil  
BOS in Chemistry

Sign of the  
Offg. Associate Dean  
Dr. Madhav R. Rajwade  
Faculty of Science &  
Technology

Sign of the  
Offg. Dean  
Prof. Shivram S. Garje  
Faculty of Science &  
Technology

# Preamble

## 1) **Introduction**

The B.Sc (Chemistry) program is meticulously structured to foster a deep understanding of chemical principles and their real-world applications. The curriculum is a blend of theoretical knowledge and hands-on experience, ensuring that students not only grasp the core concepts but also develop a passion for the subject. With a focus on continuous assessment through quizzes, class tests, and assignments, the program emphasizes the importance of a strong conceptual foundation. This approach is complemented by practical experiments, where theoretical knowledge is applied, enhancing the learning experience and preparing students to tackle the multifaceted challenges in the field of chemistry.

## 2) **Aims and Objectives**

The B.Sc (Chemistry) program is structured to equip students with a comprehensive understanding of chemical principles and their real-world applications. It aims to foster a deep appreciation for the subject, encouraging students to engage in critical thinking and problem-solving. By integrating theoretical knowledge with practical skills, the course prepares graduates for diverse careers in research, industry, education, and beyond, contributing to their holistic academic and professional growth.

## 3) **Learning Outcomes**

Building a robust foundation in Applied Component principles is indeed crucial for anyone aiming to excel in scientific disciplines. This solid grounding not only prepares one for the complexities of the field but also enhances adaptability to the dynamic nature of scientific research. As the field of chemistry continues to expand, professionals who embrace continuous learning and exhibit a strong sense of curiosity will likely be at the forefront of pioneering discoveries. Moreover, the versatility of chemistry as a discipline offers a plethora of career opportunities across various industries, ensuring that those with a passion for the subject can find their niche and contribute meaningfully to society.

## 4) **Any other point (if any)**

The program is meticulously designed to lay a solid foundation in the subject, equipping students with essential skills and knowledge. Through a blend of theoretical understanding and practical application, the curriculum aims to fortify the students' grasp of the basics, ensuring they are well-prepared for advanced study or professional application in the field. This foundational strength is crucial for their academic and career progression, providing a robust platform from which they can build expertise and specialization.

**T.Y.B.Sc. CHEMISTRY (6 UNITS)**  
 Choice Based Credit System  
 To be implemented from the Academic year 2024-25

**PETROCHEMCALS**  
**SEMESTER V**

|                                |                    |                     |
|--------------------------------|--------------------|---------------------|
| <b>Course Code: USACPET501</b> | <b>Credits: 02</b> | <b>Lectures: 60</b> |
|--------------------------------|--------------------|---------------------|

| <b>Unit</b> | <b>Topic</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>No. of Lectures</b> | <b>Total No. of Lectures</b> |
|-------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------|
| <b>I</b>    | <b>1.1</b>   | <b>The Chemistry of Petroleum Kingdom</b><br>The Chemistry of Petroleum Kingdom<br>1.1.1 Compounds of Straight Run Gasolines.<br>1.1.2 Kerosene and Gas Oil Fractions.<br>1.1.3 Non-hydrocarbon Constituents                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>02</b>              | <b>15</b>                    |
|             | <b>1.2</b>   | <b>Quality parameter in petroleum Industry</b><br>1.2.1 Classification of petroleum product, Quality Monitoring and Laboratory tests.<br>1.2.2 Distillation, Vapor pressure, Flash point, Fire point, Octane number, Cetane number, Aniline point, Diesel index, Calorific value, Smoke Point, Viscosity, Viscosity index, Penetration index, Freezing point, Cloud and pour point, Drop point of grease, Melting and Setting point of wax, softening point of bitumen, Ductility of bitumen, Gum content (Oxidation stability), Copper strip corrosion test, Density and API Gravity, Refractive index, Conradson carbon residue (CCR). | <b>06</b>              |                              |
|             | <b>1.3</b>   | <b>Petroleum exploration &amp; production</b><br>1.3.1 Introduction<br>1.3.2 Formation of Oil and Gas<br>1.3.3 Characteristics of crude oils<br>1.3.4 Oils & Gas Exploration<br>1.3.5 Drilling for Oil and Gas<br>1.3.6 Production of Crude oil and Natural gas                                                                                                                                                                                                                                                                                                                                                                          | <b>07</b>              |                              |
| <b>II</b>   | <b>2.1</b>   | <b>Composition, Characteristics, Constituents of crude oil</b><br>2.1.1. Salty crude oil, sweet and sour crude oil. Classification of crude oil and natural gas.<br>2.1.2. Characterization factor, Correlation index, US Bureau of mines method, waxy and wax free crude oil Wobbe no.,sour and sweet gas, dry gas, wet gas and lean gas.                                                                                                                                                                                                                                                                                               | <b>06</b>              | <b>15</b>                    |

|            |          |                                                                                                                                                                                                                                                                                                                                                                                                  |           |           |
|------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|
|            |          | 2.1.3. Types of Hydrocarbons and Non- hydrocarbons present in petroleum, their physical and chemical properties.                                                                                                                                                                                                                                                                                 |           |           |
|            | 2.2      | <b>Refinery processes and products</b><br>2.2.1 Chemical Composition (2L)<br>2.2.2 Distillation – separation based on relative volatilities – fractions obtained with flowsheet diagrams. (2L)<br>2.2.3 Conditions of conversion processes (catalyst, temperature, pressure etc.)Mentioned below–<br>Pyrolysis, Catalytic cracking and hydrocracking, Isomerization, Alkylolation, Reforming(5L) | <b>09</b> |           |
| <b>III</b> | 3.1      | Preparation of petrochemicals From Propylene: Isopropanol, cumene, glycerin, and acrylonitrile                                                                                                                                                                                                                                                                                                   | <b>03</b> | <b>15</b> |
|            | 3.2      | Preparation of petrochemicals From acetylene: Vinyl chloride, Chloroprene, acrylonitrile and acetaldehyde                                                                                                                                                                                                                                                                                        | <b>04</b> |           |
|            | 3.3      | Preparation of petrochemicals From C4 – hydrocarbons: Butadiene, isobutene and butane                                                                                                                                                                                                                                                                                                            | <b>03</b> |           |
|            | 3.4      | Preparation of petrochemicals From aromatic hydrocarbon: Aniline, chlorobenzene, D.D.T, Xylene.                                                                                                                                                                                                                                                                                                  | <b>05</b> |           |
| <b>IV</b>  | <b>4</b> | <b>Alternative sources for Fuels</b>                                                                                                                                                                                                                                                                                                                                                             |           | <b>15</b> |
|            |          | 4.1 Natural Gas                                                                                                                                                                                                                                                                                                                                                                                  | <b>3</b>  |           |
|            |          | 4.2 Hydrogen & Alcohols                                                                                                                                                                                                                                                                                                                                                                          | <b>5</b>  |           |
|            |          | 4.3 Biofuels                                                                                                                                                                                                                                                                                                                                                                                     | <b>3</b>  |           |
|            |          | 4.4 Other fuels                                                                                                                                                                                                                                                                                                                                                                                  | <b>2</b>  |           |
|            |          | 4.5 Wind and solar Energy                                                                                                                                                                                                                                                                                                                                                                        | <b>2</b>  |           |

**PETROCHEMCALS  
SEMESTER V  
PRACTICALS**

|                                |                    |
|--------------------------------|--------------------|
| <b>Course Code: USACPET5P1</b> | <b>Credits: 02</b> |
|--------------------------------|--------------------|

**Title of Experiments**

- 1) Determination of Specific gravity and viscosity of Oil
- 2) To check the quality of Petrol
- 3) To check the quality of Diesel
- 4) Determination of drop point and melting of wax
- 5) Determination of Flash point and Fire point of petroleum sample by Cleveland open cup apparatus
- 6) Determination of Congealing point of wax
- 7) Determination of Cloud point, Pour point, Aniline point
- 8) Determination of smoke point of given petroleum sample

**PETROCHEMICALS  
SEMESTER VI**

|                                |                    |                     |
|--------------------------------|--------------------|---------------------|
| <b>Course Code: USACPET601</b> | <b>Credits: 02</b> | <b>Lectures: 60</b> |
|--------------------------------|--------------------|---------------------|

| <b>Unit</b>   | <b>Topic</b>                                                                                                                                                                                          | <b>No. of Lectures</b> | <b>Total no. of Lectures</b> |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------|
| <b>Unit I</b> | <b>1.1 Chemicals from C<sub>3</sub>, C<sub>4</sub> and Higher Alkanes</b><br>1.1.1 Products from Propane<br>1.1.2 Chemicals from Propylene.<br>1.1.3 Derivatives of hydrocarbons Higher than Butanes. | 05                     | 15                           |
|               | <b>1.2. General study of the following reactions used in petrochemical industry</b>                                                                                                                   | 10                     |                              |

|                 |                                                                                                                                                                                                                                                                                                                                    |           |           |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|
|                 | 1. 2.1 Oxidation<br>1. 2.2 Ammoxidation<br>1. 2.3 Hydroformylation (oxo reaction)<br>1. 2.4 Hydration of olefins<br>1. 2.5 Chlorination<br>1.2.6 Polymerization (free radical and ionic)                                                                                                                                           |           |           |
| <b>Unit II</b>  | 2.1 Sources of higher olefins and aromatic petrochemicals with flow sheet diagrams hydrocarbons, secondary materials from Petrochemicals with flow sheet diagrams.<br><b>2.2 UNIT OPERATIONS</b><br>2.2.1 Extraction<br>2.2.2 Filtration<br>2.2.3 Crystallization<br>2.2.4 Drying<br>2.2.5 Evaporation                             | <b>05</b> | <b>15</b> |
|                 |                                                                                                                                                                                                                                                                                                                                    | <b>10</b> |           |
| <b>Unit III</b> | <b>3.1 INDUSTRIAL CHEMICALS</b>                                                                                                                                                                                                                                                                                                    | <b>07</b> |           |
|                 | 3.1.1 Plastic: polyvinyl chloride, polystyrene.<br>3.1.2 Synthetic elastomers- styrene, Butadiene rubber, polychloroprene, nitrile rubber.                                                                                                                                                                                         |           |           |
|                 | <b>3.2 Petroleum Products</b>                                                                                                                                                                                                                                                                                                      | <b>08</b> |           |
|                 | 3.2.1 Liquified Petroleum Gases (Composition, properties, extraction & Uses and its product.)<br>3.2.2 Naphthas (Composition, Manufacture, properties & Uses its product.)<br>3.2.3 Kerosene (Composition, properties, extraction & Uses and its product.)<br>3.2.4 Diesel Fuel (Composition, Properties & Uses and its products ) |           |           |
| <b>Unit 4</b>   | <b>4.1 Environmental aspects related to Petroleum Products</b>                                                                                                                                                                                                                                                                     |           |           |
|                 | 4.1.1 Uses of synthesis gas, Uses of synthesis gas<br>4.1.2 Methanol production -Oxo synthesis process. Properties and uses of methanol.<br>4.1.3 Production proportionality of propanol in petroleum ,<br>4.1.4.Chemicals based on carbon monoxide                                                                                | <b>08</b> | <b>15</b> |
|                 | <b>4.2 Air pollution</b>                                                                                                                                                                                                                                                                                                           | <b>03</b> |           |
|                 | 4.2.1 Introduction<br>4.2.2 Air Pollutants from refining operation and air pollution control technique                                                                                                                                                                                                                             |           |           |
|                 | <b>4.3 Water Pollution</b>                                                                                                                                                                                                                                                                                                         | <b>03</b> |           |
|                 |                                                                                                                                                                                                                                                                                                                                    |           |           |

|  |                                                                                                                                                                                             |           |  |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|
|  | 4.3.1 Introduction of water pollution,<br>4.3.2. Types of water pollution<br>4.3.3 Control of water pollution in petroleum refining.<br>4.3.4 Study of various parameters of polluted water |           |  |
|  | <b>4.4 Carbon Credit</b>                                                                                                                                                                    | <b>01</b> |  |

## PRACTICALS

### SEMESTER VI

|                                                  |                    |
|--------------------------------------------------|--------------------|
| <b>Course Code: USACPET6P2</b>                   | <b>Credits: 02</b> |
| <b>The Regional Case-Study Project (30 Hrs.)</b> |                    |

#### **Introduction:**

As per the guidelines from UGC, HEIs are expected to introduce a compulsory course to provide community engagement to all undergraduate students so that their appreciation of Social realities is holistic, respectful and inspiring. Such course will enable students to learn about rural/urban challenges and develop understanding of social wisdom and life-style in a respectful manner.

#### **Objectives:**

- To develop an appreciation of rural/urban culture, life style and wisdom amongst students.
- To understand a real life situation about a problem.
- To apply classroom knowledge of Chemistry courses to field realities and thereby improve quality of learning.
- To interact with key stakeholders such as government officials, people Representatives, common people etc.
- To communicate key findings of the study to stakeholders.

#### **Learning Outcomes:**

After completing course, students will be able to

- Gain an understanding of rural/urban life, culture and social realities
- Gain an understanding real-life problems
- Develop a sense of empathy and bonds of mutuality with local community
- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic improvement

#### **Course Contents:**

##### **Part-I Theory of case study:**

- Introduction to case study
- What is a case study?
- Types of case studies
- Planning a Case Study
- Researching a Case Study
- Strengths and Weaknesses of Case Studies
- Writing a Case Study
- References

##### **Part II Case study Project (Field work)**

##### **Typical Key Areas for field-based project activities:**

- **Environmental Problems:** For example estimation of PAH from soil/sewage

samples, estimation of water pollution in nearby locality, estimation of the micro-plastics in Soil in the nearby locality, study of solid and liquid waste generation in a ward/city/village etc.

- **Analysis of food Material:** For example, identification and estimation of food adulterants, estimation of selenium content in bread available in the local market etc.

- **Soil, Water, material analysis:** For example, examination and analysis water quality in nearby locality, study of materials and dyes used in a local industry, conduct soil health test (for analysis of Pb, N, P, K, S, C, moisture content, pH and micronutrient contents such as Cu, Zn, Mn, Fe) etc.

- **Study of government development programs:** For example effects of Swachh Bharat Abhiyan on the quality of soil and water, to prepare a village sanitation plan, Energy use and fuel efficiency surveys etc.

- **Agriculture:** For example, Organise orientation programmes for farmers regarding Organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants etc.

(Above activities represent some of the possible activities that can be undertaken by Students. However, depending upon local needs students can select and undertake relevant Case-study projects. It is recommended that a practical batch of 20 students can undertake minimum 5-6 case-study projects i.e. one case-study project can be undertaken by group of maximum four students)

### **Case-Study Project Evaluation:**

#### **Project Report:**

After successful completion of a case-study project, the student group will prepare a consolidated report covering title, Rational and gap analysis, objectives, hypothesis, project design and methodology, preliminary work/survey, expected out-come, benefits to society (Project outcome), SWOC analysis and important references etc.

#### **Project presentation (by students Group):**

The students group will present the case study project at the time of practical examination.

#### **Evaluation scheme:**

|                                                                                                                                                                                            |                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Evaluation of student based on Part -I                                                                                                                                                     | <b>10 Marks</b> |
| Identification of problem, Rational, Problem statement and expected benefits-                                                                                                              | <b>10Marks</b>  |
| Case-study design and methodology, Data management and interpretation, , clarity, coherence and appropriateness of case study design, Organisation and logical flow of ideas and materials | <b>30 Marks</b> |
| Presentation skills, role, responsibilities involvement of group members, learning mechanism in group, clear, concise and thoughtful responses to questions, team work                     | <b>20 Marks</b> |

|                                                                                                             |                     |
|-------------------------------------------------------------------------------------------------------------|---------------------|
|                                                                                                             |                     |
| Major findings and outcome reported, Stakeholders feedback-                                                 | <b>10<br/>Marks</b> |
| <b>Industrial Visit –</b><br>Detailed report- GMP/ETP/FDA/ISO/ /ENVIRONMENTAL QA, QC and TQM and R & D etc. | <b>20<br/>Marks</b> |

### Reference Books:

1. Advanced Petroleum Refining, G. N. Sarkar
2. Petroleum Refining Technology, Dr. Ram Prasad
3. Petroleum Industries Technology and Process, Chhitta Ranjan Lahiri, Dipa Biswas.
4. A Text Book on Petro Chemicals, Dr. B. K. Bhaskararao.
5. A. I. Vogel: Text book of Quantitative Analysis including Instrumental Analysis.
6. A. I. Vogel: Text book of Quantitative Organic Analysis.
7. Advanced Practical Organic Chemistry 3<sup>rd</sup> Edition, N.K. Vishnoi, Vikas Publication,
8. Practical Organic Chemistry by Mann and Saunders.
9. Vogel's Textbook of Quantitative Chemical Analysis 5<sup>th</sup> Edition
10. Vogel's Qualitative Inorganic Analysis 5<sup>th</sup> Edition

### Suggested Readings for Case study:

1. Abramson, P.R. (1992). A Case for Case Studies: An Immigrant's Journal. Newbury Park: Sage.
2. Bassey, M. (1999). Case Study Research in Educational Settings. Buckingham: Open University.
3. Campbell, D.T. & Stanley, J.C. (1966) Experimental and Quasi-experimental Designs For Research. Chicago: Rand McNally.
4. Kazdin, A. E. (1982). Single-case Research Designs: Methods for Clinical and Applied Settings. New York: Oxford Press.
5. Zaidah Zainal, Case study as a research method, *JurnalKemanusiaan bil.9, (2007)*
6. WALTER ISARD, Methods of Regional Analysis: An Introduction to Regional Science, THE M. I. T. PRESS, Cambridge, Massachusetts, (1960).

## Evaluation Pattern for Semesters V and VI

### Semester End Theory Examination

| <b>Internal Continuous Assessment:<br/>25% (25 Marks)</b>                                                                                      | <b>Semester End<br/>Examination:<br/>75% (75 Marks)</b> | <b>Duration for End<br/>Semester<br/>Examination</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------|
| <b>Continuous Evaluation through:</b><br>Quizzes, Class Tests, Presentations,<br>Projects, Role Plays, Creative<br>Writings, Assignments, etc. | As per following pattern                                | 2 hrs 30 minutes                                     |

### Pattern for Semester End Examination (75 Marks):

1. Duration - This examination shall be of **Two hours and 30 minutes** duration.
2. Theory question paper pattern:
  - a. There shall be **05** questions each of **15 marks**.
  - b. All questions shall be compulsory with internal choice within the questions.

| <b>Question</b> | <b>Option</b>                                                                                            | <b>Marks</b> | <b>Based on<br/>Units</b> |
|-----------------|----------------------------------------------------------------------------------------------------------|--------------|---------------------------|
| Q.1             | Subjective questions 3 out of 5                                                                          | 15           | Unit I                    |
| Q.2             | Subjective questions 3 out of 5                                                                          | 15           | Unit II                   |
| Q.3             | Subjective questions 3 out of 5                                                                          | 15           | Unit III                  |
| Q.4             | Subjective questions 3 out of 5                                                                          | 15           | Unit IV                   |
| Q.5             | A. True or False<br>(Any Five out of Eight)                                                              | 05           | All Units                 |
|                 | B. Fill in the Blank with correct<br>alternative. (MCQs with Four<br>Options)<br>(Any Five out of Eight) | 05           |                           |
|                 | C. Match the following<br>(Any Five out of Eight)                                                        | 05           |                           |
| <b>Total</b>    |                                                                                                          | <b>75</b>    | <b>--</b>                 |

## **Practical**

1. Total Marks for Practical Examination is 100 Marks.
2. Every student shall perform **two experiments** (If there are two major parts in the curriculum of applied component then assign one experiment from Component I for first session and another experiment from Component II for second session).
3. Each experiment shall carry 50 Marks.
4. Scheme of Examination:
  - a. Experiment : 40 Marks
  - b. Journal : 05 Marks
  - c. Viva-Voce : 05 Marks
  - Total : 50 Marks**

## **Practical Book/Journal:**

The students are required to perform 75% of the Practical for the journal to be duly certified. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

**Sign of the BOS  
Coordinator  
Dr. Sunil Patil  
BOS in Chemistry**

**Sign of the  
Offg. Associate Dean  
Dr. Madhav R. Rajwade  
Faculty of Science &  
Technology**

**Sign of the  
Offg. Dean  
Prof. Shivram S. Garje  
Faculty of Science &  
Technology**