



आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

**SCHOOL OF PHARMACEUTICAL SCIENCES
IFTM UNIVERSITY, MORADABAD.**

www.iftmuniversity.ac.in

Study & Evaluation Scheme of Master of Pharmacy

<i>Programme</i>	:	<i>Master of Pharmacy (Pharmacognosy)</i>
<i>Course Level</i>	:	<i>Post Graduate Degree</i>
<i>Duration</i>	:	<i>Four Semester (two academic year) Full Time</i>
<i>Medium of instruction</i>	:	<i>English</i>
<i>Minimum Required Attendance</i>	:	<i>80%</i>
<i>Total Credit Points</i>	:	<i>Minimum=95, Maximum=100</i>

Programme Outcomes (POs):

On completion of the M. Pharm. program, a student will be able to:

PO1: Explain the knowledge of the basics and advanced pharmaceutical sciences and the ability to acquire, manage and use current information with problem solving approach.

PO2: Perform the synthesis, development of analytical techniques for identification, characterization and quantification of drugs, formulation, pharmacological, pharmacognostical, biotechnological and regulatory aspects of drugs and biomolecules.

PO3: Undergo the applied and interdisciplinary research for betterment of society at national and international level.

PO4: Comply and work on rules and regulations involved in the drug discovery & development, manufacture and other allied area of the field.

PO5: Develop problem-based learning approach and analytical thinking in his/her academic and professional life.

PO6: Apply critical thinking skills, including investigation, application, analysis, creativity, evaluation of information, data and documents related to research at local, regional and global platform.

PO7: Tackle professional challenges through lifelong learning attitude.

PO8: Demonstrate the ability to plan and implement professional activities.

PO9: Act efficiently as a leader in the diverse areas of the profession including writing research papers and articles of contemporary trends.

PO10: Apply the knowledge and skills to gain recognition in professional circle as well as society.

PO11: Make initiatives to create awareness in society about the effective and safe use of medicines.

PO12: Exercise ethical practices and moral values in personal and professional endeavors.

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2016

THE MASTER OF PHARMACY (M. PHARM.) COURSE REGULATION 2014

(BASED ON NOTIFICATION IN THE GAZETTE OF INDIA No. 362, DATED DECEMBER 11, 2014)

SCHEME AND SYLLABUS



PHARMACY COUNCIL OF INDIA
Combined Council's Building, Kotla Road,
Aiwan-E-Ghalib Marg, New Delhi-110 002.
Website : www.pci.nic.

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भारत का राजपत्र The Gazette of India

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NEW DELHI, THURSDAY, DECEMBER 11, 2014/AGRAHAYANA 20, 1936

PHARMACY COUNCIL OF INDIA

NOTIFICATION

New Delhi, the 10th December, 2014

The Master of Pharmacy (M.Pharm) Course Regulations, 2014

No. 14-136/2014-PCI.—In exercise of the powers conferred by Sections 10 and 18 of the Pharmacy Act, 1948 (8 of 1948), the Pharmacy Council of India, with the approval of the Central Government hereby makes the following regulations: namely—

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CHAPTER –I:REGULATIONS

1. Short Title and Commencement

These regulations shall be called as “The Revised Regulations for the Master of Pharmacy (M. Pharm.) Degree Program - Credit Based Semester System (CBSS) of the Pharmacy Council of India, New Delhi”. They shall come into effect from the Academic Year 2016-17. The regulations framed are subject to modifications from time to time by the authorities of the university.

2. Minimum qualification for admission

A Pass in the following examinations

a) B. Pharm Degree examination of an Indian university established by law in India from an institution approved by Pharmacy Council of India and has scored not less than 55% of the maximum marks (aggregate of 4 years of B. Pharm.)

b) Every student, selected for admission to post graduate pharmacy program in any PCI approved institution should have obtained registration with the State Pharmacy Council or should obtain the same within one month from the date of his/her admission, failing which the admission of the candidate shall be cancelled.

Note: It is mandatory to submit a migration certificate obtained from the respective university where the candidate had passed his/her qualifying degree (B. Pharm.)

3. Duration of the program

The program of study for M. Pharm. shall extend over a period of four semesters (two academic years). The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from the month of December/January to May/June in every calendar year.

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6. Attendance and progress

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

7. Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, practical classes, seminars, assignments, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week/per activity.


Credit assignment

Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having four lectures per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2. The contact hours of seminars, assignments and research work shall be treated as that of practical courses for the purpose of calculating credits. i.e., the contact hours shall be multiplied by 1/2. Similarly, the contact hours of journal club, research work presentations and discussions with the supervisor shall be considered as theory course and multiplied by 1.

Minimum credit requirements

The minimum credit points required for the award of M. Pharm. degree is 95. However based on the credit points earned by the students under the head of co-curricular activities, a student shall earn a maximum of 100 credit points. These credits are divided into Theory courses, Practical, Seminars, Assignments, Research work, Discussions with the supervisor, Journal club and Co-Curricular activities over the duration of four semesters. The credits


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are distributed semester-wise as shown in Table 14. Courses generally progress in sequence, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

8. Academic work

A regular record of attendance both in Theory, Practical, Seminar, Assignment, Journal club, Discussion with the supervisor, Research work presentation and Dissertation shall be maintained by the department / teaching staff of respective courses.

9. Course of study

The specializations in M.Pharm program is given in Table 1.

Table – 1: M.Pharm. Specialization with Code

S. No.	Specialization	Code
1.	Pharmacognosy	MPG

The course of study for M.Pharm specializations shall include Semester wise Theory & Practical as given in Table – 2. The number of hours to be devoted to each theory and practical course in any semester shall not be less than that shown in Table – 2.

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Table – 2: Course of study for M. Pharm. (Pharmacognosy)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPG101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPG102T	Advanced Pharmacognosy-I	4	4	4	100
MPG103T	Phytochemistry	4	4	4	100
MPG104T	Industrial Pharmacognostical Technology	4	4	4	100
MPG105P	Pharmacognosy Practical I	12	6	12	150
MPG111P	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPG201T	Medicinal Plant biotechnology	4	4	4	100
MPG202T	Advanced Pharmacognosy-II	4	4	4	100
MPG203T	Indian system of medicine	4	4	4	100
MPG204T	Herbal cosmetics	4	4	4	100
MPG205P	Pharmacognosy Practical II	12	6	12	150
MPG222P	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

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Table – 3: Course of study for M. Pharm (Pharmacognosy). III Semester

Course Code	Course	Credit Hours	Credit Points
MRM 301T	Research Methodology and Biostatistics*	4	4
MPG302	Journal club	1	1
MPG303	Discussion / Presentation (Proposal Presentation)	2	2
MPG304	Research Work	28	14
Total		35	21

* Non University Exam

Table – 4: Course of study for M. Pharm (Pharmacognosy). IV Semester

Course Code	Course	Credit Hours	Credit Points
MPG 401	Journal Club	1	1
MPG 402	Discussion / Presentation (Proposal Presentation)	3	3
MPG403	Research Work and Colloquium	31	16
Total		35	20

Table – 5: Semester wise credits distribution

Semester	Credit Points
I	26
II	26
III	21
IV	20
Co-curricular Activities (Attending Conference, Scientific Presentations and Other Scholarly Activities)	Minimum=02 Maximum=07*
Credit Points for Co-curricular Activities M. Pharm Pharmacognosy Total Credit Points	Minimum=95 Maximum=100*

Cancelled
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Table – 6: Guidelines for Awarding Credit Points for Co-curricular Activities


Name of the Activity	Maximum Credit Points Eligible / Activity
Participation in National Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	01
Participation in international Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	02
Academic Award/Research Award from State Level/National Agencies	01
Academic Award/Research Award from International Agencies	02
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	01
Research / Review Publication in International Journals (Indexed in Scopus / Web of Science) Outside India	02

*The credit points assigned for extracurricular and/or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

10. Program Committee

1. The M. Pharm. programme shall have a Programme Committee constituted by the Head of the institution in consultation with all the Heads of the departments.
2. The composition of the Programme Committee shall be as follows:
A teacher at the cadre of Professor shall be the Chairperson; One Teacher from each M.Pharm specialization and four student representatives (two from each academic year), nominated by the Head of the institution.
3. Duties of the Programme Committee:
 - i. Periodically reviewing the progress of the classes.
 - ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.
 - iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.


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- iv. Communicating its recommendation to the Head of the institution on academic matters.
- v. The Programme Committee shall meet at least twice in a semester preferably at the end of each sessional exam and before the end semester exam.

11. Examinations/Assessments

The schemes for internal assessment and end semester examinations are given in Table – 7.

End semester examinations

The End Semester Examinations for each theory and practical course through semesters I to IV shall be conducted by the respective university except for the subject with asterix symbol (*) in table I and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.


Date _____
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Table – 7: Schemes for internal assessments and end semester
(Pharmacognosy- MPG)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPG101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPG102T	Advanced Pharmacognosy-1	10	15	1 Hr	25	75	3 Hrs	100
MPG103T	Phytochemistry	10	15	1 Hr	25	75	3 Hrs	100
MPG104T	Industrial Pharmacognostical Technology	10	15	1 Hr	25	75	3 Hrs	100
MPG105P	Pharmacognosy Practical I	20	30	6 Hrs	50	100	6 Hrs	150
MPG111P	Seminar /Assignment	.	.	.	.	.	.	100
Total								650
SEMESTER II								
MPG201T	Medicinal Plant biotechnology	10	15	1 Hr	25	75	3 Hrs	100
MPG202T	Advanced Pharmacognosy-II	10	15	1 Hr	25	75	3 Hrs	100
MPG203T	Indian system of medicine	10	15	1 Hr	25	75	3 Hrs	100
MPG204T	Herbal cosmetics	10	15	1 Hr	25	75	3 Hrs	100
MPG205P	Pharmacognosy Practical II	20	30	6 Hrs	50	100	6 Hrs	150
MPG222P	Seminar /Assignment	100
Total								650

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Tables-8: Schemes for internal assessments and endsemester examinations (Semester III & IV)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER III								
MRM301T	Research Methodology Biotastics*	10	15	1 Hr	25	75	3 Hrs	100
MPG302	Journal club	.	.	.	25	.	.	25
MPG303	Discussion / Presentation (Proposal Presentation)	.	.	.	50	.	.	50
MPG304	Research work*	.	.	.	.	350	1 Hr	350
Total								525
SEMESTER IV								
MPG401	Journal club	.	.	.	25	.	.	25
MPG402	Discussion / Presentation (Proposal Presentation)	.	.	.	75	.	.	75
MPG403	Research work and Colloquium	400	1 Hr	400
Total								500

*Non University Examination

MPG-

Pharmacognosy

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Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table – 9: Scheme for awarding internal assessment: Continuous mode

Theory			
Criteria			Maximum Marks
Attendance (Refer Table – 28)			8
Student – Teacher interaction			2
Total			10
Practical			
Attendance (Refer Table – 28)			10
Based on Practical Records, Regular viva voce, etc.			10
Total			20
Percentage of Attendance	Total	Theory	Practical
95 – 100		8	10
90 – 94		6	7.5
85 – 89		4	5
80 – 84		2	2.5
Less than 80		0	0

Sessional Exams


Two sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s). The scheme of question paper for theory and practical sessional examinations is given in the table. The average marks of two sessional exams shall be computed for internal assessment as per the requirements given in tables.

12. Promotion and award of grades

A student shall be declared PASS and eligible for getting grade in a course of M.Pharm. programme if he/she secures at least 50% marks in that particular course including internal assessment.

13. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessment


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shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

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14. Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the sessional exam component of the internal assessment. The re-conduct of the sessional exam shall be completed before the commencement of next endsemester theory examinations.

15. Reexamination of end semester examinations

Reexamination of end semester examination shall be conducted as per the schedule given in table 11. The exact dates of examinations shall be notified from time to time.

Table – 11: Tentative schedule of end semester examinations

Semester	For Regular Candidates	For Failed Candidates
I and III	November / December	May / June
II and IV	May / June	November / December

16. Allowed to keep terms (ATKT):

No student shall be admitted to any examination unless he/she fulfills the norms given in 6. ATKT rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I and II semesters till the III semester examinations. However, he/she shall not be eligible to attend the courses of IV semester until all the courses of I, II and III semesters are successfully completed.


A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to IV semesters within the stipulated time period as per the norms.

Note: Grade AB should be considered as failed and treated as one head for deciding ATKT. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

17. Grading of performances

Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in Table – 12.


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Table – 12: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C₁, C₂, C₃ and C₄ and the student's grade points in these courses are G₁, G₂, G₃ and G₄, respectively, and then students' SGPA is equal to:


$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4}{C_1 + C_2 + C_3 + C_4}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * \text{ZERO}}{C_1 + C_2 + C_3 + C_4}$$

19. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the IV semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all IV semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA


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shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4}{C_1 + C_2 + C_3 + C_4}$$

where C_1, C_2, C_3, \dots is the total number of credits for semester I, II, III, \dots and S_1, S_2, S_3, \dots is the SGPA of semester I, II, III, \dots

20. Declaration of class

The class shall be awarded on the basis of CGPA as follows: First Class with

Distinction = CGPA of 7.50 and above	
First Class	= CGPA of 6.00 to 7.49
Second Class	= CGPA of 5.00 to 5.99

21. Project work

All the students shall undertake a project under the supervision of a teacher in Semester III to IV and submit a report. 4 copies of the project report shall be submitted (typed & bound copy not less than 75 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). The projects shall be evaluated as per the criteria given below.

Evaluation of Dissertation Book:

Objective(s) of the work done	50 Marks
Methodology adopted	150 Marks
Results and Discussions	250 Marks
Conclusions and Outcomes	50 Marks
Total	500 Marks

Evaluation of Presentation:

Presentation of work	100 Marks
Communication skills	50 Marks
Question and answer skills	100 Marks
Total	250 Marks

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22. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the M.Pharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the M. Pharm program in minimum prescribed number of years, (two years) for the award of Ranks.

23. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

24. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration of the program and the students have to pass within the said period, otherwise they have to get fresh Registration.

25. Revaluation I Retotaling of answer papers

There is no provision for revaluation of the answer papers in any examination. However, the candidates can apply for retotaling by paying prescribed fee.

26. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.


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PHARMACOGNOSY (MPG)
MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES
(MPG101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know about,

- Chemicals and Excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY


60 Hrs


1	<p>UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.</p> <p>Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence</p> <p>Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.</p>	10 Hrs
2	<p>NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR.</p> <p>Applications of NMR spectroscopy.</p>	10 Hrs
3	<p>Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical,</p>	10 Hrs

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	field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	
4	<p>Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:</p> <p>Thin Layer chromatography High Performance Thin Layer Chromatography Ion exchange chromatography Column chromatography Gas chromatography High Performance Liquid chromatography Ultra-High-Performance Liquid chromatography Affinity chromatography Gel Chromatography</p>	10 Hrs
5	<p>Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:</p> <p>Paper electrophoresis Gel electrophoresis Capillary electrophoresis Zone electrophoresis Moving boundary electrophoresis Iso electric focusing</p> <p>X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.</p>	10 Hrs
6	<p>Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.</p> <p>Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental</p>	10 Hrs


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<p>conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications.</p> <p>Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivativedifferential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.</p>	
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Course Outcomes:

Upon completion of this course, the student should be able to:

CO1: Understand theory, instrumentation and applications of various spectroscopic techniques for skill development, entrepreneurship and employability at local, regional and global platform.

CO2: Know about the concept and applications of NMR spectroscopy for skill development, entrepreneurship and employability.

CO3: Learn theory, instrumentation and applications of Mass spectroscopy for skill development, entrepreneurship and employability.

CO4: Understand principle and instrumentation of various chromatographic methods for skill development, entrepreneurship and employability.

CO5: Understand electrophoresis, X-Ray Crystallography, potentiometry, different thermal techniques and/or immunological assay for skill development, entrepreneurship and employability.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	2	2	2	2	2	2	3
CO2	2	2	2	2	2	2	3	2	2	3	2	3
CO3	2	2	2	2	3	2	2	2	3	2	2	3
CO4	2	2	2	2	2	2	3	2	2	2	2	2
CO5	2	2	2	2	2	2	2	3	2	3	2	3

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CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	2
CO2	3	2	1
CO3	2	3	2
CO4	2	2	1
CO5	3	2	2

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel.Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley eastern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

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ADVANCED PHARMACOGNOSY-I(MPG102T)

Scop

To learn and understand the advances in the field of cultivation and isolation of drugs of natural origin, various phytopharmaceuticals, nutraceuticals and their medicinal use and healthbenefits.

Objectives

Upon completion of the course the student shall be able to:

- Advances in the cultivation and production of drugs.
- Various phyto-pharmaceuticals and their source, its utilization and medicinal value.
- Various nutraceuticals/herbs and their health benefits.
- Drugs of marine origin.
- Pharmacovigilance of drugs of natural origin.

THEORY

60 Hrs

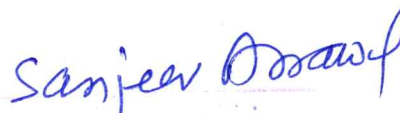
1	Plant Drug Cultivation General introduction to the importance of Pharmacognosy in herbal drug industry Indian Council of Agricultural Research Current Good Agricultural Practices Current Good Cultivation Practices Current Good Collection Practices Conservation of medicinal plants- <i>ex-situ</i> and <i>in-situ</i> conservation of medicinal plants	12 Hrs
2	Marine Natural Products General methods of isolation and purification Study of Marine toxins Recent advances in research in marine drugs Problems faced in research on marine drugs such as taxonomical identification	12 Hrs

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	Chemical screening and their solution	
3	<p>Nutraceuticals</p> <p>Current trends and future scope</p> <p>Inorganic mineral supplements, Vitamin supplements, Digestive enzymes</p> <p>Dietary fibres, Cereals and grains</p> <p>Health drinks of natural origin</p> <p>Antioxidants</p> <ul style="list-style-type: none"> • Polyunsaturated fatty acids <p>Herbs as functional foods</p> <p>Formulation and standardization of nutraceuticals</p> <p>Regulatory aspects, FSSAI guidelines</p> <p>Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits of following</p> <p>Spirulina</p> <p>Soya bean</p> <p>Ginseng</p> <p>Garlic</p> <p>Broccoli</p> <p>Green and Herbal Tea</p> <p>Flax seeds</p> <p>Black cohosh</p> <p>Turmeric</p>	12 Hrs
4	<p>Phytopharmaceuticals</p> <p>Occurrence, isolation and characteristic features (Chemical nature, uses in pharmacy, medicinal and health benefits) of following</p> <p>Carotenoids – α and β – Carotene, Xanthophyll (Lutein)</p> <p>Limonoids – d-Limonene, α – Terpineol</p> <p>Saponins – Shatavarins</p>	12 Hrs


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	Flavonoids – Resveratrol, Rutin, Hesperidin, Naringin, Quercetin Phenolic acids- Ellagic acid Vitamins Tocotrienols and Tocopherols Andrographolide, Glycolipids, Gugulipids, Withanolides, Vascine, Taxol Miscellaneous	
5	Pharmacovigilance of Drugs of Natural Origin WHO and AYUSH guidelines for safety monitoring of natural medicine Spontaneous reporting schemes for bio-drug adverse reactions Bio drug-drug and bio drug-food interactions with suitable examples	12 Hrs

Course Outcomes:

Upon completion of this course, the student should be able to:

CO1: Attain the knowledge about cultivation, production and conservation of medicinal plants for skill development and employability.

CO2: Understand about marine natural products with their isolation, purification, taxonomical identification and chemical screening for skill development and employability..

CO3: Learn the formulation and standardization of various nutraceuticals/ herbs and their regulatory aspects for skill development and employability.

CO4: Learn the occurrence, isolation and characteristic features of phyto-pharmaceuticals for skill development and employability.

CO5: Understand about pharmacovigilance of natural drugs for safety monitoring and spontaneous reporting schemes for skill development and employability at national and international level.

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PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	2	2	3	2	2	2	2	3	2
CO2	2	3	2	3	3	2	3	2	2	2	3	2
CO3	1	2	2	3	2	3	2	2	2	3	2	2
CO4	2	2	2	2	2	2	2	2	2	3	2	2
CO5	2	3	2	2	1	2	3	2	2	2	2	2

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	2	3
CO2	3	3	2
CO3	2	3	3
CO4	2	2	3
CO5	2	2	3

Recommended Books (Latest editions)

1. Pharmacognosy - G. E. Trease and W.C. Evans. Saunders Edinburgh, New York.
2. Pharmacognosy-Tyler, Brady, Robbers.
3. Modern Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I&II.
4. Text Book of Pharmacognosy by T.E. Wallis.
5. Marine Natural Products-Vol.I to IV.
6. Natural products: A lab guide by Raphael Ikan, Academic Press.
7. Glimpses of Indian Ethano Pharmacology, P. Pushpangadam. Ulf Nyman. V.GeorgeTropical Botanic Garden & Research Institute.
8. Medicinal natural products (a biosynthetic approach), Paul M. Dewick, John Wiley & Sons Ltd.,

England.

9. Chemistry of Marine Natural Products- Paul J. Schewer.
10. Herbal Drug Industry by RD. Choudhary, Eastern Publisher, New Delhi.
11. Cultivation of Medicinal Plants by C.K. Atal & B.M. Kapoor.
12. Cultivation and Utilization of Aromatic Plants, C.K. Atal & B.M. Kapoor.
13. Cultivation of medicinal and aromatic crops, AA Farooqui and B.S. Sreeramu. University Press.
14. Natural Products from Plants, by Peter B. Kaufman, CRC Press, New York.
15. Recent Advances in Phytochemistry- Vol. 1&4: Scikel Runeckles- Appleton Century Crofts.
16. Text book of Pharmacognosy, C.K. Kokate, Purohit, Ghokhale, Nirali Prakasshan.
17. Pharmacognosy and Pharmacobiotechnology, Ashutoshkar, New Age Publications, New Delhi.

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PHYTOCHEMISTRY(MPG103T)

Scope

Students shall be equipped with the knowledge of natural product drug discovery and will be able to isolate, identify and extract and the phyto- constituents.

Objectives

Upon completion of the course the student shall be able to:

- Different classes of phytoconstituents, their biosynthetic pathways, their properties, extraction and general process of natural product drug discovery.
- Phytochemical fingerprinting and structure elucidation of phytoconstituents.

THEORY

60 Hrs

1	Biosynthetic Pathways and Radio Tracing Techniques Constituents & their Biosynthesis, Isolation, Characterization and purification with a special reference to their importance in herbal industries of following phyto-pharmaceuticals containing drugs Alkaloids: Ephedrine, Quinine, Strychnine, Piperine, Berberine, Taxol, Vinca alkaloids Glycosides: Digitoxin, Glycyrrhizin, Sennosides, Bacosides, Quercetin Steroids: Hecogenin, guggulosterone and withanolides • Coumarin: Umbelliferone Terpenoids: Cucurbitacins	12 Hrs
2	Drug Discovery and Development History of herbs as source of drugs and drug discovery The lead structure selection process, structure development, product discovery process and drug registration Selection and optimization of lead compounds with suitable examples from the following source: Artemesin, andrographolides Clinical studies emphasising on phases of clinical trials, protocol design for lead molecules	12 Hrs

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3	Extraction and Phytochemical studies Recent advances in extractions with emphasis on selection of method and choice of solvent for extraction, successive and exhaustive extraction and other methods of extraction commonly used like microwave assisted extraction, Methods of fractionation. Separation of phytoconstituents by latest CCET, SCFE techniques including preparative HPLC and Flash column chromatography.	12 Hrs
4	Phytochemical Finger Printing HPTLC and LCMS/GCMS applications in the characterization of herbal extracts Structure elucidation of phytoconstituents	12 Hrs
5	Structure elucidation of the following compounds by spectroscopic techniques like UV, IR, MS, NMR (¹H, ¹³C) Carvone, Citral, Menthol Luteolin, Kaempferol Nicotine, Caffeine Glycyrrhizin	12 Hrs

Course Outcomes:

Upon completion of this course, the student should be able to:


CO1: Learn biosynthetic pathways and radio-tracing techniques for phytopharmaceuticals for skill development, entrepreneurship and employability at local, regional and global platform.

CO2: Understand drug discovery and development of lead molecule from natural origin for skill development, entrepreneurship and employability.

CO3: Understand drug discovery and development of lead molecule from natural origin for skill development, entrepreneurship and employability.

CO4: Acquire knowledge about phytochemical fingerprinting of herbal extracts for skill development, entrepreneurship and employability.

CO5: Understand structure elucidation of phytoconstituents by spectroscopic techniques for skill development, entrepreneurship and employability.


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PO-CO Mapping (Please write 3, 2, 1 wherever required)**(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	2	2	2	3	2	2	3	2
CO2	2	2	1	3	3	2	2	2	3	2	3	2
CO3	2	2	3	3	3	2	2	2	2	2	2	3
CO4	2	2	2	3	2	3	2	3	2	3	3	2
CO5	2	2	2	2	3	2	2	2	2	3	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)**(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)**

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	2
CO2	2	2	2
CO3	3	2	2
CO4	2	2	3
CO5	2	2	2

Recommended Books (Latest editions)

1. Organic chemistry by I.L. Finar Vol.II.
2. Pharmacognosy by Trease and Evans, ELBS.
3. Pharmacognosy by Tylor and Brady.
4. Text book of Pharmacognosy by Wallis.
5. Clark's isolation and Identification of drugs by A.C. Mottal.
6. Plant Drug Analysis by Wagner & Bladt.
7. Wilson and Gisvolds Text book of Organic Medicinnal and Pharmaceutical Chemistry byDeorge. R. F.
8. The Chemistry of Natural Products, Edited by R.H. Thomson, Springer International Edn.

9. Natural Products Chemistry Practical Manual by Anees A Siddiqui and Seemi Siddiqui.
10. Organic Chemistry of Natural Products, Vol. 1 & 2. Gurdeep R. Chatwal.
11. Chemistry of Natural Products- Vol. 1 onwards IWPAC.
12. Modern Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I & II.
13. Medicinal Natural products – a biosynthetic approach, Dewick PM, John Wiley & Sons, Toronto.
14. Chemistry of Natural Products, Bhat SV, Nagasampagi BA, Meenakshi S, Narosa Publishing House, New Delhi.
15. Pharmacognosy & Phytochemistry of Medicinal Plants, Bruneton J, Intercept Ltd., New York.

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INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY(MPG104T)

Scope

To understand the Industrial and commercial potential of drugs of natural origin, integrate traditional Indian systems of medicine with modern medicine and also to know regulatory and quality policy for the trade of herbals and drugs of natural origin.

Objectives

By the end of the course, the student shall be able to know:

- The requirements for setting up the herbal/natural drug industry.
- The guidelines for quality of herbal/natural medicines and regulatory issues.
- The patenting/IPR of herbals/natural drugs and trade of raw and finished materials.

▪ THEORY

60 Hrs

1	Herbal Drug Industry Infrastructure of herbal drug industry involved in production of standardized extracts and various dosage forms Current challenges in upgrading and modernization of herbal formulations Entrepreneurship Development, Project selection, project report, technical knowledge, Capital venture, plant design, layout and construction Pilot plant scale –up techniques, case studies of herbal extracts. Formulation and production management of herbals	12 Hrs
2	Regulatory Requirements for Setting Herbal Drug Industry Global marketing management Indian and international patent law as applicable herbal drugs and natural products Export - Import (EXIM) policy, TRIPS Quality assurance in herbal/natural drug products Concepts of TQM, GMP, GLP, ISO-9000	12 Hrs
3	Monographs of Herbal Drugs	12 Hrs


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	General parameters of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic Pharmacopoeia, Siddha and Unani Pharmacopoeia, American herbal pharmacopoeia, British herbal pharmacopoeia WHO guidelines in quality assessment of herbal drugs	
4	Testing of Natural Products and Drugs Herbal medicines - clinical laboratory testing Stability testing of natural products, protocols	12 Hrs
5	Patents Indian and international patent laws, proposed amendments as applicable to herbal/natural products and process Geographical indication, Copyright, Patentable subject matters, novelty, non obviousness, utility, enablement and best mode, procedure for Indian patent filing, patent processing, grant of patents, rights of patents, cases of patents, opposition and revocation of patents, patent search and literature, Controllers of patents	12 Hrs

Course Outcomes:

Upon completion of this course, the student should be able to:

CO1: Understand infrastructure of herbal drug industry and learn current challenges in upgrading of herbal medicines and entrepreneurship development for skill development and employability..

CO2: Learn knowledge about regulatory requirements for setting herbal drug industry including concepts of TQM, GMP, GLP, ISO-9000, export - import (EXIM) policy, TRIPS and understand quality assurance in herbal/natural drug products for skill development and employability.

CO3: Gain knowledge about structure of monographs of herbal drugs in pharmacopoeias, and understand WHO guidelines in quality assessment of herbal drugs.

CO4: Learn concepts of stability testing of natural products, protocols and clinical laboratory testing for skill development and employability.

CO5: Understand Indian and international patent laws in reference to herbal drugs and to gain detail knowledge about Geographical indication, Copyright and Patentable subject matters for skill development and employability at local, regional and global platform.

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PO-CO Mapping (Please write 3, 2, 1 wherever required)


(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3	3	2	2	2	2	2	3
CO2	3	2	2	3	2	2	3	2	2	3	2	3
CO3	3	2	2	2	3	2	2	2	2	2	3	3
CO4	2	3	2	3	2	3	2	2	2	2	3	2
CO5	2	2	2	2	3	2	2	2	2	2	2	2

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	2	2
CO2	2	3	2
CO3	2	2	2
CO4	2	2	2
CO5	3	2	3


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Recommended Books (Latest editions)

1. Herbal Drug Industry by R.D. Choudhary, Eastern Publisher, New Delhi.
2. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine by Pulok K Mukharjee, Business horizons Robert Verpoorte, New Delhi.
3. Quality control of herbal drugs by Pulok K Mukarjee, Business Horizons Pharmaceutical Publisher, New Delhi.
4. PDR for Herbal Medicines, Medicinal Economic Company, New Jersey.
5. Indian Herbal Pharmacopoeia (2002), IDMA, Mumbai.
6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae, Nirali Prakashan, New Delhi.
7. Text book of Pharmacognosy and Phytochemistry by Vinod D. Rangari, Part I & II, Career Publication, Nasik, India.
8. Plant drug analysis by H. Wagner and S. Bladt, Springer, Berlin.
9. Standardization of Botanicals. Testing and extraction methods of medicinal herbs by V. Rajpal, Vol.I, Eastern Publisher, New Delhi.
10. Phytochemical Dictionary. Handbook of Bioactive Compounds from Plants by J.B.Harborne, Taylor and Francis Ltd, UK.
11. Herbal Medicine. Expanded Commission E Monographs by M. Blumenthal.
12. Drug Formulation Manual by D.P.S.Kohli and D.H.Shah, Eastern Publisher, New Delhi.

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PHARMACOGNOSY PRACTICAL – I(MPG105P)

1. Analysis of Pharmacopoeial compounds of natural origin and their formulations by UV Vis spectrophotometer
2. Analysis of recorded spectra of simple phytoconstituents
3. Experiments based on Gas Chromatography
4. Estimation of sodium/potassium by flame photometry
5. Development of fingerprint of selected medicinal plant extracts commonly used in herbal drug industry viz. Ashwagandha, Tulsi, Bael, Amla, Ginger, Aloe, Vidang, Senna, Lawsonia by TLC/HPTLC method
6. Methods of extraction
7. Phytochemical screening
8. Demonstration of HPLC- estimation of glycerrhizin
9. Monograph analysis of clove oil
10. Monograph analysis of castor oil
11. Identification of bioactive constituents from plant extracts
12. Formulation of different dosage forms and their standardisation

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MEDICINAL PLANT BIOTECHNOLOGY(MPG201T)

Scope

To explore the knowledge of Biotechnology and its application in the improvement of quality of medicinal plants.

Objectives

Upon completion of the course the student shall be able to:

- Know the process like genetic engineering in medicinal plants for higher yield of Phytopharmaceuticals.
- Use the biotechnological techniques for obtaining and improving the quality of natural products/medicinal plants.

THEORY

63 Hrs

1	Introduction to Plant Biotechnology Historical perspectives prospects for development of plant biotechnology as a source of medicinal agents Applications in pharmacy and allied fields Genetic and molecular biology as applied to pharmacognosy, study of DNA, RNA and protein replication, genetic code, regulation of gene expression, structure and complicity of genome, cell signalling DNA recombinant technology	15 Hrs
2	Different Tissue Culture Techniques Organogenesis and embryogenesis synthetic seed and monoclonal variation Protoplast fusion Hairy root multiple shoot cultures and their applications Micro propagation of medicinal and aromatic plants Sterilization methods involved in tissue culture, gene transfer in plants and	15 Hrs

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	their applications	
3	Immobilisation Techniques & Secondary Metabolite Production Immobilization techniques of plant cell and its application on secondary metabolite Production Cloning of plant cell: Different methods of cloning and its applications Advantages and disadvantages of plant cell cloning Secondary metabolism in tissue cultures with emphasis on production of medicinal agents Precursors and elicitors on production of secondary metabolites	15 Hrs
4	Biotransformation and Transgenesis Biotransformation, bioreactors for pilot and large scale cultures of plant cells and retention of biosynthetic potential in cell culture Transgenic plants, methods used in gene identification, localization and sequencing of genes Application of PCR in plant genome analysis	13 Hrs
5	Fermentation Technology Application of Fermentation technology Production of ergot alkaloids Single cell proteins Enzymes of pharmaceutical interest	05 Hrs

Course Outcomes:

Upon completion of this course, the student should be able to:

CO1: To understand plants on molecular and genetics basis for application in pharmacy and allied fields for skill development, entrepreneurship and employability at national and international level.

CO2: To understand various tissue culture techniques and their applications for skill development, entrepreneurship and employability.

CO3: To understand immobilization techniques of plant cell and its application on secondary metabolite Production for skill development, entrepreneurship and employability.

CO4: To understand biotransformation of plant cells, biosynthetic potential in cell culture, transgenic methods and application of PCR in genome analysis for skill development, entrepreneurship

and employability.

CO5: To understand fermentation technology, enzyme, single cell protein production and its application for skill development, entrepreneurship and employability.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1	2	1	1	2	3	3	1
CO2	3	3	3	2	1	1	1	1	2	3	1	1
CO3	2	2	1	2	2	1	1	1	3	3	2	2
CO4	3	3	3	2	2	2	1	1	2	2	2	1
CO5	2	3	2	2	2	2	1	2	3	3	3	2

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	2
CO2	2	3	2
CO3	2	2	2
CO4	2	2	3
CO5	2	2	2

Recommended Books (Latest editions)

1. Plant tissue culture, Bhagwani, vol 5, Elsevier Publishers.
2. Plant cell and Tissue Culture (Lab. Manual), JRMM. Yeoman.
3. Elements in biotechnology by PK. Gupta, Rastogi Publications, New Delhi.
4. An introduction to plant tissue culture by MK. Razdan, Science Publishers.
5. Experiments in plant tissue culture by John HD and Lorin WR., Cambridge University Press.
6. Pharmaceutical biotechnology by SP. Vyas and VK. Dixit, CBS Publishers.

7. Plant cell and tissue culture by Jeffrey W. Pollard and John M Walker, Humana press.
8. Plant tissue culture by Dixon, Oxford Press, Washington DC.
9. Plant tissue culture by Street.
10. Pharmacognosy by G. E. Trease and WC. Evans, Elsevier.
11. Biotechnology by Purohit and Mathur, Agro-Bio.
12. Biotechnological applications to tissue culture by Shargool, Peter D, Shargoal, CKCPress.
13. Pharmacognosy by Varo E. Tyler, Lynn R. Brady and James E. Robberrt, That Tjen, NGO.
14. Plant Biotechnology, Ciddi Veerasham.

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ADVANCED PHARMACOGNOSY –II(MPG202T)

Scope

To know and understand the Adulteration and Deterioration that occurs in herbal/natural drugs and methods of detection of the same. Study of herbal remedies and their validations, including methods of screening.

Objectives

Upon completion of the course the student shall be able to:

- Validation of herbal remedies.
- Methods of detection of adulteration and evaluation techniques for the herbal drugs.
- Methods of screening of herbals for various biological properties.

THEORY

60 Hrs

1	Herbal Remedies Toxicity and Regulations: Herbals vs Conventional drugs Efficacy of Herbal medicine products Validation of herbal therapies Pharmacodynamic and Pharmacokinetic issues	12 Hrs
2	Adulteration and Deterioration Introduction, Types of Adulteration/ Substitution of Herbal drugs Causes and Measures of Adulteration Sampling Procedures Determination of Foreign Matter DNA Finger printing techniques in identification of drugs of natural origin Detection of heavy metals Pesticide residues, phytotoxin, microbial contamination in herbs and their formulations	12 Hrs
3	Ethnobotany and Ethnopharmacology	12 Hrs

	Ethnobotany in herbal drug evaluation Impact of Ethnobotany in traditional medicine New development in herbals Bio-prospecting tools for drug discovery Role of Ethnopharmacology in drug evaluation Reverse Pharmacology	
4	Analytical Profiles of Herbal Drugs <i>Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelica officinalis, Psoralea corylifolia</i>	12 Hrs
5	Biological Screening of Herbal Drugs Introduction and Need for Phyto-Pharmacological Screening New Strategies for evaluating Natural Products <i>In vitro</i> evaluation techniques for Antioxidants, Antimicrobial and Anticancer drugs <i>In vivo</i> evaluation techniques for Anti-inflammatory, Antiulcer, Anticancer, Wound healing, Antidiabetic, Hepatoprotective, Cardioprotective, Diuretics and Antifertility Toxicity studies as per OECD guidelines	12 Hrs

Course Outcomes:

Upon completion of this course, the student should be able to:

CO1: To understand pharmacokinetics and pharmacodynamics of herbal medicines for skill development, entrepreneurship and employability.

CO2: To understand quality control of herbal medicines for skill development, entrepreneurship and employability at national and international level.

CO3: To understand ethnobotany and ethnopharmacology of herbal drugs for skill development, entrepreneurship and employability.

CO4: To understand analytical profile of herbal drugs for skill development, entrepreneurship and employability.

CO5: To understand in vitro, in vivo biological screening of herbal drugs and toxicity studies as per OECD guidelines for skill development, entrepreneurship and employability.

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PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	1	1	2	2	3	3	2	2
CO2	3	3	3	2	2	2	2	2	3	3	3	1
CO3	3	3	3	3	3	2	2	1	2	2	2	1
CO4	3	3	1	3	2	2	2	2	3	3	2	1
CO5	3	3	1	2	2	1	1	1	2	3	2	2

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)


(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	2
CO2	3	2	2
CO3	2	2	2
CO4	2	2	2
CO5	3	3	3

Recommended Books (Latest editions)

1. Glimpses of Indian Ethano Pharmacology by P. Pushpangadam. Ulf Nyman. V.George Tropical Botanic Garden & Research Institute.
2. Natural products: A lab guide by Raphael Ikan, Academic Press.
3. Pharmacognosy-G. E. Trease and W.C. Evans. WB. Saunders Edinburgh,New York.
4. Pharmacognosy-Tyler, Brady, Robbers, Lee & Fetiger.
5. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I & II, Springer Publishers.
6. Herbal Drug Industry by RD. Choudhary, Eastern Publishers, New Delhi.

7. Text book of Pharmacognosy by C.K.Kokate, Purohit, Ghokhale, Nirali Prakashan.
8. Text Book of Pharmacognosy by T.E. Wallis, J & A Churchill Ltd., London.
9. Quality control of herbal drugs by Pulok K Mukherjee, Business Horizons Pharmaceutical Publishers, New Delhi.
10. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
11. Textbook of Pharmacognosy and Phytochemistry by Vinod D. RangarI, Part I & II, Career Publication, Nasik, India.
12. Plant drug analysis by H.Wagner and S.Bladt, 2nd edition, Springer, Berlin.
13. Standardization of Botanicals. Testing and extraction methods of medicinal herbs by V.Rajpal ,Vol.I, Eastern PublisherS, New Delhi.
14. Herbal Medicine. Expanded Commission E Monographs, M.Blumenthal.


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INDIAN SYSTEMS OF MEDICINE (MPG203T)

Scope

To make the students understand thoroughly the principles, preparations of medicines of various Indian systems of medicine like Ayurveda, Siddha, Homeopathy and Unani. Also focusing on clinical research of traditional medicines, quality assurance and challenges in monitoring the safety of herbal medicine.

Objectives

Upon completion of the course the student shall be able to:

- To understand the basic principles of various Indian systems of medicine.
- To know the clinical research of traditional medicines, Current Good Manufacturing Practice of Indian systems of medicine and their formulations.

THEORY

60 Hrs

1	Introduction Fundamental concepts of Ayurveda, Siddha, Unani and Homoeopathysystems of medicine Different dosage forms of the ISM Ayurveda: Ayurvedic Pharmacopoeia, Analysis of formulations and biocrude drugs with references to: Identity, purity and quality Siddha: Gunapadam (Siddha Pharmacology), raw drugs/Dhatu/Jeevam in Siddha system of medicine, Purification process (Suddhi)	12 Hrs
2	Naturopathy, Yoga and Aromatherapy Practices Naturopathy - Introduction, basic principles and treatment modalities Yoga - Introduction and Streams of Yoga, Asanas, Pranayama, Meditations and Relaxation techniques Aromatherapy – Introduction, aroma oils for common problems, carrier oils	12 Hrs
3	Formulation Development of Various Systems of Medicine Salient features of the techniques of preparation of some of the important	12 Hrs

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	class of Formulations as per Ayurveda, Siddha, Homeopathy and Unani Pharmacopoeia and texts Standardization Shelf life and Stability studies of ISM formulations	
4	Schedule T – Good Manufacturing Practice of Indian Systems of Medicine Components of GMP (Schedule – T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records Quality assurance in ISM formulation industry - GAP, GMP and GLP Preparation of documents for new drug application and export registration Challenges in monitoring the safety of herbal medicines: Regulation, quality assurance and control, National/Regional Pharmacopoeias	12 Hrs
5	TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU	12 Hrs

Course Outcomes:

Upon completion of this course, the student should be able to:

CO1: To understand fundamental concepts of Indian system of medicines for skill development and employability.

CO2: To understand naturopathy, yoga and aromatherapies for skill development and employability at national and international level.

CO3: To understand formulation of traditional medicines as Indian, Unani, Ayurvedic and Siddha pharmacopeia along with their shelf life and stability studies for skill development and employability.

CO4: To understand schedule T (GMP) of Indian system of Medicine for skill development and employability at local, regional and global platform.

CO5: To understand about AYUSH portal and departments for skill development and employability.

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PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	2	1	1	2	2	1
CO2	2	2	3	3	2	2	2	2	3	3	1	1
CO3	3	2	2	2	2	2	2	1	1	2	2	1
CO4	2	2	1	1	1	1	1	2	2	3	3	2
CO5	3	3	2	2	1	2	1	2	1	1	3	3


CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)


(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	2	2
CO2	3	2	2
CO3	2	2	3
CO4	3	2	3
CO5	3	2	2

Recommended Books (Latest editions)


1. Ayurvedic Pharmacopoeia, The Controller of Publications, Civil Lines, Govt. of India, New Delhi.
2. Hand Book on Ayurvedic Medicines, H. Panda, National Institute of Industrial Research,


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New Delhi.

3. Ayurvedic System of Medicine, Kaviraj Nagendranath Sengupata, Sri Satguru Publications, New Delhi.
4. Ayurvedic Pharmacopoeia. Formulary of Ayurvedic Medicines, IMCOPS, Chennai.
5. Homeopathic Pharmacopoeia. Formulary of Homeopathic Medicines, IMCOPS, Chennai.
6. Homeopathic Pharmacy: An introduction & Handbook, Steven B. Kayne, Churchill Livingstone, New York.
7. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
8. British Herbal Pharmacopoeia, British Herbal Medicine Association, UK.
9. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine, Pulok K Mukharjee, Business Horizons, New Delhi.
10. Indian System of Medicine and Homeopathy in India, Planning and Evaluation Cell, Govt. of India, New Delhi.
11. Essential of Food and Nutrition, Swaminathan, Bappco, Bangalore.
12. Clinical Dietetics and Nutrition, F.P. Antia, Oxford University Press, Delhi.
13. Yoga - The Science of Holistic Living by V.K. Yoga, Vivekananda Yoga Prakashna Publishing, Bangalore.


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HERBAL COSMETICS

(MPG204T)

Scope

This subject deals with the study of preparation and standardization of herbal/natural cosmetics. This subject gives emphasis to various national and international standards prescribed regarding herbal cosmeceuticals.

Objectives

U After completion of the course, student shall be able to:

- Understand the basic principles of various herbal/natural cosmetic preparations.
- Current Good Manufacturing Practices of herbal/natural cosmetics as per the regulatory authorities.

THEORY

60 Hrs

1	Introduction Herbal/natural cosmetics, Classification & Economic aspects Regulatory Provisions Relation to Manufacture of Cosmetics License, GMP, offences & Penalties, Import & Export of Herbal/natural cosmetics, Industries involved in the production of Herbal/natural cosmetics	12 Hrs
2	Commonly used herbal cosmetics, raw materials, preservatives, surfactants, humectants, oils, colors, and some functional herbs Preformulation studies, compatibility studies, possible interactions between chemicals and herbs Design of herbal cosmetic formulation	12 Hrs
3	Herbal Cosmetics Physiology and chemistry of skin and pigmentation, hairs, scalp, lips and nail, Cleansing cream, Lotions, Face powders, Face packs, Lipsticks, Bath products, soaps and baby product Preparation and standardisation of the following : Tonic, Bleaches, Dentifrices and Mouth washes & Tooth Pastes, Cosmetics for Nails	12 Hrs
4	Cosmeceuticals of Herbal and Natural Origin	12 Hrs

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	Hair growth formulations, Shampoos, Conditioners, Colorants & hair oils, Fairness formulations, vanishing & foundation creams, anti-sun burn preparations, moisturizing creams, deodorants	
5	Analysis of Cosmetics, Toxicity Screening and Test Methods Quality control and toxicity studies as per Drug and Cosmetics Act	12 Hrs

Course Outcomes:

Upon completion of this course, the student should be able to:

CO 1: To understand herbal cosmetics, their classification, economic aspects and regulatory affairs for skill development and employability.

CO2: To understand preformulation studies and formulation of herbal cosmetics for skill development and employability at national and international level.

CO3: To understand physiology of skin, nails, hair, their specific cosmetics and their formulations for skill development and employability.

CO4: To understand formulation of cosmaceuticals of herbal and natural origin for skill development and employability.

CO5: To understand analysis and toxicity screening of cosmetics as per Drug and Cosmetic Act for skill development and employability.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	2	2	3	3	3	3
CO2	3	3	2	2	3	3	2	2	2	3	3	2
CO3	3	3	3	2	2	2	3	3	3	3	3	2
CO4	3	3	3	2	2	3	2	2	3	2	2	1
CO5	3	3	2	1	2	3	2	1	2	3	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

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	Skill Development	Employability	Entrepreneurship Development
CO1	2	2	3
CO2	2	2	3
CO3	2	2	2
CO4	3	2	3
CO5	2	2	2

Recommended Books (Latest editions)

1. Panda H. Herbal Cosmetics (Handbook), Asia Pacific Business Press Inc, New Delhi.
2. Thomson EG. Modern Cosmetics, Universal Publishing Corporation, Mumbai.
3. P.P.Sharma. Cosmetics - Formulation, Manufacturing & Quality Control, VandanaPublications, New Delhi.
4. Supriya K B. Handbook of Aromatic Plants, Pointer Publishers, Jaipur.
5. Skaria P. Aromatic Plants (Horticulture Science Series), New India Publishing Agency, New Delhi.
6. Kathi Keville and Mindy Green. Aromatherapy (A Complete Guide to the Healing Art), Sri Satguru Publications, New Delhi.
7. Chattopadhyay PK. Herbal Cosmetics & Ayurvedic Medicines (EOU), National Institute of Industrial Research, Delhi.
8. Balsam MS & Edward Sagarin. Cosmetics Science and Technology, Wiley Interscience, New York.

PHARMACOGNOSY PRACTICAL – II

(MPG205P)

1. Isolation of nucleic acid from cauliflower heads
2. Isolation of RNA from yeast
3. Quantitative estimation of DNA
4. Immobilization technique
5. Establishment of callus culture
6. Establishment of suspension culture
7. Estimation of aldehyde contents of volatile oils
8. Estimation of total phenolic content in herbal raw materials
9. Estimation of total alkaloid content in herbal raw materials
10. Estimation of total flavonoid content in herbal raw materials
11. Preparation and standardization of various simple dosage forms from Ayurvedic, Siddha, Homoeopathy and Unani formulary
12. Preparation of certain Aromatherapy formulations
13. Preparation of herbal cosmetic formulation such as lip balm, lipstick, facial cream, herbal hair and nail care products
14. Evaluation of herbal tablets and capsules
15. Preparation of sunscreen, UV protection cream, skin care formulations
16. Formulation & standardization of herbal cough syrup

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Semester III

MRM301T -Research Methodology & Biostatistics

UNIT – I

General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.

UNIT – II

Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students "t" test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxon rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.

UNIT – III


Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.


UNIT – IV

CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.

UNIT – V

Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.


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Course Outcomes:

Upon completion of this course, the student should be able to:

CO1: Learn the general research methodology for skill development and employability.

CO2: Learn the biostatistics, sample size, statistical tests of significance, parametric tests, non-parametric tests, null hypothesis, P values, degree of freedom and interpretation of P values for skill development and employability at local, regional and global platform.

CO3: Attain detailed knowledge about medical Research for skill development and employability at national and international level.


CO4: Understand the CPCSEA guidelines for laboratory animal facility for skill development and employability.

CO5: Understand the declaration of Helsinki, basic principles for all medical research and additional principles for medical research combined with medical care for skill development and employability.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	1	2	1	1	2	1	2	1
CO2	1	3	2	1	3	2	2	2	1	2	1	1
CO3	1	2	1	2	2	2	2	1	1	2	1	2
CO4	2	2	1	1	1	3	1	2	2	1	2	1
CO5	1	3	1	2	1	2	1	1	1	2	1	2


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CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	2
CO2	2	3	2
CO3	3	2	1
CO4	2	3	1
CO5	3	2	2

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