Subject Description Form

Subject Code	ABCT4772
Subject Title	Advanced Physical Chemistry
Credit Value	2
Level	4
Pre-requisite	Intermediate Physical Chemistry or Physical Chemistry II
Objectives	This module aims to provide an understanding of the physico-chemical principles underlying microscopic properties of molecules. Students are further provided with an insight into the structure and macroscopic properties of materials.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. apply principles of Quantum Mechanics to understand molecular properties and the motions of nuclei in molecules b. analyse spectra of simple molecules to determine molecular properties c. demonstrate a better understanding on the fundamental principles ofcrystal structures as well as their contemporary applications d. identify and solve problems on learned topics in related areas of chemistry and other fields as well as real-life cases
Subject Synopsis/ Indicative Syllabus	<u>Molecular spectroscopy and photochemistry</u> Fundamental Postulates of quantum mechanics, solutions of Schrodinger equation for rigid rotor and harmonic oscillator, Born-Oppenheimer approximation, computational methods, spectra of diatomic molecules: rotational spectra, vibrational spectra, vibration-rotation spectra, electronic spectra, selection rules. Photochemical processes: photochemical principles, pathways of molecular excitation, fluorescence and phosphorescence, quantum yield. Laser and industrial application. <u>Materials</u> Crystal : crystal systems, space lattice, Miller index, crystal structures, types of crystal defect and their physical significance. Liquid crystal, ceramics, semi-conductors, superconductors, nanostructures. X-ray diffraction techniques: powder method, single crystal diffraction. Surface probing techniques: electron spectroscopy, low-energy electron diffraction, field emission and ionization microscopy, scanning tunnelling microscopy.
Teaching/Learning Methodology	Lectures will provide students with basic outlines of key concepts and guidance on further reading. Examples in Physical Chemistry itself as well as other chemistry subjects and real-life examples are utilized to illustrate the principles taught. Students are encouraged to present their answers to questions posed in lectures and problem sets in tutorial sessions.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d		
1. Continuous Assessment	60 %	√	√	√	√		
2. Examination	40 %	√	√	√	√		
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The course aims at provide basic trainings in molecule spectroscopy and material sciences so that students are able to understand the basic functions and theories as well as to apply them to solve problems. Thus, continuous assessment and examination are suitable for assessing their progress.

Student Study Effort Expected

Class contact:	
▪ Lecture	20Hrs.
▪ Tutorial	6 Hrs.
Other student study effort:	
▪ Self Study	38Hrs.
▪ Preparation of Tutorials	16Hrs.
Total student study effort	80Hrs.

Reading List and References

1. Peter W. Atkins and J. de Paula, Physical Chemistry (9th Ed.), Oxford University Press, 2010
2. Peter W. Atkins and J. de Paula, Elements of Physical Chemistry (4th Ed.), Oxford University Press, 2005
3. I.N. Levine, Physical Chemistry (6th Ed.), McGraw-Hill 2009
4. Thomas Engel, Physical Chemistry (2nd Ed.), Pearson 2010