Birla Institute of Technology & Science, Pilani
Hyderabad Campus

First Semester 2022-2023
Course Handout Part II

Date: 18-08-2022

In addition to Part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

Course No.	: **PHA G540**
Course Title	: **Modern Pharmaceutical Analytical Techniques**
Instructor-in-Charge	: **A. SAJELI BEGUM**
Instructors	: Samrun N, Lakshmi Soukya, Suraj Gupta, and Venkatesh E

Course description:
Principles of sample preparation, method development for analysis and characterization of Active Pharmaceutical Ingredients (API) and formulations, using techniques such as High Performance Liquid chromatography (HPLC), biochromatography, size exclusion, affinity, chiral, fast protein chromatography (FPLC). Characterization of nanopharmaceutcials using Atomic Force Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Dynamic Light Scattering techniques. ^{1}H and ^{13}C Nuclear Magnetic Resonance (NMR) spectroscopy in structural characterization, Mass Spectrometry and its applications, Elemental analysis, Optical, chiro-optical techniques in structure elucidation.

Scope and Objective of the Course:
The course is aimed at exposing the students to modern analytical techniques in relevance to pharmaceutical industries. Training with respect to the handling of sophisticated instruments and their operation, interpretation of results obtained with relevance to the identification and characterization of molecules, their qualitative and quantitative evaluation and control are emphasized.

Learning Outcome:
- Handling of analytical instruments for performing qualitative and quantitative analyses of drugs.
- Design and development of suitable analytical methods for drugs based on their physico-chemical characters meeting the standard requirements.
- Ability to interpret the analytical graphs and spectra for drug identification, characterization, evaluation and decision making

Textbooks:
T1. Yuri Kazakevich and Rosario Lobrutto. HPLC for pharmaceutical Scientists. John Wiley and Sons, Inc., N.Y., 2007.
T2. Robert M Silverstein, Francis X Webster -"Spectroscopic Identification of Organic Compounds", Eighth Edition, John Wiley and Sons, Inc., N.Y., 2014.
T3. Robert Kelsall, Ian Hamley and Mark Geogegan. Nanoscale Science and Technology. John Wiley and Sons, Inc., N.Y., 2005

Reference books

R1. Handbook of Analytical Techniques. Edited by Helmut Gunzler and Alex Williams, Vol I and II, Wiley VCH, 2001.
R2. Comprehensive Chiro-optical Spectroscopy by Nina B. Prasad LP, Koji N, Robert WW. John Wiley and Sons, Inc., N.Y 2012.
R3. Organic Elemental Analysis by Wolfganf j. Kristen. Academic Press. 1983
R3. A.H. Beckett and J.B. Stenlake -"Practical Pharmaceutical Analysis", Fourth Edition, CBS Pub., New Delhi., Vol. I & II, 1988.
R4. Willard H. H. Instrumental methods of Analysis. Seventh Edition., 1988.

Course Plan:

a. Lecture Plan

Lect. No.	Learning Objectives	Topics	Chapter in the Text Book
01	Introduction of different analytical techniques to understand the scope and applications in the area of Pharmacy – broad discussion	Introduction to Modern Pharmaceutical Analytical Techniques	TB-1: 1-5; TB-2: 1,2
02-04	Understand the principles of sample preparation, method development for analysis and characterization of Active Pharmaceutical Ingredients (API) and formulations.	General principles of sample preparation, method development for analysis and characterization of Active Pharmaceutical Ingredients (API) and formulations using various chromatographic techniques.	T1-6 and R1 - 6
05-12	Learn the theory, instrumentation, data analysis followed by applications in analytical method development of API and formulations	High Performance Liquid chromatography (HPLC), biochromatography, size exclusion, affinity, chiral, fast protein chromatography (FPLC).	T1-2 to 7; T1-22 and R1-12
13-20	Characterization of nanopharmaceuticals using various modern techniques.	Techniques: Atomic Force Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Dynamic Light Scattering techniques.	T3 - 2
21-28	Knowledge on ^{1}H and ^{13}C NMR Spectroscopy – Theory and spectra interpretation	^{1}H and ^{13}C NMR Spectroscopy	T2-4 and 5
29-34	Learn the theory, various instrumental	Mass Spectroscopy	T2-2

	aspects and spectra analysis in structure characterization.		
35-40	Knowledge on elemental analysis, optical, chiro-optical techniques in structure elucidation	Elemental analysis, Optical, chiro-optical techniques	R3 and R2

b. Plan for Laboratory:

Laboratory sessions will be conducted so that students get hands on experience on the following analytical instruments. Certain instruments will only be demonstrated to the students.

1. High Performance Liquid chromatography
2. Gel Permeation Chromatography
3. Liquid chromatography-Mass Spectrometry (LC-MS)
4. Gas Chromatography
5. Zeta Sizer Nano Series (Dynamic Light Scattering Tech)
6. Differential Scanning Calorimeter (DSC)
7. Thermogravimetric Analyser (DTA-TGA)
8. Field Emission Scanning Electron Microscope (FE-SEM)
9. ^{1}H and ^{13}C Nuclear Magnetic Resonance Spectrometer (NMR)
10. Powder XRD
11. Circular Dichroism Spectrophotometer
12. FT-IR Spectrophotometer

Note:

i. Modifications/adjustments would be made in the theory/experimental pattern / part, if necessary as and when situation arises.

ii. Students should submit a report for every practical class.

iii. It is imperative that all students come prepared for the experiment in the next turn completing all pending work concerned with the previous experiment. Adequate preparation for the practical in terms of principles and operation of the instrument as per instructions, familiarization of protocols involved, outside class hours, is mandatory.

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Sem Test	90 min	25	05/11 11.00 - 12.30PM	CB
Other Evaluation – Lab Component (Day to day evaluation) Assignment	During Lab class	30 10		OB OB
Comprehensive Exam	180 min	35	29/12 FN	OB+CB (20+20)

Note: Laboratory component may include assignments, which will be practical or theoretical type that would include interpretation of IR, NMR, Mass spectral, Elemental data - characterization of compounds, etc., besides

identification and estimation of known and unknown drugs, particle size, etc., in given samples based on experiments performed, etc.

Chamber Consultation Hour: Tuesday between 5:00 – 5:30 PM

Notices: Notices concerning the course will be displayed on CMS/Google classroom.

Make-up Policy: Make-Ups are not given as a routine. It is solely dependent upon the GENUINENESS OF THE CIRCUMSTANCES under which a student fails to appear in a scheduled evaluation component. In such circumstances, prior permission should be obtained from the Instructor-in-Charge. However, the decision of the Instructor-in-Charge in the above matter will be final.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
Instructor -in-Charge
PHA G540