



MAHATMA GANDHI UNIVERSITY, KERALA

Abstract

Industrial Chemistry (Minor) - Fourth Semester - Substitution of a course and approval of the syllabus of the same - Approved - Orders Issued.

ACA 16

No. 10765/ACA 16/2025/MGU

Priyadarsini Hills, Dated: 17.11.2025

Read:- 1. U.O.No.5797/AC A16/2024/MGU, dated.27.06.2024.

2. Minutes of the meeting of the Expert Committee on Chemistry (UG), held on 27.10.2025.

3. Orders of the Vice Chancellor under Section 10(17), Chapter III of the Mahatma Gandhi University Act 1985, dated. 14.11.2025.

ORDER

The syllabi of various Honours Under Graduate Programmes coming under The MGU-UGP (Honours) Regulations, 2024, have been approved vide paper read as (1) above and published on the website of the University.

The Expert Committee on Chemistry (UG), deliberated on substituting the course, **MG4DSCICH200: Functional Operations in Chemical Industry**, with **MG4DSCICH200: Instrumentation Techniques in Chemistry**, in the **Fourth Semester** syllabus of **Industrial Chemistry (Minor)** and has submitted recommendations, vide paper read as (2) above. **(Syllabus for the new course is attached as Annexure).**

Considering the urgency of the matter, sanction has been accorded by the Vice Chancellor, in exercise of the powers of the Academic Council vested upon him under Section 10(17), Chapter III of the Mahatma Gandhi University Act 1985, vide paper read as (3) above, to approve the aforementioned recommendations.

Orders are issued accordingly.

SUDHA MENON J

ASSISTANT REGISTRAR III
(ACADEMIC)
For REGISTRAR

Copy To

1. PS to VC
2. PA to Registrar/CE
3. Convenor, Expert Committee, Chemistry (UG)
4. JR 2 (Admin)/DR 2, AR 3 (Academic)
5. JR/DR/AR (Exam)
6. Tabulation/Academic Sections concerned
7. AC C1/AC C2 Sections
8. IT Cell 3/OQPM1Sections
9. PRO/IQAC/Records Sections
10. Stock File/File Copy

File No. 110885/AC A16-1/2025/AC A16

Forwarded / By Order

Section Officer



Mahatma Gandhi University

Kottayam

Programme					
Course Name	Instrumentation Techniques in Chemistry				
Type of Course	DSC C				
Course Code	MG4DSCICH200				
Course Level	200-299				
Course Summary	This course provides an integrated understanding of the principles and instrumentation of analytical techniques including UV-Visible and IR spectroscopy, polarimetry, refractometry, and thermal analysis, emphasizing their theoretical concepts, functional components, performance characteristics, and practical applications.				
Semester	IV	Credits			Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others
		3		1	
Pre-requisites, if any					

MGU-UGP (HONOURS)

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
CO1	Explain the fundamental concepts of instrumentation and classify instruments based on their mode of operation.	An	1,2
CO2	Describe the instrumentation of spectrophotometers and the role of spectroscopic methods in analytical chemistry	U	1,2
CO3	Illustrate the principle and working of Spectrophotometers	A	1,2
CO4	Assess the role of optical and thermal methods in quality control and materials research.	E	1,2
CO5	Perform practical experiments using analytical instruments, operate instruments safely, and carry out routine calibration and maintenance and apply	S	1,2,10

	spectroscopic, optical, and thermal analysis techniques to identify, quantify, and characterize materials		
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Principles of Instrumentation			
	1.1	Introduction to Instrumentation: SI units of measurements, Classification: manual/automatic, self-operated/power-operated, analog/digital, examples	4	1
	1.2	Performance characteristics: Static & dynamic characteristics; zero-order & first-order instruments; examples	4	1
	1.3	Signal and noise: Types of noises: chemical, instrumental, thermal, shot, flicker, environmental; S/N ratio, significance in analysis.	4	1
2	Basic Analytical Instruments			
	2.1	Spectroscopy: Electromagnetic Radiations, Types of spectroscopy, Origin of absorption and emission spectra.	3	2,3
	2.2	Principle of UV- visible spectrometry, Instrumentation: Light sources (tungsten, hydrogen, deuterium lamps), wavelength selectors (filters, prisms, gratings), detectors (photocell, photomultiplier, diode array), sample cells, Single vs double beam Spectrophotometers, applications	9	2,3

	2.3	Principle of IR Spectroscopy, Instrumentation: Sources (Nernst, Globar, Nichrome), wavelength selectors (prism, grating, interferometer), sample cells (liquids, solids), detectors (thermal, pneumatic, pyroelectric, photon), applications.	9	2,3
3	Optical and Thermal analysis techniques			
	3.1	Polarimetry: Principle, Instrumentation and applications of polarimetry	4	4
	3.2	Refractometry: Principle, Instrumentation and applications of refractometry	4	4
	3.3	Thermal gravimetric analysis (TGA), differential thermal analysis (DTA), Principle and applications	4	4
4	Instrumentation Techniques in Chemistry -Practicals			
	4.1	1. Verification of Beer-Lambert's Law using UV-Visible spectroscopy/Colorimeter 2. Determination of unknown concentration of a Sample using UV-Visible Spectroscopy/Colorimeter (Iron and Chromium) 3. Identification and Interpretation of Functional Groups using IR Spectra of simple compounds. (groups like OH, CHO, COOH, NH ₂) 4. Measurement of Refractive Index of Liquids using Abbe Refractometer. (refractive index of water, ethanol, and nitrobenzene). 5. Determination of sugar concentration using Refractometry 6. Measurement of optical rotation using Polarimeter (glucose and sucrose) 7. Conductometric titration of strong acid vs strong base (HCl with NaOH)		

		8. Conductometric titration of weak acid vs strong base (acetic acid with NaOH).		
		9. Determination of cell constant and conductivity of electrolytes		
		10. Potentiometric titration of acid-base system (HCl with NaOH using a pH electrode)	30	5
		11. Potentiometric titration of redox system (Fe^{2+} with KMnO_4)		
		12. Calibration and maintenance of analytical instruments (Perform calibration and routine maintenance of UV-Vis, IR, refractometer, polarimeter, conductivity meter, and potentiometer)		
5		Teacher Specific Content		

Teaching and Learning Approach	Classroom procedure (mode of transaction) ICT enabled demonstrations Group discussion Lecture Visit to Instrumentation centers/Labs
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory (25 marks) Assignments/MCQ/viva/Involvement in classroom activities Practical (15 marks) Lab involvement / report /Lab test B. End Semester Evaluation Theory (50 marks)-1.5 hrs. MCQ 10 questions : $10 \times 1 = 10$ Short answer 4 questions (out of 6): $4 \times 3 = 12$ Short essay 4 questions (out of 6): $4 \times 7 = 28$ Practical (35 marks)-1 hrs. Lab report: 5 Viva: 10 Analysis and procedure: 20

References

1. Jeffry, Basset, Mendhem, R.C Denwy, Vogel's Text Book of Quantitative Inorganic Analysis, 4th & 5th Edition.
2. Skoog and Leary, Principles of Instrumental analysis, 4th Edition, Sanders College Publishing.
3. D. Patranabis, Principles of Industrial Instrumentation, 2nd Edition, Tata McGraw Hill Company, Delhi.
4. James W. Robinson, Eileen M. Skelly Frame and George M. Frame II, Undergraduate Instrumental analysis, 6th Edition, Marcel Dekker, New York.
5. Francis Rouessac and Annick Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, 2nd Edition, John Wiley & Sons.
6. Frank A. Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall PTR.
7. Skoog and West, Fundamentals of Analytical Chemistry, 9th edition, Sanders College Publishing.
8. John Kenkel. Analytical Chemistry for Technicians, 4th Edition, CRC Press.
9. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Vyvyan, J. A. Introduction to spectroscopy. Cengage learning.



MGU-UGP (HONOURS)

Syllabus