

KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)
COIMBATORE – 641 029



DEPARTMENT OF BOTANY

**CERTIFICATE PROGRAMME IN HERBAL
SCIENCE AND ANALYTICAL TECHNIQUES**

CURRICULUM AND SCHEME OF EXAMINATIONS
(CBCS)
(2026 – 2027 onwards)

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PROGRAMME OUTCOMES (PO)

PO1

- ❖ Demonstrate a basic understanding of herbal science

PO2

- ❖ Apply logical and reasoning skills in the area of medicinally important plant species
- ❖ Demonstrate a basic understanding of herbal science

PO3

- ❖ Utilization and implementation of techniques in plant secondary metabolite analysis

PO4

- ❖ Identify the proper techniques for extraction process

PO5

- ❖ Comply with current needs and industrial expectations

PO6

- ❖ Compare and apply different techniques for qualitative and quantitative analysis.

PO7

- ❖ Show how to operate and trouble shoot the instruments

PO8

- ❖ Translate theoretical knowledge in to applications

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1

- ❖ To gain knowledge on various Indian traditional medicinal system and their advantages

PSO 2

- ❖ Isolate and identify the phytochemicals to treat various ailments

PSO3

- ❖ Use classical and advanced techniques for the mass multiplication of herbs

PSO4

- ❖ Make aware about the handling of analytical instruments.

PSO5

- ❖ Develop self entrepreneurship and research skills

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**PROGRAMME NAME: CERTIFICATE PROGRAMME IN HERBAL SCIENCE
AND ANALYTICAL TECHNIQUES**

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2026-2027 and onwards)

Semester	Subject Code	Title of the Paper	Instruction hour/cycle	Exam Marks			Duration of Exam (hours)	Credits
				CIA	ESE	Total		
	26CHA101	C.P.1- Herbal Science	2	25	75	100	3	2
	26CHA102	C.P.2 Analytical Techniques	2	25	75	100	3	2
	26CHA1CL	C.Pr.1. Analytical Techniques Lab	2	40	60	100	3	2
	26CHA1Z1	Project & Viva-Voce	2	20	80	100	3	2
		Grand Total	8	-	-	400	-	8

Note:

CBCS - Choice Based Credit System

CIA - Continuous Internal Assessment

ESE - End of Semester Examinations

Tally Table:

S.No.	Subject	Marks	Credits
1.	Core-Theory	200	4
2.	Core Practical	100	2
3.	Project & Viva-Voce	100	2
Grand Total		400	8

- 25% CIA is applicable for all subjects

Teaching Pedagogy

Smart Class Room / Powerpoint presentation/Seminar/Quiz/Discussion/Flipped Classroom/Peer Learning/Experimental Learning/Blended learning

Flipped Classroom

Preamble:

- Under flipped classroom model, students review foundational content before class, with class time dedicated to practice, discussion, and problem – solving where the role of the teachers will be facilitating discussions and enabling students to embark on a holistic learning perspectives

Work instructions:

- One flipped session / unit is made mandatory and the course In-charge shall identify and specify the topic to be covered in the flipped session in the lesson plan.
- Detailed session plans must be intimated to all students at least one week in advance.
- Curated content such as LORs, video lectures, animations, and other relevant digital content shall be provided to students in advance to facilitate effective preparation for the flipped classroom session.

Peer Learning

Preamble:

- Peer Assisted learning enables students to learn from each other sharing knowledge in a collaborative learning environment.
- Development of leadership skills and student engagement through student to student academic support.
- Reduce drop out/failure rates of the students and create a supportive academic culture where a high performing or trained student assists peers academically.

Work Instructions:

- Course In-charge shall supervise the programme by periodically reviewing its implementation, conducting review meetings, and monitoring the progress reports.
- Course In-charge shall identify 5 to 6 fast learners based on their academic performance in internal and external examinations.
- Course In-charge shall also identify students who require additional academic support and assign 4 to 5 such students to each fast learner to facilitate peer learning.

This team will operate remedial classes on a peer learning mode as per the following:

- a) One session / week / course and each session shall be for 30 minutes in duration, with follow-up learning activities.
- b) The faculty In-charge shall review attendance records and monitor the academic progress of the students.

Blended learning

Preamble:

- Blended learning integrates traditional in class instruction with digital tools exposing students to a myriad options for learning from subject experts across the globe
- It is provided with online learning sessions on recorded videos, lecture captured sessions (included under guided library hours), digital resources, and guided sessions facilitated by internal faculty members and external experts through Zoom meets etc.,

Work Instructions:

- For every course, students will be motivated to attend additional webinar/online courses through any interactive learning tools such as, telepresence systems, podcasts,

interactive videos etc. with minimum of 2 sessions/course and maximum of 3 sessions/course.

Components of Continuous Internal Assessment (CIA)

Components		Marks	Total
Theory			
CIA I	75	(75+75=150/10) 15	25
CIA II	75		
Objective capacity Testing */Seminar		5	
Attendance		5	
Practical			
CIA Practical		25	40
Observation Notebook		10	
Attendance		5	
Project			
Review		15	20
Regularity		5	

* Objective Capacity Testing:

- For the first assessment, questions shall be set from 2 ½ units (25 questions) and evaluation for 5 marks. The assessment shall be conducted through any authentic online platform, one week prior to the commencement of I CIA theory examinations.
- For the second assessment, questions shall be set from 2 ½ units (25 questions) and evaluation for 5 marks. The assessment shall be conducted through any authentic online platform, one week prior to the commencement of II CIA theory examinations.
- The average of the first and second assessment scores shall be considered for the final **5 marks** allocation.

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1 - Remembering; **K2** - Understanding; **K3** - Applying; **K4** - Analyzing; **K5** - Evaluating

1. Theory Examination - Part I, II & III

(i) CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	75
K1 – K5 Q11 to 15	B (Either or Pattern)	5 x 5 = 25	Short Answers	
K2 - K5 Q16 to 20	C (Either or Pattern)	5 x 8 = 40	Descriptive / Detailed	

2. Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments & Record Work	50	60
K4		10	
K5			

3. Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report & Viva voce	60	80
K4		20	
K5			

Programme Code: 05	CERTIFICATE PROGRAMME IN HERBAL SCIENCE AND ANALYTICAL TECHNIQUES			
Core Paper: 1 HERBAL SCIENCE				
Batch 2026-2027	Hours / Week 2	Total Hours 30	Credits 2	Entrepreneurship

COURSE OBJECTIVES

- To study the importance of medicinal plants
- To learn the uses of plant secondary metabolites
- To inculcate vegetative and *in vitro* propagation techniques

COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Acquire knowledge on various types of Indian system of medicine
	CO2	Utilize the applications of different pharmacopoea
	CO3	Apply knowledge on secondary metabolite extraction
	CO4	Implement the cultivation practices for propagation of medicinal plants
	CO5	Know how to patent and commercialize a product

SYLLABUS

UNIT I: (6 hours)

Introduction to Herbal Science: Historical background and scope, role of medicinal plants in Siddha and Ayurvedic systems of medicine, medicinal plants-cultivation, harvesting, extraction, storage and marketing.

UNIT II: (6 hours)

Secondary Metabolites: *History, classification, properties, distribution in nature, extraction, biosynthesis, biological role and applications of alkaloids, phenolics and terpenes.

UNIT III: (6 hours)

Propagation techniques: Tubers-root and stem, rhizome, bulb, corm, runner, stolon, sucker, bulbils, hydroponics, aeroponics and polyhouses

UNIT IV: (6 hours)

***In vitro* propagation techniques:** *History of tissue culture, aseptic conditions, micropropagation, callus culture, cell culture, protoplast culture, embryo culture anther and pollen culture. Biotransformation and elicitation.

UNIT V: (6 hours)

Literature search in medicinal plant research: Definition, purpose of literature search, internet as an information search tool, planning a search and electronic database. **Patenting of herbal drugs:** definition, benefits of patent protection, patent application, plant breeders right, point to remember while drafting and filling a patent, Indian and international patent laws, trade related aspects of IPR

* Self study

TEXT BOOKS

1. H.S. Chawla, (2002). Introduction to Plant Biotechnology. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
2. Kalyan Kumar De. (2004). An Introduction to Plant Tissue Culture. 2008. New Central Book Agency, Kolkata.
3. NIIR Board of Consultants and Engineers. (2006). Cultivation and processing of selected medicinal plants. Asia Pacific Business Press Inc. India.
4. Alice Kurian and Asha Shankar (2007). Medicinal plants. New India Publishing Agency, India.

REFERENCE BOOKS

1. Matthew Wood. (1997). The Book of Herbal Wisdom: Using Plants as Medicines. 1st Edition. North Atlantic Books.
2. Buchanan, Gruissem and Jones. (2000). Biochemistry and Molecular Biology of Plants. John Wiley & Sons, UK.
3. Manuchair Ebadi. (2002). Pharmacodynamic Basis of Herbal Medicine. CRC Press.
4. Razdan. (2003). Introduction to Plant Tissue Culture. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
5. David Hoffmann. (2003). Medical Herbalism: The Science and Practice of Herbal Medicine. Healing Arts Publishers.
6. Willow J. H. Liu. (2010). Traditional Herbal Medicine Research Methods: Identification, Analysis, Bioassay, and Pharmaceutical and Clinical Studies. John Wiley & Sons.
7. Agrawal and Paridhavi. (2012). Herbal drug technology. 2nd Edition, University Press, India.
8. K.V. Peter, (2012). Handbook of Herbs and Spices. 2nd Edition. Science direct Publishers.

WEB RESOURCES

1. <https://www.ncbi.nlm.nih.gov/books/NBK92773/>
2. <https://pmc.ncbi.nlm.nih.gov/articles/PMC12300753/>
3. <https://resourcecentral.org/plant-propagation-methods/?srsltid=AfmBOopk6kB41dfezt37sFMIMFj9DyyTk9yIwlVyzXlsAhWRsIp3CZOI>
4. <https://pmc.ncbi.nlm.nih.gov/articles/PMC9606719/>

CHA3**26CHA101****MAPPING**

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	S	M	S	M	M
CO3	H	S	M	S	H
CO4	S	S	H	S	H
CO5	S	M	M	H	H

S - Strong**H** - High**M** - Medium**L** - Low

Content Prepared by (Based on Inputs)	
Dr. R. Thirugnanasampandan Signature of the Course In-charge	Signature of the HOD

Programme	CERTIFICATE PROGRAMME IN HERBAL SCIENCE AND			
Code: 05	ANALYTICAL TECHNIQUES			
Core Paper 2: ANALYTICAL TECHNIQUES				
Batch	Hours / Week	Total Hours	Credits	Entrepreneurship
2026-2027	2	30	2	

COURSE OBJECTIVES

- To learn the basics of analytical instruments
- To apply instruments for various applications
- To perform the trouble shooting of instruments

COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Know how important instruments in entrepreneurship
	CO2	Utilize the instruments for academic and research purpose
	CO3	Handle and get results for the study samples
	CO4	Get job opportunities in herbal companies
	CO5	Start an instrumentation facility centre for plant sample analysis

SYLLABUS**UNIT I: (6 hours)**

Photometry: Principle, working mechanism and applications: Colorimetry, UV-visible spectrophotometry, Fluorimetry and Flame photometry. Biophotometer and microplate reader.

UNIT II: (6 hours)

Chromatography: Principle, working mechanism and applications: Paper chromatography*, Thin layer chromatography (TLC), Column chromatography and Affinity chromatography. Lyophilization.

UNIT III: (6 hours)

Analytical chromatography and spectroscopy: High performance liquid chromatography (HPLC) and Gas chromatography (GC), Infrared spectroscopy, Mass spectroscopy and Nuclear magnetic resonance spectroscopy.

UNIT IV: (6 hours)

Distillation and extraction: Soxhlet apparatus, Clevenger apparatus, Sonicator, Rotary vacuum evaporator and Magnetic stirrer

UNIT V: (6 hours)

Electrophoresis: Principle, working mechanism and applications: Agarose gel electrophoresis (AGE), Polyacrylamide gel electrophoresis (PAGE), PCR and its types and Gel documentation system

* Self study

TEXT BOOKS

1. B.K. Sharma (2005). Instrumental Methods of Chemical analysis. 24th Revised Edition, Goel Publishing House, Meerut.
2. L. Veerakumari (2009). Bioinstrumentation. MJP Publishers, New Delhi, India.

3. M.H. Fulekar and Bhawana Pandey. (2013). Bioinstrumentation. International Publishing House Pvt Ltd.
4. N. Arumugam and V. Kumaresan. (2015). Biophysics and Bioinstrumentation. Saras Publication.

REFERENCE BOOKS

1. Skoog and Leary. (1992). Principles of Instrumental analysis, 4th Edition. Saunder's College Publishing, New York.
2. Holme and Peck. (1998). Analytical Biochemistry, 3rd Edition, Pearson Education Ltd, Essex, England
3. K. Wilson and J. Walker (2000). Principles and Techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge.
4. Khandpur. R.S. (2003). Handbook of Biomedical Instrumentation, Tata McGraw Hill
5. John Denis Enderle (2006). Bioinstrumentation. Morgan & Claypool Publishers.
6. John G. Webster. (2008). Bioinstrumentation. Wiley India Edition. India
7. R.S. Khandpu (2014). Handbook of Biomedical Instrumentation, Tata McGraw Hill Essex, England.
8. M.J. Reilly (2018). Bioinstrumentation. CBS Publishers and Distributors Pvt Ltd, India.

WEB RESOURCES

1. <https://gyansanchay.csjmu.ac.in/wp-content/uploads/2021/11/Photometry-April-2020.pdf>
2. <https://www.thermofisher.com/blog/ask-a-scientist/what-is-chromatography/>
3. <https://www.sciencedirect.com/science/article/pii/S2468227623000443>
4. <https://www.vbspu.ac.in/e-content/Prabhakar-Singh/ELECTROPHORESIS.pdf>

MAPPING

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	M	S
CO2	S	M	S	H	H
CO3	H	S	S	H	S
CO4	S	H	H	S	M
CO5	S	M	M	H	H

S - Strong

H - High

M - Medium

L – Low

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Programme Code: 05	CERTIFICATE PROGRAMME IN HERBAL SCIENCE AND ANALYTICAL TECHNIQUES			
Core practical 1: ANALYTICAL TECHNIQUES LAB				
Batch 2026-2027	Hours / Week 2	Total Hours 30	Credits 2	Entrepreneurship

COURSE OBJECTIVES

- To study the various plant samples
- To prepare solutions and samples for analysis
- To work with various instruments

COURSE OUTCOMES

On successful completion of the course, the students will be able to

K3 ↑ ↓ K5	CO1	Analyze various study samples
	CO2	Work with instruments and get reports
	CO3	Optimize and operate the instruments individually
	CO4	Start consultancy services
	CO5	Start their own business

SYLLABUS**LIST OF PRACTICALS**

1. Molarity, Normality, Percentage solution and PPM calculations
2. Preliminary qualitative techniques for phytochemicals identification
3. pH meter
4. Colorimeter and UV-Visible spectrophotometer
5. Biophotometer
6. Microplate reader
7. Paper and Thin layer chromatography
8. Column chromatography
9. Lyophilization
10. HPLC (Demo with instrument)
11. IR spectroscopy (Demo with instrument)
12. Soxhlet apparatus and Clevenger apparatus
13. Rotary vacuum evaporator
14. Thermocycler- Polymerase Chain Reaction (PCR)
15. Agarose gel electrophoresis

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	S
CO2	S	S	H	S	H
CO3	S	H	S	S	S
CO4	S	S	M	M	S
CO5	S	M	M	H	H
S - Strong		H - High	M - Medium	L - Low	

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CERTIFICATE PROGRAMME QUESTION PAPER (PRACTICALS)

End of Semester Examination Question Paper Pattern

(For the candidates admitted from the academic year 2026-202 onwards)

Time: 3 Hours

Max. Marks: 60 Marks

BREAK UP OF MARKS

a)	Qualitative analysis of given plant powder	10 Marks
b)	Photometric analysis of given sample	10 Marks
c)	Chromatography separation of plant compounds	10 Marks
d)	Extraction of given plant sample	10 Marks
e)	Spotters	10Marks
f)	Record	10 Marks
		60 Marks

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Programme Code: 05	CERTIFICATE PROGRAMME IN HERBAL SCIENCE AND ANALYTICAL TECHNIQUES			
PROJECT & VIVA – VOCE				
Batch 2026-2027	Hours / Week 2	Total Hours 30	Credits 2	Entrepreneurship

COURSE OBJECTIVES

- To identify practical issues in field of herbal science
- To understand the data collection and processing
- To apply proper techniques to analyze and interpret the research data

COURSE OUTCOMES

On successful completion of the project work, the students will be able to

K3 ↑ K5 ↓	CO1	Apply theoretical skill sets in lab oriented experiments
	CO2	Analyze the importance of project work while collecting necessary data
	CO3	Evaluate variations between theories and experiments
	CO4	Apply the principles and concepts in their research components
	CO5	Execute standard operating procedures and interpretation of appropriate results

Group project work will be allotted to the students under the supervision and guidance of the Faculty members. The project work will be allotted based on the field of herbal science and instrumentation. The students can execute their projects under their supervisors and submit the dissertation at the end of the Semester. Both the Internal and External Examiners shall jointly evaluate the project work submitted by the students and marks will be awarded as follows

Guidelines for the Distribution of Marks:

CIA	Project Review	15	20
	Regularity	5	
ESE	Project Report Present	60	80
	Viva – Voce	20	
	Grand Total		100

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	S	M	S
CO2	S	S	H	S	H
CO3	S	H	S	H	S
CO4	S	H	M	S	M
CO5	H	M	S	M	L

S - Strong

H - High

M - Medium

L – Low

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