نموذج توصيف مقرر
Course Description Form

Name of College\Faculty : Science **اسم الكلية:**

Name of Department: Chemistry **اسم القسم العلمي:**

Course Name	Spectroscopy	**اسم المقرر**
Course No.	0420372	**رقم المقرر**
No. of Credits	2	**عدد الوحدات**
Theoretical Hours	2	**عدد الساعات النظرية**
Practical Hours	0	**عدد الساعات المحلية**

Course topics **مواضيع المقرر**

1. Fundamental concepts in thermodynamics.
2. Fundamental concepts in kinetics.
3. Basic calculus (differentiation and integration).
4. Organic Chemistry.

Text book: (Name, Author , Year , Publisher) **عنوان الكتاب : (الاسم ، المؤلف ، سنة الطبع ، دار النشر)**

Peter Atkins, Physical Chemistry, Oxford University Press, Oxford, Latest Edition.

References: (Name , Author , Year . Publisher) **عنوان المرجع : (الاسم ، المؤلف ، سنة الطبع ، دار النشر)**

1. P.A. Rock, Chemical Thermodynamics, Oxford Univ. Press, Oxford, Latest Edition.
2. I.N. Levine, Physical Chemistry, McGraw-Hill, New York, Latest Edition.
3. D.L. Pavia, G.M. Lampman, and G.S. Kriz, Introduction to Spectroscopy - A Guide for Students of Organic Chemistry, Saunder College Publishing, Philadelphia, 1996, Latest Edition.
4. R. M. Silverstein and F. X. Webster, Spectroscopic Identification of Organic Compounds, John Wiley & Sons Inc., 1998, Latest Edition.

Prerequisites					متطلبات المقرر	
Grading	Exams	50	%		الاختبارات	آلية رصد المقرر
	Quizzes	10	%		امتحانات قصيرة	
	H.W.	0	%		واجبات	
	Project (field study)	0	%		مشاريع (دراسة ميدانية)	
	Final	40	%		الاختبار النهائي	
	100%					

Course objectives					
No.	Course Objectives (Learning Outcomes)	Example(s) of relevant (Topics and activities)	Recommended Level to satisfy the objectives		
			High	Medium	Low
1	To convey the basic concepts and methods of quantum mechanics that describe the discrete energies and statistical behaviour of microscopic systems.	• Relate the frequency, wavelength, and speed of light and other waves. • Describe black body radiation, molar heat capacities, atomic and molecular spectra, photoelectric effect and the diffraction of electrons in their path and discuss show these paradoxes of classical physics were resolved by quantum mechanics. • Use the law of conservation of energy, relate the work function of metal to the wavelength of light used to eject electrons in the photoelectric effect and kinetic energy of these electrons. • Discuss the de Broglie relation and use it to calculate the wavelengths associated with particles in motion.	X		

		• Use Schrödinger equation to obtain dynamic information about the system. • Understand the Born interpretation of the wavefunction, probability density, probability amplitude and normalization constant. • Identify the information in a wavefunction. • State the Heisenberg uncertainty principle and use it to establish bounds within which the position and momentum of a particle can be known. • Understand wavefunction of a free particle.			
2	To discuss energy states of molecules and explain the interaction of radiation with molecules (molecular spectroscopy).	• Determine the energy levels for a particle in a box (one, two and three dimensions). • Understand the origin of spectral lines in molecular spectroscopy (absorption, • Emission and scattering of a photon) when the energy of a molecule changes. • Relates the moments of inertia, bond length, and vibrational force constant of the diatomic to their rotational and vibrational spectra. • Determine the rotational and vibrational energy levels. • Discusses the Boltzmann distribution of population among possible molecular quantum states. • Outline the Franck-Condon principle. • Describe the preparation of excited electronic states by	**X**		

		absorption of radiation and subsequent flow of Energy (Florescence, Phosphorescence, and Dissociation). • Use photoelectron spectroscopy to determine the binding energies for atoms (UPS and XPS).			
3	To introduce the basic theory and different instrumentation and techniques used in mass spectroscopy.	• Apply the basic theory and different instrumentation and techniques used in mass spectrometry • Utilize the general rules governing the mass fragmentation patterns and to relate the parent peaks and Constituting atoms of the molecules. • Know the information obtained from this technique. • Obtain structural information from the Mass Spectra (MS) of an organic compound. • Determine the molecular weight, molecular formula, to identify different mass peaks and to study the Fragmentation pattern of different classes of organic compounds. • Understand the isotope effect in mass spectra. • Correlates the mass spectrum with structural and molecular formulas.	**X**		
4	To introduce the basics of IR spectroscopy and electromagnetic radiations.	• Explain the origin and nature of IR spectra • Calculate the expected stretching frequency of different covalent bonds. • Interpret the characteristic IR absorptions of different	**X**		

		functional groups in organic molecules. • Utilize the IR as a fingerprint for organic molecules.			
5	To introduce the basic theory and techniques of nuclear magnetic resonance (NMR).	• Apply 1H NMR for structural assignment of organic molecules. • Uses information obtained from 1H NMR to assign the structure of organic molecules. • Apply 13C NMR for structural assignment of organic molecules. • Apply 2-D NMR for structural assignment of organic compounds.	**X**		
Fields	Physical Chemistry				
Skills					
Coordinator (Name and Rank) :		Physical Chemistry Coordinator			
Signature and stamp :					
Date:		**28/11/2025**			

Chapters included:

Chapter	**Topic**	**Section**
CH.1	Quantum states of molecules	Section 2
CH.2	Spectroscopic identification of organic compounds (IR, MS, NMR)	Section 2, part 15