

SYLLABUS (NEP-2020)

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY

**H.N.B. GARHWAL UNIVERSITY, SRINAGAR-
GARHWAL**

(A CENTRAL UNIVERSITY)



MASTER OF PHARMACEUTICAL CHEMISTRY

TWO YEARS (Ist TO IVth SEMESTER COURSE)

2026-28 ONWARDS

The following course structures under NEP 2020 is designed for M.Sc. PHARMACEUTICAL CHEMISTRY- I to IV SEMESTER which has practical based courses or have relatively larger offerings of practical and skill development based learning course.

Admission of the Master's Program in Pharmaceutical Chemistry shall be through entrance examination conducted by the University or merit basis (decided by competent authority of University) and the program shall be based on credit system in which credit defines the quantum of content/ syllabus prescribed for a course system.

The student shall be eligible for admission to a Master's Degree Program in Pharmaceutical Chemistry after he/she has successfully completed a three years or four years B. Sc or B .Pharm. undergraduate degree or earned prescribed number of credits or through the examinations conducted by University as equivalent to an undergraduate degree. Discipline Specific Core (DSC) courses prescribed for every Semester shall be mandatory for all students registered for the Master's Program in Pharmaceutical Chemistry. Besides this there shall be skill development courses offered in semester I, II, III and IV. Each candidate is must to participate in the Hospital Training, Field work, industrial training and excursions required for the Laboratory Courses when organized by the Department. Subsequent to that the student would have to present a detailed report of such trainings at the time of Semester Practical examination. 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 research work presentations and discussions with the supervisor shall be considered as theory course and multiplied by 1. In order to qualify for a two year master's degree, a student must acquire a minimum of 96 credits including a minimum of 24 credits in elective courses by choosing four electives may be (leading to a minimum 04 credits) offered by other departments. Internship/Dissertation (Project) is a major one mandatory for every student. Internship/Dissertation (Project) should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide. The dissertation is to be allotted in the beginning of III Semester and would be submitted during the examination of the IV Semester.

Course Structure along with credit distribution for M.Sc. PHARMACEUTICAL CHEMISTRY (From batches 2026-28 and onwards)

M.Sc. PHARMACEUTICAL CHEMISTRY- 1st SEMESTER (FIRST YEAR)

(TWO-YEARS P.G. PROGRAM)

Entry requirement		3-year Bachelor's degree (minimum 120 credits) or 4-Year Bachelor's Degree (In case of B.Tech and B.E programme-Minimum-160 credits) and candidates who have met the entrance requirements, including specified levels of attainment, in the programme admission regulations.	Maximum Marks 100		T	P	Total Credits
			Internal 40	External 60			
Course category	Semester-I	Subject Title	Course code	40	60		
Discipline Specific Core (DSC)	DSC-1	Quantitative Analytical Methods	SOS/PC/DSC001	40	60	3	2
	DSC-2	Modern Analytical Methods-1	SOS/PC/DSC002	40	60	3	2
	DSC-3	Chemistry of Natural Products	SOS/PC/DSC003	40	60	3	2
Skill Enhancement courses (SEC/Vocational)	SEC-1	Field survey on Medicinal Plants of Uttarakhand	SOS/PC/SEC001	40	60	2	3
Discipline Specific Elective (DSE)	DSE-1	Basic Pharmacology	SOS/PC/DSE001	40	60	3	1
		OR					
	DSE-2	Laboratory Guidelines and Techniques	SOS/PC/DSE002	40	60	3	1
		OR					
Multidisciplinary Elective (MDE)	MDE-1	Cosmeceuticals	SOS/PC/MDE001	40	60	3	1
		<i>A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.</i>					
AEC (Non-CGPA Course)	Indian Knowledge System			-	-	-	-
Total Credits							24

Note:

- In lieu of DSE the departments may offer any one course i.e. Field work based/Swayam Course work of 5 credits.*
- Departments are suggested to offer Swayam courses under DSE/MDE.*
- In cases where an elective course includes both theory and practical components, the concerned Department may bifurcate the total of four (4) credits appropriately between the theory and practical components, as per the course requirements and approved curriculum structure.*
- If a department intends to introduce any DSC without a practical component, it may do so; in such cases, the entire course shall carry 5 credits.*
- The Departments must ensure the provision of a diverse range of skill-based courses (SEC) that can lead to vocations, professions, or employment opportunities, in accordance with students' aspirations. Such skill-based courses shall include competencies relevant to the local context and shall be aligned with the principles of 'Vocal for Local'. Entrepreneurship development-related courses may also be included.*
- Internship may be offered either under the Skill Enhancement Course (SEC) category or in lieu of other Discipline Specific Courses (DSC), subject to the following provisions: a three-month internship shall carry 10 credits, equivalent to 3.33 credits per month. Accordingly, a 45-day internship shall carry 5 credits within a semester.*
- IKS-Departments may develop and offer a discipline-specific Indian Knowledge Systems (IKS) course or, alternatively, adopt the IKS course prescribed by the University.*

M.Sc. PHARMACEUTICAL CHEMISTRY- IInd SEMESTER (FIRST YEAR)
(TWO-YEARS P.G. PROGRAM)

Course category	Semester-II	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-4	Modern Analytical Methods-2	SOS/PC/DSC004	40	60	3	2	5
	DSC-5	Drug Delivery system and Bio-pharmaceutics	SOS/PC/DSC005	40	60	3	2	5
	DSC-6	Medicinal Chemistry	SOS/PC/DSC006	40	60	3	2	5
Skill Enhancement courses (SEC/Vocational)	SEC-2	Internship (Hospital Training, Two months) Skill Development	SOS/PC/SEC002	40	60	-	5	5
Discipline Specific Elective (DSE)	DSE-3	Field work (Survey) on health problems in the Garhwal Himalaya	SOS/PC/DSE003	40	60	-	4	4
		OR						
	DSE-4	Environmental Chemistry	SOS/PC/DSE004	40	60	3	1	4
		OR						
Multidisciplinary Elective (MDE)	MDE-2	Intellectual Property Right	SOS/PC/MDE002	40	60	4	0	4
		<i>A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.</i>						
AEC (Non-CGPA Course)		Constitutional, ethical, and moral values		-	-	-	-	1
Total Credits								24

Note: 1. In lieu of DSE/MDE the departments may offer any one course i.e. Field work based/Swayam, Course work of 4 credits.

2. Departments are suggested to offer Swayam courses under DSE/MDE.

3. In cases where an elective course includes both theory and practical components, the concerned Department may bifurcate the total of four (4) credits appropriately between the theory and practical components, as per the course requirements and approved curriculum structure.

4. If a department intends to introduce any DSC without a practical component, it may do so; in such cases, the entire course shall carry 5 credits.

5. The Departments must ensure the provision of a diverse range of skill-based courses (SEC) that can lead to vocations, professions, or employment opportunities, in accordance with students' aspirations. Such skill-based courses shall include competencies relevant to the local context and shall be aligned with the principles of 'Vocal for Local'. Entrepreneurship development-related courses may also be included.

6. A Summer Internship may be offered either under the Skill Enhancement Course (SEC) category or in lieu of other Discipline Specific Courses (DSC), subject to the following provisions: a three-month internship shall carry 10 credits, equivalent to 3.33 credits per month. Accordingly, a 45-day internship shall carry 5 credits within a semester.

7. The University shall provide a common syllabus for the course titled "Constitution, Ethical and Moral Values."

M.Sc. PHARMACEUTICAL CHEMISTRY- IIIrd SEMESTER (SECOND YEAR)

(TWO-YEARS P.G. PROGRAM)

Course category	Semester-III	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-7	Drug Design	SOS/PC/DSC007	40	60	3	2	5
	DSC-8	General Pharmaceutics	SOS/PC/DSC008	40	60	3	2	5
	DSC-9	Phytopharmaceuticals and Nutraceuticals	SOS/PC/DSC009	40	60	3	2	5
SEC(Skill Enhancement Course)/Vocational	DSC-10	Industrial Training (Two months)	SOS/PC/SEC010	40	60	-	5	5
Discipline Specific Elective (DSE)	DSE- 5	Herbal Drug Technology	SOS/PC/DSE005	40	60	3	1	4
		OR						
	DSE- 6	Presentation/ Seminars/ Reports writing/Assignments	SOS/PC/DSE006	40	60	3	1	4
		OR						
Multidisciplinary Elective (MDE)	M.D.E-3	Swayam Course, MOOCS (Relevant subjects of Pharmaceutical Chemistry)	SOS/PC/MDE003	40	60	4	-	4
		A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.						
AEC (Ability Enhancement Course) (Non-CGPA Course)	Academic Library Systems and Services							1
AEC (Non-CGPA Course)	Entrepreneurship & Startup Awareness							1
Total Credits								24

Note: 1. In lieu of DSE/MDE the departments may offer any one course i.e. dissertation/project/Field work/Swayam Course work of 4 credits. Departments are suggested to offer Swayam courses under DSE/MDE.

2. In cases where an elective course includes both theory and practical components, the concerned Department may bifurcate the total of four (4) credits appropriately between the theory and practical components, as per the course requirements and approved curriculum structure.

3. If a department intends to introduce any DSC without a practical component, it may do so; in such cases, the entire course shall carry 5 credits.

4. In the third semester of two-year P.G. program, if a department wishes to offer one more Discipline Specific Elective course, it may do so by replacing one of the Discipline-Specific Core courses. The credit value of the additional elective must be equal to that of the core course it replaces. This provision/flexibility is limited to only one additional elective course.

5. Research based courses such as Research methodology, Research writing and ethics, etc may be offered in the P.G. programme as core courses.

6. The University shall provide a common syllabus for the course titled "Academic Library Systems and Services"

7. Entrepreneurship & Startup Awareness- Departments may develop and offer an 'Entrepreneurship & Startup Awareness' course or, alternatively, adopt the 'Entrepreneurship & Startup Awareness' course prescribed by the University.

Departments shall offer this course to familiarize students with entrepreneurial mindset, startup ecosystem, innovation, and self-employment opportunities. The course may include basic business planning, case studies, interaction with entrepreneurs, and awareness of government startup schemes, with assessment based on participation and practical exercises. The course aims to promote creativity, leadership, and employment generation in alignment with NEP 2020.

M.Sc. PHARMACEUTICAL CHEMISTRY- IVth SEMESTER (SECOND YEAR)
(TWO-YEARS P.G. PROGRAM)

Course category	Semester-IV	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-9	Project (Project work should be completed within six months under the guidance of a faculty member in the same Department or Industry or any Govt. research organization).	SOS/PC/DSC009	40	60	-	15	15
SEC/Vocational	DSC-10	Final Presentation of Project	SOS/PC/SEC010	40	60	3	2	5
Discipline Specific Elective (DSE)	DSE- 7	Traditional Healthcare system of Uttarakhand (Field Work)	SOS/PC/DSE007	40	60	3	1	4
		OR						
	DSE- 8	Conference Presentation/ Paper Publication	SOS/PC/DSE008			3	1	4
		OR						
Multidisciplinary Elective (M.D.E)	M.D.E-4	Food Chemistry and Food Analysis	SOS/PC/MDE004	40	60	3	1	4
		OR						
		Artificial Intelligence in Pharmaceutical Research	SOS/PC/MDE005	40	60	2	2	4
		A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.						
SEC (Non-CGPA Course)	Community outreach activities			-				1
Total Credits				24				1
NHEQF Level- 6.5	Student on successfully completing two-year PG programme (i.e., securing minimum required 96 credits will be awarded "Postgraduate Degree", in related field/discipline/subject.						24	

Note: 1. In lieu of DSE/MDE the departments may offer any one course i.e. dissertation/project/Field work/Swayam Course work of 4 credits. Departments are suggested to offer Swayam courses under DSE/MDE.

2. In cases where an elective course includes both theory and practical components, the concerned Department may bifurcate the total of four (4) credits appropriately between the theory and practical components, as per the course requirements and approved curriculum structure.

3. If a department intends to introduce any DSC without a practical component, it may do so; in such cases, the entire course shall carry 5 credits.

4. In the fourth semester of two-year P.G. program, if a department wishes to offer one more Discipline Specific Elective course, it may do so by replacing one of the Discipline-Specific Core courses. The credit value of the additional elective must be equal to that of the core course it replaces. This provision/flexibility is limited to only one additional elective course.

5. Research based courses such as Research methodology, Research writing and ethics, etc may be offered in the P.G. programme as core courses.

6. Community outreach activities- Departments will offer a community outreach-based non-CGPA course focusing on societal engagement, local needs, and institutional social responsibility. The course may include activities such as field visits, awareness programmes, surveys, or collaboration with local bodies/NGOs, with evaluation based on participation, field reports, and reflective learning. This course aims to inculcate social sensitivity, ethical values, and experiential learning in alignment with NEP 2020.

M.Sc. PHARMACEUTICAL CHEMISTRY- 1st SEMESTER (FIRST YEAR)
(ONE-YEAR P.G. PROGRAM)

Course category	Semester-I	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-1	Drug Design	SOS/PC/DSC001	40	60	3	2	5
	DSC-2	General Pharmaceutics	SOS/PC/DSC002	40	60	3	2	5
	DSC-3	Phytopharmaceuticals and Nutraceuticals	SOS/PC/DSC003	40	60	3	2	5
SEC(Skill Enhancement Course)/Vocational	DSC-1	Industrial Training (Two months)	SOS/PC/SEC001	40	60	-	5	5
Discipline Specific Elective (DSE)	DSE- 1	Herbal Drug Technology	SOS/PC/DSE001	40	60	3	1	4
		OR						
	DSE- 2	Presentation/ Seminars/ Reports writing/Assignments	SOS/PC/DSE002	40	60	3	1	4
		OR						
Multidisciplinary Elective (M.D.E)	M.D.E-1	Swayam Course, MOOCS (Relevant subjects of Pharmaceutical Chemistry)	SOS/PC/MDE001	40	60	4	-	4
		A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.						
AEC (Ability Enhancement Course) (Non-CGPA Course)		Academic Library Systems and Services						1
AEC (Non-CGPA Course)		Entrepreneurship & Startup Awareness						1
Total Credits								24

Note: 1. In lieu of DSE/MDE the departments may offer any one course i.e. dissertation/project/Field work/Swayam Course work of 4 credits. Departments are suggested to offer Swayam courses under DSE/MDE.

2. In cases where an elective course includes both theory and practical components, the concerned Department may bifurcate the total of four (4) credits appropriately between the theory and practical components, as per the course requirements and approved curriculum structure.

3. If a department intends to introduce any DSC without a practical component, it may do so; in such cases, the entire course shall carry 5 credits.

4. In the third semester of two-year P.G. program, if a department wishes to offer one more Discipline Specific Elective course, it may do so by replacing one of the Discipline-Specific Core courses. The credit value of the additional elective must be equal to that of the core course it replaces. This provision/flexibility is limited to only one additional elective course.

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M.Sc. PHARMACEUTICAL CHEMISTRY- IInd SEMESTER (SECOND YEAR)
(ONE-YEAR P.G. PROGRAM)

Course category	Semester-II	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-4	Project (Project work should be completed within six months under the guidance of a faculty member in the same Department or Industry or any Govt. research organization).	SOS/PC/DSC004	40	60	-	15	15
SEC/Vocational	DSC-2	Final Presentation of Project	SOS/PC/SEC002	40	60	3	2	5
Discipline Specific Elective (DSE)	DSE- 3	Traditional Healthcare system of Uttarakhand (Field Work)	SOS/PC/DSE003	40	60	3	1	4
		OR						
	DSE- 4	Conference Presentation/ Paper Publication	SOS/PC/DSE004			3	1	4
		OR						
Multidisciplinary Elective (M.D.E)	M.D.E-2	Food Chemistry and Food Analysis	SOS/PC/MDE002	40	60	3	1	4
		OR						
		Artificial Intelligence in Pharmaceutical Research	SOS/PC/MDE005	40	60	2	2	4
		A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.						
SEC (Non-CGPA Course)	Community outreach activities			-				1
Total Credits				24				1
NHEQF Level- 6.5	Student on successfully completing two-year PG programme (i.e., securing minimum required 96 credits will be awarded “Postgraduate Degree”, in related field/discipline/subject.						24	

Note: 1. In lieu of DSE/MDE the departments may offer any one course i.e. dissertation/project/Field work/Swayam Course work of 4 credits. Departments are suggested to offer Swayam courses under DSE/MDE.

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3. If a department intends to introduce any DSC without a practical component, it may do so; in such cases, the entire course shall carry 5 credits.

4. In the fourth semester of two-year P.G. program, if a department wishes to offer one more Discipline Specific Elective course, it may do so by replacing one of the Discipline-Specific Core courses. The credit value of the additional elective must be equal to that of the core course it replaces. This provision/flexibility is limited to only one additional elective course.

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TWO-YEARS P.G. PROGRAM

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			Internal 40	External 60			
Course category	Semester-I	Subject Title	Course code	40	60		
Discipline Specific Core (DSC)	DSC-1	Quantitative Analytical Methods	SOS/PC/DSC001	40	60	3	2
	DSC-2	Modern Analytical Methods-1	SOS/PC/DSC002	40	60	3	2
	DSC-3	Chemistry of Natural Products	SOS/PC/DSC003	40	60	3	2
SEC/Vocational	SEC-1	Field survey on Medicinal Plants of Uttarakhand	SOS/PC/SEC001	40	60	-	5
Discipline Specific Elective (DSE)	DSE-1	Basic Pharmacology	SOS/PC/DSE001	40	60	3	1
		OR					
	DSE-2	Laboratory Guidelines and Techniques	SOS/PC/DSE002	40	60	3	1
		OR					
Multidisciplinary Elective (M.D.E)	M.D.E-1	Cosmeceuticals	SOS/PC/MDE001	40	60	3	1
		<i>A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.</i>					
AEC (Non-CGPA Course)	Indian Knowledge System			-	-	-	-
Total Credits							24

QUANTITATIVE ANALYTICAL METHODS
PAPER- I; COURSE CODE: (SOS/PC/DSC001)

Unit I

Fundamental of volumetric analysis: Methods of expressing concentrations, primary and secondary standards.

Neutralization reactions: Theory of indicators and neutralizations indicators.

Unit II

Oxidation-reduction titration: Principle of oxidation reduction Titrations, redox indicators & their use in pharmaceutical analysis.

Precipitation titration : Theory of precipitation titrations and use of adsorption indicators.

Unit III

Gravimetric analysis: Method of gravimetric analysis

Unit IV

Complexometric titrations: Complexometric methods using EDTA, principle of complexometric titrations, chelating agents, indicators, titrations with disodium edetate.

Unit V

Nonaqueous titrations: General discussion and principle of titrations in non-aqueous media, aprotic, protophilic, protogenic and amphiprotic solvents. Titrations with perchloric acid, potassium methoxide and tetrabutyl ammonium hydroxide.

BOOKS SUGGESTED

1. A. H. Becket and J. B. Stenlake, Practical Pharmaceutical Chemistry, Part I, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
2. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5th ed., ELBS, U.K., 1989 .
3. A. Keneth & A. Connors, A Text Book of Pharmaceutical Analysis, 3rd ed., Wiley Interscience Singapore, 1982.

LABORATORY I- PHARMACEUTICAL ANALYSIS

LABORATORY- 1; CODE: (SOS/PC/ DSC001)

Experiments based on SOS/PC/DSC001 Theory paper

Standardization of analytical weights and calibration of volumetric apparatus.

Titrametric analysis including acid base titration, redox titration, precipitation titrations, gravimetric analysis.

BOOKS SUGGESTED

1. A. H. Becket and J. B. Stenlake, Practical Pharmaceutical Chemistry, Part I, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
2. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5th ed., ELBS, U.K., 1989 .
3. A. Keneth & A. Connors, A Text Book of Pharmaceutical Analysis, 3rd ed., Wiley Interscience Singapore, 1982.

MODERN ANALYTICAL METHODS-1

CORE COURSE: PAPER-II; CODE- (SOS/PC/DSC002)

Unit-I

Chromatography, Principles of separation, application of techniques, absorption, partition, paper and thin layer chromatography. HPTLC, HPLC, Gas Chromatography, GLC, Ionexchange Chromatography and Gel Electrophoresis, Colorimetry, theory, methods of colour measurements or comparison, instrumentation.

Spectrofluorimetry, instrumentation, application.

Unit-II

Atomic absorption and flame emission spectroscopy, theory, instrumentation, atomic absorption spectrophotometers, structure determinations.

Principle, techniques, instrumentation & application including interpretation of data of UV spectrophotometry & infrared spectrophotometry.

Unit-III

Optical rotation, its significance, instrumentation.

Optical rotatory dispersion-terminology, plain curve, rotatory dispersion & circular dichroism and octane rule.

BOOKS SUGGESTED

1. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds, 6th ed. John Wiley and Sons-Inc 1998.
2. Comin N. Banwell, Elian M. McCash, Fundamentals of molecular spectroscopy 4th ed. Tata McGraw -Hill Publishing Company Limited New Delhi, 1995.
3. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
4. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

M. Sc. Pharm. Chem. 1st Sem.

LABORATORY II- Moder Analytical METHODS -1

LABORATORY- 2; COURSE CODE- SOS/PC/ DSC002

Experiments based on SOS/PC/DSC002 Theory paper

Analysis of pharmacopoeia compounds and their formulations by UV Vis spectrophotometer

Experiments based on Chromatography

BOOKS SUGGESTED

1. A. H. Becket and J. B. Stenlake, Practical Pharmaceutical Chemistry, Part I, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
2. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5th ed., ELBS, U.K., 1989 .
3. A. Keneth & A. Connors, A Text Book of Pharmaceutical Analysis, 3rd ed., Wiley Interscience Singapore, 1982.

CHEMISTRY OF NATURAL PRODUCTS

PAPER- IV; COURSE CODE: SOS/PC/DSC003

Unit-I

Heterocyclic Compounds: Five membered heterocycles: Furan, Thiophene, pyrrole, thiazole, pyrazole, oxazole, Six membered: Pyridine, pyrimidine, Quinilene.

Unit-II

Carbohydrate : Introduction, mutarotation, ring structure of glucose, configuration of monosaccharides, structure elucidation of disaccharides, sucrose, maltose, lactose, polysaccharides, starch. Glycosides arbutin, amygdaline.

Unit-III

Alkaloids : General introduction, distribution in plants, isolation & purification. General methods of structure determination. Structural elucidation of atropine, quinine, Nicotine

Unit-IV

Terpenoids : General introduction, isolation, purification, structure elucidation of citral, menthol, camphor,

BOOKS SUGGESTED

1. I.L. Finar, Organic chemistry, Vol. II, 1st Indian ed., Pearson Education Pte Ltd Indian Branch, Delhi, 2002.
2. O.P. Agarwal, Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.

CHEMISTRY OF NATURAL PRODUCTS

LABORATORY III ; COURSE CODE: SOS/PC/DSC003

Experiments based on theory paper SOS/PC/DSC003

Laboratory II shall constitute of the following:

Experiments based on the determination of saponification value, acid value, ester value and iodine value of vegetable oils.

Extraction and isolation of compounds from the different plants.

BOOKS SUGGESTED

1. I.L. Finar, Organic chemistry, Vol. II, 1st Indian ed., Pearson Education Pte Ltd Indian Branch, Delhi, 2002.
2. O.P. Agarwal, Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
3. Pharmacognosy: Trease and Evans

**SEC/VOCATIONAL FIELD SURVEY ON MEDICINAL PLANTS OF
UTTARAKHAND; COURSE CODE: SOS/PC/SEC001**

The course will be started in the month of July and August due to short time availability of medicinal plants of high altitude Himalayan region. Uttarakhand Himalaya has been known to be home to many medicinal plants and herbs since time immemorial. Even the mythical Sanjeevni Booti of the Ramayana which revived Lakshman after he had fallen in battle was claimed to have been brought from the Uttarakhand Himalaya (Dronagiri). The story reveals that this region as the source as many medicinal plants. A Report on Medicinal Plants of Uttarakhand will be submitted by the students in the Department with photographs and brief description at the end of Semester.

BASIC PHARMACOLOGY

DSE COURSE PAPER- I; CODE- (SOS/PC/DSE001)

Unit-I

History of development of Pharmacology, introduction & general principles of route of drug administration, pharmacokinetics (absorption, distribution, metabolism & excretion) & pharmacodynamics (general mechanism of drug action).

Elementary introduction to adverse drug reactions & drug interactions, Drug allergy.

Unit-II

General concepts of toxicity, Acute, subacute & chronic toxicity tests, teratogenicity & carcinogenicity, itrogenic diseases, LD₅₀, ED₅₀, tolerance, habituation & addiction.

Unit-III

Bio-assays :General principles, general methods, biological variations & animal ethics. Bioassays of insulin, heparin, d-tubocurarin, digitalis, acetylcholine, adrenaline, histamine.

BOOKS SUGGESTED

1. Goodman & Gillman, The Pharmacological Basis of Therapeutics 9th ed., McGraw Hill Companies, New York, USA, 1996.
2. Katzung G. Bertram, Basic and Clinical Pharmacology, 8th ed., McGraw Hill Companies, New York, USA, 2001.

3. Rang H.P., Dale M.M., Ritter J.M., Pharmacology, 4th ed., Churchill livingstone, N. Y., 1999.
4. R.S. Satoshkar, Pharmacology and Pharmacotherapeutics, vol. I & II: 16th ed., Mumbai Popular Prakashan, 1999.
5. Laurence & Bennett, Clinical Pharmacology, 8th ed., Churchill Livingstone, N. Y. 1997.
6. S. D. Seth, Text Book of Pharmacology, 2nd ed. Churchill Livingstone Pvt. Ltd., New Delhi.
7. F.S.K. Barar, Essential of Pharmacotherapeutics, 3rd ed. S. Chand and Company Ltd., New Delhi, 1995.
8. K.D. Tripathi, Essentials of Medical Pharmacology, 9th ed., Jaypee Brothers New Delhi, 1995.

BASIC PHARMACOLOGY

LABORATORY IV; COURSE CODE: SOS/PC/DSC001

- i. Experiments based on theory paper SOS/PC/DSC003.
- ii. Blood typing, estimation of hemoglobin in blood, determination of bleeding time, clotting time, RBC counts, TLC, DLC & ESR.
- iii. Recording of body temp, pulse rate, and blood pressure, basic understanding of ECG.

BOOKS RECOMMENDED

1. Ross and Wilson, Anatomy, Physiology in Health and Illness, 9th ed., Churchill Livingstone, N. Y., 2001.
2. C.C. Chatterjee, Human Physiology, vol. I&II, 11th ed., Medical Allied Agency, Ballygurge 2nd Lane, Calcutta.
3. Guyton Arthure C. and Hall John E., TextBook of Medical Physiology, 9th ed., W.B. saunders Company, Bangalore, 1996.
4. Doroland's Medical Dictionary, 25th ed., Oxford University press.
5. Principles of Anatomy and Physiology, Tortora & Grabowski, 10th edition.
6. Textbook of Practical Physiology by C.L. Ghai.
7. Mosby's Medical dictionary, 4th edition, Mosbey publications.

LABORATORY GUIDELINES AND TECHNIQUES

COURSE CODE: SOS/PC/DSE002

Unit I

Introduction of Chemistry Laboratory General introduction of the chemistry laboratory, common instructions for safe working in chemical laboratories,

Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP). Laboratory design, Storage, ventilation, lighting, fume, cupboard and arrangement of the store.

Unit II

Safety provisions, Organization of practical work, Maintenance of laboratory, equipment Cleaning of laboratories and glasswares/plasticwares and preparation room.

Classification of apparatus in store and laboratory. Introduction of Chemistry Apparatus Glass apparatus - Beaker, test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser Liebig flask, watch glass etc.

Unit III

measuring conical or condenser, Petridis, desiccators. Volumetric Apparatus -Measuring cylinder, burette, pipette, volumetric flask, analytical balance, single-pan electronic balance/ electrical analytical balance, Micropipette, Three way Pipette Bulb etc.

Introduction of Chemistry Equipments Clevenger apparatus, Buchner funnel, Soxhlet extractor, wire gauze, cork borers, filter pumps, crucible, mohl clip, pipe clay triangle, pestle and mortar, spirit lamp, spatulas, thermometer, pH meter, and laboratory centrifuge.

Apparatus for heating and reaction: Magnetic Stirrer, Bunsen burner, water bath, oil bath hot plate, sand bath, hot air oven, heating mantle etc.

LABORATORY GUIDELINES AND TECHNIQUES

LABORATORY-V COURSE CODE: SOS/PC/DSE002

Experiments based on theory paper SOS/PC/DSE002.

1. Handling of common laboratory equipment
2. Preparation of solutions, indicators and reagents (e.g. ceric ammonium nitrate, 2,4-dinitro phenyl hydrazine, Tollen's reagent, Fehling solution, etc).

3. Preparation of some organic compound and determination of their boiling point and melting point (e.g. ester derivative of benzoic acid, ester of alcohol like ethanol, butanol etc).

4. Cork boring experiment 5. Calibration of volumetric glassware

References: • Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall,.

- Vogel's textbook of chemical quantitative analysis, Longman Scientific
- Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, Universities Press.
- Laboratory Manual of Organic Chemistry, R. K. Bansal, New Age Pub.
- Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
- Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, S. Chand.

M. Sc. Pharm. Chem. 1st Sem.

COSMECEUTICALS

DSE COURSE; PAPER CODE- (SOS/PC/DSE003)

Unit I

Cosmetics – Regulatory : Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import cosmetics.

Cosmeticeuticals - Biological aspects : Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm.

Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.

Herbal Cosmetic : Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics.

REFERENCES

1. Harry's Cosmeticology. 8th edition.
2. Poucher's perfumecosmeticsandSoaps, 10th edition.
3. Cosmetics - Formulation, Manufacture and quality control, PP.Sharma, 4th edition

4. Handbook of cosmetic science and Technology A.O.Barel, M.Paye and H.I. Maibach. 3 rd edition
5. Cosmetic and Toiletries recent suppliers catalogue.
6. CTFA directory.

M. Sc. Pharm. Chem. 1st Sem.

COSMECEUTICALS

LABORATORY V; COURSE CODE: SOS/PC/DSE003

Experiments based on theory paper SOS/PC/DSE003.

Formulation of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.

M.Sc. PHARMACEUTICAL CHEMISTRY- II SEMESTER (FOR 2-YEARS COURSE)

Course category	Semester-II	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-4	Modern Analytical Methods-2	SOS/PC/DSC004	40	60	3	2	5
	DSC-5	Drug Delivery system and Bio-pharmaceutics	SOS/PC/DSC005	40	60	3	2	5
	DSC-6	Medicinal Chemistry	SOS/PC/DSC006	40	60	3	2	5
SEC/Vocational	SEC-2	Internship (Hospital Training, one month)Skill Development	SOS/PC/SEC002	40	60	-	5	5
Discipline Specific Elective (DSE)	DSE-3	Field work on health problems in the Garhwal Himalaya	SOS/PC/DSE003	40	60	-	4	4
		OR						
	DSE-4	Environmental Chemistry	SOS/PC/DSE004	40	60	3	1	4
		OR						
Multidisciplinary Elective (M.D.E)	M.D.E-2	IPR	SOS/PC/MDE002	40	60	4	0	4
		A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.						
AEC (Non-CGPA Course)	Constitutional, ethical, and moral values			-	-	-	-	1
Total Credits								24

MODERN ANALYTICAL METHODS-2

CORE COURSE: PAPER- I; CODE (SOS/PC/DSC004)

UNIT-I

Molecular Emission Spectroscopy: Principle, molecule exhibiting fluorescence, Factors interfering with fluorescence intensity and Application, Raman Spectroscopy-Principle, Instrumentation and Application

Unit-II

Mass Spectroscopy: Principle, techniques, instrumentation, fragmentation pattern & structural elucidation of compounds. GC-MS and LC-MS Principle and Application.

Unit-III

Proton Magnetic Resonance, Principle, techniques, instrumentation, ¹H NMR signals, chemical shift, spin-spin coupling, shielding deshielding effect, diamagnetic anisotropy, geminal coupling, AMX, ABX, ABC system, shift reagents & interpretation of spectra. ¹³C-NMR, introduction and interpretation of data.

Unit-IV

Application of spectroscopic techniques to structural elucidation, introduction aids to spectral interpretation exercises.

Microbiology assays, Principles of microbiological assays, assays of vitamins & antibiotics.

BOOKS SUGGESTED

1. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds, 6th ed. John Wiley and Sons-Inc 1998.
2. Comin N. Banwell, Elian M. McCash, Fundamentals of molecular spectroscopy 4th ed. Tata McGraw -Hill Publishing Company Limited New Delhi, 1995.
3. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
4. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

ADVANCE ANALYTICAL METHODS

CORE LABORATORY-I; CODE (SOS/PC/DSC004)

- i. Experiments based on theory paper SOS/PC/DSC004
- ii. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
- iii. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
- iv. Experiments based on Chrometography

DRUG DELIVERY SYSTEM & BIOPHARMACEUTICS

CORE COURSE: PAPER- II; CODE- (SOS/PC/DSC005)

Unit-I

Types, advantages, disadvantages & formulation of oral dosage forms including:

- a) Liquid dosage forms like solution, syrups, suspension & emulsion.
- b) Solid dosage forms like tablets, capsules etc.

Unit-II

Types, advantages, disadvantages & formulation of parenteral. Dosage forms & topical semi-solid dosage forms. Quality control of various dosage forms.

Unit-III

Quality Control of various dosage forms.

Disintegration, Disintegration time, factors affecting disintegration.

Dissolution, Dissolution models, factors affecting dissolution rate, co-rrelation of dissolution with bioavailability. Factors affecting drug absorption including physicochemical, biological & Pharmaceutical Passive Diffusion, Active Diffusion.

Unit-IV

Drug disposition: Distribution in blood, plasma protein binding, cellular distribution, drug excretion, biotransformation of drugs.

Bioavailability : Concept of bioavailability & comparative bioavailability, methods of estimation of bioavailability, bioequivalence studies.

BOOKS SUGGESTED

1. Hand book of Basic Pharmacokinetics-Ritschel, W.A., Drug Intelligenc Publication, M. Hamilton, 1977.
2. Fundamentals of Clinical Pharmacokinetics-Wagner, J.C., Drug Intelligence Publication, M. Hamilton, 1975.
3. Remington's Pharmaceutical Sciences-Gennaro A.R., ed., 19th Edition, Mack Publishing kco., Easton, PA. 1995.
4. Clinical Pharmacokinetics-Rowland, M, & Tozer, N., 2nd edition, Lea & Febiger, Philadelphia, 1989.
5. Pharmacokinetics-Gibaldi M. & Perrier, D., 2nd ed., Marcel Dekker, New York, 1982.
6. Pharmacokinetics for the pharmaceutical scientist-Wagner, J.C., Technomic Publishing AG, Switzerland, 1993.
7. Biopharmaceutcs and Pharmacokinetics- Notrari, R.E., 2nd ed., marcel Dekker, New York, 1975.
8. Biopharmaceutcs and Pharmacokinetics: Bramhankar & Jai

M. Sc. Pharm. Chem. IInd Sem.

DRUG DELIVERY SYSTEM & BIOPHARMACEUTICS

LABORATORY II; CODE- (SOS/PC/DSC005)

Experiments based on theory paper SOS/PC/DSC005

M. Sc. Pharm. Chem. IInd Sem.

MEDICINAL CHEMISTRY

CORE COURSE: PAPER-III; CODE (SOS/PC/DSC006)

The Following topics shell cover –Nomenclature and classification of each topic, Structure Activity Relationship(SAR) (where stand) ,Mode of action ,Biochemical and Molecular basis (where applicable) and Therapeutic uses of :

Sulphonamides, penicillins & semisynthetic penicillins.

Cephalosporins, tetracyclines & Aminoglycosides, Antibiotics

Antimycobacterial agents-anti-T.B. & antileprosy drugs. Antimalarials.

Antiamobic & antiprotozoal

Antihelminitics

Antifungal

Anticancer

Antiviral

BOOKS SUGGESTED

1. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989.
2. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
3. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.
4. Kadam & Mahadik, Bothara, Principles of Medicinal Chemistry vol. I & II, 4th ed. Nirali Prakash Pune, 1997

M. Sc. Pharm. Chem. IInd Sem.

MEDICINAL CHEMISTRY

LABORATORY-III; CODE (SOS/PC/DSC006)

Syntheses involving some name reactions, heterocyclic nuclei and some simple drugs

M. Sc. Pharm. Chem. IInd Sem.

SEC/VOCATIONAL INTERNSHIP – (HOSPITAL TRAINING,

SKILL DEVELOPMENT

(SOS/PC/SEC005)

The duration period of Hospital Training shall be one month, started at the time of winter vacations, after completion of end of Ist Semester Examination.

SEC/Vocational courses (Hospital Training) emphasizes the connection between Pharmaceutical Chemistry and entrepreneur skills highlighting how students can apply their scientific knowledge to create and develop Pharmaceutical based businesses and start-ups

BOOKS SUGGESTED

1. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989.
2. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
3. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.

**FIELD WORK/ SURVEY ON HEALTH PROBLEMS IN THE GARHWAL
HIMALAYA (SOS/PC/DSE003)**

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic activities, as Fieldwork (community outreach program) in the Garhwal Himalaya offers a unique opportunity for students to study the nexus of environmental, social, and health factors. Key health issues in this region include waterborne diseases, acute respiratory issues from indoor air pollution, nutritional deficiencies, mental health struggles due to lack of access to healthcare. The hypertension, diarrhea, accidental injuries, and eye problems are also prevalent in the remote areas of Garhwal Himalaya.

ENVIRONMENTAL CHEMISTRY

COURSE CODE: SOS/PC/DSE004

Unit I

Environment Introduction, composition of atmosphere, vertical temperature, heat budget of the earth atmospheric system, vertical stability atmosphere. Biogeochemical cycles of C, N, P, S and O. Bio distribution of elements.

Unit II

Hydrosphere Aquatic pollution- inorganic, organic, pesticides, agricultural, industrial and sewage, detergents, oil spills and oil pollutants. Water quality parameters-dissolved oxygen, biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and micro-organisms. Water quality standards. Analytical methods for measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.) residual chloride and chlorine demand. Purification and treatment of water. Unit III Soils Composition, micro and macro nutrients, Pollution of fertilizers, pesticides and metals.

Unit III

Soils Composition, micro and macro nutrients, Pollution of fertilizers, pesticides and metals.

Unit IV

Atmosphere Chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect, pollution by chemicals, petroleum, minerals chlorofluorohydrocarbons. Analytical methods for measuring air pollutants. Continuous monitoring instruments. Unit V Industrial Pollution Pollution from cement, sugar, distillery, drug; paper and pulp, thermal power plants, nuclear power plants, metallurgy, polymers and drugs etc.

Unit VI

Environmental Toxicology Chemical solutions to environmental problems, biodegradability, principles of decomposition, better industrial processes.

M. Sc. Pharm. Chem. IInd Sem.

ENVIRONMENTAL CHEMISTRY

LABORATORYIV; COURSE CODE: SOS/PC/DSE004

Experiments based on theory paper SOS/PC/DSE004

Water quality parameters-dissolved oxygen, biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and micro-organisms. Water Analytical methods for measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.) residual chlorid. Purification and treatment of water. Pollution of fertilizers, pesticides and metals.

BOOKS SUGGESTED

1. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
2. Environmental Chemistry, Sharma and Kaur, Krishna Publishers.
3. Environmental Chemistry, A.K. De, Wiley Eastern.
4. Environmental Pollution Analysis, S.M. Khopkar, Wiley Eastern.

5. Standard Method of Chemical Analysis, F.J. Welcher Vol. III, Van Nostrand Reinhold Co.
6. Environmental Toxicology, Ed. J. Rose, Gordon and Breach Science Publication.
7. Elemental Analysis of Airborne Particles, Ed. S. Landsberger and M. Creatchman, Gordon and Breach Science Publication.
8. Environmental Chemistry, C. Baird, W.H. Freeman.

M. Sc. Pharm. Chem. IInd Sem.

INTELLECTUAL PROPERTY RIGHTS

COURSE CODE: SOS/PC/MDE002

1. Definition, Need for patenting, Types of Patents, Conditions to be satisfied by an invention to be patentable, Introduction to patent search. Parts of patents. Filling of patents.
2. The essential elements of patent; Guidelines for preparation of laboratory note book, Non-obviousness in Patent. 12 Hrs
3. Role of GATT, TRIPS, and WIPO 12 Hrs
4. Brief introduction to Trademark protection and WHO Patents. IPR's and its types, Major bodies regulating Indian Pharmaceutical sector.
5. Brief introduction to CDSCO. WHO, USFDA, EMEA, TGA, MHRA, MCC, ANVISA
6. Regulatory requirements for contract research organization. Regulations for Biosimilars

REFERENCES :

1. Pharmaceutical Process Validation: By Fra R. Berry and Robert A. Nash, Vol 57, 2nd Edition
2. Applied Production and Operation Management By Evans, Anderson and Williams
3. GMP for pharmaceuticals Material Management by K.K. Ahuja Published by CBS publishers
4. ISO 9000-Norms and explanations
5. GMP for pharmaceuticals- Willing S.H. Marcel and Dekker

M.Sc. PHARMACEUTICAL CHEMISTRY- IIIrd SEMESTER (SECOND YEAR) TWO-YEARS P.G. PROGRAM

Course category	Semester-III	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-7	Drug Design	SOS/PC/DSC007	40	60	3	2	5
	DSC-8	General Pharmaceutics	SOS/PC/DSC008	40	60	3	2	5
	DSC-9	Phytopharmaceuticals and Nutraceuticals	SOS/PC/DSC009	40	60	3	2	5
SEC(Skill Enhancement Course)/Vocational	DSC-10	Industrial Training (Two months)	SOS/PC/SEC010	40	60	-	5	5
Discipline Specific Elective (DSE)	DSE- 5	Herbal Drug Technology	SOS/PC/DSE005	40	60	3	1	4
		OR						
	DSE- 6	Presentation/ Seminars/ Reports writing/Assignments	SOS/PC/DSE006	40	60	3	1	4
		OR						
Multidisciplinary Elective (MDE)	MDE-3	Swayam Course, MOOCS (Relevant subjects of Pharmaceutical Chemistry)	SOS/PC/MDE003	40	60	4	-	4
		A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.						
AEC (Ability Enhancement Course) (Non-CGPA Course)	Academic Library Systems and Services							1
AEC (Non-CGPA Course)	Entrepreneurship & Startup Awareness							1
Total Credits								24

DRUG DESIGN

PAPER- I; COURSE CODE- (SOS/PC/DSC007)

Unit-I

Dose response curve, concept of agonist, partial agonist, antagonist, partial antagonist, competitive & none-competitive antagonism. Drug metabolism.

Unit-II

Specific & non-specific drug action, concept of receptor, drug-receptor interactions. Receptor theories, spare receptor, ion-channels.

Unit-III

Topography receptors, adrenergic, cholinergic, H₁, H₂, steroidal, serotonin, diazepam & opiod receptors.

Unit-IV

Drug metabolism approaches to drug design. Concept of isosterism & bioisoterism, metabolite antagonism, stereochemistry & drug action. Analog design, concept of prodrug.

Unit-V

Introduction to QSAR. Chemical information computing system in drug discovery. Molecular modeling drug action.

BOOKS SUGGESTED

1. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and
2. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
3. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.
4. Kadam & Mahadik, Bothara, Principles of Medicinal Chemistry vol. I & II, 4th ed. Nirali Prakash Pune,

DRUG DESIGN

LABORATORY I; COURSE CODE- (SOS/PC/DSC007)

- i. Experiments based on theory paper SOS/PC/DSC007
- ii. Calculation of physicochemical and ADME properties using SwissADME (e.g. logP, molecular weight, H-bond donors/acceptors)
- iii. Perform basic molecular docking studies using any of open-source academic tools such as: AutoDock Vina, PyRx, SwissDock, MZDock

M. Sc. Pharm. Chem. IIIrd sem.

GENERAL PHARMACEUTICS

PAPER- II; COURSE CODE- (SOS/PC/DSC008)

Unit I

Extraction Processes: Infusion, decoction, maceration and percolation processes and preparation involving them.

Size Reduction: Objectives , factor affecting, method of size reduction. Construction and working of hammer mill, fluid energy mill, colloid mill.

Size Separation: Official standards for powders, sieving methods.

Unit II

Mixing: Definition, objectives, type of mixtures, types of equipments used in mixing, propeller, turbine paddle, mixer, collide mixer, sigma mixer, arm mixer, tumbler mixer.

Drying: Introduction to drying process, study of tray dryer, fluidized bed dryer , vaccume and freeze dryer.

Unit III

Pharmaceutical Literature and Ethics: Importance of various Pharmacopoeias with special reference to those which are official in India , general introduction to code of Pharmaceutical ethics.

BOOKS SUGGESTED

1. Hand book of Basic Pharmacokinetics-Ritschel, W.A., Drug Intelligence Publication, M. Hamilton, 1977.
2. Fundamentals of Clinical Pharmacokinetics-Wagner, J.C., Drug Intelligence Publication, M. Hamilton, 1975.
3. Remington's Pharmaceutical Sciences-Gennaro A.R., ed., 19th Edition, Mack Publishing kco., Easton, PA. 1995.
4. Clinical Pharmacokinetics-Rowland, M, & Tozer, N., 2nd edition, Lea & Febiger, Philadelphia, 1989.

GENERAL PHARMACEUTICS

LABORATORY-II; COURSE CODE- (SOS/PC/DSC008)

- iv. Experiments based on theory paper SOS/PC/DSC008
- v. Pharmaceutical calculations like dilution and concentration, techniques.
- vi. Preparation of various dosage forms like monophasic, biphasic, solid, semisolid, and pediatric preparations.
- vii. Pharmacopeial requirements and implement them in preparation of pharmaceutical products.
- viii. Analyze formulation ingredients and achieve stability, safety, and therapeutic efficacy.

PHYTOPHARMACEUTICALS AND NUTRACEUTICALS

PAPER- III; COURSE CODE- SOS/PC/DSC009

Unit I

Introduction Definition, historical background present status and future scope of Phytopharmaceuticals.

Unit II

Classification of crude drug: Alphabetical, morphological, pharmacological and chemical classification.

Unit III

Adulteration and evaluation of drugs: Causes and types of Adulteration organoleptic, biological, chemical and physical methods of evaluation.

Unit IV

General principle of formulation of primary and secondary plant metabolites. Biogenesis of carbohydrates, lipids, volatile oils and resins.

Unit V

Plants and their environmental factors influencing the variability in drug activity

Unit VI

General introduction and uses of Nutraceuticals.

Unit VI

An introduction to tissue culture and its scope in production of phytopharmaceuticals

BOOKS SUGGESTED

1. Evans, W.C. Trease and Evans Pharmacognosy, 16th Edition, W.B. Saunders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R., and Robbers, J.E. Pharmacognosy, 9th Edition, Lea & Febiger, Philadelphia, 1988.
3. Wallis, T.E. Textbook of Pharmacognosy.
4. Ali, Mohammad. Pharmacognosy and Phytochemistry, CBS Publishers & Distributors, New Delhi.
5. Ahmad S, Introduction to Pharmacognosy, Dreamtech Press, New Delhi, 2nd Edition, 20019
6. Kalia, A.N. Pharmacognosy and Phytochemistry – I, CBS Publishers & Distributors, New Delhi.
7. Kokate, C.K., Purohit, A.P., and Gokhale, S.B. Textbook of Pharmacognosy, 37th Edition (2007), Nirali Prakashan, Pune.
8. Jalalpure, Sunil S. and Patil, Akshay K. Textbook of Pharmacognosy and Phytochemistry – I, Nirali Prakashan, Pune, 2024.
9. Ansari, S.H. Essentials of Pharmacognosy, 2nd Edition, Birla Publications, New Delhi, 2007.
10. Iyengar, M.A. Anatomy of Crude Drugs.
11. Khandelwal, K.R. and Sethi, Vrinda. Practical Pharmacognosy.
12. Kokate, C.K., Purohit, A.P., and Gokhale, S.B. Practical Pharmacognosy, Nirali Prakashan, Pune.

M. Sc. Pharm. Chem. IIIrd Sem.

PHYTOPHARMACEUTICALS AND NUTRACEUTICALS

LABORATORY III; COURSE CODE- SOS/PC/DSC009

- i. Experiments based on theory paper SOS/PC/DSC009
- ii. Chemical tests for identification of carbohydrates, proteins, lipids, alkaloids, anthraquinones, cardiac glycosides, flavonoids, and tannins and Terpenoids
- iii. Determination of loss on drying (Moisture content), ash values, extractive value(s), foreign organic matter, bitterness value, foaming index, swelling index, viscosity, acid value, and saponification value.
- iv. Experiential learning based experiments involving collection, identification of medicinal plant material,

INTERNSHIP: INDUSTRIAL TRAINING (TWO MONTHS)

COURSES; CODE (SOS/PC/SEC010)

The purpose of Internship in the Pharmaceutical Industries is to full fill the spirit of NEP-2020 to Training the students to real work of environment experience at industry and at the same time, to gain the knowledge through hands on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and industrial rule regulations. Moreover, this practical training program exposes the students to relate theoretical knowledge with its application in the pharmaceutical industry.

Industrial Training will be of Two Months compulsory. The purpose of Internship in the industries is to expose students to real work of environment experience at industry, and at the same time, to gain the knowledge through hands on observation.

BOOKS SUGGESTED

1. British Pharmacopoeia
2. E.A.Rawlins- Text Book of pharmaceuticals, Bailliere Tindall.
3. G. Gun and S.J. Carter, Cooper & Gunn's Tutorial Pharmacy, Pitman Medical Publishing Co. London.
4. Gilbert S, ,, Banker and Cristopher T.Rhodes- Moder pharmaceuticals and Pharmaceutical Sciences Series, M.& D. Inc. , New York.
5. Leon Lachman- The Theory and Practice of Industrial Pharmacy, K.M. Verghease Co. Bombay.
6. Pharmacopoeia of India.

HERBAL DRUG TECHNOLOGY

COURSE CODE- (SOS/PC/DSE005)

2. Definition of Herbal drugs, Importance of Herbal therapies, Herbal verses Conventional drugs, Safety in Herbal drugs, Toxicity in Herbs and interaction.
3. Herbs used as nutraceuticals or healing agents.
4. Herbal cosmetics.
5. Making and using Herbal medicines for common ailments like cold, skin infection and diarrhea.
6. Analytical profiles of selected herbs- *Brahmi*, *Arandrographis paniculata*, *Aegle marmelos* and *Gymnema sylvestre*
7. Quality control and quality Assurance of Herbal drugs.

BOOKS SUGGESTED

1. Quality Control of Herbal Drugs; Pulk K. Mukharjee

2. Pharmacognosy – C.K.Kokate
3. Quality Control Methods for Medicinal Plant material by WHO, Geneva.
4. Indian Herbal Pharmacopeia Vol. I & II.
5. Trease and Evan's Pharmacognosy 15 edition.
6. Botanical safety hand book by Michael Meguffin, Christopher Hobbs Published by American Herbal Product Asso.

M. Sc. Pharm. Chem. III Sem.

HERBAL DRUG TECHNOLOGY

LABORATORY IV; COURSES CODE (SOS/PC/DSE005)

1. Qualitative analysis of crude drug: Analysis of alkaloids, volatile oils, fixed oils, fats and waxes, Flavonoids, Terpenoids, Resins, Tannins, Glycosides and Steroids.
2. Extraction of Herbal drugs: Procedure for extraction of Herbal drugs Extraction methods for specific phytochemical group, treatment of drug residue after extraction.
3. Application of TLC and Paper Chromatographic Methods in qualitative analysis of crude drug.

M. Sc. Pharm. Chem. IIIrd Sem.

PRESENTATION/ SEMINARS/ REPORTS WRITING/ASSIGNMENTS

ELECTIVE COURSE; CODE (SOS/PC/E007)

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic, co/extracurricular (Participation in conferences/seminars/ workshops/Training programmes etc.) activities are appreciable.

The contact hours of seminars and assignments hour's presentations and discussions with the supervisor shall be considered as practical course.

M. Sc. Pharm. Chem. IIIrd Sem.

ONLINE COURSES (SWAYAM/NPTEL/ MOOCS)

ELECTIVE COURSES; CODE (SOS/PC/E008)

One online elective course from SWAYAM/NPTEL/MOOCs of 06 credits to be qualified under the supervision of the Department during the IIIrd Semester. Visit to the University Website - hnbgu.ac.in for online MOOCS courses. Course should be relevant to Pharmaceutical Chemistry.

M. Sc. Pharm. Chem. IIIrd Sem.

PRESENTATION/ SEMINARS/ REPORTS WRITING/ASSIGNMENTS

COURSE CODE : SOS/PC/DSE006

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic, co/extracurricular (Participation in conferences/seminars/ workshops/Training programmes) activities are appreciable.

The contact hours of seminars and assignments hours presentations and discussions with the supervisor shall be considered as practical course.

M. Sc. Pharm. Chem. IVth Sem.

ONLINE COURSES (SWAYAM/NPTEL/ MOOCS)

COURSES CODE : SOS/PC/MDE003

One online elective course from SWAYAM/NPTEL/MOOCs of 06 credits to be qualified under the supervision of advisor of the Department during the IIIrd Semester. Visit to the University Website - hnbgu.ac.in for online MOOCS courses. Course should be relevant to Pharmaceutical Chemistry.

M.Sc. PHARMACEUTICAL CHEMISTRY- IVth SEMESTER (SECOND YEAR) TWO-YEARS P.G. PROGRAM

Course category	Semester-IV	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-9	Project (Synopsis writing and Project work should be completed within six months under the guidance of a faculty member of the Department or Industry or any Govt. research organization).	SOS/PC/DSC009	40	60	-	15	15
SEC/Vocational	DSC-10	Traditional Healthcare system of Uttarakhand	SOS/PC/SEC010	40	60	3	2	5
Discipline Specific Elective (DSE)	DSE- 7	Thesis writing and Final Presentation of the Project	SOS/PC/DSE007	40	60	3	1	4
		OR						
	DSE- 8	Conference Presentation/ Paper Publication (Minimum Participation in the two National /International LevelSeminar/Conference/Workshop /Symposium/ Training Programs (relevant to the specialization of the course))	SOS/PC/DSE008			3	1	4
		OR						
Multidisciplinary Elective (MDE)	MDE-4	Food Chemistry and Food Analysis	SOS/PC/MDE004	40	60	3	1	4
		<i>A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.</i>						
SEC (Non-CGPA Course)	Community outreach activities			-				1
Total Credits				24				1
NHEQF Level- 6.5	Student on successfully completing two-year PG programme (i.e., securing minimum required 96 credits will be awarded "Postgraduate Degree", in related field/discipline/subject.						24	

PROJECT

COURSE CODE: SOS/PC/DSC009

Project from parent institute/industry/Research Organizations. Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide.

- The project shall be submitted in the Department.
- Pre submission presentation is compulsory; pre-presentation should be done in the presence of staff members of the department
- The Dissertation would carry 15 credits in all..

- Following topics/research fields are proposed to undertake Dissertation/ Project Work.
- Traditional Health care System of Uttarakhand
- Study of Medicinal plants of Uttarakhand Himalaya
- Quality control of herbal drugs, Quality control of Synthetic drugs
- Any other current trends / topics suggested by the Departmental committee may also be considered for the dissertation/project work other current problems / topics suggested by the Departmental committee.

TRADITIONAL HEALTHCARE SYSTEM OF UTTARAKHAND

COURSE CODE: SOS/PC/DSC010

The course will be started in the month of July and August due to short time availability of medicinal plants of high altitude Himalayan region. Himalayas have been known to be home to many medicinal plants and herbs since time immemorial. Even the mythical Sanjeevni Booti of the Ramayana which revived Lakshman after he had fallen in battle was claimed to have been brought from the Himalayas. The story reveals that this region as the source as many medicinal plants.

Uttarakhand, a natural environment of the Himalayas also known as ‘Dev Bhoomi’ or “Herbal State” is rich with majestic natural beauty, great wealth of medicinal plants, and traditional medicinal knowledge. People in remote village areas are dependent upon the folk medicines and household remedies to a great extent. Local inhabitants who have lived in the vicinity of forests, due to being close to the nature, possess a deep practical knowledge on indigenous flora, pertaining to curatives, culture, customs, ethos, cults, religion, belief, legends, myths as

well as other miscellaneous uses. The prevalent practice of using herbal remedies has passed down from generation to generation and includes the cure of simple ailments to the most complicated ones.

As NEP-2020 has the emphasis on a diverse range of skill-based courses (SEC) that can lead to vocations, professions, or employment opportunities, in accordance with students' aspirations. Such skill-based courses include competencies relevant to the local context and are aligned with the principles of 'Vocal for Local'. The Traditional Healthcare system of Uttarakhand is fulfilled the spirit of NEP-2020 and enhance employability with Entrepreneurship development

M. Sc. Pharm. Chem. IVth Sem.

THESIS WRITING AND FINAL PRESENTATION OF THE PROJECT

COURSE CODE: SOS/PC/DSE007

The Thesis (Dissertation) writing and presentation would carry 4 credits in all.

Dissertation is a core one and mandatory for every student. The dissertation is to be allotted in the beginning of III Semester and would be submitted at the time of the examination of IV Semester.

The distribution of marks for the Dissertation will be as below:

Periodical presentation	:	20 Marks
Dissertation writing	:	60 Marks
End Semester Presentation/Viva Voce:		20 Marks
Total	:	100 Marks

M. Sc. Pharm. Chem. IVth Sem.

PRESENTATION/ SEMINARS/ REPORTS WRITING

COURSE CODE: SOS/PC/DSE008

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic, co/extracurricular (Participation in conferences/seminars/ workshops/Training programmes) activities are appreciable.

Conference Presentation/ Paper Publication (Minimum Participation in the two National /International Level Seminar/Conference/Workshop/Symposium/ Training Programs (relevant to the specialization of the course))

The contact hours of seminars and assignments hours presentations and discussions with the supervisor shall be considered as practical course.

M. Sc. Pharm. Chem. IVth Sem

FOOD CHEMISTRY AND FOOD ANALYSIS

COURSE CODE: SOS/PC/MDE004

Unit I

Carbohydrates: classification and properties of food carbohydrates, General methods of analysis of food carbohydrates, Changes in food carbohydrates during processing, Digestion, absorption and metabolism of carbohydrates, Dietary fibre, Crude fibre and application of food carbohydrates Proteins: Chemistry and classification of amino acids and proteins, Physico-Chemical properties of protein and their structure, general methods of analysis of proteins and amino acids, Digestion, absorption and metabolism of proteins.

Unit II

Lipids: Classification, general methods of analysis, refining of fats and oils; hydrogenation of vegetable oils, Determination of adulteration in fats and oils, Various methods used for measurement of spoilage of fats and fatty foods.

Unit III

Vitamins: classification of vitamins, methods of analysis of vitamins, Principles of microbial assay of vitamins of B-series.

Unit IV

Food additives: Introduction, analysis of Preservatives, antioxidants, artificial sweeteners, flavors, flavor enhancers, stabilizers, thickening and jelling agents.

Unit V

Pigments and synthetic dyes: Natural pigments, their occurrence and characteristic properties, permitted synthetic dyes, Non-permitted synthetic dyes used by industries, Method of detection of natural, permitted and non-permitted dyes.

Unit VI

General Analytical methods for milk, milk constituents and milk products like ice cream, milk powder, butter, margarine, cheese including adulterants and contaminants of milk. Analysis of fermentation products.

Legislation regulations of food products with special emphasis on BIS, Agmark, FDA and US-FDA.

M. Sc. Pharm. Chem. IVth Sem

**FOOD CHEMISTRY AND FOOD ANALYSIS
LABORATORY; COURSE CODE: SOS/PC/MDE004**

- i. Experiments based on theory paper SOS/PC/DSE004
- ii. Determination of adulteration in fats and oils
- iii. Analysis of proteins and amino acids
- iv. Analysis adulterants and contaminants of milk
- v. Analysis of heavy metals, pesticide residue, microbial, fungal growth in Fruits & Vegetables

BOOKS SUGGESTED

1. The chemical analysis of foods – David Pearson, Seventh edition, Churchill Livingstone, Edinburgh London, 1976
2. . Introduction to the Chemical analysis of foods – S. Nielsen, Jones & Bartlett publishers, Boston London, 1994.
3. Official methods of analysis of AOAC International, sixth edition, Volume I & II, 1997.
4. Analysis of Food constituents – Multon, Wiley VCH.
5. Dr. William Horwitz, Official methods of analysis of AOAC International, 18th edition, 2005.

ONE-YEAR P.G. PROGRAM

Course category	Semester-I	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-1	Drug Design	SOS/PC/DSC001	40	60	3	2	5
	DSC-2	General Pharmaceutics	SOS/PC/DSC002	40	60	3	2	5
	DSC-3	Phytopharmaceuticals and Nutraceuticals	SOS/PC/DSC003	40	60	3	2	5
SEC(Skill Enhancement Course)/Vocational	DSC-1	Industrial Training (Two months)	SOS/PC/SEC001	40	60	-	5	5
Discipline Specific Elective (DSE)	DSE- 1	Herbal Drug Technology	SOS/PC/DSE001	40	60	3	1	4
		OR						
	DSE- 2	Presentation/ Seminars/ Reports writing/Assignments	SOS/PC/DSE002	40	60	3	1	4
		OR						
Multidisciplinary Elective (M.D.E)	M.D.E-1	Swayam Course, MOOCS (Relevant subjects of Pharmaceutical Chemistry)	SOS/PC/MDE001	40	60	4	-	4
		<i>A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.</i>						
AEC (Ability Enhancement Course) (Non-CGPA Course)		Academic Library Systems and Services						1
AEC (Non-CGPA Course)		Entrepreneurship & Startup Awareness						1
Total Credits								24

DRUG DESIGN

PAPER- I; COURSE CODE- (SOS/PC/DSC001)

Unit-I

Dose response curve, concept of agonist, partial agonist, antagonist, partial antagonist, competitive & none-competitive antagonism. Drug metabolism.

Unit-II

Specific & non-specific drug action, concept of receptor, drug-receptor interactions. Receptor theories, spare receptor, ion-channels.

Unit-III

Topography receptors, adrenergic, cholinergic, H1, H2, steroidal, serotonin, diazepam & opioid receptors.

Unit-IV

Drug metabolism approaches to drug design. Concept of isosterism & bioisosterism, metabolite antagonism, stereochemistry & drug action. Analog design, concept of prodrug.

Unit-V

Introduction to QSAR. Chemical information computing system in drug discovery. Molecular modeling drug action.

BOOKS SUGGESTED

5. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and
6. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
7. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.
8. Kadam & Mahadik, Bothara, Principles of Medicinal Chemistry vol. I & II, 4th ed. Nirali Prakash Pune,

DRUG DESIGN

LABORATORY I; COURSE CODE- (SOS/PC/DSC001)

- ix. Experiments based on theory paper SOS/PC/DSC001
- x. Calculation of physicochemical and ADME properties using SwissADME (e.g. logP, molecular weight, H-bond donors/acceptors)
- xi. Perform basic molecular docking studies using any of open-source academic tools such as: AutoDock Vina, PyRx, SwissDock, MZDock

GENERAL PHARMACEUTICS

PAPER- II; COURSE CODE- (SOS/PC/DSC002)

Unit I

Extraction Processes: Infusion, decoction, maceration and percolation processes and preparation involving them.

Size Reduction: Objectives , factor affecting, method of size reduction. Construction and working of hammer mill, fluid energy mill, colloid mill.

Size Separation: Official standards for powders, sieving methods.

Unit II

Mixing: Definition, objectives, type of mixtures, types of equipments used in mixing, propeller, turbine paddle, mixer, collide mixer, sigma mixer, arm mixer, tumbler mixer.

Drying: Introduction to drying process, study of tray dryer, fluidized bed dryer , vaccume and freeze dryer.

Unit III

Pharmaceutical Literature and Ethics: Importance of various Pharmacopoeias with special reference to those with are official in India , general introduction to code of Pharmaceuitical ethics.

BOOKS SUGGESTED

- 5. Hand book of Basic Pharmacokinetics-Ritschel, W.A., Drug Intelligence Publication, M. Hamilton, 1977.
- 6. Fundamentals of Clinical Pharmacokinetics-Wagner, J.C., Drug Intelligence Publication, M. Hamilton, 1975.
- 7. Remington's Pharmaceutical Sciences-Gennaro A.R., ed., 19th Edition, Mack Publishing kco., Easton, PA. 1995.
- 8. Clinical Pharmacokinetics-Rowland, M, & Tozer, N., 2nd edition, Lea & Febiger, Philadelphia, 1989

GENERAL PHARMACEUTICS

LABORATORY-II; COURSE CODE- (SOS/PC/DSC002)

- xii. Experiments based on theory paper SOS/PC/DSC002
- xiii. Pharmaceutical calculations like dilution and concentration, techniques.
- xiv. Preparation of various dosage forms like monophasic, biphasic, solid, semisolid, and pediatric preparations.
- xv. Pharmacopeial requirements and implement them in preparation of pharmaceutical products.
- xvi. Analyze formulation ingredients and achieve stability, safety, and therapeutic efficacy.

PHYTOPHARMACEUTICALS AND NUTRACEUTICALS

PAPER- III; COURSE CODE- SOS/PC/DSC003

Unit I

Introduction Definition, historical background present status and future scope of Phytopharmaceuticals.

Unit II

Classification of crude drug: Alphabetical, morphological, pharmacological and chemical classification.

Unit III

Adulteration and evaluation of drugs: Causes and types of Adulteration organoleptic, biological, chemical and physical methods of evaluation.

Unit IV

General principle of formulation of primary and secondary plant metabolites. Biogenesis of carbohydrates, lipids, volatile oils and resins.

Unit V

Plants and their environmental factors influencing the variability in drug activity

Unit VI

General introduction and uses of Nutraceuticals.

Unit VI

An introduction to tissue culture and its scope in production of phytopharmaceuticals

BOOKS SUGGESTED

1. Evans, W.C. Trease and Evans Pharmacognosy, 16th Edition, W.B. Saunders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R., and Robbers, J.E. Pharmacognosy, 9th Edition, Lea & Febiger, Philadelphia, 1988.
3. Wallis, T.E. Textbook of Pharmacognosy.
4. Ali, Mohammad. Pharmacognosy and Phytochemistry, CBS Publishers & Distributors, New Delhi.
5. Ahmad S, Introduction to Pharmacognosy, Dreamtech Press, New Delhi, 2nd Edition, 20019
6. Kalia, A.N. Pharmacognosy and Phytochemistry – I, CBS Publishers & Distributors, New Delhi.
7. Kokate, C.K., Purohit, A.P., and Gokhale, S.B. Textbook of Pharmacognosy, 37th Edition (2007), Nirali Prakashan, Pune.
8. Jalalpure, Sunil S. and Patil, Akshay K. Textbook of Pharmacognosy and Phytochemistry – I, Nirali Prakashan, Pune, 2024.
9. Ansari, S.H. Essentials of Pharmacognosy, 2nd Edition, Birla Publications, New Delhi, 2007.
10. Iyengar, M.A. Anatomy of Crude Drugs.
11. Khandelwal, K.R. and Sethi, Vrinda. Practical Pharmacognosy.
12. Kokate, C.K., Purohit, A.P., and Gokhale, S.B. Practical Pharmacognosy, Nirali Prakashan, Pune.

M. Sc. Pharm. Chem. Ist Sem.

PHYTOPHARMACEUTICALS AND NUTRACEUTICALS

LABORATORY III; COURSE CODE- SOS/PC/DSC003

- v. Experiments based on theory paper SOS/PC/DSC003
- vi. Chemical tests for identification of carbohydrates, proteins, lipids, alkaloids, anthraquinones, cardiac glycosides, flavonoids, and tannins and Terpenoids
- vii. Determination of loss on drying (Moisture content), ash values, extractive value(s), foreign organic matter, bitterness value, foaming index, swelling index, viscosity, acid value, and saponification value.
- viii. Experiential learning based experiments involving collection, identification of medicinal plant material,

M. Sc. Pharm. Chem. Ist Sem.

INTERNSHIP: INDUSTRIAL TRAINING (TWO MONTHS)

COURSES; CODE (SOS/PC/SEC001)

The purpose of Internship in the Pharmaceutical Industries is to full fill the spirit of NEP-2020 to Training the students to real work of environment experience at industry and at the same time, to gain the knowledge through hands on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and industrial rule regulations. Moreover, this practical training program exposes the students to relate theoretical knowledge with its application in the pharmaceutical industry.

Industrial Training will be of Two Months compulsory. The purpose of Internship in the industries is to expose students to real work of environment experience at industry, and at the same time, to gain the knowledge through hands on observation.

BOOKS SUGGESTED

7. British Pharmacopoeia
8. E.A.Rawlins- Text Book of pharmaceutics, Bailliere Tindall.
9. G. Gun and S.J. Carter, Cooper & Gunn's Tutorial Pharmacy, Pitman Medical Publishing Co. London.
10. Gilbert S, ,, Banker and Cristopher T.Rhodes- Moder pharmaceutics and Pharmaceutical Sciences Series, M.& D. Inc. , New York.
11. Leon Lachman- The Theory and Practice of Industrial Pharmacey, K.M. Verghease Co. Bombay.
12. Pharmacopoeia of India.

M. Sc. Pharm. Chem. Ist Sem.

HERBAL DRUG TECHNOLOGY

COURSE CODE- (SOS/PC/DSE001)

8. Definition of Herbal drugs, Importance of Herbal therapies, Herbal verses Conventional drugs, Safety in Herbal drugs, Toxicity in Herbals and interaction.
9. Herbals used as nutraceuticals or healing agents.
10. Herbal cosmetics.
11. Making and using Herbal medicines for common ailments like cold, skin infection and diarrhea.
12. Analytical profiles of selected herbs- *Brahmi*, *Arandrographis paniculeta*, *Aegle marmelos* and *Gymnema sylvestre*
13. Quality control and quality Assurance of Herbal drugs.

BOOKS SUGGESTED

7. Quality Control of Herbal Drugs; Pulok K. Mukharjee
8. Pharmacognosy – C.K.Kokate
9. Quality Control Methods for Medicinal Plant material by WHO, Geneva.
10. Indian Herbal Pharmacopeia Vol. I & II.
11. Trease and Evan's Pharmacognosy 15 edition.

12. Botanical safety hand book by Michael Meguffin, Christopher Hobbs Published by American Herbal Product Asso.

M. Sc. Pharm. Chem. Ist Sem.

HERBAL DRUG TECHNOLOGY

LABORATORY IV; COURSES CODE (SOS/PC/DSE001)

4. Qualitative analysis of crude drug: Analysis of alkaloids, volatile oils, fixed oils, fats and waxes, Flavonoids, Terpenoids, Resins, Tannins, Glycosides and Steroids.
5. Extraction of Herbal drugs: Procedure for extraction of Herbal drugs Extraction methods for specific phytochemical group, treatment of drug residue after extraction.
6. Application of TLC and Paper Chromatographic Methods in qualitative analysis of crude drug.

M. Sc. Pharm. Chem. Ist Sem.

PRESENTATION/ SEMINARS/ REPORTS WRITING/ASSIGNMENTS

ELECTIVE COURSE; CODE (SOS/PC/DSE002)

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic, co/extracurricular (Participation in conferences/seminars/ workshops/Training programmes etc.) activities are appreciable.

The contact hours of seminars and assignments hour's presentations and discussions with the supervisor shall be considered as practical course.

M. Sc. Pharm. Chem. Ist Sem.

ONLINE COURSES (SWAYAM/NPTEL/ MOOCS)

ELECTIVE COURSES; CODE (SOS/PC/MDE001)

One online elective course from SWAYAM/NPTEL/MOOCs of 06 credits to be qualified under the supervision of advisor of the Department during the IIIrd Semester. Visit to the University Website - hnbgu.ac.in for online MOOCS courses. Course should be relevant to Pharmaceutical Chemistry.

M.Sc. PHARMACEUTICAL CHEMISTRY- IInd SEMESTER (SECOND YEAR) ONE-YEARS P.G. PROGRAM

Course category	Semester-II	Subject Title	Course code	Maximum Marks 100		T	P	Total Credits
				Internal 40	External 60			
Discipline Specific Core (DSC)	DSC-4	Project (Project work should be completed within six months under the guidance of a faculty member in the same Department or Industry or any Govt. research organization).	SOS/PC/DSC004	40	60	-	15	15
SEC/Vocational	DSC-2	Final Presentation of Project	SOS/PC/SEC002	40	60	3	2	5
Discipline Specific Elective (DSE)	DSE- 3	Traditional Healthcare system of Uttarakhand (Field Work)	SOS/PC/DSE003	40	60	3	1	4
		OR						
	DSE- 4	Conference Presentation/ Paper Publication	SOS/PC/DSE004			3	1	4
		OR						
Multidisciplinary Elective (M.D.E)	M.D.E-2	Food Chemistry and Food Analysis	SOS/PC/MDE002	40	60	3	1	4
		<i>A student may opt for either one Discipline Specific Elective (DSE) or one Multidisciplinary Elective (MDE) as an elective course.</i>						
SEC (Non-CGPA Course)	Community outreach activities			-				1
Total Credits				24				1

M. Sc. Pharm. Chem. II Sem.

PROJECT

COURSE CODE: SOS/PC/DSC004

Project from parent institute/industry/Research Organizations. Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide.

- The project shall be submitted in the Department.
- Pre submission presentation is compulsory; pre-presentation should be done in the presence of staff members of the department
- The Dissertation would carry 15 credits in all.
- Following topics/research fields are proposed to undertake Dissertation/ Project Work.
- Traditional Health care System of Uttarakhand
- Study of Medicinal plants of Uttarakhand Himalaya
- Quality control of herbal drugs, Quality control of Synthetic drugs
- Any other current trends / topics suggested by the Departmental committee may also be considered for the dissertation/project work other current problems / topics suggested by the Departmental committee.

M. Sc. Pharm. Chem. II Sem.

TRADITIONAL HEALTHCARE SYSTEM OF UTTARAKHAND

COURSE CODE: SOS/PC/DSE002

The course will be started in the month of July and August due to short time availability of medicinal plants of high altitude Himalayan region. Himalayas have been known to be home to many medicinal plants and herbs since time immemorial. Even the mythical Sanjeevani Booti of the Ramayana which revived Lakshman after he had fallen in battle was claimed to have been brought from the Himalayas. The story reveals that this region as the source as many medicinal plants.

Uttarakhand, a natural environment of the Himalayas also known as ‘Dev Bhoomi’ or “Herbal State” is rich with majestic natural beauty, great wealth of medicinal plants, and traditional medicinal knowledge. People in remote village areas are dependent upon the folk medicines and household remedies to a great extent. Local inhabitants who have lived in the vicinity of forests, due to being close to the nature, possess a deep practical knowledge on indigenous flora, pertaining to curatives, culture, customs, ethos, cults, religion, belief, legends, myths as well as other miscellaneous uses. The prevalent practice of using herbal remedies has passed down from generation to generation and includes the cure of simple ailments to the most complicated ones.

As NEP-2020 has the emphasis on a diverse range of skill-based courses (SEC) that can lead to vocations, professions, or employment opportunities, in accordance with students’ aspirations. Such skill-based courses include competencies relevant to the local context and are aligned with the principles of ‘Vocal for Local’. The Traditional Healthcare system of Uttarakhand is fulfilled the spirit of NEP-2020 and enhance employability with Entrepreneurship development

M. Sc. Pharm. Chem. II Sem.

THESIS WRITING AND FINAL PRESENTATION OF THE PROJECT

COURSE CODE: SOS/PC/DSE003

The Thesis (Dissertation) writing and presentation would carry 4 credits in all.

Dissertation is a core one and mandatory for every student. The dissertation is to be allotted in the beginning of III Semester and would be submitted at the time of the examination of IV Semester.

The distribution of marks for the Dissertation will be as below:

Periodical presentation	:	20 Marks
Dissertation writing	:	60 Marks
End Semester Presentation/Viva Voce:		20 Marks
Total	:	100 Marks

M. Sc. Pharm. Chem. II Sem.

PRESENTATION/ SEMINARS/ REPORTS WRITING

COURSE CODE: SOS/PC/DSE004

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic, co/extracurricular (Participation in conferences/seminars/ workshops/Training programmes) activities are appreciable.

Conference Presentation/ Paper Publication (Minimum Participation in the two National /International Level Seminar/Conference/Workshop/Symposium/ Training Programs (relevant to the specialization of the course))

The contact hours of seminars and assignments hours presentations and discussions with the supervisor shall be considered as practical course.

M. Sc. Pharm. Chem. II Sem

FOOD CHEMISTRY AND FOOD ANALYSIS

COURSE CODE: SOS/PC/MDE002

Unit I

Carbohydrates: classification and properties of food carbohydrates, General methods of analysis of food carbohydrates, Changes in food carbohydrates during processing, Digestion, absorption and metabolism of carbohydrates, Dietary fibre, Crude fibre and application of food carbohydrates Proteins: Chemistry and classification of amino acids and proteins, Physico-Chemical properties of protein and their structure, general methods of analysis of proteins and amino acids, Digestion, absorption and metabolism of proteins.

Unit II

Lipids: Classification, general methods of analysis, refining of fats and oils; hydrogenation of vegetable oils, Determination of adulteration in fats and oils, Various methods used for measurement of spoilage of fats and fatty foods.

Unit III

Vitamins: classification of vitamins, methods of analysis of vitamins, Principles of microbial assay of vitamins of B-series.

Unit IV

Food additives: Introduction, analysis of Preservatives, antioxidants, artificial sweeteners, flavors, flavor enhancers, stabilizers, thickening and jelling agents.

Unit V

Pigments and synthetic dyes: Natural pigments, their occurrence and characteristic properties, permitted synthetic dyes, Non-permitted synthetic dyes used by industries, Method of detection of natural, permitted and non-permitted dyes.

Unit VI

General Analytical methods for milk, milk constituents and milk products like ice cream, milk powder, butter, margarine, cheese including adulterants and contaminants of milk. Analysis of fermentation products.

Legislation regulations of food products with special emphasis on BIS, Agmark, FDA and US-FDA.

M. Sc. Pharm. Chem. II Sem

FOOD CHEMISTRY AND FOOD ANALYSIS

LABORATORY; COURSE CODE: SOS/PC/MDE002

- vi. Experiments based on theory paper SOS/PC/DSE004
- vii. Determination of adulteration in fats and oils
- viii. Analysis of proteins and amino acids
- ix. Analysis adulterants and contaminants of milk
- x. Analysis of heavy metals, pesticide residue, microbial, fungal growth in Fruits & Vegetables

BOOKS SUGGESTED

1. The chemical analysis of foods – David Pearson, Seventh edition, Churchill Livingstone, Edinburgh London, 1976
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