National Institute of Technology, Tiruchirappalli–620015

Department of Chemistry

COURSE PLAN			
Course Title	Molecular Spectroscopy		
Course Code	CH 608	**No. of Credits**	3
Department	Chemistry	**Faculty**	Dr. S. Amudhan Senthan
Pre-requisites Course Code	NA		
Course Coordinator (if, applicable)	Dr. S. Amudhan Senthan		
E-mail	amudhansenthan.s@gmail.com	**Mobile No.**	9840699833
Course Type	Core course		

COURSE OVERVIEW

This is a core three credit course offered to I M.Sc. Chemistry students. Three theory classes will be conducted per week.

COURSE OBJECTIVES

Enabling the students to grasp the basics of spectroscopy and to gain a clear mental picture of the principles and processes which underlie the subject, with the minimum of mathematics.

COURSE OUTCOMES (CO)

The students will familiarize themselves in

- ✓ Learning about the interaction of electromagnetic radiation and matter.
- ✓ Understanding the fundamentals of different modes of spectroscopy.
- ✓ Using spectroscopy to determine the structure of matter.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No	Week	Topic	Mode of Delivery
1	I week of Jan 2017	**UNIT-I** **Electromagnetic Radiation:** Interaction of radiation with matter–Spectroscopic Transitions-Einstein coefficients	C&T, PPT
2	II week of Jan 2017	Transition probability-transition dipole moments -energy levels in atoms and molecules Relaxation phenomena-Born-Oppenheimer approximation	C&T, PPT

3	III week of Jan 2017	Selection rules - Intensity and width of spectral lines - Fourier transformation.	C&T, PPT
4	IV week of Jan 2017	**UNIT-II** **Rotational spectroscopy:** Principal moments of Inertia - Diatomic and polyatomic molecules - selection rules	C&T, PPT
5	I week of Feb 2017	Diatomic Rigid Rotor – Non Rigid Rotor – Nonlinear polyatomic molecules-Effect of Nuclear spin	C&T, PPT
6	II week of Feb 2017	Inversion Phenomenon – The Stark Effect – Applications and Experimental Considerations	C&T, PPT
7	III week of Feb 2017	**UNIT-III** **Vibrational spectra:** Polyatomic molecules -harmonic oscillators – Anharmonic oscillators Morse potential-selection rules – Fermi Resonance-Group Frequencies.	C&T, PPT
8	IV week of Feb 2017	Normal modes of vibrations of polyatomic molecules-selection rules-Fourier transformation in IR spectroscopy-Instrumentation.	C&T, PPT
9	I week of Mar 2017	Raman spectroscopy – fundamentals- rotational Raman - vibrational Raman spectra - Selection rules – Resonance Raman - Surface Enhanced Raman –Non-linear effects	C&T, PPT
10	II week of Mar 2017	**UNIT-IV** **Electronic spectroscopy:** Atoms and molecules-term symbols - Frank Condon principle- vertical transitions-selection rules.	C&T, PPT
11	III week of Mar 2017	Parity, symmetry and spin selection rules-polarization of transitions - Fluorescence and phosphorescence- Russell Sanders coupling-different types of electronic transitions.	C&T, PPT
12	IV week of Mar 2017	Electronic spectra of conjugated systems - transition metal complexes - surface plasmon resonance - dynamic light scattering	C&T, PPT
13	I week of Apr 2017	UV-Vis instrumentation – Fluorescence Spectroscopy – Jablonski Diagram- Kashas rules - circular dichorism – ORD –cotton effect - selection rules - applications	C&T, PPT
14	II week of Apr 2017	**UNIT-V** **Electron spectroscopy:** Photoelectric effect, basic principles of electron spectroscopy, classification - electron energy analysis-photon sources - UV, X-ray, synchrotron, theory.	C&T, PPT
15	III week of Apr 2017	Angular dependence-cross section and its determination-Introduction to ESCA- Auger electron spectroscopy-EXAFS.	C&T, PPT

COURSE ASSESSMENT METHODS				
S.No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1	Assignment/Quiz/Seminar	I week of February	Depends on the activity	5
2	Cycle Test - I	III week of February	1 h	20
3	Assignment/Quiz/Seminar	III week of March	Depends on the activity	5
4	Cycle Test - II	I week of April	1 h	20
5	End Semester	IV week of April	3 h	50

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. C. N. Banwell and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4th revised edition, Tata McGraw Hill, New Delhi, 2011.
2. J. M. Hollas, *Modern Spectroscopy*, 4th edition, John Wiley & Sons Ltd., Chichester, 2004.
3. D. N. Sathyanarayana, *Handbook of Molecular Spectroscopy - From Radio Waves to Gamma Rays*, IK International Publishing House, 2015.
4. D. L. Pavia, G. M. Lampman, G. A. Kriz, and J. R. Vyvyan, *Introduction to Spectroscopy*, 5th ed., Brooks Cole, 2015.
5. R. M. Silverstein and F. X. Webster, *Spectroscopic Identification of Organic Compounds*, 6th ed., John Wiley & Sons, New York, 2003.
6. D. C. Harris and M. D. Bertolucci, *Symmetry and Spectroscopy*, Dover, 1990.
7. R. S. Drago, *Physical Methods in Chemistry*; Saunders: Philadelphia, 1977.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

1. Feedback from students during class committee meetings.
2. Anonymous feedback through questionnaire (as followed previously).

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. Tests I and II will be conducted in regular class.
2. The question paper for end semester examination will be set by the course faculty.
3. 75% attendance is mandatory for writing the end semester examination.
4. A retest will be conducted for those who missed the CT - I or II for genuine reasons.

ADDITIONAL COURSE INFORMATION

The course faculty will be available for consultation at times as per the intimation by the faculty.

FOR SENATE'S CONSIDERATION

Course Faculty	CC-Chairperson	HOD