M. Sc.(Physical Chemistry)
Semester – IV

Course Code	**PS04EPHC22**	Title of the Course	**Advanced Characterization Techniques – II**
Total Credits of the Course	**04**	Hours per Week	**04**

Main Focus of the Course outcomes	Employability	Skill Development	Entrepreneurship
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Course Objectives:	This course is in continuation to the third semester and aims to introduce the concept, principles and theory involved in advanced techniques based on impedance and microwave spectroscopy, circular dichroism, chromatographic techniques for separation.

Course Content

Unit	Description	Weightage* (%)
I	**Impedance Spectroscopy :** Fundamental of Electrochemical Impedance Spectroscopy – Concept ofcomplex impedance, Complex dielectric, modulus and impedance datarepresentations, Electrochemical Experiment : Charge and material transport, Fundamental ambiguity of impedance spectroscopy analysis,Graphical representation of impedance spectroscopy data – Nyquist andBode representation of complex impedance data for ideal electrical circuits, Dielectric data representation, Applications.	25
II	**Optical Rotatory Dispersion and Circular Dichroism :** Introduction, Circular Birefringence, Circular Dichroism, Cotton effect, Optical Rotatory Dispersion, Comparison of ORD and CD curves, Axial Haloketone rule, The octant rule, Instrumentation for ORD and CD measurements, Applications.	25
III	**Microwave Spectroscopy :** Introduction, Differences between Microwave spectroscopy and IR Spectroscopy, Theory of Microwave Spectroscopy, Diatomic molecules as a Rigid rotator, Selection Rules for Rotational Spectra, Instrument for Microwave spectroscopy, Applications.	25
IV	**Separation Techniques :** Chromatography : Introduction, Different types of chromatographymethods, Introduction, Principles, Applications of Gas Chromotography, High Performance Liquid Chromatography, Gel Chromatography, Ion-Exchange Chromatography, Electro Chromatography.	25

Teaching-Learning Methodology	Chalk and board method along with ICT tools Model demonstration as per the demand of the topic

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	The students will learn the electrode dynamic surface phenomena at interfaces and applications based on it to study semiconductors and conductors.
2.	The qualitative and quantitative aspects of optical active substances are learnt and can be applied for their analysis.
3.	The separation techniques based on chromatography help the students in determining the purity of laboratory synthesized compounds, natural products and active pharmaceutical ingredients.
4.	The knowledge and skills acquired directly benefit the students to find jobs in various industries dealing with pharmaceuticals, sensors and advanced devices.

Suggested References:	
Sr. No.	**References**
1.	Impedance Spectroscopy : Applications to Electrochemical and Dielectric Phenomena, Vadim F. Lvovich, John Wiley & Sons
2.	Electrochemical Impedance Spectroscopy, Mark E. Orazem, Bernard Tribollet, John Wiley & Sons.
3.	Principles of Instrumental Analysis, D. A. Skoog, E. James Holler and S. R. Crouch, Thomson Brooks.
4.	Instrumental Methods of Analysis, H. H. Willard, L. L. Merritt, Jr., J. A. Dean, F. A. Settlw Jr., CBS Publishers and Distributors.

5.	Fundamentals of Analytical Chemistry, Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Brooks/Cole Cengage Learning.
6.	Instrumental Methods of Chemical Analysis, Gurdeep R. Chatwal, Sham K. Anand
7.	Instrumental Methods of Chemical Analysis, B. K. Sharma, Goel Publishing House.
8.	Instrumental Methods of Chemical Analysis, V. K. Ahluwalia, Ane Books Pvt. Ltd.

On-line resources to be used if available as reference material
On-line Resources
www.nptel.ac.in
www.swayam.gov.in
www.epgp.inflibnet.ac.in (e-PG pathshala)
www.ndl.iitkgp.ac.in (National Digital Library)

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