UTTAR PRADESH UNIVERSITY OF MEDICAL SCIENCES, SAIFAI

FACULTY OF PHARMACY

REGULATIONS, EXAMINATION SCHEME AND SYLLABUS FOR M.PHARMACY (PHARMACOGNOSY)

Adapted from Master of Pharmacy (M. Pharm Pharmacognosy)
COURSE REGULATIONS 2014 as per PCI Regulations

Regulations

1. Short Title and Commencement

These regulations shall be called as "The Regulations for the Master of Pharmacy Degree Program - Credit Based Semester System (CBSS)". 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.

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/extracurricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week/per activity.

7.1. Credit assignment

7.1.1. 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.

7.2. 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 are distributed semester wise as shown in Table 4 . 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 course of study for M. Pharm shall include Semester wise Theory & Practical as given in Table 1. The number of hours to be devoted to each theory and practical course in any semester shall not be less than that shown in Tables 1.

Table – 1: Course of study for M. Pharm. (Pharmacognosy) Semester I & II

SEMESTER I					
Course Code	**Course**	**Credit Hours**	**Credit Points**	**Hrs/wk**	**Marks**
MPG 101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPG 102T	Advanced Pharmacognosy-1	4	4	4	100
MPG 103T	Phytochemistry	4	4	4	100
MPG 104T	Industrial Pharmacognostical Technology	4	4	4	100
MPG 105P	Pharmacognosy Practical I	12	6	12	150
MPG 106	Seminar/ Assignment	7	4	7	100
Total		35	26	35	650
SEMESTER II					
MPG 201T	Medicinal Plant Biotechnology	4	4	4	100
MPG 202T	Advanced Pharmacognosy-II	4	4	4	100
MPG 203T	Indian system of medicine	4	4	4	100
MPG 204T	Herbal cosmetics	4	4	4	100
MPG 205P	Pharmacognosy Practical II	12	6	12	150
MPG206	Seminar/ Assignment	7	4	7	100
Total		35	26	35	650

Table 2: Course of study for M. Pharm. III & IV Semester

SEMESTER III			
Course Code	**Course**	**Credit Hours**	**Credit Points**
MPG 301T	Research Methodology and Biostatistics*	4	4
MPG 302	Journal club	1	1
MPG 303	Discussion / Presentation (Proposal Presentation)	2	2
MPG 304	Research Work	28	14
	Total	35	21
SEMESTER IV			
Course Code	**Course**	**Credit Hours**	**Credit Points**
MPG 401	Journal club	1	1
MPG 402	Research Work	31	16
MPG 403	Discussion / Final Presentation	3	3
	Total	35	20

* Non University Exam

Table 3: Semester wise credit 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*
Total Credit Points	Minimum = 95 Maximum = 100*

*Credit Points for Co-curricular Activities

Table 4: 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)	02

Note: International Conference: Held Outside India

International Journal: The Editorial Board outside India

*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 institute 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.
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.

11.1. End semester examination

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

Tables 5: Schemes for internal assessments and end semester for I & II Sem for M. Pharm (Pharmacognosy).

Course Code	Course	Internal Assessment				End Semester Exam		Total Marks
		Continuous Mode	Sessional Exam		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPG 101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3Hrs	100
MPG 102T	Advanced Pharmacognosy-1	10	15	1 Hr	25	75	3Hrs	100
MPG 103T	Phytochemistry	10	15	1 Hr	25	75	3 Hrs	100
MPG 104T	Industrial Pharmacognostical Technology	10	15	1 Hr	25	75	3 Hrs	100
MPG 105P	Pharmacognosy Practical I	20	30	6 Hrs	50	100	6 Hrs	150
MPG 106	Seminar /Assignment							100
Total								650
SEMESTER II								
MPG 201T	Medicinal Plant Biotechnology	10	15	1 Hr	25	75	3Hrs	100
MPG	Advanced Pharmacognosy-II	10	15	1 Hr	25	75	3Hrs	100

202T								
MPG 203T	Indian system of Medicine	10	15	1 Hr	25	75	3Hrs	100
MPG 204T	Herbal cosmetics	10	15	1 Hr	25	75	3Hrs	100
MPG 205P	Pharmacognosy Practical II	20	30	6 Hrs	50	100	6Hrs	150
MPG 206	Seminar/Assignment							100
Total								650

Tables 6: Schemes for internal assessments and End semester Examination for III and IV Sem.

Course Code	Course	Internal Assessment				End Semester Exam		Total Marks
		Continuous Mode	Sessional Exam		Total	Marks	Duration	
			Marks	Duration				
SEMESTER III								
MPG 301T	Research Methodology and Biostatistics*	10	15	1 Hr	25	75	3Hrs	100
MPG 302	Journal club				25			25
MPG 303	Discussion / Presentation (Proposal Presentation)				50			50
MPG 304	Research work*					350	1 hr	350
Total								525
SEMESTER IV								
MPG 401	Journal club				25			25
MPG 402	Discussion / Presentation (Proposal Presentation)				75			75
MPG 403	Research work and Colloquium					400	1 hr	400
Total								500

*Non University Examination

11.2. Internal assessment: Continuous mode

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

Table 7: Scheme for awarding internal assessment: Continuous mode

For Theory	
Criteria	Maximum Marks
Attendance (Refer Table 10)	8
Student – Teacher interaction	2
Total	10
For Practical	
Attendance (Refer Table 10)	10
Based on Practical Records, Regular viva voce, etc.	10
Total	20

Table 8: Guidelines for the allotment of marks for attendance

Percentage of Attendance	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

11.2.1. 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 below. The average marks of two sessional exams shall be computed for internal assessment as per the requirements given in Tables.

Question paper pattern for theory Sessional examination

I.	Multiple Choice Questions (MCQs)	= 10 x 1 = 10
	OR	
	Objective Type Questions (10 x 1)	= 10 x 1 = 10
	(Answer all the questions)	
II.	Short Answers (Answer 2 out of 3)	= 2 x 5 = 10
III.	Long Answers (Answer 1 out of 2)	= 1 x 10 = 10
	Total	= 30 marks

Question paper pattern for practical sessional examination

I. Experiment(s)	= 20
II. Viva voce	= 10
Total	= 30 marks

12. Promotion and award of grades

A student shall be declared PASS and eligible for getting grade in a course of M. Pharm. program 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 shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

14. End Semester Examination

End semester examination shall be conducted as per the schedule given in Table 11. The exact dates of examination shall be notified from time to time.

Table 9: Tentative schedule of end semester examinations

Semester	For Regular/Carry over Candidates
I and III	December/January
II and IV	May / June

15. Allowed to keep terms (ATKT):

No student shall be admitted to any examination unless he/she fulfils the norms. 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.

16. Grading of performances

16.1. 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.

Table 10: 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.

17. 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 withcreditsC1, C2, C3 and C4and the student's grade points in these courses areG1,G2,G3andG4,respectively and then students' SGPA is equal to

$$\mathbf{SGPA} = \frac{\mathbf{C1G1+C2G2+C3G3+C4G4}}{\mathbf{C1+C2+C3+C4}}$$

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 For ABS grade in course4, the SGPA shall then be computed as:

$$\mathbf{SGPA} = \frac{\mathbf{C1G1+C2G2+C3G3+C4*ZERO}}{\mathbf{C1+C2+C3+C4}}$$

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

$$CGPA = \frac{C1S1+C2S2+C3S3+C4S4}{C1+C2+C3+C4}$$

Where C1, C2, C3,…. is the total number of credits for semester I, II, III,….and S1, S2, S3,….is the SGPA of semester I, II, III, ….

19. 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

20. 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 75pages).

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 Discussion		250 Marks
Conclusion and Outcomes		50 Marks
	Total	**500 Marks**

Evaluation of Presentation:

Presentation of work		100 Marks
Communication Skill		50 Marks
Question and answer skill		100 Marks
	Total	**250 Marks**

21. 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.

22. Award of degree

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

23. 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.

24. 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

PROGRAM OUTCOMES – M. PHARM

1. Apply fundamentals of Pharmacognosy to elucidate and regulate drug discovery and product development
2. Design, synthesize and isolate a drug and drug formulation system, component, or drug use process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
3. Create an ability to function in multidisciplinary teams, at different organizational levels of academic, industry, research and health care.
4. Develop an ability to identify, formulate, and solve pharmaceutical problems to meet the professional challenges.
5. Understand pharmacy professional values and ethical responsibility in discharging professional obligations at society, national and global perspectives
6. Can relate knowledge of contemporary issues on the research, development and manufacturing technology and use of pharmaceutical products in population.
7. Develop an ability to employ the techniques, skills, and modern tools necessary for professional practice, research and development.

PROGRAM SPECIFIC OUTCOMES – M PHARM

1. Understanding the mechanism of drug action, drug delivery and advancement in analysis
2. Applying molecular and bio analytical techniques to design new drugs and formulations
3. Designing and participating in clinical research, following regulatory guidelines
4. Emphasizing the consequences of medication use and pharmacovigilance of targeted drugs
5. Following pharmacopoeia standards and international guidelines to emphasize the significance of cultivation, production, quality control and assurance of natural drugs
6. Developing formulations and dispensing to patient and counselling of patients

Syllabus

M. PHARM PHARMACOGNOSY (MPG)

SEMESTER I and II

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPG 101T)

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.

Course Outcomes: After completion of course student is able to
CO1: Demonstrate the principle, techniques and applications of chromatographic techniques
CO2: Illustrate the fundamentals of Fourier transform infrared spectroscopy and its convergence.
CO3: Outline the principle and working of the thermal analytical techniques
CO4: Apply NMR, IR, MS, UV-Vis spectroscopic techniques in solving structure of organic molecules and in determination of their stereochemistry
CO5: Interpret the spectroscopic data of unknown compounds to solve structure elucidation problems.
CO6: Compare the role of different separation techniques

THEORY: **60 Hours**

Unit 1 **12 Hours**

UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible 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
Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer, Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications

Unit 2 **12 Hours**

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, Applications of NMR spectroscopy
Mass Spectroscopy:
Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, 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

Unit 3 **12 Hours**

Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:
a) Thin Layer chromatography
b) High Performance Thin Layer Chromatography
c) Ion exchange chromatography
d) Column chromatography
e) Gas chromatography
f) High Performance Liquid chromatography
g) Ultra High Performance Liquid chromatography
h) Affinity chromatography
i) Gel Chromatography

Unit 4 **12 Hours**

Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:

a) Paper electrophoresis
b) Gel electrophoresis
c) Capillary electrophoresis
d) Zone electrophoresis
e) Moving boundary electrophoresis
f) Iso electric focusing

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.

Unit 5 **12 Hours**

Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

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2. 2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5 th 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 estern Ltd., Delhi.

ADVANCED PHARMACOGNOSY - I (MPG 102T)

SCOPE

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 health benefits.

Course Outcomes: After completion of course student is able to
CO1: Understand the advances in drug cultivation and production
CO2 : Understand various phytopharmaceuticals along with their sources, its utilization and medicinal value
CO3 : Summarize knowledge about various nutraceuticals or herbs and their health benefits
CO4 : Outine about the drugs of marine origin
CO5 : Examine the Pharmacovigilance of natural origin drugs

Theory : 60 Hours

Unit 1 **12 Hours**

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- Ex-situ and In- situ conservation of medicinal plants.

Unit 2 **12 Hours**

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, chemical screening and their solution

Unit 3 **12 Hours**

Nutraceuticals: Current trends and future scope, Inorganic mineral supplements, Vitamin supplements, Digestive enzymes, Dietary fibres, Cereals and grains, Health drinks of natural origin, Antioxidants, Polyunsaturated fatty acids, Herbs as functional foods, Formulation and standardization of neutraceuticals, Regulatory aspects, FSSAI guidelines, Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits of following i) Spirulina, ii) Soya bean, iii) Ginseng, iv) Garlic, v) Broccoli, vi) Green and Herbal Tea, vii) Flax seeds viii) Black cohosh, ix) Turmeric

Unit 4 **12 Hours**

Phytopharmaceuticals: Occurrence, isolation and characteristic features (Chemical nature, uses in pharmacy, medicinal and health benefits) of following.
a) Carotenoids – i) α and β – Carotene, ii) Xanthophyll (Lutein)
b) Limonoids – i) d-Limonene, ii) α – Terpineol
c) Saponins – i) Shatavarins
d) Flavonoids – i) Resveratrol, ii) Rutin, iii) Hesperidin, iv) Naringin, v) Quercetin
e) Phenolic acids- Ellagic acid
f) Vitamins
g) Tocotrienols and Tocopherols
h) Andrographolide, Glycolipids, Gugulipids, Withanolides, Vascine, Taxol
i) Miscellaneous

Unit 5 **12 Hours**

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

REFERENCES (Latest Editions of)

1. Pharmacognosy - G. E. Trease and W.C. Evans. Saunders Edinburgh, New York.
2. Pharmacognosy-Tyler, Brady, Robbers
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6. Natural products: A lab guide by Raphael Ikan , Academic Press 1991.
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17. Pharmacognosy and Pharmacobiotechnology, Ashutoshkar, New Age Publications, New Delhi.

PHYTOCHEMISTRY (MPG 103T)

SCOPE

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

Course Outcomes: After completion of course student is able to

CO1: Knowledge about the various classes/categories of phytoconstituents along with their biosynthesis, isolation and characterization techniques

CO2: Understand the process of drug discovery from plants and acquire knowledge about various steps involved in drug development

CO3: Categorize different methods of extraction and fractionation of phytoconstituents

CO4:Relate about phytochemical fingerprinting of extracts by chromatography techniques

CO5: Determine in vitro and in vivo screening techniques for detection of bioactive phytoconstituents

THEORY **60 Hours**

Unit 1 **12 Hours**

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 phytopharmaceuticals containing drugs:

a) Alkaloids: Ephedrine, Quinine, Strychynine, Piperine, Berberine, Taxol, Vinca alkoloids

b) Glycosides: Digitoxin, Glycyrrhizin, Sennosides, Bacosides, Quercitin

c) Steroids: Hecogenin, guggulosterone and withanolides

d) Coumarin: Umbelliferone

e) Terpenoids: Cucurbitacins

Unit 2 **12 Hours**

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 emphasizing on phases of clinical trials, protocol design for lead molecules.

Unit 3 **12 Hours**

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 CCCET, SCFE techniques including preparative HPLC and Flash column chromatography

Unit 4 **12 Hours**

Phytochemical finger printing: HPTLC and LCMS/GCMS applications in the characterization of herbal extracts, Structure elucidation of phytoconstituents.

Unit 5 **12 Hours**

Structure elucidation of the following compounds by spectroscopic techniques like UV, IR, MS, NMR (^{1}H, ^{13}C)

a. Carvone, Citral, Menthol

b. Luteolin, Kaempferol

c. Nicotine, Caffeine

d. Glycyrrhizin

REFERENCES (Latest Editions of)

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 Gisvold's text book of Organic Medicinal and Pharmaceutical Chemistry by Deorge. R .F.
8. The Chemistry of Natural Products, Edited by R.H. Thomson, Springer International Edn. 1994.
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. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I&II
13. Medicinal Natural products – a biosynthetic approach, Dewick PM, John Wiley & Sons, Toronto, 1998.
14. Chemistry of Natural Products, Bhat SV, Nagasampagi BA, Meenakshi S, Narosa Publishing House, New Delhi.
15. Pharmacognosy & Phytochemistry of Medicinal Plants, 2nd edition, Bruneton J, Interceptt Ltd., New York, 1999.

INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY (MPG 104T)

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.

Course Outcomes: After completion of course student is able to

CO1: Propose about starting up of new herbal drug industry

CO2: Develop knowledge about regulatory requirements or documentation for starting a new herbal drug industry

CO3: Find information about Export and import policies in herbal industry sector

CO4: Understand the concept of ISO documentation, GMP / GLP in Herbal drug sector and Monograph preparation

CO5: Develop different testing protocols of herbal drugs and acquire knowledge about Intellectual Property Rights and Patenting

THEORY **60 Hours**

Unit 1 **12 Hours**

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

Unit 2 **12 Hours**

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

Unit 3 **12 Hours**

Monographs of herbal drugs: 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

Unit 4 **12 Hours**

Testing of natural products and drugs: Herbal medicines - clinical laboratory testing. Stability testing of natural products, protocols.

Unit 5 **12 Hours**

Patents: Indian and international patent laws, proposed amendments as applicable to herbal/natural products and process, Geographical indication, Copyright, Patentable subject maters, 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.

REFERENCES (Latest Editions of)

1. Herbal drug industry by R.D. Choudhary (1996), Eastern Publisher, New Delhi.
2. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine by Pulok K Mukharjee (2003), Ist Edition, Business horizons Robert Verpoorte, New Delhi.
3. Quality control of herbal drugs by Pulok K Mukherjee (2002), Business Horizons Pharmaceutical Publisher, New Delhi.

4. PDR for Herbal Medicines (2000), Medicinal Economic Company, NewJersey.
5. Indian Herbal Pharmacopoeia (2002), IDMA, Mumbai.
6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (1996), Nirali Prakashan, New Delhi.
7. Text book of Pharmacognosy and Phytochemistry by Vinod D. Rangari (2002), 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 (2004), Vol. I, Eastern Publisher, New Delhi
10. Phytochemical Dictionary. Handbook of Bioactive Compounds from Plants by J.B. Harborne, (1999), IInd Edition, Taylor and Francis Ltd, UK
11. Herbal Medicine. Expanded Commission E Monographs by M. Blumenthal, (2004), IST Edition
12. Drug Formulation Manual by D.P.S. Kohli and D.H. Shah (1998), Eastern Publisher, New Delhi.

PHARMACOGNOSY PRACTICAL - I (MPG I05P)

This course is designed to provide hand-on practice for analysis of Pharmacopoeial compounds of natural origin and their formulations. It also includes performing isolation, purification and characterization of natural compounds through chromatography and spectroscopy.

Course Outcomes: After completion of course student is able to
CO1: Outline the principles involved in analysis of phytoconstituents
CO2: Apply appropriate techniques for the qualitative and quantitative analysis of phytochemicals in laboratory
CO3: Interpret spectra of unknown phyotconstituents using various spectral approaches
CO4: Illustrate separation of phytoconstituents by chromatographic methods.
CO5: Illustrate both basics and practical aspects of separation techniques
CO6: Interpret NMR, IR, MS, UV-Vis spectroscopic techniques for structure elucidation

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 glycirrhizin
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 standardization
13. Any other experiment as per the syllabus & resources available

Seminar/Assignment-I (MPG 106)

This course provides path to acquire skills and focuses on work in a professional digital format online/offline towards specific job goals and so forth. It also provides an opportunity to re-address previous projects, assignments for inclusion in their portfolios.

Course Outcomes: Through this course students should be able to

CO1: Analyze the knowledge gained during degree program to generate new skills and present it in a scientific manner
CO2: Develop the presentation proficiency
CO3: Develop specific communication skills associated with reporting technical information
CO4: Apply substantive argumentation, utilizing personal views that are based on critical analysis of works of various field of analysis
CO5: Outline how to cite the different information sources and previous reports related to specific area of the study
CO6: Develop good scientific and writing skills in paper presentation

SEMESTER II

MEDICINAL PLANT BIOTECHNOLOGY (MPG 201T)

SCOPE

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

Course Outcomes: After completion of course student is able to

CO1: Relate the role of plant biotechnology and rDNA technology in the field of pharmacy

CO2: Understand different techniques of plant tissue culture and their applications

CO3: Apply the process like genetic engineering in medicinal plants for higher yield of Phytopharmaceuticals

CO4- Utilize the biotechnological techniques for obtaining and improving the quality of natural products/medicinal plants

THEORY **60 Hours**

Unit 1 **12 Hours**

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 signaling, DNA recombinant technology

Unit 2 **15 Hours**

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 their applications.

Unit 3 **15 Hours**

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

Unit 4 **13 Hours**

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

Unit 5 **5 Hours**

Fermentation technology: Application of Fermentation technology, Production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest

REFERENCES (Latest Editions of)

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, 1985
9. Plant tissue culture by Street.
10. Pharmacognosy by G. E. Trease and WC. Evans, Elsevier.
11. Biotechnology by Purohit and Mathur, Agro-Bio, 3 rd revised edition.
12. Biotechnological applications to tissue culture by Shargool, Peter D, Shargoal, CKC Press.
13. Pharmacognosy by Varo E. Tyler, Lynn R. Brady and James E. Robberrt, That Tjen, NGO.
14. Plant Biotechnology, Ciddi Veerasham.

ADVANCED PHARMACOGNOSY - II (MPG 202T)

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

Course Outcomes: After completion of course student is able to

CO1: Recall about validation of herbal remedies
CO2- Demonstrate about drug adulteration and evaluation techniques
CO3- Develop Analytical Profiles of herbal drugs
CO4- Understand about different methods of screening of herbals for various biological properties

THEORY **60 Hours**

Unit 1 **12 Hours**

Herbal remedies –Toxicity and Regulations: Herbals vs Conventional drugs, Efficacy of Herbal medicine products, Validation of herbal therapies, Pharmacodynamic and Pharmacokinetic issues.

Unit 2 **12 Hours**

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.

Unit 3 **12 Hours**

Ethnobotany and Ethnopharmacology: 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

Unit 4 **12 Hours**

Analytical Profiles of herbal drugs: Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelica officinalis, Psoralea corylifolia

Unit 5 **12 Hours**

Biological screening of herbal drugs: Introduction and Need for Phyto-Pharmacological Screening, New Strategies for evaluating Natural Products, In vitro evaluation techniques for Antioxidants, Antimicrobial and Anticancer drugs. In vivo evaluation techniques for Anti-inflammatory, Antiulcer, Anticancer, Wound healing, Antidiabetic, Hepatoprotective, Cardio protective, Diuretics and Antifertility, Toxicity studies as per OECD guidelines.

REFERENCES (Latest Editions of)

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. Text book 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 (2004), Vol. I, Eastern Publisher, New Delhi
14. Herbal Medicine. Expanded Commission E Monographs, M.Blumenthal

INDIAN SYSTEMS OF MEDICINE (MPG 203T)

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 medicines

Course Outcomes: After completion of course student is able to

CO1: Understand the basic principles of various Indian systems of medicine

CO2: Find salient features of the techniques of preparation of some of the important class of Formulations as per Ayurveda, Siddha, Homeopathy and Unani Pharmacopoeia

CO3: Make use of the clinical research of traditional medicines, Current Good Manufacturing Practice in Indian systems of medicine and their formulations

THEORY **60 Hours**

Unit 1 **12 Hours**

Fundamental concepts of Ayurveda, Siddha, Unani and Homoeopathy systems of medicine Different dosage forms of the ISM.

Ayurveda: Ayurvedic Pharmacopoeia, Analysis of formulations and bio crude drugs with references to: Identity, purity and quality. Siddha: Gunapadam (Siddha Pharmacology), raw drugs/Dhatu/Jeevam in Siddha system of medicine, Purification process (Suddhi).

Unit 2 **12 Hours**

Naturopathy, Yoga and Aromatherapy practices

a) Naturopathy - Introduction, basic principles and treatment modalities.

b) Yoga - Introduction and Streams of Yoga. Asanas, Pranayama, Meditations and Relaxation techniques

c) Aromatherapy – Introduction, aroma oils for common problems, carrier oils.

Unit 3 **12 Hours**

Formulation development of various systems of medicine Salient features of the techniques of preparation of some of the important class of Formulations as per Ayurveda, Siddha, Homeopathy and Unani Pharmacopoeia and texts. Standardization, Shelf life and Stability studies of ISM formulations

Unit 4 **12 Hours**

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.

Unit 5 **12 Hours**

TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU

REFERENCES (Latest Editions of)

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, 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 & Hand book, 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 Dietitics 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.

HERBAL COSMETICS (MPG 204T)

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.

Course Outcomes: After completion of course student is able to
CO1: Understand the basic principles of various herbal/natural cosmetic preparations
CO2 Demonstrate Current Good Manufacturing Practices of herbal/natural cosmetics as per the regulatory authorities
CO3- Analysis of Cosmetics, Toxicity screening and testing methods
CO4- Explain Quality control and toxicity studies as per Drug and Cosmetics Act

THEORY **60 Hours**

Unit 1 **12 Hours**
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.

Unit 2 **12 Hours**
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

Unit 3 **12 Hours**
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

Unit 4 **12 Hours**
Cosmeceuticals of herbal and natural origin: Hair growth formulations, Shampoos, Conditioners, Colorants & hair oils, Fairness formulations, vanishing & foundation creams, anti-sun burn preparations, moisturizing creams, deodorants.

Unit 5 **12 Hours**
Analysis of Cosmetics, Toxicity screening and test methods: Quality control and toxicity studies as per Drug and Cosmetics Act.

REFERENCES (Latest Editions of)
1. Panda H. Herbal Cosmetics (Hand book), 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, Vandana Publications, 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. Aromatheraphy (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

HERBAL COSMETICS PRACTICALS (MPG 205P)

Scope- This course is designed to provide knowledge of different techniques involved in isolation technique of nucleic acid, immobilization and plant tissue culture. It also includes preparation and standardization study of various herbal products.

Course Outcomes: After completion of course student is able to
CO1: Outline the principles involved in isolation of nucleic acid
CO2: Apply appropriate estimation techniques for nucleic acid and phytoconstituents
CO3: Acquire knowledge about preparation and standardization of herbal products
CO4: Demonstrate about manufacturing process of aromatherapy formulations.
CO5: Explain more about preparation of Herbal cosmetics

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.
17. Any other experiment as per the syllabus & resources available

Seminar Assignment-II (MPG 206)

This course provides path to acquired skills and focuses on work in a professional digital format online/offline towards specific job goals and so forth. It also provides an opportunity to re-address previous projects, assignments for inclusion in their portfolios.

Course Outcomes: Through this course students should be able to

CO1: Discuss the methods in the major subject/field of study
CO2: Apply substantive argumentation, utilizing personal views that are based on critical analysis of works from various fields of knowledge
CO3: Assess and critically analyze different solutions
CO4: Demonstrate professional competence by identifying and analyzing emerging issues
CO5: Prioritize professional competence by identifying and analyzing emerging issues
CO6: Apply foundational research skills to address a research question

M. Pharm III Sem

Research Methodology & Biostatistics (MPG301T)

The subject trains the user in statistical methods to see the significance in the data derived from research experiments.

Course Outcomes: Through this course students should be able to

CO1: Apply different parametric and non parametric tests in research
CO2: Apply different research design required in research
CO3: Make use of different statistical tools required for research
CO4: Formulate and test hypothesis based on the nature of the research problem
CO5: Adapt with the ethics of medical research
CO6: Understand the purpose of control and supervision of experiments on animals

Unit 1 **12 Hours**

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 2 **12 Hours**

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 (Wilcoxan rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.

Unit 3 **12 Hours**

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 4 **12 Hours**

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 5 **12 Hours**

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

REFERENCES

1. Kothari C.R., Research Methodology Methods and Techniques, Vishwa Prakashan, New Delhi.
2. Lokesh K., Methodology of Educational research, Vikash Publishing House Pvt. Ltd., New Delhi.
3. Kumar R., Research Methodology, Dorling Kindersley (India) Pvt. Ltd., New Delhi.

4. Rao G.N., Research Methodology and Qualitative Methods, B.S. Publications, Hyderabad.
5. Saunders M., Lewis P. and Thornhill A., Research Methods for Business Students, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
6. Bolton S. and Bon C., Pharmaceutical Statistics: Practical and Clinical Applications, Marcel Dekker, New York.
7. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, An introduction to Research Methodology, RBSA Publishers, Jaipur.
8. Fisher R.A. Statistical Methods for Research Works, Oliver and Boyd, Edinburgh.
9. Chow S.S. and Liu J.P., Statistical Design and Analysis in Pharmaceutical Sciences, Marcel Dekker, New York.
10. Buncher C.R., Statistics in the Pharmaceutical Industry, Marcel Dekker, New York.

Journal Club (MPG 302)

It provides a platform to enhance the research aptitude, reading capabilities and presenting capabilities of researcher by using various published articles.

Course Outcomes: Through this course students should be able to
CO1: Create substantive argumentation, utilizing personal views that are based on critical analysis of works from various fields of knowledge
CO2: Identify the various recent studies in the field of research
CO3: Demonstrate different tools employed in arranging references in manuscripts
CO4: Illustrate professional competence by identifying and analyzing emerging issues
CO5: Analyze ability of self-learning and professional development
CO6: Develop a capacity to communicate research results clearly, comprehensively and persuasively

Discussion/Presentation (MPG 303)

This course helps the students to analyze the research done and search its future perspective

Course Outcomes: Through this course students should be able to
CO1: Explore the methods in the major subject/field of study
CO2: Outline possible strategies to deal with field problems
CO3: Analyze the problem and evaluate alternative solutions
CO4: Propose scientific argumentation based on critical analysis of work
CO5: Integrate their knowledge and practical skills during problem solving
CO6: Develop the key skills required to facilitate a scientific discussion

Research Work (MPG 304)

This course involves the students to use rigorous methods to solve problems related to a substantive area of the study.

Course Outcomes: Through this course students should be able to

CO1: Identify the recent studies in the field of research
CO2: Create substantive argumentation, utilizing personal views that are based on critical analysis of works from various fields of knowledge
CO3: Find skills of planning and execution of work
CO4: Illustrate professional competence by identifying and analyzing emerging issues
CO5: Apply foundational research skills to address a research issue
CO6: Demonstrate different tools employed in arranging references in manuscripts

M. Pharm IV Sem

Journal Club-II (MPG 401)

It provides a platform to enhance the research aptitude, reading capabilities and presenting capabilities of researcher by using various published articles.

Course Outcomes: Through this course students should be able to
CO1: Analyze the recent studies in the field of research
CO2: Apply substantive argumentation, utilizing personal views that are based on critical analysis of works from various fields of knowledge
CO3: Prioritize on keeping up-to-date with literature & promoting evidence-based practice
CO4: Summarize the outcomes of a study with the existing literature
CO5: Determining the importance of valid research findings into regular practice at individual or community level
CO6: Recommend his/her knowledge in design and development of novel compounds

Research Work (MPG 402)

This course involves the students to use rigorous methods to solve problems related to a substantive area of the study.

Course Outcomes: Through this course students should be able to

CO1: Understand and appreciate the relevance of the specific research area to current developments in drug discovery
CO2: Examine a research problem and critically categorize relevant papers retrieved from various sources for the study.
CO3: Demonstrate reflective learning skills based on their research work
CO4: Outline and present an overview of the proposed topic of interest, as well as the findings from the investigation of various parameters.
CO5: Find novel strategies for resolving identified problems and examine the outcomes of interventions adopted
CO6: Evaluate the usefulness of various research methods for the study of a specific problem by selecting one of the options and justifying your choice

Discussion/Presentation (MPG 403)

This course helps the students to analyze the research done and search its future perspective
Course Outcomes: Through this course students should be able to
CO1: Identify the research gap and review the methods in the major subject/field of study
CO2: Find the relevant research methodology to solve the given problem
CO3: Propose possible solution to the given problem based on the outcomes
CO4: Analyze the usefulness of various anthropological research methods for the study of a specific problem by selecting one of the options and justifying your choice.
CO5: Demonstrate presentation skill of his /her work effectively and accurately
CO6: Evaluate his/her capacity to communicate research results clearly, comprehensively and persuasively