

|                              |                                         |
|------------------------------|-----------------------------------------|
| <b>Branch Name:</b>          | <b>B.Sc. Chemistry</b>                  |
| <b>Program Code:</b>         | <b>SC103</b>                            |
| <b>Course Name:</b>          | <b>Physical Chemistry- II</b>           |
| <b>Course Code:</b>          | <b>2SC1030603</b>                       |
| <b>Pre-requisite Course:</b> | Basic fundamental of Physical chemistry |

### Course Objectives:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To make student understand about Statistical thermodynamics
3. To redesign the courses the special emphasis on local requirements, environment, to link the courses with requirements of the industries and research.
4. To learn about the photochemistry and chemical kinetics for the reactions.

### Teaching and Examination Scheme:

| Teaching Scheme<br>(Hours per week) |                 |                  |        | Evaluation Scheme (Marks) |                          |                          |                          |                  |
|-------------------------------------|-----------------|------------------|--------|---------------------------|--------------------------|--------------------------|--------------------------|------------------|
| Lecture<br>(L)                      | Tutorial<br>(T) | Practical<br>(P) | Credit | Theory (Marks)            |                          | Practical (Marks)        |                          | Total<br>(Marks) |
|                                     |                 |                  |        | University<br>Assessment  | Continuous<br>Assessment | University<br>Assessment | Continuous<br>Assessment |                  |
| 3                                   | --              | -                | 3      | 70                        | 30                       | -                        | -                        | 100              |

### Subject Contents:

| Sr.<br>No | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Total<br>Hours | Weightage<br>(%) |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|
| 1         | <u><b>Statistical thermodynamics</b></u> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Combination and permutation,</li> <li>• Probability</li> <li>• Sterling approximate formula</li> </ul> <b>Types of statistics</b> <ul style="list-style-type: none"> <li>• Maxwell-Boltzmann</li> <li>• Bose-Einstein Statistics</li> <li>• Fermi-Direct statistics</li> </ul> <b>Partition Function</b> <ul style="list-style-type: none"> <li>• Translational partition functions.</li> <li>• Vibrational partition functions.</li> <li>• Rotational partition functions.</li> </ul> <b>Numerical</b>                                           | 18             | 34%              |
| 2         | <u><b>Photochemistry</b></u> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Difference between Thermal and Photochemical reaction</li> </ul> <b>The Law of Absorption</b> <ul style="list-style-type: none"> <li>• Lambert-Beer law</li> </ul> <b>Laws of Photochemistry</b> <ul style="list-style-type: none"> <li>• Grotthuss-Draper law</li> <li>• Stark- Einstein law and it's deviation</li> </ul> <b>Quantum Efficiency or Quantum Yield</b> <ul style="list-style-type: none"> <li>• Experimental determination of Quantum yield</li> <li>• Reason of high and low Quantum yield</li> </ul> <b>Types of Photochemical reaction</b> | 15             | 33%              |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |    |     |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|
|   | <ul style="list-style-type: none"> <li>• Photosensitized reaction</li> <li>• Photochemical equilibrium</li> </ul> <b>Qualitative description</b> <ul style="list-style-type: none"> <li>• fluorescence</li> <li>• phosphorescence</li> <li>• chemiluminescence's</li> </ul> <b>Flash Photolysis</b><br><b>Numerical</b>                                                                                                                                                                                                                        |    |     |
| 3 | <b><u>Chemical Kinetics</u></b> <ul style="list-style-type: none"> <li>• Effect of temperature on rate of reaction (Arrhenius equation),</li> <li>• Concept of Activation energy</li> <li>• Collision theory</li> <li>• Transition state theory</li> <li>• Comparison of collision and transition state theory</li> <li>• Theories of Unimolecular reaction</li> <li>• Lindemann's theory</li> <li>• Trimolecular reaction</li> <li>• Trautz's Law</li> <li>• Primary salt effect</li> <li>• Secondary salt effect</li> </ul> <b>Numerical</b> | 15 | 33% |

#### Text Books:

1. **Physical Chemistry** by P. Atkins and J. de Paula
2. **Physical Chemistry – A Molecular Approach** by D. A. McQuarrie ...

#### Reference Books:

1. Advance Physical Chemistry by Gurdeep Raj.
2. Physical Chemistry (Question and Answer) by R. N. Madan, G.D. Tuli, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P. Rastogi and R.R.Mishra.
5. Physical chemistry by atkins.
6. Essentials of Physical Chemistry by B. S. Bahal, Arun Bahal, G.D.Tuli,
7. Physical Chemistry by P.W. Atkins, 5th edn, Oxford 1994 7th edn-2002.
8. Physical Chemistry by R.A. Albern and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5th edn, Mac Graw Hill, 1988,6th edn, 1996.
10. Physical Chemistry by W.J.Moore, 4th edn, Orient Longmans 1969

#### List of Open Source Software/learning website:

- 1) <https://www.slideshare.net/swapnilchemistry/photochemistry>
- 2) <https://www.slideshare.net/GajananRawate/photochemistry>
- 3) <https://www.slideshare.net/SanchitDhankhar/chemical-kinetics-physical-chemistry>
- 4) <https://www.slideshare.net/VirajDande/lecture-7-8-statistical-thermodynamics-introduction>

**Course Learning Outcomes (CLO): On completion of this course, the students will be able to:**

| CLO  | Description                                                                                                    | Bloom's Taxonomy Level |
|------|----------------------------------------------------------------------------------------------------------------|------------------------|
| CLO1 | <b>Define</b> the photochemical and chemical kinetics for chemical reaction.                                   | 1 Remembering          |
| CLO2 | <b>Classify</b> the statistic term in thermodynamic and <b>compare</b> the photochemical and thermal reaction. | 2 Understanding        |
| CLO3 | <b>Use</b> the transition state theory for find out the activation energy in chemical reaction.                | 3 Applying             |
| CLO4 | <b>Categorize</b> the partition function for molecules in electronic transitions.                              | 4 Analyzing            |
| CLO5 | Calculate the <b>value</b> of rate of any chemical reaction and absorbed photo in different unit.              | 5 Evaluate             |
| CLO6 | <b>Develop</b> the new chemical synthesis and <b>modified</b> their physical term value.                       | 6 Create               |

### Mapping of CLOs with POs & PSOs

| Course Learning Outcomes | Programme Outcomes (POs) |     |     |     |     |     |     |     |     |
|--------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
|                          | PO1                      | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
| CLO1                     | H                        | M   |     |     |     |     |     |     |     |
| CLO2                     |                          | M   |     |     |     |     |     | L   |     |
| CLO3                     |                          |     |     |     |     |     | L   |     |     |
| CLO4                     | L                        |     |     |     | M   |     | L   |     |     |
| CLO5                     |                          | L   | M   |     |     |     |     | H   |     |
| CLO6                     |                          |     |     |     |     | L   | M   |     |     |

**H: High, M: Medium, L: Low**