Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
❖ Approved by AICTE ❖ ISO 21001:2018 Certified
Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.
Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in
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KL College of Pharmacy

19th BOS Meeting Minutes

19th BOS meeting of KL College of Pharmacy was held on 03-08-2026 at Principal chamber R-309A from 03:00 PM onwards.

WELCOMED ALL THE MEMBERS

At the beginning of the meeting, the Chairman of the BOS welcomed all the members and briefly discussed about the progress of the College of pharmacy.

Following members are present

1. Dr. G. Chakravarthi, BoS Chairman
2. Dr. A. Ankarao, Faculty Representative
3. Dr Buchi N Nalluri, Faculty Representative
4. Dr. M. Narender, Faculty Representative
5. Dr. Sivadasu Praveen, Faculty Representative
6. Dr. M. Kasi Viswanadh, Faculty Representative
7. Dr. M. Manikanta, Faculty Representative
8. Dr. K. V. N. Chenchulakshmi, Faculty Representative
9. Dr. A. Narayana Rao, Faculty Representative
10. Dr Shailendra Singh, Faculty Representative
11. Dr. Pasupula Rajeswari, Faculty Representative
12. Dr. P. Ranakishor, Faculty Representative
13. Prof. Shobha Rani S, Subject Expert
14. Dr. Hasitha Shilpa Anantharaju, Industry Representative
15. Dr. K. Sivacharan, Industry Representative
16. Mr. V. Niranjan, Industry Representative
17. Ms. R. Sravani, Alumni Representative
18. Mrs. G. Gouri Sindhu, Alumni Representative
19. Mr. Y. Venkata Balaji, Alumni Representative
20. Ms. K. Lakshmi Deepika, Student Representative

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21. Mr. Shaik Mohammad Jani, Student Representative
22. Mr. K. Vineeth Kumar, Student Representative
23. Ms. Chetana Damera, Student Representative
24. Ms. Haritha Gade, Student Representative
25. Mr. A. Akash Gupta, Student Representative
26. Ms. S. Baji Amulya, Student Representative
27. Mr. Kakumanu Lakshmi Satya Sai Bharadwaj, Student Representative
28. Mr. Shaik Mohammad Noor, Student Representative
29. Ms. Kavuri Deshna, Student Representative

AGENDA and RESOLUTIONS

AGENDA ITEM-1

To consider and approve the resolutions made by 18th BOS conducted on 07th August 2025	Approved and Recommended to Academic Council

Discussion: The minutes of 18th BOS meeting conducted on 07th August 2025 were circulated among the BOS members and all BOS members reviewed the 18th BOS minutes.

Resolution: It was resolved to approve the 18th BOS meeting minutes conducted on 07th August 2025. **(Annexure: I)**

AGENDA ITEM-2

To consider and approve the resolutions made by 19th DAC conducted on 13th July 2026	Approved and Recommended to Academic Council

Discussion: The minutes of the 19th DAC meeting conducted on 13th July 2026 were circulated among the BOS members and all BOS members reviewed the DAC minutes.

Resolution: All the members reviewed the DAC minutes conducted on 13th July 2026 and all the members approved the minutes of 19th DAC meeting **(Annexure: II)**

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AGENDA ITEM-3

Structure and Syllabus for the A.Y. 2026-27 as per the PCI norms.	Approved and Recommended to Academic Council

Discussion: The faculty members reviewed the new curriculum proposed by PCI for the B. Pharmacy programme for the A.Y. 2026–27, along with the existing curricula for the M. Pharmacy and Pharm. D programmes. A detailed discussion was held regarding the curriculum structure, implementation strategies, and the integration of Artificial Intelligence (AI) concepts and applications into the academic framework.

Resolution: All the members reviewed the curriculum structure for the A.Y. 2026–27 and unanimously resolved to adopt and implement the syllabus prescribed by PCI without any deviations. **(Annexure: III)**

AGENDA ITEM-4

To consider the feedback received from various stakeholders	Approved and Recommended to Academic Council

Resolution: Following is the feedback given by stakeholders on curriculum

- Dr. K. Swathi, Associate Professor, Sri Padmavathi Mahila Vishwavidyalayam, recommended implementing the new AI-driven B.Pharmacy curriculum prescribed by the Pharmacy Council of India (PCI) to enhance students' competencies and industry readiness.
- Dr. K. Sivacharan working as Head and Vice President at Dr. Reddy's Laboratories Biopharmaceutics division, has given the feedback to strengthen industry collaborations and enhance practical exposure for students.
- Mr. Abdullah Akim (Y21 Batch), currently working at All States Insurance Company, Uganda, recommended introducing more advanced certification courses to equip students with specialized skills and enhance their employability.
- Mr. K. Vineeth Kumar bearing Reg No: 2300530002 has given the feedback to provide more industrial visits to the students so that students gain more insights about the latest developments in the pharmaceutical industries.

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- Dr. Sivadasu Praveen working as Assistant Professor bearing Emp Id: 6775 has recommended implementing the new AI-driven B.Pharmacy curriculum prescribed by the Pharmacy Council of India (PCI) to enhance students' competencies and industry readiness. **(Annexure: IV)**

AGENDA ITEM-5

Review of the Y25 Structures and syllabus	Approved and Recommended to Academic Council

Discussion: As PCI framed syllabus should be followed for B. Pharm, M. Pharm and Pharm. D programmes, all the members reviewed the structures and syllabus followed for the AY 2025-26.

Resolution: All the members reviewed the Y25 structure and unanimously agreed to the syllabus which was followed without deviating from the PCI norms. **(Annexure: V)**

AGENDA ITEM-6

To consider and approve the Program development documents of B. Pharmacy, M. Pharmacy and Pharm. D for 2026 admitted batch.	Approved and Recommended to Academic Council

Discussion: Program development documents of B. Pharmacy, M. Pharmacy and Pharm. D for AY 2026-27 were circulated among members, and the members verified the document and ensured that the course structure developed is not deviating from the structure suggested by PCI.

Resolution: All the members reviewed all the PDD Y26 documents including the thrust areas and approved it.

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AGENDA ITEM-7

To discuss placements, higher education and entrepreneurship analytics of A.Y. 2025-26.	Approved and Recommended to Academic Council

Discussion: Placements, Higher education and Entrepreneurship analytics were reviewed by the BoS members and suggested to improve by bringing better pharmaceutical companies for the placements for the upcoming A.Y.

Resolution: All the members agreed upon the placements, higher education and entrepreneurship analytics and recommended same for approval by Academic council. **(Annexure: VI)**

AGENDA ITEM-8

To focus on Certification courses to be implemented for the upcoming R26 batch.	Approved and Recommended to Academic Council

Discussion: The faculty members reviewed the certificate course options proposed by the Dean of Skill Development and Student Progression for the upcoming R26 batch students. A detailed discussion was held on the feasibility of integrating these certificate courses into the curriculum to enhance students' skill sets and improve their employability prospects.

Resolution: All the members reviewed the proposed certification course options and unanimously agreed to offer them to the upcoming R26 batch students, with the objective of enhancing their skills, employability, and career opportunities. **(Annexure: VII)**

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AGENDA ITEM-9

To confirm the course closure minutes from the 2025-26 courses	Approved and Recommended to Academic Council

Discussion: All the BoS members reviewed the course closure minutes of 2025-26 AY Courses and verified whether all the criteria's mentioned in the minutes were met and approved the same

Resolution: All the members reviewed all the Course closure minutes of courses offered in 2025-26 courses and approved it. **(Annexure: VIII)**

Yours Sincerely,

G. Chakravarthi 3/8/26

Dr. G. Chakravarthi

BOS Chairman

K L College of Pharmacy, KLEF

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Photographs of 19th BOS meeting



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The following members have attended the 19th BOS meeting held on 03-08-2026 at from 3:00 Pm onwards, Venue: Principal Chamber, K L College of Pharmacy

S.NO	Full Name	Position of the meeting	Organization	Signature
1	Dr. G. Chakravarthi	BoS Chairman	K L College of Pharmacy, KLEF	
2	Dr. A. Ankarao	Faculty Representative	K L College of Pharmacy, KLEF	
3	Dr Buchi N Nalluri	Faculty Representative	K L College of Pharmacy, KLEF	
4	Dr. M. Narender	Faculty Representative	K L College of Pharmacy, KLEF	
5	Dr. Sivadasu Praveen	Faculty Representative	K L College of Pharmacy, KLEF	
6	Dr. M. Kasi Viswanadh	Faculty Representative	K L College of Pharmacy, KLEF	
7	Dr. M. Manikanta	Faculty Representative	K L College of Pharmacy, KLEF	
8	Dr. K. N. V. Chenchulakshmi	Faculty Representative	K L College of Pharmacy, KLEF	
9	Dr. A. Narayana Rao	Faculty Representative	K L College of Pharmacy, KLEF	
10	Dr Shailendra Singh	Faculty Representative	K L College of Pharmacy, KLEF	
11	Dr. Pasupula Rajeswari	Faculty Representative	K L College of Pharmacy, KLEF	
12	Dr. P. Ranakishor	Faculty Representative	K L College of Pharmacy, KLEF	
13	Prof. Shobha Rani S	Subject Expert	Centre for Pharmaceutical Sciences, JNTUH, Hyderabad	
14	Dr. Hasitha Shilpa Anantharaju	Industry Representative	GSK, Bengaluru	
15	Dr. K. Sivacharan	Industry Representative	Dr. Reddy's Hyderabad	
16	Mr. V. Niranjan	Industry Representative	Integra Pharma Consultants, Hyderabad	
17	Ms. R. Sravani	Alumni Representative	Annasaheb Dange College of Pharmacy, Ashta, Maharashtra	
18	Mrs. G. Gouri Sindhu	Alumni Representative	Propharma Groups, Hyderabad	
19	Mr. Y. Venkata Balaji	Alumni Representative	Hetero Labs, Hyderabad	
20	Ms. K. Lakshmi Deepika	Student Representative	K L College of Pharmacy, KLEF	

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21	Mr. Shaik Mohammad Jani	Student Representative	K L College of Pharmacy, KLEF	
22	Mr. K. Vineeth Kumar	Student Representative	K L College of Pharmacy, KLEF	
23	Ms. Chetana Damera	Student Representative	K L College of Pharmacy, KLEF	
24	Ms. Haritha Gade	Student Representative	K L College of Pharmacy, KLEF	
25	Mr. A. Akash Gupta	Student Representative	K L College of Pharmacy, KLEF	
26	Ms. S. Baji Amulya	Student Representative	K L College of Pharmacy, KLEF	
27	Mr. Kakumanu Lakshmi Satya Sai Bharadwaj	Student Representative	K L College of Pharmacy, KLEF	
28	Mr. Shaik Mohammad Noor	Student Representative	K L College of Pharmacy, KLEF	
29	Ms. Kavuri Deshna	Student Representative	K L College of Pharmacy, KLEF	

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Annexure I

Minutes of 18th BOS Meeting conducted on 07th August 2025

AGENDA and RESOLUTIONS

AGENDA ITEM-1

To consider and approve the resolutions made by 17th BOS conducted on 26th March 2025	Approved and Recommended to Academic Council

Discussion: The minutes of 17th BOS meeting conducted on 26th March 2025 were circulated among the BOS members and all BOS members reviewed the 17th BOS minutes.

Resolution: It was resolved to approve the 17th BOS meeting minutes conducted on 26th March 2025. **(Annexure: I)**

AGENDA ITEM-2

To consider and approve the resolutions made by 18th DAC conducted on 29th July 2025	Approved and Recommended to Academic Council

Discussion: The minutes of the 18th DAC meeting conducted on 29th July 2025 were circulated among the BOS members and all BOS members reviewed the DAC minutes.

Resolution: All the members reviewed the DAC minutes conducted on 29th July 2025 and all the members approved the minutes of 18th DAC meeting **(Annexure: II)**

AGENDA ITEM-3

Structure and Syllabus for the A.Y. 2025-26 as per the PCI norms.	Approved and Recommended to Academic Council

Discussion: As PCI framed syllabus should be followed for B. Pharm, M. Pharm and Pharm. D programmes, all the members reviewed the structures and syllabus followed for the AY 2025-26.

Resolution: All the members reviewed the Y25 structure and unanimously agreed to the syllabus which was followed without deviating from the PCI norms. **(Annexure: III)**

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AGENDA ITEM-4

To consider the feedback received from various stakeholders	Approved and Recommended to Academic Council

Resolution: Following is the feedback given by stakeholders on curriculum

- Dr. Parasuraman. P working as Associate Professor at MS Ramaiah University of Applied Sciences has given the feedback to generate more industry and research collaborations so that faculty and students can gain more research opportunities.
- Mr. V. Pavan Kumar working as Senior Associate at Sterlis Biopharma, has given the feedback to include AI and Python Programming as a skill course to B. Pharmacy students as this kind of course gives more skill sets to the students to secure jobs in the field of drug discovery.
- Ms. A. Lahari of Y19 batch working in Granules has given the feedback to conduct more clinically oriented workshops so that both faculty and students can gain the latest insights in the field of Pharmacy.
- Ms. Y. Chinmayi Sathvika bearing Reg No: 2200530007 has given the feedback to provide more industrial visits to the students so that students gain more insights about the latest developments in the pharmaceutical industry.
- Dr. Shailender Singh, working as Assistant Professor bearing Emp Id: 8617 has given the feedback to include AI and Python Programming as a skill course to B. Pharmacy students as this kind of course gives more skill sets to the students to secure jobs in the field of drug discovery. **(Annexure: IV)**

AGENDA ITEM-5

To introduce a new course, AI and Python Programming for Pharmacy as a skill course in the 5th Semester of B. Pharmacy.	Approved and Recommended to Academic Council

Discussion: By including this skill course in AI students gain skill sets to grab job opportunities in the field of drug discovery.

Resolution: Upon discussion all the BoS members approved the incorporation of following skill course for the 5th Semester of B. Pharmacy for Y25 batch. **(Annexure: III)**

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S No	Course Code	Course Title	Category	LTPS	Offering Year
1.	25PY3122S	AI AND PYTHON PROGRAMMING FOR PHARMACY	SDC	0-0-0-4	2027-28

AGENDA ITEM-6

Review of the Y24 Structures and syllabus	Approved and Recommended to Academic Council

Discussion: As PCI framed syllabus should be followed for B. Pharm, M. Pharm and Pharm. D programmes, all the members reviewed the structures and syllabus followed for the AY 2024-25.

Resolution: All the members reviewed the Y24 structure and unanimously agreed to the syllabus which was followed without deviating from the PCI norms. **(Annexure: V)**

AGENDA ITEM-7

To consider and approve the Program development documents of B. Pharmacy, M. Pharmacy and Pharm. D for 2025 admitted batch.	Approved and Recommended to Academic Council

Discussion: Program development document of B. Pharmacy, M. Pharmacy and Pharm. D for AY 2025-26 were circulated among members and the members verified the document and ensured that the course structure developed is not deviating from the structure suggested by PCI.

Resolution: All the members reviewed all the PDD Y25 documents including the thrust areas and approved it.

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AGENDA ITEM-8

To include the evaluation plans	Approved and Recommended to Academic Council

Discussion: Evaluation plans for all the programmes i.e. B. Pharm, M. Pharm and Pharm. D should contain all the components suggested by PCI.

Resolution: All the members reviewed the evaluation plans and unanimously agreed to the same evaluation plan for all the courses in the curriculum. **(Annexure: VI)**

AGENDA ITEM-9

To discuss placements, higher education and entrepreneurship analytics of A.Y. 2024-25.	Approved and Recommended to Academic Council

Discussion: Placements, Higher education and Entrepreneurship analytics were reviewed by the BoS members and suggested to improve by bringing better pharmaceutical companies for the placements for the upcoming A.Y.

Resolution: All the members agreed upon the placements, higher education and entrepreneurship analytics and recommended same for approval by Academic council. **(Annexure: VII)**

AGENDA ITEM-10

To focus on Value added courses	Approved and Recommended to Academic Council

Discussion: By adding courses like Base SAS, Pharmacovigilance, Regulatory Affairs and clinical data management as certificate courses, students will gain the skills pertaining to those areas which in turn increases the employability options for the students.

Resolution: Value added courses like Base SAS, Pharmacovigilance, Regulatory Affairs and clinical data management were identified and all the members agreed to include the above in the Y25 structure. (Without deviating the PCI norms). **(Annexure: VIII)**

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AGENDA ITEM-11

To confirm the course closure minutes from the 2024-25 courses	Approved and Recommended to Academic Council

Discussion: All the BoS members reviewed the course closure minutes of 2024-25 AY Courses and verified whether all the criteria's mentioned in the minutes were met and approved the same

Resolution: All the members reviewed all the Course closure minutes of courses offered in 2024-25 courses and approved it. **(Annexure: IX)**

G. Chaitanya
3/8/26

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Annexure II

Minutes of the 19th DAC meeting, KL College of pharmacy held on 13-07-2026 at Room 309 A, from 11:30 AM onwards

AGENDA ITEM-1

❖ **Structure and Syllabus for the A.Y. 2026-27 as per the PCI norms.** ❖ Resolution: It was resolved to include the Y26 structure and syllabus as per the PCI norms ❖ All the members agreed to incorporate the Y26 structure and syllabus as per the PCI norms for the A.Y. 2026-27. **(Annexure: I)**	Approved

AGENDA ITEM-2

❖ To implement the comments received from feedback given by various stakeholders **Following is the feedback given by stakeholders on curriculum** ❖ Dr. K. Swathi, Associate Professor, Sri Padmavathi Mahila Vishwavidyalayam, recommended implementing the new AI-driven B.Pharmacy curriculum prescribed by the Pharmacy Council of India (PCI) to enhance students' competencies and industry readiness. ❖ Dr. K. Sivacharan working as Head and Vice President at Dr. Reddy's Laboratories Biopharmaceutics division, has given the feedback to strengthen industry collaborations and enhance practical exposure for students. ❖ Mr. Abdullah Akim (Y21 Batch), currently working at All States Insurance Company, Uganda, recommended introducing more advanced certification courses to equip students with specialized skills and enhance their employability.	Approved

G. Chellaram
13/8/26

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❖ Mr. K. Vineeth Kumar bearing Reg No: 2300530002 has given the feedback to provide more industrial visits to the students so that students gain more insights about the latest developments in the pharmaceutical industries. ❖ Dr. Sivadasu Praveen working as Assistant Professor bearing Emp Id: 6775 has recommended implementing the new AI-driven B.Pharmacy curriculum prescribed by the Pharmacy Council of India (PCI) to enhance students' competencies and industry readiness. ❖ The analysis of feedback received from various stakeholders is given in **(Annexure: II)**	

AGENDA ITEM-3

❖ Review of the Y25 Structures and syllabus ❖ Resolution: All the members reviewed the Y25 structure and unanimously agreed with the syllabus without deviating from the PCI norms. **(Annexure: III)**	Approved

AGENDA ITEM-4

❖ To confirm the Program development documents for Y26 ❖ Resolution: All the members reviewed all the PDD Y26 documents including the thrust areas and approved it.	Approved

AGENDA ITEM-5

❖ To discuss placements, higher education and entrepreneurship analytics of A.Y. 2025-26. ❖ Resolution: After a detail discussion regarding placements, higher education and entrepreneurship analytics members suggested that the placements must be improved by	Approved

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bringing better pharmaceutical companies for the placements for the upcoming A.Y. 2026-27. **(Annexure: V)**	

AGENDA ITEM-6

❖ To focus on Certification courses to be implemented for the upcoming R26 batch. ❖ Resolution: All the members reviewed the proposed certification course options and unanimously agreed to offer them to the upcoming R26 batch students, with the objective of enhancing their skills, employability, and career opportunities. **(Annexure: VI)**	Approved

AGENDA ITEM-7

❖ To confirm the course closure minutes from the 2025-26 courses ❖ Resolution: All the members reviewed all the Course closure minutes of courses offered in 2025-26 and approved it. **(Annexure: VII)**	Approved

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Annexure III:

B. Pharm Y26 Program Structure Focused on Focused on Employability/Entrepreneurship/Skill Development

SNO	COURSE CODE	COURSE NAME	Course Category	L	T	P	S	CR	Pre-requisite	New Course/Revised Course/ Retained Course	Changes Proposed by	EES
1	26PY1101T	Basics of Python Programming for Pharmaceutical Sciences (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	
2	26PY1102T	General Pharmacy (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	
3	26PY1102P	General Pharmacy (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
4	26PY1103T	Healthcare Psychology and Communication Skills (Theory)	HAS	1	0	0	0	1	Nil	New Course	Academic Peers	
5	26PY1103P	Healthcare Psychology and Communication Skills (Practical)	HAS	0	0	2	0	1	Nil	New Course	Academic Peers	
6	26PY1104T	Human Anatomy, Physiology and Pathophysiology I (Theory)	PCC	4	0	0	0	4	Nil	New Course	Academic Peers	
7	26PY1104P	Human Anatomy, Physiology And Pathophysiology I (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
8	26PY1105T	Introduction to Pharmacognosy (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	
9	26PY1105P	Introduction to Pharmacognosy (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
10	26PY1106T	Pharmaceutical Inorganic and	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	

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		Analytical Chemistry (Theory)										
11	26PY1106P	Pharmaceutical Inorganic and Analytical Chemistry (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
12	26PY1207T	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	
13	26PY1208T	Biochemistry (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	
14	26PY1208P	Biochemistry (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
15	26PY1209T	Human Anatomy, Physiology and Pathophysiology II (Theory)	PCC	4	0	0	0	4	Nil	New Course	Academic Peers	
16	26PY1209P	Human Anatomy, Physiology and Pathophysiology II (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
17	26PY1210T	Pharmaceutical Organic Chemistry (Theory)	PCC	4	0	0	0	4	Nil	New Course	Academic Peers	
18	26PY1210P	Pharmaceutical Organic Chemistry (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
19	26PY1211T	Pharmacognosy and Phytochemistry (Theory)	PCC	4	0	0	0	4	Nil	New Course	Academic Peers	
20	26PY1211P	Pharmacognosy and Phytochemistry (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
21	26PY1212T	Physical Pharmaceutics (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	
22	26PY1212P	Physical Pharmaceutics (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	
23	26PYSEC01	Communication Skills	SEC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling

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24	26PYSEC02	Mental Well-Being, Stress & Conflict Management	SEC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
25	26PYSEC03	Fundamentals of Computer Operations	SEC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
26	26PY2113T	Introduction to Machine Learning in Pharmaceutical Sciences (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability
27	26PY2114T	Environmental Sciences (Theory)	BSC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
28	26PY2115T	Ethics and Universal Human Values (Theory)	HAS	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
29	26PY2116T	General Pharmacology (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
30	26PY2116P	General Pharmacology (Practical)	PCC	0	0	4	0	2	Nil	New Course	Academic Peers	Skilling
31	26PY2117T	Heterocyclic Compounds and Stereochemistry (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
32	26PY2117P	Heterocyclic Compounds and Stereochemistry (Practical)	PCC	0	0	4	0	2	Nil	New Course	Academic Peers	Skilling
33	26PY2118T	Pharmaceutical Dosage Forms I (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
34	26PY2118P	Pharmaceutical Dosage Forms I (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
35	26PY2119T	Pharmaceutical Engineering (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
36	26PY2120T	Pharmaceutical Microbiology (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
37	26PYAEC01	Nutraceuticals and Functional Foods	AEC	0	0	1	0	1	Nil	New Course	Academic Peers	Skilling
38	26PYAEC02	Food Analysis	AEC	0	0	1	0	1	Nil	New Course	Academic Peers	Skilling
39	26PYAEC03	Yoga and Life Sciences	AEC	0	0	1	0	1	Nil	New Course	Academic Peers	Skilling

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40	26PY2221T	Herbal Drug Technology (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
41	26PY2221P	Herbal Drug Technology (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
42	26PY2222T	Medicinal Chemistry (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
43	26PY2222P	Medicinal Chemistry (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
44	26PY2223T	Pharmaceutical Biotechnology (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
45	26PY2223P	Pharmaceutical Biotechnology (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
46	26PY2224T	Social Pharmacy and Public Health (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability
47	26PY2224P	Social Pharmacy and Public Health (Practical)	PCC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
48	26PY2225T	Systemic Pharmacology I (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
49	26PY2225P	Systemic Pharmacology I (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
50	26PY2226	Internship	PRI	0	0	8	0	4	Nil	New Course	Academic Peers	Skilling
51	26PY3127T	Biomedicinal Chemistry (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
52	26PY3127P	Biomedicinal Chemistry (Practical)	PCC	0	0	4	0	2	Nil	New Course	Academic Peers	Skilling
53	26PY3128T	Industrial Pharmacognosy (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
54	26PY3128P	Industrial Pharmacognosy (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
55	26PY3129T	Innovation and Startup Ecosystem (Theory)	HAS	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
56	26PY3130T	Pharmaceutical Dosage Form II (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability

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57	26PY3130P	Pharmaceutical Dosage Form II (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
58	26PY3131T	Pharmaceutical Quality Assurance (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
59	26PY3132T	Systemic Pharmacology II (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
60	26PY3132P	Systemic Pharmacology II (Practical)	PCC	0	0	4	0	2	Nil	New Course	Academic Peers	Skilling
61	26PY3233T	Advanced Pharmacognosy (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
62	26PY3234T	Biopharmaceutics and Pharmacokinetics (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
63	26PY3234P	Biopharmaceutics and Pharmacokinetics (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
64	26PY3235T	Intellectual Property Rights (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
65	26PY3236T	AI Applications In Pharmaceutical Sciences (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability
66	26PY3237T	Pharmaceutical Analysis (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
67	26PY3237P	Pharmaceutical Analysis (Practical)	PCC	0	0	4	0	2	Nil	New Course	Academic Peers	Skilling
68	26PY3238T	Pharmaceutical Jurisprudence (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
69	26PYAEC04	Green Chemistry	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
70	26PYAEC05	Materiovigilance and Hemovigilance	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
71	26PYAEC06	Scientific Writing	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
72	26PYAEC07	Drug Store and Business Management	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability

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73	26PYAEC08	Career Building in Cultivation of Medicinal Plants	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
74	26PYAEC09	Active Pharmaceutical Ingredients and Excipient Sciences	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
75	26PYSEC04	Computer-Aided Drug Design	SEC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
76	26PYSEC05	Analytical Method Development and Validation	SEC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
77	26PYSEC06	Principles of Preclinical Studies	SEC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
77	26PYVAC01	Professional Skills	VAC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
78	26PYVAC02	Process Analytical Technology (PAT) And QbD in Formulation Science	VAC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
79	26PY3239	Internship	PRI	0	0	8	0	4	Nil	New Course	Academic Peers	Skilling
80	26PY4140T	Biostatistics Research Methodology (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
81	26PY4141T	Cosmetics And Cosmeceuticals (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
82	26PY4142T	Ai in Clinical Applications (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability
83	26PY4143T	Modern Analytical Techniques (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Entrepreneurship
84	26PY4143P	Modern Analytical Techniques (Practical)	PCC	0	0	3	0	1	Nil	New Course	Academic Peers	Skilling
85	26PY4144T	Pharmacovigilance (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
86	26PY4145T	Pharmacy Practice (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
87	26PY4146T	Regulatory Affairs (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability

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88	26PYAEC10	Current Good Manufacturing Practices (cGMP)	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
89	26PYAEC11	Pharmaceutical Automation	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
90	26PYAEC12	Modern Techniques in Cellular Biology	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
91	26PYAEC13	Medical Devices	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Entrepreneurship
92	26PYAEC14	Transformation of Food Waste Into Medicinal Products	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Entrepreneurship
93	26PYAEC15	Biosimilars, Vaccines and Macromolecules	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
94	26PYAEC16	Precision Medicine	AEC	1	0	0	0	1	Nil	New Course	Academic Peers	Employability
95	26PY4147RP	Research Project	PRI	0	0	12	0	6	Nil	New Course	Academic Peers	Skilling
96	26PY4248T	Ethical Considerations and Translational Applications of AI in Pharmacy (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability
97	26PY4249T	Clinical Pharmacotherapeutics (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability
98	26py4250t	Industrial Pharmacy and Facility Design (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Entrepreneurship
99	26PY4251T	Pharmaceutical Management (Theory)	PCC	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
100	26PY4252T	Sterile Dosage Forms and Novel Drug Delivery System (Theory)	PCC	3	0	0	0	3	Nil	New Course	Academic Peers	Employability
101	26PY4252P	Sterile Dosage Forms and Novel Drug Delivery System (Practical)	PCC	0	0	4	0	2	Nil	New Course	Academic Peers	Skilling
102	26PYAEC17	Pharmaceutical Packaging	AEC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability

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103	26PYAEC18	Supply Chain Management	AEC	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
104	26PYAEC19	Industrial Safety and Waste Management	AEC	2	0	0	0	2	Nil	New Course	Academic Peers	Employability
105	26PYAEC20	Traditional Healing Practices of India	AEC	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
106	26PYAEC21	Futuristic Pharma Through AR/VR: PHARMA 4.0	AEC	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
107	26PYAEC22	Herbal Cosmetics for Industry Perspective	AEC	2	0	0	0	2	Nil	New Course	Academic Peers	Entrepreneurship
108	26PY4253P	Pharmaceutical Marketing Skills (Practical)	PCC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
109	26PYVAC03	Cleaning Validation	VAC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
110	26PYVAC04	Basic Training in Aseptic Handling Techniques	VAC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
111	26PYVAC05	Impurity Profiling	VAC	0	0	2	0	1	Nil	New Course	Academic Peers	Skilling
112	26PY4254RP	Research Project	PRI	0	0	12	0	6	Nil	New Course	Academic Peers	Skilling

Percentage of Syllabus Revision= 100%

Percentage of Courses focusing on Employability= 39.28%

Percentage of Courses focusing on Entrepreneurship= 10.71%

Percentage of Courses focusing on Skill Development = 31.25%

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Syllabus of New Course

26PY1101T: Basics of Python Programming for Pharmaceutical Sciences (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamentals of Python programming, including variables, data types, operators, and libraries.	PO1, PO4	2
CO2	Analyse program logic using control structures and functions.	PO1, PO2	4
CO3	Organize, manipulate, and retrieve data using data structures and file handling techniques.	PO1, PO4, PO8	4
CO4	Analyse pharmaceutical datasets using Python libraries.	PO1, PO2, PO4	4
CO5	Visualize and interpret pharmaceutical data using graphical tools.	PO1, PO2, PO4	2

Syllabus

Introduction to Python programming: Installing Python and an Integrated Development Environment (IDE) [Jupyter Notebook, PyCharm, VS Code etc.], Advantages of IDEs over text editors. Python variables and data types (integers, floats, strings, booleans), Type casting and basic operators (arithmetic, comparison, logical), Input and output operations. Basic string operations and manipulation techniques. Introduction to standard libraries and third-party libraries, installing and uninstalling libraries. **Control Structures & Functions:** Conditional statements (if, if-else, if-elif-else), nested conditions. Loops (for loop, while loop). Break and continue statements. Defining and calling functions, passing arguments and returning values. Writing modular programs for simple pharmaceutical applications- dosage calculation and BMI calculation. **Data Structures & File Handling:** Lists, tuples, and dictionaries. Indexing and slicing lists, basic operations on lists and dictionaries, string manipulation techniques. Introduction to NumPy arrays, basic operations using NumPy (array creation, arithmetic operations). Reading and writing CSV files. Understanding structured healthcare datasets. Importing small pharmaceutical datasets and performing basic data access and manipulation tasks. **Data Handling with Pandas:** Introduction to Pandas library. Pandas Series and Data Frame structures. Reading CSV and Excel files-PK study datasets and ADR reports. Inspecting datasets using functions such as head(), tail(), info(), and describe(). Data cleaning techniques and handling missing values. Filtering and selecting data based on conditions. Grouping data and performing aggregation functions. **Data Visualization with Matplotlib:** Introduction to Matplotlib. Creating line plots, histograms, scatter plots, and box plots. Labeling axes, titles, and legends. Create plots and visualize pharmaceutical datasets - concentration-time curves for oral and IV administration, ADR reporting rates across drugs, dissolution profiles. Scientific interpretation of plots.

Textbooks

1. Weiss, C.J., 2017. Scientific Computing for Chemists with Python.
2. Perkovic, L., 2015. Introduction to Computing Using Python: An Application Development Focus. 2nd ed. Hoboken: Wiley.
3. Sweigart, A., 2025. Automate the Boring Stuff with Python. 3rd ed.

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26PY1102T: General Pharmacy (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the history and evolution of the pharmacy profession, including pharmacopeial practices and prescription handling	PO1, PO3	2
CO2	Apply pharmaceutical calculation principles in the formulation and preparation of various types of dosage forms.	PO1, PO3	3
CO3	Understand the properties and functions of APIs, excipients, and the preparation of solid dosage forms.	PO1, PO3	2
CO4	Illustrate the formulation principles of liquid dosage forms by analyzing the role of APIs and excipients involved.	PO1, PO3	2
CO5	Compare and evaluate the formulation of semisolid dosage forms based on the characteristics of APIs, excipients, and preparation methods.	PO1, PO2, PO3	4

Syllabus

Introduction to the Profession of Pharmacy: History of the Profession of Pharmacy in India: In relation to pharmacy education, pharmaceutical industries and organizations – evolution, development and milestones. Scope of the Pharmacy Profession: Role and responsibilities of pharmacists in retail/community pharmacy, hospital and clinical pharmacy, and industrial pharmacy including research and development. Pharmacopoeias: Introduction to IP, BP, USP, BPC, International Pharmacopoeia, other pharmacopoeias and the National Formulary of India; structure and content of the Indian Pharmacopoeia; study of one model IP monograph. Introduction to Prescription: Structure and format/parts of prescription, handling of prescriptions, Latin terminology related to prescriptions. **Introduction to Pharmaceutical Calculations and Dosage Forms:** Metric system of weights and measures; calculations based on alligation, proof spirit, isotonic solutions, dilute solutions (percentage and ratio) and geometric dilution; scientific notation of units and measures. Posology: Definition and dose calculation based on age, body weight and body surface area. Introduction to Dosage Forms: Routes of administration and classification of dosage forms. Introduction to Active Pharmaceutical Ingredients and Excipients: Definition, ideal characteristics and importance. **Solid Dosage Forms:** Powders: Classification, advantages and disadvantages; dusting powders, effervescent powders, efflorescent powders, hygroscopic powders and eutectic mixtures; introduction to excipients and methods of preparation. Tablets: Definition, types of tablets including moulded tablets and pills with examples; advantages and disadvantages; introduction to excipients and methods of preparation. Capsules: Definition, types of capsules, advantages and disadvantages, capsule sizes; introduction to excipients and methods of preparation. **Monophasic and Biphasic Liquids:** For internal use – aromatic waters, syrups, elixirs and linctus (definition and preparation). For external use and body cavities – liniments, lotions, throat paints, applications, gargles, mouthwashes, enemas, eye drops, ear drops, nasal drops and tinctures with examples. Study of official preparations- Introduction to excipients and methods of preparation. Suspensions- Definition and types (flocculated and deflocculated), advantages and disadvantages, formulation excipients and general methods of preparation. Emulsions- Definition and types, emulsifying agents, tests for identification of types of emulsions, formulation excipients and general methods of preparation.

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Semisolid Dosage Forms: Definitions, classification, advantages and disadvantages, ointment bases and other excipients used in semisolid dosage forms; general methods of preparation of ointments, pastes, creams and gels. Suppositories / Pessaries: Definition, types of suppositories, advantages and disadvantages, formulation excipients used in suppositories, properties of ideal suppository bases, types of suppository bases, displacement value and general method of preparation.

Textbooks

1. Ansel, H.C., Allen, L.V. and Popovich, N.G., Pharmaceutical Dosage Forms and Drug Delivery Systems. Lippincott Williams & Wilkins, New Delhi.
2. Carter, S.J., Cooper and Gunn's Dispensing for Pharmaceutical Students. CBS Publishers, New Delhi.
3. Indian Pharmacopoeia Commission, Indian Pharmacopoeia. Ghaziabad.
4. British Pharmacopoeia Commission, British Pharmacopoeia. London.
5. United States Pharmacopeial Convention, United States Pharmacopeia (USP–NF). Rockville, Maryland, USA.
6. Lachman, L., Lieberman, H.A. and Kanig, J.L., The Theory and Practice of Industrial Pharmacy. Lea & Febiger, University of Michigan.
7. Gennaro, A.R., Remington: The Science and Practice of Pharmacy. Lippincott Williams & Wilkins, New Delhi.

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26PY1102P: General Pharmacy (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Perform accurate pharmaceutical calculations using dilution and allegation principles for the preparation of various dosage forms.	PO1, PO3	3
CO2	Apply pharmacopeial procedures to prepare and dispense liquid dosage forms.	PO1, PO3	3
CO3	Apply standard procedures to formulate solid dosage forms.	PO1, PO3, PO6	3
CO4	Apply appropriate techniques to prepare semisolid and specialized dosage forms using suitable bases.	PO1, PO3, PO4	3
CO5	Apply pharmacopeial standards and labeling requirements to evaluate marketed dosage forms.	PO1, PO2, PO3	3

Syllabus

Pharmaceutical Calculations: Solutions based on allegation and dilution methods.

Solutions: Strong solution of ammonium acetate – IP, Cresol with soap solution – IP and Lugol's solution – BPC.

Syrups: Simple Syrup – IP

Powders & Granules: ORS powder – WHO, Effervescent granules – IP, Dusting powder – IP and Divided powders – IP.

Suppositories: Glycerogelatin suppository – BPC, Cocoa butter suppository – IP and Zinc Oxide suppository – IP.

Semisolids: Sulphur ointment – IP and Non-staining iodine ointment with methyl salicylate – BPC.

Gargles & Mouthwashes: Iodine gargle – BPC and Chlorhexidine mouthwash – IP

Textbooks

1. Carter, S.J., Cooper and Gunn's Dispensing for Pharmaceutical Students. 12th ed. New Delhi: CBS Publishers.
2. Indian Pharmacopoeia Commission, Indian Pharmacopoeia, Vol. I. Ghaziabad: IPC.
3. United States Pharmacopeial Convention, United States Pharmacopeia–National Formulary (USP–NF). Rockville, MD, USA.
4. British Pharmacopoeia Commission, British Pharmacopoeia Codex. London: The Stationery Office.

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26PY1103T: Healthcare Psychology and Communication Skills (Theory)

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental concepts of psychology and their relevance in healthcare.	PO1	2
CO2	Understand human development, personality traits, and behavioral responses to illness and recovery.	PO1	2
CO3	Apply effective communication models and techniques in clinical and interdisciplinary healthcare scenarios..	PO7, PO9	3
CO4	Apply professional communication skills for effective patient interaction and clinical documentation.	PO7, PO9	3
CO5	Analyse psychological and behavioral interventions for mental health and treatment adherence.	PO1, PO2	4

Syllabus

Introduction to Psychology in Healthcare: Definition, scope, and relevance of psychology in health sciences. Branches of psychology with healthcare relevance: clinical, health, behavioural, and developmental psychology. Sensation, perception, and attention in clinical assessment. Learning and memory: reinforcement in health behaviour change. Emotion and motivation: theories and implications in health contexts. **Developmental and Behavioural Psychology:** Human developmental stages and healthcare needs. Personality theories and patient interaction styles. Psychological factors affecting illness perception and recovery. Common psychological disorders in healthcare: anxiety, depression, and somatization. Coping strategies, resilience, and stress management techniques. **Foundations of Health Communication:** Elements and models of communication in healthcare. Types of communication: interpersonal, group, mass, and telehealth communication. Barriers to effective communication in clinical settings. Active listening, questioning techniques, and empathy. Culturally appropriate and inclusive communication. **Professional Communication in Healthcare Settings:** Communication with patients, caregivers, and interdisciplinary teams. Delivering difficult news and handling emotionally charged situations. Legal and ethical issues in health communication (confidentiality, consent). Writing patient records, reports, and discharge summaries. Use of technology and digital communication tools in healthcare services. **Health Psychology and Behavioural Interventions:** Health belief models and illness behaviour. Psychosomatic illnesses and the mind–body connection. Behaviour change theories (e.g., CBT, TTM) in treatment adherence. Psychological first aid and crisis communication. Mental health promotion and stigma reduction through communication.

Textbooks:

1. Feldman, R.S., Understanding Psychology. McGraw-Hill Education, New York.
2. Taylor, S.E., Health Psychology. McGraw-Hill Education, New York.
3. Hargie, O., The Handbook of Communication Skills. Routledge, London.
4. Nevid, J.S., Rathus, S.A. and Greene, B., Psychology and the Challenges of Life: Adjustment and Growth. Wiley, New York.

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26PY1103P: Healthcare Psychology and Communication Skills (Practical)

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply patient-centered communication in clinical settings.	PO7, PO9	3
CO2	Analyse healthcare communication challenges using case study discussions.	PO2, PO7	4
CO3	Apply effective listening and communication strategies.	PO3, PO7	3
CO4	Apply health education strategies to deliver effective community health messages.	PO1, PO9	3
CO5	Reflect on personal emotional growth and improvement in communication competencies.	PO1, PO7	5

Syllabus

Role Plays and Simulations: Counselling a patient with chronic illness, Breaking bad news in a clinical setting and Empathetic listening in crisis response.

Case Study Discussions: Mental health cases in primary care and Impact of miscommunication in healthcare errors.

Peer-to-Peer Practice Sessions: Reflective listening and paraphrasing and Effective team communication and decision-making.

Community Engagement Tasks: Designing IEC materials for public health awareness and Conducting mock health education sessions.

Journaling & Self-Reflection Logs: Weekly reflection on emotional responses during care simulations and Growth in communication skill development over the semester.

Textbooks

1. Morgan, C.T. and King, R.A., Introduction to Psychology. New York: McGraw-Hill.
2. Taylor, S.E., Health Psychology. New York: McGraw-Hill Education.
3. Hargie, O., Skilled Interpersonal Communication: Research, Theory and Practice. London: Routledge.
4. Balzer-Riley, J., Communication in Nursing and Healthcare. Boston: Pearson.
5. Weinman, J., Petrie, K.J. and Moss-Morris, R., The Psychology of Health and Illness. London: Routledge.

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26PY1104T: Human Anatomy, Physiology and Pathophysiology I (Theory)

L-T-P-S: 4-0-0-0 **Credits: 4** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental concepts of Human Anatomy, Physiology and Pathophysiology.	PO1	2
CO2	Understand the gross morphology, structure and functions of various organs of the human body.	PO1	2
CO3	Understand the etiology and pathogenesis of disorders of the integumentary, peripheral nervous, and cardiovascular systems.	PO1	2
CO4	Understand the basic mechanism behind inflammation.	PO1	2
CO5	Understand and differentiate the various tissues and organs of different systems of human body.	PO1, PO2	2

Syllabus

Introduction to human body: Cellular and tissue level of organization. Definition and scope of anatomy, physiology and pathophysiology. Levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminologies. Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, forms of intracellular signalling- a) Contact-dependent, b) Paracrine, c) Synaptic, d) Endocrine Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues. **Basic principles of cell injury and adaptation:** Components and types of feedback systems, causes of cellular injury, pathogenesis (cell membrane damage, mitochondrial damage, ribosome damage and nuclear damage), morphology of cell injury – adaptive changes (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia), cell swelling, intra cellular accumulation and cell death. Definitions of commonly used relevant medical terminologies. **Integumentary system and wound healing:** Structure and functions of skin. Skin disorders: Psoriasis and dermatitis and pathophysiology of Leprosy. Basic principles of wound healing. **Skeletal system and joints:** Divisions of skeletal system, types of bones, salient features and functions of bones of axial and appendicular skeletal system. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction. Structural and functional classification of joints. **Diseases of bones and joints:** Pathophysiology of rheumatoid arthritis, osteoporosis and gout. **Body fluids, blood and lymphatic system:** Body fluids, composition and functions of blood, hemopoiesis, formation of haemoglobin, mechanisms of coagulation, blood grouping, Rh factors and transfusion. Lymphatic organs and tissues, lymphatic vessels, lymph formation, circulation and functions of lymphatic system. **Basic mechanism of inflammation and repair:** Introduction, classification and pathophysiology of inflammation, mediators of inflammation. **Haematological diseases:** Pathophysiology of iron deficiency, megaloblastic anaemia (Vit B12 and folic acid), sickle cell anaemia, Thalassemia, hereditary acquired anaemia and haemophilia. **Peripheral nervous system:** Classification of peripheral nervous system: structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. **Special senses:** Structure and functions of eye, ear, nose and tongue. Pathophysiology of special sense disorders- glaucoma, cataract, myopia, otitis externa, otitis media, vertigo and anosmia.

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Cardiovascular system: Anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram. Pathophysiology of hypertension, cardiac arrhythmias, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and coronary artery disease).

Textbooks

1. Sembulingam, K. and Sembulingam, P., Essentials of Medical Physiology. Jaypee Brothers Medical Publishers, New Delhi.
2. Guyton, A.C. and Hall, J.E., Textbook of Medical Physiology. Elsevier Saunders, Philadelphia, USA.
3. Tortora, G.J. and Grabowski, S.R., Principles of Anatomy and Physiology. Wiley, Palmetto, GA, USA.
4. Kumar, V., Cotran, R.S. and Robbins, S.L., Basic Pathology. W.B. Saunders Company, Philadelphia.

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26PY1104P: Human Anatomy, Physiology and Pathophysiology I (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles and applications of microscopy and the fundamentals of laboratory experiments related to the nervous system and special senses.	PO1, PO3, PO4	2
CO2	Understand the structure and functions of major human organs and organ systems in maintaining normal physiology.	PO1	2
CO3	Evaluate hematological parameters and interpret homeostatic mechanisms in health and disease.	PO1, PO2	5
CO4	Understand the etiology and pathogenesis of selected disease states, linking structural and functional changes to clinical manifestations.	PO1, PO9	2
CO5	Understand the common diseases with respect to their signs, diagnosis, prevention, and treatment.	PO1, PO3	2

Syllabus

1. Study of compound microscopes.
2. Microscopic study of epithelial and connective tissue.
3. Microscopic study of muscular and nervous tissue.
4. Identification of axial bones.
5. Identification of appendicular bones.
6. Introduction to hemocytometry
7. Demonstration of total blood count by cell analyser.
8. Enumeration and interpretation of white blood cell (WBC) count, differential count.
9. Enumeration and interpretation of total red blood corpuscles (RBC) count.
10. Determination of bleeding time and clotting time.
11. Estimation and interpretation of haemoglobin content.
12. Determination of blood group.
13. Determination and interpretation of erythrocyte sedimentation rate (ESR).
14. Determination of pulse rate, heart rate and blood pressure.
15. Recording and interpretation of ECG.
16. To study the cardiovascular system and integumentary system.
17. Case studies/files of patients with anaemia, thalassemia, haemophilia, leprosy, gout, hypertension and ischemic heart disease.

Textbooks

1. Wilson, K.J.W., Anatomy and Physiology in Health and Illness. New York: Churchill Livingstone.
2. Guyton, A.C. and Hall, J.E., Textbook of Medical Physiology. Philadelphia: Elsevier.
3. Tortora, G.J. and Grabowski, S.R., Principles of Anatomy and Physiology. New York: Wiley.

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26PY1105T: Introduction to Pharmacognosy (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the historical development, classification, and scope of Pharmacognosy.	PO1	2
CO2	Understand the cultivation, processing, and conservation techniques for medicinal plants.	PO1, PO3, PO8	2
CO3	Apply quality evaluation methods to crude drugs using organoleptic, microscopic, and chemical parameters.	PO1, PO3, PO4	3
CO4	Understand the primary and secondary metabolites with their therapeutic relevance.	PO1	2
CO5	Understand the traditional systems of medicine and commonly used phytotherapeutic agents.	PO1	2

Syllabus

Fundamentals of Pharmacognosy: Definition, history, present status, scope and development of pharmacognosy. Sources of drugs: Plants, animals, microbial, marine, mineral and plant tissue culture. Historical milestones in drug discovery: Morphine, quinine, aspirin, warfarin, penicillin, cephalosporin, taxol and artemisinin. Introduction to different herbal / traditional pharmacopoeias: Indian Pharmacopoeia, British Herbal Pharmacopoeia, United States Pharmacopeia – Herbal Medicines and Dietary Supplements, Ayurvedic Pharmacopoeia of India, Unani Pharmacopoeia of India and American Herbal Pharmacopoeia. Official and non-official; codified and non-codified drugs. Classification of crude drugs: alphabetical, morphological, taxonomical, chemical, pharmacological and chemotaxonomic classification along with their merits and limitations. **Cultivation, Collection, Processing and Storage of Drugs of Natural Origin:** Methods of plant cultivation and Good Agricultural and Collection Practices (WHO / GAP / GCP guidelines) for medicinal plants. Factors influencing cultivation, collection and storage of medicinal plants. Plant hormones and their applications in cultivation of medicinal plants. Application of polyploidy, mutation and hybridization concepts with reference to secondary metabolites. Ex-situ and in-situ conservation and strategies for value addition of medicinal plants. Role of eco-pharmacognosy in sustainable conservation of endangered medicinal plants such as kutki and chirata. **Quality Control of Drugs of Natural Origin (WHO Guidelines):** Adulteration of drugs of natural origin. Evaluation of drugs using organoleptic, microscopic (qualitative and quantitative), physical, chemical and biological methods. Physicochemical parameters: extractive values, moisture content, foreign organic matter, ash values, bitterness value, foaming index, haemolytic potential, swelling index, viscosity, optical rotation, refractive index, acid value and saponification value. DNA barcoding. **Introduction to Metabolites of Plant Origin:** Definition and general properties of plant metabolites. Primary and secondary metabolites such as carbohydrates, proteins, lipids, alkaloids, glycosides, flavonoids, tannins, terpenoids, volatile oils and resins. **Traditional Systems of Medicine:** Basic principles of treatment of diseases in different systems of medicine including AYUSH and TCM. Types of dosage forms in AYUSH medicines. Role of pharmacognosy in allopathy and traditional systems of medicine such as AYUSH and TCM.

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Phyto-therapeutic Agents: Biological source, major constituents and uses of the following classes of drugs: Adaptogens and Immunomodulators: Ashwagandha, Tulsi, Amla, Hepatoprotectives: Milk thistle, Kutki • Cardiovascular drugs: Garlic, Arjuna • Antidiabetics: Gymnema, Fenugreek • Anti-inflammatory and analgesics: Turmeric, Boswellia • CNS drugs: Brahmi • Antimicrobial and antivirals: Giloy, Neem, Andrographis • Gastrointestinal drugs: Psyllium • Dermatological agents: Aloe • Drugs used in women's health: Chasteberry, Shatavari • Respiratory drugs: Vasaka

Textbooks

1. Evans, W.C., Trease and Evans Pharmacognosy. 16th ed. London: W.B. Saunders & Co., 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy. 9th ed. Philadelphia: Lea & Febiger, 1988.
3. Wallis, T.E., Textbook of Pharmacognosy. London: J. & A. Churchill Ltd.
4. World Health Organization (2002) WHO traditional medicine strategy 2002–2005. Geneva: World Health Organization

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26PY1105P: Introduction to Pharmacognosy (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Identify medicinal plants and crude drugs using morphological and microscopical characters.	PO1, PO8	2
CO2	Analyse powdered drugs microscopically to identify diagnostic cell contents.	PO1, PO2	4
CO3	Perform quantitative microscopy for stomatal and vein parameters.	PO1, PO3	3
CO4	Evaluate quality and purity of crude drugs using physicochemical parameters.	PO1, PO2	5
CO5	Apply standard techniques to collect medicinal plants and prepare voucher specimens.	PO1, PO3, PO8	3

Syllabus

1. Morphological study of medicinal plants (as mentioned in Unit V Theory).
2. Organoleptic evaluation and powder microscopical characters of the following drugs: Tulsi and Ashwagandha.
3. Organoleptic evaluation and powder microscopical characters of the following drugs: Amla and Arjuna.
4. Organoleptic evaluation and powder microscopical characters of the following drugs: Turmeric and Psyllium husk.
5. Organoleptic evaluation and powder microscopical characters of the following drugs: Brahmi and Fenugreek.
6. Determination of moisture content of crude drugs.
7. Determination of swelling index and foaming index of crude drugs.
8. Determination of stomatal number and stomatal index of leaf.
9. Determination of vein islet and vein termination number of leaf.
10. Determination of ash value and extractive values of crude drugs.
11. Determination of foreign organic matter of crude drugs.
12. Determination of dimensions of calcium oxalate crystals and phloem fibers by eyepiece micrometry.
13. Determination of percentage purity of powder drug using lycopodium spore method.
14. Experiential learning-based experiments involving collection, identification of medicinal plant material, preparation of voucher specimens and excursion visits to medicinal plant garden.

Textbooks

1. Evans, W.C., 2009. Trease and Evans Pharmacognosy. 16th ed. London: W.B. Saunders & Co.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., 1988. Pharmacognosy. 9th ed. Philadelphia: Lea & Febiger.
3. Wallis, T.E., Textbook of Pharmacognosy. London: J. & A. Churchill Ltd.

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26PY1106T: Pharmaceutical Inorganic and Analytical Chemistry (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the sources and types of errors in pharmaceutical analysis, and impurities products	PO1	2
CO2	Apply concepts of acid-base chemistry, buffer systems with importance of electrolytes	PO1, PO3	3
CO3	Understand analytical techniques, including titrimetric methods, and their applications in pharmaceutical quality assessment.	PO1, PO3	2
CO4	Analyse the properties, mechanisms, and therapeutic uses of pharmaceutical agents.	PO1, PO2	4
CO5	Understand the drugs used in expectorants, emetics, haemintics, poison and antidote and astringents.	PO1	2

Syllabus

Introduction to pharmaceutical analysis: Different techniques of analysis, Methods of expressing strength of solutions, Primary and secondary standards with examples. **Errors:** Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures. **Impurities:** Definition, types, contents and regulatory importance. Sources and types of impurities in Pharmaceuticals, limit tests for chloride, sulphate, iron, arsenic, lead, heavy metals, and modified limit test for chloride and sulphate. **Acid-Base Chemistry and Buffer Systems in Pharmacy:** Definition of acids, bases, buffers, pH Scale and its significance, Buffer equation, calculation of pH for Buffer solution. Isotonicity and its application in IV Fluids and Ophthalmic Solutions. **Major extra and intracellular electrolytes:** Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium chloride and Oral Rehydration Salt (ORS), Physiological acid base balance. **Acid base titrations:** Theories of acid base indicators, classification of acid base titrations. Preparation and standardization of titrants viz. hydrochloric acid and sodium hydroxide. Theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves. Assay of Ammonium hydroxide. **Non-aqueous titrations:** Types of solvents used, acidimetric and alkalimetric titration using non-aqueous solvents. Preparation and standardization of acidic and basic titrants. Estimation of weakly acidic and basic substances using non-aqueous titrants, estimation of Sodium benzoate. **Precipitation titrations and gravimetry:** Principle and steps involved in gravimetric analysis, Mohr's method, Volhard's, Modified Volhard's, Fajans method. Estimation of barium sulphate by gravimetry. **Complexometric titrations:** Classification, metal ion indicators, masking and demasking reagents, preparation and standardization of disodium EDTA. Estimation of Magnesium sulphate and Calcium gluconate*. **Redox titrations:** Concepts of oxidation and reduction, Types of redox titrations viz. Permanganometry, Cerimetry, Iodimetry, Iodometry and titrations with potassium iodate. **Gastrointestinal agents:** Acidifiers: Sodium acid phosphate and Dilute Hydrochloric acid. Antacids: Ideal properties of antacids, combinations of antacids, Sodium bicarbonate*, Aluminium hydroxide gel*. Agents promote bowel movements: Magnesium hydroxide, Sodium orthophosphate, Sodium Potassium tartrate and magnesium trisilicate. Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.

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Radiopharmaceuticals: Basics of radioactivity, applications of radioisotopes of Sodium Iodide I-131, Technetium-99m, Cobalt-60, Phosphorus-32 including safe handling, storage, and disposal of radiopharmaceuticals, adhering to regulatory guidelines for safety. **Miscellaneous Compounds:** Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartrate. Haematinics: Ferrous sulphate*, Ferrous gluconate. Poison and Antidote: Definition, classification of antidotes, Sodium thiosulphate.

Textbooks:

1. Bentley, R. and Driver, J., Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford: Oxford University Press.
2. Vogel, A.I., Vogel's Textbook of Quantitative Chemical Analysis. Essex: Pearson Education Limited.
3. Beckett, A.H. and Stenlake, J.B., Practical Pharmaceutical Chemistry. Part I & II. London: The Athlone Press, University of London.
4. Schroff, M.L., Inorganic Pharmaceutical Chemistry. New Delhi: Oxford Book Company.
5. Indian Pharmacopoeia Commission, Indian Pharmacopoeia. Ghaziabad, India.

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26PY1106P: Pharmaceutical Inorganic and Analytical Chemistry (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply limit tests to detect impurities in pharmaceutical substances.	PO1, PO3	3
CO2	Apply standard procedures to prepare pharmaceutical inorganic compounds.	PO1, PO3	3
CO3	Analyse the significance of quality control in pharmaceutical products and raw materials.	PO1, PO2	4
CO4	Demonstrate proficiency in titrimetric analysis using different volumetric techniques.	PO1, PO3	3
CO5	Apply analytical skills to qualitative and quantitative data.	PO3, PO4	3

Syllabus

Limit tests (Any 4 Experiments): a. Limit test and modified limit test for Chloride as per Indian Pharmacopoeia b. Limit test and modified limit test for sulphate as per \Indian Pharmacopoeia c. Limit test for Iron d. Limit test for Lead e. Limit test for arsenic.

Preparation of inorganic pharmaceuticals (Any 3 Experiments): a. Preparation of Aluminium hydroxide b. Preparation of potash alum c. Preparation of ferrous sulphate d. Preparation of Magnesium sulphate from magnesium hydroxide or magnesium carbonate.

Test for Purity (Any 2 Experiments): a. Assessment of swelling power of bentonite as per Indian Pharmacopoeia b. Evaluation of acid neutralizing capacity of aluminium hydroxide gel c. Determination of potassium iodate and iodine in potassium Iodide.

Assay of the following inorganic compounds including standardization of titrant (Any 5 Experiments): a. Assay of ammonium chloride by acid base titration, b. Assay of Ferrous sulphate by Cerimetry, c. Assay of Copper sulphate by Iodometry, d. Assay of Calcium gluconate by Complexometry, e. Assay of Hydrogen peroxide by Permanganometry, f. Assay of Sodium benzoate by non-aqueous titration, g. Assay of Sodium Chloride by precipitation titration (Modified Volhard's method).

Textbooks

1. Bentley, R. and Driver, J., Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford: Oxford University Press.
2. Vogel, A.I., Vogel's Textbook of Quantitative Chemical Analysis. Essex: Pearson Education Limited.
3. Beckett, A.H. and Stenlake, J.B., Practical Pharmaceutical Chemistry. Part I & II. London: The Athlone Press, University of London.
4. Kennedy, J.H., Analytical Chemistry: Principles. New York: Saunders College Publishing.
5. Schroff, M.L., Inorganic Pharmaceutical Chemistry. New Delhi: Oxford Book Company.

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26PY1207T: Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the use of descriptive statistics in classifying pharmaceutical data.	PO1, PO4	2
CO2	Apply probability concepts and statistical distributions in clinical and pharmaceutical contexts.	PO1, PO4	3
CO3	Apply sampling and hypothesis testing techniques for research decision-making.	PO3, PO5	4
CO4	Analyse correlation and regression relationships in pharmaceutical datasets	PO1, PO4	4
CO5	Demonstrate statistical analysis using Python and interpret outputs appropriately.	PO1, PO4	4

Syllabus

Descriptive Statistics: Types of data in pharmaceutical sciences (nominal, ordinal, interval, ratio). Sources of data in pharmacy: clinical trials, pharmacovigilance, quality control, PK studies. Measures of central tendency: mean, median, mode, their calculation and interpretation. Measures of dispersion (range, variance, standard deviation) and their interpretation using pharmaceutical data. Skewness and understanding distribution shape in biological measurements. Perform descriptive statistical analysis using Python libraries such as NumPy and Pandas, with focus on Interpretation of results. **Probability & Statistical Distributions in Healthcare:** Basic probability concepts and laws (addition and multiplication rules), conditional probability and its interpretation. Bayes' theorem and its application in clinical decision-making. Concept of random variables (discrete and continuous). Normal distribution and its importance in biological and pharmaceutical measurements. Binomial distribution demonstrating applications in clinical trial outcomes. Poisson distribution for modeling rare events such as adverse drug reactions. Graphical visualization of these probability distributions using Python. . **Sampling & Statistical Inference:** Population versus sample, sampling techniques used in clinical research, Sampling error and bias. Conceptual understanding of the Central Limit Theorem. Confidence intervals and their interpretation. Hypothesis testing framework (null and alternative hypotheses). Type I and Type II errors, p-value and statistical significance. Demonstration, calculation and interpretation of these parameters using python with pharmaceutical data. **Basics of Correlation & Regression:** Conceptual understanding of the following concepts with emphasis on their interpretation- correlation and Pearson correlation coefficients, Interpretation of positive and negative correlations, Scatter plots and trend visualization using pharmaceutical data such as dose-response relationships, Simple linear regression concept, interpretation of regression coefficients and Introduction to odds ratio and its application in clinical risk analysis. **Statistical Analysis Using Python – Case based learning:** Demonstration of descriptive statistics, correlation analysis and linear regression using Python libraries- SciPy / Stats models / Scikit-learn on pharmaceutical datasets. Interpretation of the output summaries and p-values. Preparation of statistical reports.

Textbooks:

1. Lane, D.M., Introduction to Statistics. Houston: Rice University.
2. Walters, S.J., Campbell, M.J. and Machin, D., Medical Statistics: A Textbook for the Health Sciences. Hoboken, NJ: Wiley-Blackwell.
3. Rowe, P., Essential Statistics for the Pharmaceutical Sciences. London: Pharmaceutical press.

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26PY1208T: Biochemistry (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles of enzymology and various tests in clinical chemistry	PO1, PO9	2
CO2	Understand the classification, structure, and functions of major biomolecules, enzymes, and vitamins.	PO1	2
CO3	Understand the principles of bioenergetics, biological oxidation, and metabolic pathways with clinical significance.	PO1, PO9	2
CO4	Understand the metabolism of lipids and its significance.	PO1	2
CO5	Understand the metabolism of proteins and its significance in monitoring metabolic and organ-specific disorders.	PO1	2

Syllabus

Enzymology: a. Introduction, properties, nomenclature, and IUB classification of enzymes and coenzymes. Enzyme kinetics (Michaelis plot, Lineweaver–Burk plot). Enzyme inhibitors with examples. Regulation of enzymes: enzyme induction and repression, allosteric enzyme regulation. Therapeutic and diagnostic application of enzymes and isoenzymes. Factors affecting enzyme activity. Digestion, absorption function of dietary Macro and Micronutrients, including Vitamins and Minerals, Biochemical functions of vitamins and associated diseases.b. Clinical Chemistry: Liver function tests (routinely performed tests based on liver function). Renal function tests (routinely performed tests based on kidney function, ELISA test). **Biomolecules:** a. Introduction about biomolecules – Introduction of carbohydrate, lipids, nucleic acids, amino acids and proteins. **Bioenergetics:** Concept of free energy; relationship between free energy, enthalpy, and entropy; redox potential; energy-rich compounds (ATP, GTP, etc.) and their biological significance. **Carbohydrate Metabolism and their role in diabetes mellitus:** Overview and significance of major pathways: Glycolysis, Citric Acid Cycle (TCA), Gluconeogenesis, Hexose Monophosphate (HMP) shunt, and Glycogen metabolism; regulation of blood glucose levels; metabolic adaptations during fed state, fasting, and prolonged starvation; metabolic derangements in diabetes mellitus and related disorders. **Biological Oxidation:** Electron Transport Chain (ETC), oxidative phosphorylation, and mechanisms of ATP synthesis; regulation and clinical implications of mitochondrial dysfunction and oxidative stress. **Lipid metabolism:** a. Classification, functions, and properties of lipids and lipoproteins (HDL, LDL, VLDL, chylomicrons) b. β-oxidation and de-novo synthesis of fatty acids: Ketone bodies: synthesis, utilization, and clinical significance c. Biological significance of cholesterol, lipid profile, and its clinical significance. d. Disorders associated with lipid metabolism: Hyperlipidaemias and hypercholesterolemia, lipid storage diseases, atherosclerosis, fatty liver disease, and obesity. **Amino acids and protein metabolism:** a. Classification and Biological Functions: Classification and physiological roles of amino acids. Structure and functions of proteins and plasma proteins. b. General Metabolism of Amino Acids: Transamination, oxidative and non-oxidative deamination, decarboxylation. Urea cycle – nitrogen disposal and detoxification. Fate of carbon skeletons of amino acids (glucogenic vs ketogenic). c. Catabolism of Specific Amino Acids and Related Disorders: Catabolism of phenylalanine and tyrosine and their metabolic disorders. (Phenylketonuria, Albinism, Alkaptonuria, Tyrosinemia) and Inborn errors of branched chain and aromatic amino acids. d. Biochemical significance of neurotransmitters and hormones derived from amino acids:5-HT (serotonin), melatonin, dopamine, noradrenaline, adrenaline. e. Catabolism of heme and related disorders (jaundice).

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Nucleic acid metabolism and genetic information transfer: a. Nucleotide Metabolism and their related disorders: Biosynthesis of purine and pyrimidine nucleotides. Catabolism of purine nucleotides (uric acid formation). Clinical significance of Hyperuricemia and Gout. b. Genome Structure and Central Dogma: Organization of the mammalian genome. Introduction to DNA replication, Transcription, and Translation. c. Genetic Code and Regulation of Protein Synthesis: Properties of the genetic code: Inhibitors of transcription and translation (antibiotics, toxins). d. DNA Repair and Related Disorders: DNA damage types, Repair mechanisms. Overview of clinical disorders associated with faulty DNA repair.

Textbooks:

1. Nelson, D.L., Cox, M.M. and Hoskins, A., Lehninger Principles of Biochemistry. New York: W.H. Freeman.
2. Kennelly, P.J., Rodwell, V.W., Bender, D.A., Botham, K.M. and Weil, P.A., Harper's Illustrated Biochemistry. New York: McGraw-Hill Education.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Weil, P.A., Harper's Biochemistry. New York: McGraw-Hill.
4. Voet, D. and Voet, J.G., Biochemistry. New York: John Wiley & Sons.
5. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations. New York: Wile-Liss.
6. Satyanarayana, U. and Chakrapani, U., Biochemistry. Kolkata: Books and Allied (P) Ltd.

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26PY1208P: Biochemistry (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Identify proteins and carbohydrates using qualitative biochemical tests and explain their physiological relevance.	PO1	2
CO2	Analyse normal and abnormal urinary constituents and their diagnostic significance.	PO1, PO2	4
CO3	Analyse the levels of biochemical parameters and correlate the results with clinical conditions.	PO1, PO2, PO9	4
CO4	Demonstrate enzyme–substrate reactions and evaluate the effect of temperature and substrate concentration on enzymatic activity.	PO1, PO2	3
CO5	Analyse and interpret biochemical results for clinical application.	PO1, PO2	4

Syllabus

1. Identification tests for proteins (Albumin and Casein).
2. Qualitative analysis of carbohydrates* (Glucose, Fructose, Lactose, Sucrose, and Starch).
3. Qualitative analysis of urine for normal and abnormal constituents.
4. Estimation of blood glucose.
5. Estimation of total cholesterol and HDL cholesterol.
6. Estimation of urea, creatinine, and uric acid in serum.
7. Estimation of serum total protein and albumin.
8. Study of enzymatic hydrolysis of starch.
9. Study of the effect of temperature on salivary amylase activity.
10. Study of the effect of substrate concentration on salivary amylase activity.
11. Estimation of haemoglobin in blood by Sahli's method / Cyanmethemoglobin method.
12. Estimation of serum bilirubin (total and direct bilirubin).
13. Estimation of glycogen content.
14. Estimation of SGOT and SGPT.

Textbooks

1. Plummer, D. T. An Introduction to Practical Biochemistry. McGraw-Hill, New York.
2. Wilson, K., and Walker, J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
3. Varley, H., Gowenlock, A. H., Bell, M., and Bell, J. L. Varley's Practical Clinical Biochemistry. Heinemann Medical Books.
4. Burtis, C. A., Ashwood, E. R., and Bruns, D. E. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. Elsevier.
5. Rodwell, V. W., Bender, D. A., Botham, K. M., Kennelly, P. J., and Weil, P. A. Harper's Illustrated Biochemistry. McGraw-Hill.

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26PY1209T: Human Anatomy, Physiology and Pathophysiology II (Theory)

L-T-P-S: 4-0-0-0 **Credits: 4** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the structural organization of the nervous, gastrointestinal, respiratory, urinary, endocrine and reproductive systems.	PO1	2
CO2	Understand the physiological mechanisms that regulate the functions of nervous, endocrine and reproductive systems.	PO1	2
CO3	Understand the etiology and development of common diseases affecting different organ systems including cancer	PO1	2
CO4	Analyse pathophysiological alterations in the nervous, gastrointestinal, respiratory, renal, and endocrine systems.	PO1, PO2	4
CO5	Understand the clinical manifestations and case findings related to organ system dysfunctions.	PO1, PO2	2

Syllabus

Nervous System: a) Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse and neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem and cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity). b) Pathophysiology of epilepsy, Parkinson's disease, stroke, migraine, depression, schizophrenia, Alzheimer's disease and meningitis. **Gastrointestinal System:** a) Anatomy of GI tract with special reference to anatomy and functions of stomach (acid production in the stomach and its regulation through parasympathetic nervous system; role of pepsin in protein digestion). Anatomy and functions of small intestine and large intestine. Anatomy and functions of salivary glands, pancreas and liver. Movements of GIT, digestion and absorption of nutrients. b) Pathophysiology of inflammatory bowel diseases, peptic ulcer, jaundice, hepatitis, typhoid and alcoholic and non-alcoholic fatty liver disease. **Respiratory System:** Anatomy of respiratory system with special reference to anatomy of lungs. Mechanism of respiration and regulation of respiration. Lung volumes and capacities, transport of respiratory gases, artificial respiration and resuscitation methods. b) Pathophysiology of asthma, chronic obstructive pulmonary diseases and tuberculosis. **Urinary System:** Anatomy of urinary tract with special reference to anatomy of kidney and nephrons. Functions of kidney and urinary tract. Physiology of urine formation, micturition reflex and role of kidneys in acid–base balance. Role of Renin Angitensin Aldosterone System in kidney. d) Pathophysiology of acute and chronic renal failure and urinary tract infections. **Endocrine System:** a) Classification of hormones and mechanism of hormone action. Structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland and thymus. b) Pathophysiology of diabetes, hypothyroidism, hyperthyroidism, goitre and polycystic ovary syndrome. **Reproductive System and Cancer:** a) Anatomy of male and female reproductive system. Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition. b) Pathophysiology of sexually transmitted diseases: AIDS, syphilis and gonorrhoea. c) Etiology and pathogenesis of cancer.

Textbooks:

1. Wilson, K.J.W., Ross and Wilson Anatomy and Physiology in Health and Illness. Churchill Livingstone, New York.
2. Tortora, G.J. and Grabowski, S.R., Principles of Anatomy and Physiology. Palmetto, GA, U.S.A.

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26PY1209P: Human Anatomy, Physiology and Pathophysiology II (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the gross morphology, structures, and functions of various organs and organ systems of the human body.	PO1	2
CO2	Apply basic emergency response procedures, including cardiopulmonary resuscitation (CPR).	PO1, PO3	3
CO3	Understand the etiology and pathogenesis of selected disease states	PO1	2
CO4	Understand the signs, diagnosis, prevention, treatment, and complications of diseases.	PO1, PO3	2
CO5	Understand the coordinated working patterns of different organs of each system and perform experiments related to special senses and the nervous system.	PO1, PO3	2

Syllabus

1. Study of nervous system using specimens and models.
2. Study of respiratory system using models.
3. Study of gastrointestinal system using models.
4. Study of reproductive system using models.
5. Demonstration of general neurological examination.
6. Demonstration of function of olfactory nerve.
7. Examination of different types of taste.
8. Demonstration of visual activity.
9. Demonstration of reflex activity.
10. Recording of body temperature.
11. Determination of tidal volume and vital capacity.
12. Recording of body mass index (BMI).
13. Study of family planning devices and pregnancy diagnosis tests.
14. Understanding pathophysiology of IBD, peptic ulcer, jaundice, hepatitis, typhoid, asthma, tuberculosis, diabetes, and thyroid disorders through case files / case reports.
15. Hands-on training in cardiopulmonary resuscitation (CPR).

Textbooks

1. Wilson, K. J. W., and Waugh, A. Anatomy and Physiology in Health and Illness. Churchill Livingstone, New York.
2. Best, C. H., and Taylor, N. B. The Physiological Basis of Medical Practice. Williams & Wilkins, Baltimore.
3. Guyton, A. C., and Hall, J. E. Textbook of Medical Physiology. Elsevier / W.B. Saunders, Philadelphia.
4. Tortora, G. J., and Grabowski, S. R. Principles of Anatomy and Physiology. John Wiley & Sons.
5. Brunton, L., Chabner, B., and Knollmann, B. Goodman & Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill, New York.

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26PY1210T: Pharmaceutical Organic Chemistry (Theory)

L-T-P-S: 4-0-0-0 **Credits: 4** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the chemical reactions and mechanisms of aliphatic saturated hydrocarbons.	PO1	2
CO2	Understand the reactions and mechanisms of aliphatic unsaturated hydrocarbons.	PO1	2
CO3	Understand nucleophilic substitution and elimination reactions of alkyl halides.	PO1	2
CO4	Understand electrophilic aromatic substitution reactions and the effect of substituents.	PO1	2
CO5	Apply knowledge of carbonyl compounds and reaction mechanisms in pharmaceutical chemistry.	PO1, PO3	3

Syllabus

Aliphatic Saturated Hydrocarbons: Alkanes: Methods of preparation: Wurtz reaction, Kolbe's reaction, Clemmensen reduction, Wolff–Kishner reduction. Chemical reactions of alkanes. Mechanism of free radical substitution (halogenation). Pharmaceutical applications of alkanes: Liquid paraffin, soft paraffin, hard paraffin. Cycloalkanes: Baeyer's strain theory and its limitations. Coulson–Moffitt modification. Sachse–Mohr theory. **Aliphatic Unsaturated Hydrocarbons:** Alkenes: Methods of preparation: Dehydration of alcohols, Dehydrohalogenation of alkyl halides, Dehalogenation of vicinal dihalides and Wittig reaction. Chemical reactions of alkenes. Mechanism of electrophilic addition reactions. Markovnikov's and anti-Markovnikov's rule. Ozonolysis. Conjugated Dienes: Stability of conjugated dienes and Mechanism of Diels–Alder reaction. Electrophilic and free radical addition reactions: 1,2- and 1,4-addition reactions. **Alkyl Halides:** Nucleophilic substitution reactions: SN1 and SN2: Mechanism, kinetics, substrate structure, solvent effect, stereochemistry. Elimination reactions: E1 and E2: Mechanism, kinetics, substrate structure, solvent effect, stereochemistry. Zaitsev's (Saytzeff's) rule with examples. Comparison of substitution vs elimination reactions. **Benzene and Its Derivatives:** IUPAC nomenclature of mono- and di-substituted benzene derivatives. Structure of benzene. Molecular orbital picture and resonance. Aromaticity and Hückel's rule. Electrophilic aromatic substitution reactions: Nitration, Halogenation, Friedel–Crafts alkylation and its limitations, Friedel–Crafts acylation and Sulphonation and desulphonation. Effect of substituents on reactivity and orientation. **Carbonyl Compounds:** Aldehydes and Ketones: Preparation and properties of carbonyl compounds. Nucleophilic addition reactions. Aldol condensation and crossed aldol condensation. Cannizzaro and crossed Cannizzaro reactions. Benzoin and Perkin condensation. Oxidation and reduction reactions. Pharmaceutical applications of carbonyl compounds: Chloral, Paraldehyde, Ketoprofen.

Textbooks:

1. Morrison, R.T., Boyd, R.N. and Bhattacharjee, S.K., Organic Chemistry. Pearson Education India.
2. Finar, I.L., Organic Chemistry, Vol. I. Pearson Books.

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26PY1210P: Pharmaceutical Organic Chemistry (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the preliminary qualitative tests used for identifying water-insoluble and immiscible organic compounds.	PO1	2
CO2	Understand the synthesis methods for preparing simple organic compounds and their derivatives.	PO1, PO3	2
CO3	Apply crystallization techniques to purify organic compounds effectively	PO1, PO3	3
CO4	Analyse experimentally to detect elements and functional groups to identify unknown organic compounds.	PO1, PO3	4
CO5	Understand the qualitative analysis of organic compounds to confirm their chemical nature.	PO1, PO2	2

Syllabus

Systematic qualitative analysis of minimum of five water-insoluble or water-immiscible unknown organic compounds from different chemical classes: Preliminary tests: Color, odour, Solubility tests, test for aromaticity, test for saturation/unsaturation etc. Detection of elements such as nitrogen, sulphur and halogens by Lassaigne's test. Determination of Functional group tests such as phenols, amides, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated hydrocarbons and nitro compounds. Preparation of the derivatives and confirmation of the unknown organic compound by melting point / boiling point.

Building Molecular Models: Students will use ball-and-stick models to create structures of molecules and understand their shapes and bonding.

Crystallization Method: Students will learn how to purify three organic compounds using the crystallization technique.

Textbooks

1. Furniss, B. S., Hannaford, A. J., Smith, P. W. G. and Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry. Longman Scientific & Technical, London.
2. Mann, F. G. and Saunders, B. C. Practical Organic Chemistry. Pearson Education.
3. Shriner, R. L., Hermann, C. K. F., Morrill, T. C., Curtin, D. Y. and Fuson, R. C. The Systematic Identification of Organic Compounds. John Wiley & Sons.
4. Vogel, A. I. Elementary Practical Organic Chemistry. Longman Group Ltd.
5. Pavia, D. L., Lampman, G. M., Kriz, G. S. and Engel, R. Introduction to Organic Laboratory Techniques. Cengage Learning.

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26PY1211T: Pharmacognosy And Phytochemistry (Theory)

L-T-P-S: 4-0-0-0 **Credits: 4** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the biosynthetic pathways and genetic tools involved in phytoconstituent production	PO1, PO4	2
CO2	Understand the classification and therapeutic significance of drugs containing primary and secondary metabolites.	PO1	2
CO3	Apply traditional and modern extraction and isolation methods	PO1, PO3, PO4	3
CO4	Understand the qualitative and quantitative analysis of plant metabolites.	PO1, PO8	2
CO5	Understand the identity, purity, and quality of herbal raw materials.	PO1, PO2	2

Syllabus

Metabolic Pathways and Biogenetic Studies: Brief study of basic metabolic pathways and biosynthesis of secondary metabolites including: Shikimic acid pathway, Acetate pathway and Amino acid pathways. Utilization of radioactive isotopes in biogenetic studies. Introduction to pathway prediction tools and modern genetic tools such as CRISPR/Cas9. **Primary Metabolites:** General classification and identification tests: Pharmacognostic study (biological source, distribution, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of: Carbohydrates: Acacia, Agar, Tragacanth and Honey. Proteins and Enzymes: Gelatin, Casein and Proteolytic enzymes: Papain, Bromelain, Serratiopeptidase, Urokinase, Streptokinase, Pepsin. Lipids (Waxes, Fats, Fixed Oils): Castor oil, Olive oil, Cocoa butter, Wool fat and Beeswax. **Secondary Metabolites:** General classification and identification tests Pharmacognostic study (biological source, distribution, cultivation of underlined drugs, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of: Alkaloids: Vinca, Rauwolfia and Opium. Volatile Oils: Lemongrass, Clove, Cinnamon and Fennel. Tannins: Myrobalans, Catechu and Pomegranate. Resins: Guggul and Asafoetida. Glycosides: Senna, Liquorice and Digitalis. Phenylpropanoids and Flavonoids: Green Tea, Ginkgo and Flax seed. Iridoids, Other Terpenoids and Naphthoquinones: Gentian and Artemisia. **Extraction Methods for Medicinal Plants:** Conventional Methods of Extraction: Infusion, Decoction, Digestion, Maceration, Percolation, Reflux, Distillation, Soxhlet extraction and Successive solvent extraction. Modern Methods of Extraction: Supercritical fluid extraction, Microwave-assisted extraction, Ultrasonic-assisted extraction, Enzyme-assisted extraction and Pressurized liquid extraction. **Overview of Isolation, Identification and Characterization Techniques:** Separation and Isolation Techniques: Planar chromatography, Column chromatography, Preparative TLC and Flash chromatography. Identification Techniques: Phytochemical tests, Chromatographic techniques and Spectroscopic techniques. Fingerprinting of medicinal plants using TLC/HPTLC. Types and significance of markers (phytochemical reference standards). Screening and analysis of major metabolites: Alkaloids, Glycosides, Saponins, Tannins, Resins, Flavonoids, Phenolics and Steroids.

Textbooks:

1. Dewick, P.M., Medicinal Natural Products: A Biosynthetic Approach. John Wiley & Sons.
2. Evans, W.C., Trease and Evans' Pharmacognosy. W.B. Saunders & Co., London.
3. Wagner, H., and Bladt, S., Plant Drug Analysis: A Thin Layer Chromatography Atlas. Springer-Verlag.
4. Harborne, J.B., Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Chapman & Hall.

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26PY1211P: Pharmacognosy And Phytochemistry (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Identify unorganized crude drugs using specific chemical tests.	PO1, PO8	2
CO2	Analyse organized crude drugs through microscopy and powder analysis.	PO1, PO2	4
CO3	Understand and perform appropriate extraction methods for herbal drugs.	PO1, PO3	2
CO4	Isolate and characterize phytoconstituents using laboratory techniques and TLC.	PO1, PO3	3
CO5	Analyse the quality and purity of herbal raw materials using official standards.	PO1, PO2	4

Syllabus

1. Chemical tests for identification of Agar, Acacia, Tragacanth, Honey.
2. Chemical tests for identification of Castor oil, Olive oil, Wool fat, Beeswax.
3. Chemical tests for identification of Asafoetida, Catechu, Aloe.
4. Transverse section and powder microscopy of a vinca leaf.
5. Transverse section and powder microscopy of a cinnamon bark.
6. Transverse section and powder microscopy of a fennel fruit.
7. Transverse section and powder microscopy of a clove flower bud.
8. Transverse section and powder microscopy of a Tulsi stem.
9. Transverse section and powder microscopy of a Liquorice roots.
10. Study of effect on different extraction techniques on yield of crude extract (maceration, decoction, soxhlation).
11. Isolation of volatile oil and it's TLC.
12. Isolation of caffeine from tea.
13. Isolation of Hesperidin from lemon peel.
14. Isolation of Glycyrhizin from liquorice roots.
15. Isolation of Pectin from orange peel.
16. Experiential learning based experiment involving evaluation and comparison of field/market collected herbal raw materials with Pharmacopeial standards.

Textbooks

1. Trease, G. E. and Evans, W. C. Pharmacognosy. Elsevier.
2. Harborne, J. B. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Springer.
3. Wallis, T. E. Textbook of Pharmacognosy. CBS Publishers & Distributors, New Delhi.
4. Tyler, V. E., Brady, L. R. and Robbers, J. E. Pharmacognosy. Lea & Febiger.

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26PY1212T: Physical Pharmaceutics (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental principles of pharmaceutical manufacturing processes and unit operations.	PO1, PO2	2
CO2	Analyse the physicochemical properties of drugs and excipients and correlate them with formulation stability, quality, and performance	PO1, PO2	4
CO3	Apply concepts of interfacial phenomena, colloids, and dispersions in the design and evaluation of pharmaceutical dosage forms.	PO1, PO5	3
CO4	Analyse pharmaceutical processes by controlling rheology, micromeritics, and dispersion variables.	PO1, PO2	4
CO5	Apply foundational concepts in formulation development, industrial pharmacy, and pharmaceutical research.	PO1, PO5	3

Syllabus

Solubility distribution phenomenon & buffers: Solubility expression, Solute solvent interactions, Solubility of liquid and liquids, Solubility of solids and liquids, Solubility of Gas in Liquids, Raoult's Law. Factors affecting solubility, Measurement of saturation Solubility, Effect of pH on solubility, Partition Coefficient – Measurement and significance, Critical Solution Temperature and Applications. Introduction to buffers, Buffers in pharmaceutical and biological system, pH determination methos (Electrometry and colorimetry). Buffer equation / Factor influencing the pH of buffer solutions, Factor influencing Buffer capacity, General procedure for preparing buffers, Indicators. **Interfacial phenomenon:** Liquid interface: Surface and interfacial tension, surface free energy, Measurement of surface and interfacial tension, Spreading coefficient, surface active agent, HLB, detergency, types of monolayers at liquid surface. Adsorption at solid interface, Liquid Interface (contact angle, activated charcoal and Wetting). Adsorption of surface-active agents. Electric properties of interface / Electric double layer, Nernst and zeta potential effect of electrolytes. **Colloidal and Coarse Dispersion:** Colloidal dispersions: Types of colloidal dispersions (Lyophobic, Lyophilic, Association colloids), Optical properties of colloids, Kinetic properties of colloids, Electrical properties of colloids, Size and shape of colloidal systems, Stability of colloidal system (peptization and protective action), Application of Colloidal System. Coarse Dispersions: Suspensions, stokes law (Theory of sedimentation), Effect of Brownian movement / Sedimentation of flocculated particles, sedimentation parameters. Flocculation and controlled structure flocculation. Theories of emulsification and stabilizaition (DLVO Theory, Monomolecular adsorption, Multimolecular adsorption, Film formation, Solid particle adsorption). Physical instabilities of emulsions (creaming, coalescence and breaking, and phase inversion). **Rheological studies:** Newtonian systems and non-Newtonian systems. Thixotropy – measurement / Bulges and spurs. Negative thixotropy, Determination of rheological properties (Viscometers / single and multi-point). Viscoelasticity, psycho-rheology. Applications of rheology in pharmacy. **Micromeritics:** Particle size and size distribution, Particle Shape and Surface area: Methods for determination and significance. Flow properties of powders: determination, significance and methods of enhancement. Advanced flow properties of powers (Powder flow tester).

Textbooks:

1. Sinko, P.J., Martin's Physical Pharmacy and Pharmaceutical Sciences.
2. Allen, L.V. and McPherson, T.B., Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.

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26PY1212P: Physical Pharmaceutics (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply principles and procedures to measure surface tension, viscosity, density, and related physical properties using standard laboratory apparatus.	PO1, PO3, PO4	3
CO2	Analyse surfactant parameters such as CMC and HLB and interpret their significance in formulation stability and performance.	PO1, PO2, PO3	4
CO3	Analyse sedimentation behavior and the effect of suspending agents on dispersion stability.	PO1, PO2, PO3	4
CO4	Analyse the micromeritic and flow properties of powders and interpret the effect of glidants.	PO1, PO2, PO4	4
CO5	Apply experimental findings on physicochemical properties to formulation decisions.	PO1, PO2, PO3	3

Syllabus

1. Determination of surface tension of given liquids by drop count method and drop weight method.
2. Determination of critical micellar concentration (CMC) of surfactants.
3. Determination of viscosity of liquids using Ostwald's viscometer and Brookfield viscometer.
4. Determination of HLB value of a surfactant.
5. Calculation of isotonicity by different methods (Sodium Chloride Equivalent Method).
6. Determination of particle size and particle size distribution using sieving method.
7. Determination of particle size and particle size distribution using microscopic method.
8. Determination of densities and derived properties of powders (bulk density, tapped density, Hausner ratio, Carr's compressibility index), true density, and porosity.
9. Determination of angle of repose and influence of glidants on angle of repose.
10. Determination of solubility of a drug at different pH/buffer systems at room temperature.
11. Determination of partition coefficient of a drug in n-octanol and water system.
12. Determination of partition coefficient of a drug in benzene and water system.
13. Determination of critical solution temperature and composition of phenol–water system.
14. Determination of specific surface area of charcoal by adsorption of acetic acid on activated charcoal.
15. Determination of buffer capacity at various stages of titration of a weak acid against a strong base and determination of pKa.

Textbooks

1. Sinko, P. J. Martin's Physical Pharmacy and Pharmaceutical Sciences. Lippincott Williams & Wilkins.
2. Aulton, M. E. and Taylor, K. M. G. Aulton's Pharmaceutics: The Design and Manufacture of Medicines. Elsevier.
3. Lachman, L., Lieberman, H. A. and Kanig, J. L. The Theory and Practice of Industrial Pharmacy. CBS Publishers & Distributors.
4. Allen, L. V., Popovich, N. G. and Ansel, H. C. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. Lippincott Williams & Wilkins.

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26PYSEC01: Communication Skills

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply effective verbal and non-verbal communication skills in clinical, retail, and academic pharmacy settings.	PO1, PO3, PO7	3
CO2	Apply patient counselling skills in pharmacy practice scenarios.	PO3, PO7, PO9	3
CO3	Apply professional communication skills to develop emails, patient information leaflets, and drug labels.	PO3, PO7, PO9	3
CO4	Apply effective communication skills to deliver presentations and patient-friendly medical information.	PO3, PO7, PO9	3
CO5	Apply principles of ethical and culturally sensitive communication in handling patients and professional interactions.	PO3, PO7, PO9	3

Syllabus

1. **Introduction to Communication in Pharmacy:** Types of communication: verbal, non-verbal, written and Importance in clinical, academic, and retail pharmacy.
2. **Listening and Observation Skills Workshop:** Active listening techniques, barriers to listening and Observation of cues: patient posture, tone, compliance.
3. **Role-play:** Communicating with a Patient for Dispensing a Prescription: Explanation of dosage, frequency, side effects, and precautions.
4. **Role-play:** Handling Difficult Conversations (e.g., Angry Patient or Confused Elderly): Empathy, patience, tone modulation, de-escalation technique.
5. **Written Communication I:** Professional Email Writing & Documentation: Writing emails to doctors, suppliers, institutions and Structure, etiquette, and clarity in pharmacy communications.
6. **Written Communication II:** Preparing Patient Information Leaflets and Drug Labels: Use of simple language, drug facts, precautions, icons and Creating flyers for common conditions (e.g., diabetes, asthma).
7. **Non-verbal Communication Skills:** Body language, eye contact, gestures, tone of voice and Cross-cultural sensitivity in pharmacy communication.
8. **Presentation Skills I:** Basic Techniques: Voice projection, clarity, use of visuals and Individual practice with simple pharmacy topics.
9. **Presentation Skills II:** Group Presentations: Topics: health awareness campaigns, drug education, OTC safety and Peer and faculty feedback.
10. **Patient Counselling Practice (Case-Based):** Counselling for chronic illness (e.g., hypertension, diabetes) and Role-playing real-life counselling situations.
11. **Communicating with Healthcare Professionals:** Case handoff, drug information request, referral writing and Using SBAR (Situation, Background, Assessment, Recommendation) format.
12. **Mock Interview / Group Discussion Practice:** Industry/clinical job interview scenarios and GD on topics like "Generic vs Branded Medicines".

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13. **Digital Communication Skills for Pharmacists:** Creating a simple health blog, social media awareness post and Basics of teleconsultation and e-Pharmacy chat support.
14. **Ethics and Professionalism in Communication:** Confidentiality, patient rights, informed consent and Role-play ethical dilemmas in pharmacy
15. **Assessment & Reflection**: Final presentation or counselling demo and Feedback, self-evaluation, and faculty observation.

Textbooks

1. Communication Skills in Pharmacy Practice – E. M. Kelly & S. L. Svarstad, Lippincott Williams & Wilkins.
2. Developing Communication Skills for Pharmacy – Catherine Langford, Pharmaceutical Press.
3. Patient Counselling Guidelines for Pharmacists – WHO India, World Health Organization

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26PYSEC02: Mental Well-Being, Stress and Conflict Management

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the sources and effects of stress in personal and professional life.	PO1, PO11	2
CO2	Apply stress management techniques such as mindfulness, journaling, and relaxation exercises.	PO1, PO11	3
CO3	Apply conflict management strategies to resolve interpersonal and workplace conflicts.	PO7, PO8	3
CO4	Apply emotional intelligence and resilience in professional practice.	PO3, PO11	3
CO5	Apply effective communication skills for personal and professional growth.	PO2, PO5	3

Syllabus

1. Self-assessment of stress levels using Perceived Stress Scale (PSS).
2. Journaling activity: Maintain a 7-day emotional diary.
3. Mindfulness breathing exercise and reflection.
4. Guided meditation session and feedback form.
5. Time management activity using Eisenhower Matrix.
6. Role-play exercise on workplace conflict resolution.
7. SWOT analysis of personal behavior and coping mechanisms.
8. Cognitive restructuring worksheet for negative thoughts.
9. Group discussion: "How do you respond to stress?"
10. Conflict styles self-test (Thomas-Kilmann Conflict Mode Instrument).
11. Visualization technique to reduce anxiety.
12. Progressive muscle relaxation practice.
13. Team activity: Building trust through icebreakers and communication.
14. Reflection report after practicing gratitude for 5 days.
15. Case study analysis: Conflict scenario in a healthcare/pharma setup

Textbooks

1. The Relaxation and Stress Reduction Workbook – Martha Davis, Elizabeth Robbins Eshelman & Matthew McKay, New Harbinger Publications.
2. Managing Stress: Principles and Strategies for Health and Well-Being – Brian Luke Seaward, Jones & Bartlett Learning.
3. Emotional Intelligence – Daniel Goleman, Bantam Books.
4. The 7 Habits of Highly Effective People – Stephen R. Covey, Simon & Schuster.
5. Conflict Management: A Practical Guide to Developing Negotiation Strategies – Barbara A. Budjac Corvette, Pearson Education.
6. Mindfulness: An Eight-Week Plan for Finding Peace in a Frantic World – Mark Williams & Danny Penman, Rodale Books.
7. Stress Management for Life: A Research-Based Experiential Approach – Michael Olpin & Margie Hesson, Cengage Learning

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26PYSEC03: Fundamentals of Computer Operations

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply computer system operations and basic file management functions.	PO3, PO4	3
CO2	Apply skills to prepare and format digital documents and spreadsheets for academic and pharmaceutical use.	PO3, PO4	3
CO3	Apply digital tools to develop presentations and communicate effectively in professional settings.	PO4, PO5	3
CO4	Understand the use of online databases and academic search platforms for scientific information retrieval.	PO1, PO4	2
CO5	Apply basic computer skills for organizing, analyzing, and managing pharmaceutical data and documents.	PO3, PO4	3

Syllabus

1. Basic operation and navigation of a computer operating system, including system settings and file explorer functions.
2. Creating, renaming, organizing, moving, and deleting files and folders within a computer system.
3. Preparing a structured academic or pharmacy-related report using a word-processing application with appropriate formatting, tables, headers, and page layout.
4. Inserting equations, images, and formatted elements while preparing documents such as reports, notices, or certificates using document editing tools.
5. Creating spreadsheets for pharmacy-related calculations such as dose calculations, inventory records, or sales data using spreadsheet applications.
6. Applying basic spreadsheet formulas and functions such as summation, averaging, conditional calculations, and counting operations.
7. Generating graphs, charts, and data visualizations from experimental or pharmaceutical data using spreadsheet tools.
8. Preparing a short academic presentation (approximately five slides) using presentation software with text, images, and basic design elements.
9. Performing effective internet browsing and academic search techniques using online scientific literature databases and search platforms.
10. Writing and sending professional emails including file attachments, proper subject lines, and appropriate use of CC and BCC with correct communication etiquette.
11. Introduction to digital systems used in pharmacy practice such as billing, inventory management, or prescription management through demonstration or simulation.
12. Using cloud-based storage platforms for saving, organizing, and sharing academic or pharmacy-related files and data.
13. Exploring digital health technologies such as pharmacy-related mobile applications or electronic health tools used in healthcare practice.
14. Accessing and utilizing online learning platforms for professional education and course materials.
15. Preparing and submitting digital assignments using word-processing, spreadsheet, or presentation tools.

Textbooks:

1. Introduction to Computers – Peter Norton, McGraw-Hill Education.
2. Computer Basics: Absolute Beginner's Guide – Michael Miller, Que Publishing

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26PY2113T: Introduction to Machine Learning in Pharmaceutical Sciences (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basic concepts of artificial intelligence, machine learning, and model development.	PO1, PO4	2
CO2	Apply regression models to Analyse pharmaceutical data and interpret model outputs and performance metrics.	PO1, PO4	3
CO3	Analyse classification models using performance evaluation metrics.	PO1, PO4	4
CO4	Understand the tree-based and ensemble learning models for decision-making in pharmaceutical and healthcare applications.	PO1, PO4	2
CO5	Apply the unsupervised learning techniques such as clustering to identify patterns in healthcare and pharmaceutical datasets.	PO1, PO4	3

Syllabus:

Foundations of Machine Learning: Definition and scope of Artificial Intelligence, Machine Learning, and Data Science. Types of machine learning: supervised, unsupervised, and reinforcement learning, Features and labels, training data and testing data, Concept of model building and prediction, Train-test split, overfitting and underfitting, Conceptual explanation of bias-variance trade-off and Overview of the basic ML workflow. **Regression Models in Healthcare:** Overview of the concepts in predictive modeling for continuous outcomes, with emphasis on interpretation of outputs, and applications in pharmaceutical sciences. Linear regression and multiple linear regression, Model coefficients and their interpretation, Residuals and goodness-of-fit, Performance metrics such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R^2 score and Implementation of regression models on pharmaceutical data (e.g. dose–response relationships, predicting drug dissolution rates, estimating PK parameters), and demonstration of predictive modeling using python libraries such as sklearn. **Classification Models in Clinical Applications:** Overview of the following ML models used for categorical prediction, with emphasis on conceptual understanding, interpretation of outputs and applications in pharmaceutical sciences. Logistic regression, Probability output and threshold selection, Confusion matrix, Accuracy, sensitivity, specificity, precision, recall, Intuitive understanding of ROC curve and AUC, and k Nearest Neighbors and Demonstration of predictive modeling using pharmaceutical and clinical examples such as predicting adverse drug reactions, disease risk prediction, binary therapeutic outcome modeling. **Tree-Based Models & Ensemble Learning:** Overview of the following ML models with emphasis on intuitive and conceptual understanding. Decision Trees (structure and splitting criteria), interpretation of decision paths and feature importance, Random Forest, overview of ensemble concept, Advantages and limitations of tree-based models and Demonstration of these models for pharmaceutical and clinical applications such as ADR risk stratification, Patient classification, Predicting treatment outcomes etc.

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Unsupervised Learning & Practical Case Studies: Overview of the unsupervised learning with emphasis on intuitive and conceptual understanding of pattern recognition and clustering, and their applications in pharmaceutical sciences. Concept of unsupervised learning. Clustering overview, K-means clustering, choosing number of clusters, Interpreting cluster outputs and Mini-case study integrating regression, classification, or clustering on healthcare datasets to demonstrate Patient segmentation, and drug grouping based on properties.

Textbooks:

1. James, G., Witten, D., Hastie, T. and Tibshirani, R. An Introduction to Statistical Learning with Applications in Python. Springer.
2. Simon, G. J. and Aliferis, C. Artificial Intelligence and Machine Learning in Health Care and Medical Sciences: Best Practices and Pitfalls. Springer.
3. Brown, N. Artificial Intelligence in Drug Discovery. Royal Society of Chemistry.
4. Walters, S. J., Campbell, M. J. and Machin, D. Medical Statistics: A Textbook for the Health Sciences. Wiley-Blackwell.
5. Géron, A. Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow. O'Reilly Media.

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26PY2114T: Environmental Sciences (Theory)

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basic concepts of environmental pollution, its types, causes, and disaster management strategies.	PO1, PO10	2
CO2	Understand the types of pharmaceutical and biomedical waste.	PO1, PO10	2
CO3	Understand the design and operation of ETPs, STPs, and pharmaceutical water purification systems	PO1, PO8	2
CO4	Analyse the environmental risks posed by pharmaceutical manufacturing, APIs, and dosage forms.	PO1, PO10	4
CO5	Understand the importance of sustainability and green pharmacy practices in the pharmaceutical industry.	PO1, PO10	2

Syllabus

Environmental Pollution: Definition, scope, and importance of environmental studies. Types, causes, effects, and control measures of Air, water, soil, noise, and nuclear pollution. Solid waste and hazardous waste management in pharmaceuticals. Role of pharmacists in conservation and sustainable use of resources **Pharmaceutical Waste and Effluent Management:** Types of pharmaceutical waste: chemical, expired drugs, packaging, biomedical waste. Biomedical Waste Management Rules (2016) and CPCB guidelines. Effluent Treatment Plant (ETP) design and functioning. Water purification methods in pharmaceutical settings (RO, UV, distillation, filtration) **Environmental Impact of the Pharmaceutical Industry:** Sources of pollution in pharmaceutical manufacturing. Types of pharmaceutical waste: solid, liquid, and gaseous. Environmental risks of active pharmaceutical ingredients (APIs) and its dosage forms. Impact of pharmaceutical residues on ecosystems and human health **Sustainability in the Pharmaceutical Sector:** Principles of sustainable development in pharma. Principles and Practices of Green pharmacy. Energy conservation and resource optimization **Government Policies, Compliance, and Practical Exposure:** Environmental laws: Environment (Protection) Act, 1986 and Water (Prevention and Control of Pollution) Act. National Green Tribunal (NGT) and regulatory bodies (CPCB, SPCB). Government initiatives: Swachh Bharat Abhiyan, River rejuvenation program- Namami Gange Programme and Jal Jeevan Mission. ISO-14000.

Textbooks

1. Bharucha, E. Environmental Studies. University Grants Commission, New Delhi.
2. Rajagopalan, R. Environmental Studies. Oxford University Press.
3. Joseph, B. Environmental Studies. Tata McGraw Hill.

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26PY2115T: Ethics and Universal Human Values (Theory)

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles, content, and process of Value Education and apply ethical values in day-to-day life.	PO1, PO3, PO4	2
CO2	Apply self-awareness and right understanding for personal growth and well-being.	PO1, PO3, PO4	3
CO3	Analyse the needs of the Self and the Body to establish harmony.	PO1, PO2	4
CO4	Apply values such as respect, affection, kindness, gratitude, and love to maintain harmony in family and society.	PO1, PO3, PO4	3
CO5	Understand the harmony in nature, the four orders of nature, and the comprehensive human goal.	PO1, PO2	2

Syllabus

Introduction to Value Education: Concept, definition, and need for value education. Content and process of value education. Application of human values in everyday life. **Self-Exploration and Human Aspirations**: Self-exploration as a means of value education. Development of positive attitude and self-confidence. Right understanding of happiness and prosperity. **Harmony in the Human Being:** Human being as more than just the physical body. Harmony between the Self ('I') and the Body. Understanding the coexistence of the Self and the Body. **Harmony in the Individual and Society:** Understanding the needs of the Self and the needs of the Body. Activities of the Self and activities of the Body. Family as the basic unit of human interaction and the role of values in relationships. Foundations of respect in relationships: affection, kindness, guidance, reverence, glory, gratitude, and love. **Harmony in Society and Nature:** Comprehensive human goal: the five dimensions of human endeavour. Harmony in nature and the four orders in nature. Holistic perception of harmony in existence.

Textbooks

1. Tripathi, A. N. Human Values. New Age International Publishers, New Delhi.
2. Gaur, R. R., Asthana, R. and Bagaria, G. P. A Foundation Course in Human Values and Professional Ethics. Excel Books, New Delhi.
3. Gaur, R. R., Asthana, R. and Bagaria, G. P. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics. Excel Books, New Delhi.
4. Raghavan, V. Universal Human Values. Excel Books.
5. Gaur, R. R., Sangal, R. and Bagaria, G. P. Human Values and Professional Ethics. Excel Books.
6. Govindarajan, M., Natarajan, S. and Senthil Kumar, V. S. Engineering Ethics. Prentice Hall India.

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26PY2116T: General Pharmacology (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental principles of pharmacodynamics and pharmacokinetics of drugs actions on the human body.	PO1	2
CO2	Understand the drug metabolism, toxicity, and safety evaluation in preclinical drug development.	PO1, PO9	2
CO3	Apply the knowledge of pharmacological principles to efficacy, toxicity, and safety evaluation of new drug candidates.	PO1, PO4	3
CO4	Analyse the ethical and scientific principles of drug safety, efficacy, and toxicity testing.	PO1, PO2	4
CO5	Analyse the recent trends in pharmacology.	PO1, PO4	4

Syllabus

Introduction to Pharmacology: Definition, historical perspectives, branches of pharmacology and their scope, drug, nature and sources of drugs, International Classification of Diseases (ICD) and International Non proprietary Names (INN) for drugs. Concept of generic medicines, essential drugs and rational drug use (RDU). Indian Government's initiatives to promote these concepts. Routes of drug administration along with their advantages and disadvantages. **Pharmacokinetics:** Drug absorption, mechanisms of drug absorption, membrane transporters, bioavailability, bioequivalence, factors affecting drug absorption. Drug distribution in different compartments, volume of distribution, storage sites, plasma protein binding and its therapeutic importance. Drug biotransformation, microsomal, non- microsomal metabolism and cytochrome P450 enzyme system, phase I and II reactions, first-pass metabolism, entero-hepatic cycling, concept of prodrugs. Drug excretion and its kinetics. **Pharmacodynamics:** Types drug action and mechanisms of drug action, dose response relationship. Receptor theories, structure of receptors, classification and regulation of receptors, spare receptors. Concept of agonist, inverse agonist, partial agonist and antagonist. Signal transduction mechanisms of receptors. Factors modifying drug action including the concepts of tachyphylaxis, idiosyncrasy, drug tolerance, dependence, addiction, and the combined effect of drugs (Additive effect & Synergism). Adverse drug reactions (ADR) and types of ADRs. Drug interaction, types, pharmacokinetic and pharmacodynamic drug-drug interactions. **Overview of drug discovery and evaluation of new drug:** Brief discussion on drug discovery and preclinical evaluation of new drugs. Human relevant screening techniques: Reconstructed human epidermis, organ-on- Chip model, skin irritancy test by reconstructed corneal epithelium, skin corrosivity testing by Direct Peptide Reactivity Assay. Advantages and disadvantages of in vitro and in silico Pharmacological screening and evaluation. **Recent trends in pharmacology:** Chronopharmacology: Introduction, biological clock, types of rhythms, hormones, diseases and drugs affected by circadian rhythm. Introduction to chrono kinetics and importance of chronotherapeutic and future scope. Introduction, general principles, applications and scope of Pharmacogenomics, Gene therapy, Biosimilars and Precision medicine.

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Toxicology: Introduction to toxicology and its branches. Classification of poisons based on actions and lethal doses, types of antidotes. General principles of treatment of acute poisoning include heavy metal poisoning. Management of poisoning. Definition and basic knowledge of preclinical toxicity testing-acute toxicity, sub-acute toxicity, combined chronic and carcinogenicity testing as per OECD norms. Basic understanding of principles of genotoxicity and teratogenicity as per OECD guidelines. Definition and concepts of safety pharmacology as per ICH and OECD guidelines.

Textbooks

1. Brunton, L., Hilal-Dandan, R. and Knollmann, B. Goodman and Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill Education.
2. Rang, H. P., Dale, M. M., Ritter, J. M., Flower, R. J. and Henderson, G. Rang and Dale's Pharmacology. Elsevier.
3. Katzung, B. G. and Trevor, A. J. Basic and Clinical Pharmacology. McGraw-Hill Education.
4. Whalen, K. and Finkel, R. Lippincott's Illustrated Reviews: Pharmacology. Wolters Kluwer.
5. Tripathi, K. D. Essentials of Medical Pharmacology. Jaypee Brothers Medical Publishers.

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26PY2116P: General Pharmacology (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the pharmacological actions and therapeutic uses of drugs on physiological systems.	PO1	2
CO2	Analyse pharmacological experimental results to evaluate drug efficacy and safety.	PO1, PO2, PO3	4
CO3	Apply the knowledge of drug mechanisms and interactions to predict clinical outcomes.	PO1, PO2, PO3	3
CO4	Apply documentation and data collection skills for pharmacological investigations.	PO1, PO3, PO4	3
CO5	Understand the importance of pharmacology in drug development, clinical research, and its application in medical practice.	PO1, PO3, PO4	2

Syllabus

1. To describe the contributions of renowned pharmacologists and their discoveries based on pharmacological experiments (Any 5 Noble Laureates whose research contributed to the development of Pharmacology).
2. To study various laboratory safety precautions, hazards, personal hygiene, commonly used tools, devices and instruments in experimental pharmacology.
3. To study common experimental animals including transgenic animals along with their applications in the pharmacological experiments in current drug discovery paradigm.
4. To study concept of 6Rs along with the maintenance and experimentation on laboratory animals as per the CCSEA guidelines.
5. To demonstrate collection/isolation of DNA and RNA using computer simulations and audiovisual aids.
6. To study important anaesthetics and euthanasia procedures for experimental animals.
7. To demonstrate different routes drug administration using computer simulation and understand the significance of each route along with the maximum administrable dose.
8. To study preparation of different types of physiological salt solutions (PSS), cell culture media and to understand the role of each ingredient used in PSS preparation.
9. To study the instrumentation used for isolated tissue experiments (students organ bath assembly) and recent development in recording of the responses of isolated tissues.
10. To record the dose response curve of any two agonists on suitable isolated tissue preparation using computer simulation experiment.
11. To study the potentiating effect of physostigmine on DRC of acetyl choline through interactive computer simulation.
12. To study antagonizing effect of d-tubocurarine on the DRCs of acetylcholine through interactive computer simulation.
13. To determine of PD2 of given agonists using isolated tissue preparation using computer simulation experiment.

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14. To study and determine various pharmacokinetic parameters (Cmax, Tmax, Ke, t½, Vd, Clt, AUC, AUMC) from given hypothetical data.
15. To estimate LD_{50} using hypothetical data through computer-simulated experimentation (as per OECD 425 guideline) using software.
16. Software based quantification of micronucleus test and chromosomal aberration test
17. Software based prediction of teratogenicity.
18. Use of UV-Spectrophotometer for studying drug-protein interactions.

Textbooks

1. Ghosh, M. N. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
2. Vogel, H. G. Drug Discovery and Evaluation: Pharmacological Assays. Springer.
3. Hofmann, F. B. Handbook of Experimental Pharmacology (HEP Series). Springer Nature.
4. Organisation for Economic Co-operation and Development. OECD Guidelines for the Testing of Chemicals.
5. International Council for Harmonisation. ICH Guideline S7A: Safety Pharmacology Studies for Human Pharmaceuticals.
6. International Council for Harmonisation. ICH Guideline S7B: Nonclinical Evaluation of the Potential for Delayed Ventricular Repolarization.

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26PY2117T: Heterocyclic Compounds and Stereochemistry (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the preparation methods and chemical reactions of organic compounds.	PO1, PO3	2
CO2	Understand the acidity, basicity, and medicinal relevance of organic compounds.	PO1	2
CO3	Illustrate the concepts of stereoisomerism with appropriate examples.	PO1, PO4	2
CO4	Understand the classification, nomenclature, and chemistry of heterocyclic compounds.	PO1, PO2	2
CO5	Understand the synthesis, chemical behaviour, and applications of heterocyclic and polynuclear hydrocarbon compounds.	PO1, PO2, PO4	2

Syllabus

Chemistry of Carboxylic acids, Phenols, Amines and Polynuclear Aromatic hydrocarbons: Aliphatic and aromatic carboxylic acids: Methods to prepare carboxylic acids (Oxidation of alcohols, carbonation of Grignard reagent, Kolbe-Schmidt reaction). Study of acidity of carboxylic acids and effect of substituents on acidity. Study of chemical reactions of carboxylic acids [Mechanism of nucleophilic acyl substitution, Decarboxylation and Hell-Volhard Zelinsky reaction]. Pharmaceutical applications of aromatic carboxylic acids (Benzoic acid, Salicylic acid, Acetyl Salicylic acid). Aliphatic and aromatic amines: Methods to prepare amines (Reduction of nitro compound, reduction of nitriles and Hofmann degradation of amides). Study of basicity of amines and effect of substituents on basicity. Study of mechanism and synthetic applications of diazonium salts including Sandmeyer's and azo-dye coupling reaction. Alcohols and Phenols: Classification of alcohols, methods to prepare alcohols (oxymercuration - demercuration, reduction of carbonyl compounds). Acidity of alcohols and Phenols including effect of substituent on acidity. Definition of phenols, method to prepare phenols by cumene process. Comparison of the acidity of phenol vs alcohol. Study of mechanism of chemical reactions of phenols (Reimer Tiemann reaction, halogenation and nitration of phenols). Pharmaceutical applications of alcohols and phenols (Glycerine, Thymol, Paracetamol). Chemistry of polynuclear hydrocarbons: Definition, and classification of polynuclear aromatic hydrocarbons, Study of synthesis (Haworth synthesis) and mechanism of electrophilic aromatic substitution reactions of naphthalene, phenanthrene and anthracene and medicinal uses of drugs containing Naphthalene (Propranolol, Naphazoline) and Phenanthrene (Morphine, Codeine). **Optical isomerism:** Definition of stereoisomerism and types of stereoisomerism with examples. Definition with examples for optical activity, origin of chirality, elements of symmetry, chiral and achiral molecules, enantiomerism, diastereoisomerism and meso compounds. Study of configuration including D & L system, sequence rules, R & S system. Medicinal importance of optical isomers with examples. Racemic mixture and resolution of racemic mixtures. **Geometrical isomerism:** Nomenclature of geometrical isomers (Cis & Trans, E & Z, Syn & Anti system). Conformational isomerism and its analysis in ethane, butane and cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity in biphenyl compounds. **Chemistry of five membered heterocycles:** IUPAC nomenclature and classification of heterocyclic compounds as per the Hansch- Widman system. Relative aromaticity and reactivity of pyrrole, furan and thiophene. Study of synthesis of pyrrole (Paal – Knorr synthesis), furan (Feist- Bénary reaction), thiophene (Hinsberg synthesis) and Mechanism of Electrophilic substitution reactions of pyrrole, furan and thiophene. Medicinal uses

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of drugs containing pyrrole (Ethosuximide, procyclidine), furan (Furosemide, Nitrofurazone) and thiophene (Cephaloridine, Clopidogrel). **Chemistry of other heterocycles:** Study of nomenclature of fused heterocyclic compounds, synthesis for pyrazole (Knorr synthesis), imidazole (Debus-Radziszewski reaction), pyridine (The Hantzsch synthesis), quinoline (The Skraup synthesis) and Electrophilic aromatic substitution reactions of pyrazole and imidazole. Chemical structures of Indole, pyrimidine, benzimidazole, purine, azepine, pyrazole, oxazole, Phenothiazine, benzotriazole, quinoxaline. Basicity of imidazole, pyridine and quinolone. Medicinal uses of any two drugs containing pyrazole (Sildenafil, Celecoxib), imidazole (Metronidazole, Pilocarpine), pyridine (Isoniazid, Chlorpheniramine), quinoline (Chloroquine, Ciprofloxacin), indole (Indomethacin, Reserpine), benzimidazole (Albendazole, Mebendazole) pyrimidine (Fluorouracil, Sulphadiazine), purine (Mercaptopurine, Thioguanine), azepine (Diazepam, Loxapine) heterocycles.

Textbooks

1. Finar, I. L. Organic Chemistry, Vol. 1. Pearson Education.
2. Finar, I. L. Organic Chemistry: Stereochemistry and Natural Products, Vol. 2. Pearson Education.
3. Smith, M. B. and March, J. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure. Wiley.
4. Bahl, B. S. and Bahl, A. Textbook of Organic Chemistry. S. Chand.
5. Nadendla, R. R. Pharmaceutical Organic Chemistry: Heterocyclic and Natural Products. Vallabh Prakashan.
6. Gilchrist, T. L. Heterocyclic Chemistry. Prentice Hall.
7. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds. Wiley.

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26PY2117P: Heterocyclic Compounds and Stereochemistry (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Draw organic compound structures using chemical drawing tools.	PO1, PO4	3
CO2	Apply techniques for purification and characterization of organic compounds.	PO1, PO3, PO4	3
CO3	Apply laboratory methods to synthesize organic compounds.	PO1, PO3	3
CO4	Analyse and separate binary organic mixtures using suitable experimental techniques.	PO1, PO2, PO3	4
CO5	Determine molecular properties of aromatic organic and heterocyclic compounds.	PO1, PO2	4

Syllabus

Prepare, purify and characterize melting point, recrystallization following organic compounds (Minimum of 04 aromatic and any two heterocyclic compounds with different chemical reactions)

1. Benzanilide/phenyl benzoate/acetanilide from aniline/ phenol by acetylation/acylation reaction.
2. 2,4,6-Tribromo aniline from aniline/para bromo acetanilide from Acetanilide by halogenation (Bromination) reaction.
3. 5-Nitro salicylic acid f r o m salicylic acid / meta di-nitro benzene from nitro benzene by nitration reaction.
4. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
5. 1-Phenyl-azo-2-napthol from aniline by diazotization and coupling reactions.
6. Synthesis of 2,4,6- trinitrophenol by nitration reaction
7. Synthesis of 3,5-dimethyl pyrazole from acetylacetone.
8. Synthesis of benzimidazole from ortho phenylene diamine
9. Preparation of benzophenone oxime.

Qualitative analysis of binary mixture of organic compounds (any two) (Acid + Neutral and Base + Neutral).

To draw and visualize 3D structures, calculate molecular properties and to draw Chemical reactions using software tools

Textbooks

1. Furniss, B. S., Hannaford, A. J., Smith, P. W. G. and Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry. Pearson Education.
2. Mann, F. G. and Saunders, B. C. Practical Organic Chemistry. Pearson Education.
3. Pavia, D. L., Lampman, G. M. and Kriz, G. S. Introduction to Organic Laboratory Techniques: A Small Scale Approach. Brooks/Cole.

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26PY2118T: Pharmaceutical Dosage Forms I (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the pre-formulation principles and key physicochemical parameters for solid dosage forms.	PO1, PO2	2
CO2	Apply tablet formulation, manufacturing, and quality control techniques to ensure product quality.	PO1, PO3, PO4	3
CO3	Apply formulation and quality control techniques for solid dosage forms.	PO1, PO3, PO4	3
CO4	Apply formulation principles to develop and evaluate modified-release solid dosage forms.	PO1, PO2, PO3	3
CO5	Analyse microencapsulation techniques and evaluate microcapsule performance.	PO1, PO2, PO3	4

Syllabus

Fundamentals of Dosage Form Development: Pre-formulation studies: concept, need, and parameters including solubility, pKa, physical nature (amorphous and crystalline), polymorphism, particle size and shape, and powder flow parameters. Drug–excipient compatibility studies. Packaging selection for various dosage forms. Drug product and container-closure interaction. Introduction to stability guidelines of new drug substances and products (ICH Q1). **Compressed Solids:** Tablets: Excipients (roles and examples); tooling (types and specifications); manufacturing methods and equipment; tablet defects and remedies; in process quality control (IPQC); finished-product tests; packaging. Tablet Coating: Types of coating (sugar, film, compression, enteric); need, advantages, and limitations; polymers, process specifications, and equipment; coating defects; quality control of coated tablets. **Finely Divided and Filled Solids:** Medicated powders and granules: formulation considerations, manufacturing processes (mixing, granulation), quality control, and packaging. Gelatin and non-gelatin shells: composition, empty shell manufacturing, quality control, and capsule sizes. Hard gelatin capsules: formulation design; filling methods (manual, semi automatic, automatic); IPQC and finished-product tests; packaging. Soft gelatin capsules: shell composition and plasticizers; fill materials; manufacturing methods (rotary die and others); defects; quality control and stability. **Modified-Release Solids:** Types of tablets: sustained-release and controlled-release tablets. Concept, need, advantages, and disadvantages. Formulation design and drug-release mechanisms. Polymers used for sustained and controlled release. Evaluation of modified-release dosage forms. **Microencapsulation:** Microencapsulation: Concept, need, advantages, and disadvantages. Methods of microencapsulation: spray drying, spray congealing, extrusion and spheronisation, fluidized bed coating, and phase-separation coacervation. Evaluation of microcapsules.

Textbooks

1. Allen, L. V., Popovich, N. G. and Ansel, H. C. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. Lippincott Williams & Wilkins.
2. Aulton, M. E. and Taylor, K. M. G. Aulton's Pharmaceutics: The Design and Manufacture of Medicines. Elsevier.
3. Lachman, L., Lieberman, H. A. and Kanig, J. L. The Theory and Practice of Industrial Pharmacy. CBS Publishers & Distributors.
4. Troy, D. B. and Beringer, P. Remington: The Science and Practice of Pharmacy. Pharmaceutical Press.

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26PY2118P: Pharmaceutical Dosage Forms I (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply preformulation techniques to evaluate drug and excipient properties for dosage form development.	PO2, PO3	3
CO2	Analyse drug and excipient properties using preformulation techniques for dosage form development.	PO1, PO3, PO4	3
CO3	Apply suitable manufacturing methods to formulate and evaluate tablets and capsules.	PO1, PO2, PO3	3
CO4	Apply formulation and coating techniques to develop and evaluate modified-release dosage forms and microcapsules.	PO1, PO2, PO3	3
CO5	Analyse pharmaceutical packaging materials for their impact on product stability and quality.	PO1, PO2	4

Syllabus

1. Preformulation study of any drug/excipient as per pharmacopoeia.
2. Evaluation of powder flow properties for tablet blends.
3. Evaluation of effect of lubricating agents on powder flow properties.
4. Preparation and evaluation of tablets by direct compression.
5. Preparation and evaluation of tablets by dry granulation.
6. Preparation and evaluation of tablets by wet granulation.
7. Quality control of marketed tablets (IR, coated, enteric-coated).
8. Preparation and evaluation of coated tablets.
9. Comparison of dissolution profiles of marketed preparations.
10. Preparation and evaluation of hard-/non-gelatin capsules (fill weight, disintegration).
11. Virtual demonstration: hard-gelatin shell and soft-gel manufacturing (with overview of aseptic line/isolator).
12. Evaluation of packaging materials: primary and secondary/tertiary.
13. Preparation and evaluation of sustained-release tablets.
14. Preparation and evaluation of enteric-coated tablets.

Textbooks:

1. Aulton, M. E. Aulton's Pharmaceutics: The Science of Dosage Form Design. Elsevier.
2. Lachman, L., Lieberman, H. A. and Kanig, J. L. The Theory and Practice of Industrial Pharmacy. CBS Publishers & Distributors.
3. Troy, D. B. and Beringer, P. Remington: The Science and Practice of Pharmacy. Pharmaceutical Press.
4. Gibson, M. Pharmaceutical Preformulation and Formulation. CRC Press.
5. Robinson, J. R. and Lee, V. H. L. Controlled Drug Delivery: Fundamentals and Applications. CRC Press.
6. Indian Pharmacopoeia. Indian Pharmacopoeia Commission.

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26PY2119T: Pharmaceutical Engineering (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles and pharmaceutical applications of unit operations, including size reduction, mixing, size separation, and fluid flow.	PO1, PO4	2
CO2	Understand the construction, working, and utility of various pharmaceutical engineering equipment.	PO1	2
CO3	Analyse the operational efficiency of drying, evaporation, distillation, and heat transfer processes for pharmaceutical applications.	PO1, PO2	4
CO4	Apply principles of safe and efficient material handling and understand the impact of corrosion and waste management in pharmaceutical industries.	PO1, PO4	3
CO5	Analyse the role of Process Analytical Technology (PAT) and automation in enhancing pharmaceutical manufacturing processes.	PO1, PO4	4

Syllabus

Unit operations associated with solids: Principle, construction, working, advantages and disadvantages and Pharmaceutical applications of size reduction, size separation and mixing equipment. **Unit operations associated with liquids:** Principle, construction, working, advantages and disadvantages and Pharmaceutical applications of filtration, crystallization and centrifugation equipment. **Unit operations associated with heat transfer:** Principle, construction, working, advantages and disadvantages and Pharmaceutical applications of evaporation, drying, distillation and Heat transfer equipment. **Materials and material handling:** Introduction to material handling equipment and techniques, Conveyors, hoists, and automated guided vehicles (AGVs), Storage systems: bins, silos in warehouses, Safety considerations in material handling and waste management. Types of corrosion and their impact on pharmaceutical processes and environment. **Flow of fluids:** Types and measurement of flow, manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Orifice meter, Venturimeter, Pitot tube and Rotometer.

Textbooks

1. Banker, G. S. Pharmaceutical Engineering. Marcel Dekker.
2. Sambamurthy, K. Introduction to Pharmaceutical Engineering. New Age International.
3. Kennedy, T. F. Good Design Practices for GMP Pharmaceutical Facilities. CRC Press.
4. Banker, G. S. and Rhodes, C. T. Modern Pharmaceutics. CRC Press.
5. Hickey, A. J. Pharmaceutical Process Engineering. CRC Press.
6. Cole, G. C. Pharmaceutical Facilities: Design, Layouts and Validation. CRC Press.

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26PY2120T: Pharmaceutical Microbiology (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basic concepts of microbiology and the role of microorganisms in pharmaceuticals.	PO1	2
CO2	Understand the microorganisms using staining and biochemical techniques.	PO1, PO2	2
CO3	Apply GMP-based strategies to control microbial contamination in pharmaceutical manufacturing.	PO1, PO2	3
CO4	Understand the microbial spoilage mechanisms and select appropriate disinfectants, antiseptics, or preservatives.	PO1, PO4	2
CO5	Analyse sterilization methods, validation parameters, and pharmacopeial microbial limit and sterility testing procedures.	PO1, PO2	4

Syllabus

Introduction and role of microorganisms in pharmaceutical industry: Fundamentals of microbiology: Microorganisms and medicines, Introduction to various microorganisms, Microbial cultivation, isolation and enumeration. Pharmaceutical importance of microorganisms. Introduction to Microscope (Compound and Electron Microscope). Identification of bacteria using staining techniques (simple, Gram's &Acid-fast staining) and biochemical tests (IMViC). Antibiotics produced by microbiology (Production and uses streptomycin, cephalosporin). **Evaluation of microbiological contamination:** Sources and types of microbial contaminant. Control of microbial contamination during manufacture of Nonsterile dosage forms and sterile dosage forms (including Aseptic area), control of Atmosphere, Water, Raw material, Facility, Packaging, Equipment. Microbiological spoilage of pharmaceuticals, Factors affecting microbial spoilage of pharmaceuticals. Introduction to Fermentation, types and fermenters. **Microbial control and evaluation:** Designing of aseptic area. Laminar flow equipment's, clean area classification, Biological Safety Level categories. Methods of prevention. Disinfectants, antiseptics, and preservatives, and their evaluation, Factors affecting the antimicrobial activity of disinfectants. **Sterilization procedures, assurance and evaluation:** Physical, chemical, gaseous, radiation and mechanical methods of sterilization, Advances sterilization technologies, Evaluation of efficiency of sterilization; Validation of sterilization procedures and Sterility indicators. Sterility assurance, Bioburden determination, Modelling in predicting microbial growth and death, Test for bacteriostatic, bactericidal activity. **Microbiological quality control:** Microbial limit tests and Microbial assay (antibiotics, vitamins and amino acids). Sterility testing of products according to IP, BP and USP. Methods for monitoring Water and Air Quality In vitro cell cultures, general procedure for cell culture, Application of cell cultures in pharmaceutical industry and research.

Textbooks

1. Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. Microbiology: Concepts and Applications. McGraw-Hill.
2. Prescott, L. M., Harley, J. P. and Klein, D. A. Microbiology. McGraw-Hill.
3. Hugo, W. B. and Russell, A. D. Pharmaceutical Microbiology. Blackwell Science.
4. Waites, M. J., Morgan, N. L., Rockey, J. S. and Higton, G. Industrial Microbiology: An Introduction. Blackwell Science.
5. Denyer, S. P., Hodges, N. A. and Gorman, S. P. Hugo and Russell's Pharmaceutical Microbiology. Wiley-Blackwell.

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26PYAEC01: Nutraceuticals and Functional Foods

L-T-P-S: 0-0-1-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the functions of various nutraceuticals and functional foods.	PO1	2
CO2	Understand the sources of important phytochemicals and dietary bioactives.	PO1	2
CO3	Perform basic laboratory techniques for nutraceutical product development.	PO1, PO3	3
CO4	Analyse labels and evaluate quality and efficacy of marketed supplements.	PO1, PO2, PO7	4
CO5	Apply regulatory frameworks (FSSAI, FDA, EFSA) relevant to nutraceuticals in practice.	PO1, PO3, PO9	3

Syllabus

1. Identification and classification of nutraceuticals and functional foods from marketed products.
2. Preparation of a probiotic drink or yogurt using lactic acid bacteria.
3. Extraction of phytochemicals (flavonoids, alkaloids) from plant material.
4. Estimation of antioxidant activity using DPPH method.
5. Formulation of a herbal supplement capsule or powder.
6. Demonstration of dietary fiber content from cereals or vegetables.
7. Assessment of total polyphenol content using Folin–Ciocalteu reagent.
8. Label analysis of functional foods and dietary supplements (FSSAI standards).
9. Case study presentation: Role of omega-3 fatty acids in cardiovascular health.
10. Demonstration of stability testing of a nutraceutical formulation.
11. Preparation of fortified food product (e.g., iron-fortified juice).
12. Visit to a food testing laboratory or nutraceutical industry (or virtual tour).
13. Evaluation of glycemic index of selected carbohydrate-rich foods (conceptual)
14. Regulatory comparison of nutraceutical guidelines (FSSAI vs. FDA vs. EFSA).
15. Preparation of a functional food label with nutrition facts and claims.

Textbooks:

1. Functional Foods: Concept to Product by M. Guo, Woodhead Publishing (Elsevier).
2. Handbook of Nutraceuticals and Functional Foods by Robert E.C. Wildman, CRC Press (Taylor & Francis Group).
3. Nutraceuticals and Functional Foods in Human Health and Disease Prevention by Debasis Bagchi, CRC Press (Taylor & Francis Group).
4. Functional Foods and Nutraceuticals: Sources and their Development Techniques by Rotimi E. Aluko, Springer Nature.
5. Dietary Supplements and Nutraceuticals: Market, Regulations and Health Impacts by Yashwant Pathak, Academic Press (Elsevier).

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26PYAEC02: Food Analysis

L-T-P-S: 0-0-1-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the nutritional and quality aspects of food products.	PO1	2
CO2	Analyse and troubleshoot common issues in analytical instruments.	PO1, PO2	4
CO3	Apply theoretical knowledge of food chemistry in laboratory execution.	PO1, PO3, PO4	3
CO4	Perform various analytical techniques for qualitative and quantitative food analysis.	PO1, PO3	3
CO5	Understand the significance and application of food analysis in ensuring safety and quality.	PO1, PO4, PO9	3

Syllabus

1. Determination of the acid value for the given oil/fat.
2. Determination of the ester value of the given oil/fat.
3. Determination of the saponification value of the given oil/fat.
4. Determination of total and free acidity in honey as per FSSAI method.
5. Quantification of caffeine content in soft drinks.
6. Determination of fat content in milk by gravimetric method.
7. Detection of starch and urea in milk as per FSSAI method.
8. Assessment of fluoride content in drinking water.
9. Assessment of total hardness in drinking water.
10. Determination of the rancidity of the oil by UV Visible spectrophotometer.
11. Quantification of benzoic acid as preservative in beverages/jam/ jellies by titrimetric/spectrophotometric method.
12. Isolation and identification of synthetic food colours by paper chromatography/Thin layer chromatography.
13. Determination of total curcuminoid content in turmeric by UV visible spectrophotometer.
14. Assessment of the total ash content for spices and condiments.
15. Determination of gluten content in whole wheat/wheat flour.
16. Determination of alcoholic acidity in bread and bread products.
17. Determination of Caloric value of food and nutritional supplements.

Textbooks

1. Food Analysis – Suzanne Nielsen, Springer.
2. Introduction to Food Analysis – S. Suzanne Nielsen, Springer.
3. Food Analysis: Theory and Practice – Y. Pomeranz & Clifton E. Meloan, Springer.
4. Manual of Methods of Analysis of Foods – Food Safety and Standards Authority of India (FSSAI), Government of India.
5. Food Chemistry – H.-D. Belitz, Werner Grosch & Peter Schieberle, Springer

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26PYAEC03: Yoga And Life Sciences

L-T-P-S: 0-0-1-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Perform basic yoga postures (asanas) and breathing exercises (pranayama).	PO1, PO3, PO11	3
CO2	Understand the physiological and psychological benefits of yoga.	PO1, PO11	2
CO3	Apply yoga techniques for stress relief, flexibility, and mental clarity	PO1, PO3, PO11	3
CO4	Understand the therapeutic potential of yoga in managing chronic health conditions.	PO1, PO11	2
CO5	Apply the yoga into daily life for improved well-being and productivity.	PO1, PO5, PO11	3

Syllabus

1. Demonstration and practice of Surya Namaskar (Sun Salutation).
2. Practice of basic asanas: Tadasana, Vrikshasana, Bhujangasana.
3. Practice of Pranayama techniques: Nadi Shodhana, Bhramari.
4. Meditation session: Focused awareness and breath control.
5. Yoga-based stretching and warm-up routine.
6. Recording physiological parameters (heart rate, BP) before and after yoga.
7. Yoga journal: Track weekly yoga practice and mood changes.
8. Poster presentation on "Scientific benefits of yoga on immunity".
9. Yoga for specific health conditions: Back pain, asthma, stress.
10. Group chanting of Mantra – observation of mental state.
11. Learning the role of yoga in circadian rhythm regulation.
12. Visit to a yoga wellness center or attending a virtual session.
13. Assessment of flexibility using sit-and-reach test before/after practice
14. Demonstration of Yog Nidra (guided relaxation technique)
15. Case presentation: Impact of yoga on a chronic disease condition

Textbooks

1. Light on Yoga by B. K. S. Iyengar – A comprehensive guide to yoga postures and philosophy.
2. The Heart of Yoga by T. K. V. Desikachar – Explains principles and therapeutic applications of yoga.
3. Asana Pranayama Mudra Bandha by Swami Satyananda Saraswati – A classical reference on yogic practices and breathing techniques.
4. Ministry of AYUSH. Yoga Education and Practice Guidelines. Government of India.
5. World Health Organization. Traditional Medicine Strategy and integrative health resources.

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26PY2221T: Herbal Drug Technology (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply tissue culture techniques for herbal drug production and the development of edible vaccines.	PO1, PO3, PO4	3
CO2	Understand the concept of standardized extracts and incorporate them in herbal formulations and cosmetics.	PO1, PO3	2
CO3	Apply analytical methods for quality control of herbal preparations.	PO1, PO3, PO4	3
CO4	Analyse herb–drug/food interactions and their clinical significance.	PO1, PO2	4
CO5	Understand the national regulatory provisions and global standards related to herbal drug development.	PO1, PO2	2

Syllabus

Plant Tissue Culture and Standardized Extracts: Plant tissue culture as an alternative source of medicine: Historical development, Types of cultures, Nutritional requirements, Growth and maintenance of callus and suspension culture, and Role of elicitation, genetic transformation, biotransformation, precursor feeding, and somaclonal variation in biomass and secondary metabolite production. Introduction to biomanufacturing: Medicinal plant–based biomanufacturing, Utilising plant factories in obtaining valuable ingredients for food, pharmaceutical, and cosmetic industries. Examples: Shikonin and Paclitaxel. Oral vaccines in healthcare. Optimization and production of standardized extracts of medicinal plants: Strategies for preparation of desired quality extracts by optimizing and adjusting bioactives ensuring quality using analysis of metabolites and TLC fingerprints of the following: Aqueous and hydro-alcoholic extracts of Ashwagandha, Shatavari, Licorice, Neem, and Haritaki. Flavonoid-rich fraction of Sweet lime peel. Terpenoid-rich fraction of Bacopa. Phenol-rich fraction of Green Tea. Steroid-rich fraction of Tribulus. Alkaloid-rich fraction of Vasaka. **Herbal Formulations, Excipients and Cosmetics:** Herbal formulations: Conventional herbal formulations: syrups, mixtures, powders, capsules, tablets, creams, ointments. Novel dosage forms: phytosomes (phytocomplexes), liposomes, nanoformulations. Composition, preparation, and characterization using standardized extracts and bioactives. Herbal cosmetics: Sources and description of raw materials of herbal origin as active agents in skincare, hair care, and oral hygiene products. Applications in skincare, hair care, and oral hygiene products such as: Sunscreen-lotion/gel, Hair oil, shampoo, herbal dye Herbal mouthwash, chewing gums, candies, gargles, Face serums and herbal face packs. Excipients of Natural origin: Colorants, sweeteners, binders, diluents. Viscosity builders, disintegrants. Flavors and perfumes. Protective agents, waxes, bleaching agents and antioxidants. **Quality Control and Standardisation of Herbal Medicines:** WHO, AYUSH, and EU guidelines on quality control, stability, and shelf life studies of herbal medicines. Approaches for standardisation and quality control of botanicals and formulations. Testing methods and regulatory considerations. Role of DNA fingerprint and molecular markers such as rbcL, matK, and SCAR in quality control. Forensic pharmacognosy: Role in identification of illicit herbal drugs (e.g., Cannabis, Opium).

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Herb–Drug / Food / Herb Interactions: General introduction to interactions and role of ADME, Cytochrome P450, and P-gp. Herb–drug interactions: St. John's Wort with warfarin and Ginkgo biloba with aspirin. Herb–food interactions: Licorice with salty foods, Turmeric with fats and Green tea with iron-rich foods. Herb–herb interactions: Ephedra with Ginseng and Chamomile with Valerian. Adverse reactions related to plants and foods such as allergy, intolerance, and toxicity. **Regulatory Requirements of Herbal Drugs and Botanicals:** Regulatory framework in India for Herbal and ASU medicines: Role of regulatory bodies. ASU DTAB (Ayurveda, Siddha, and Unani Drugs Technical Advisory Board). ASU DCC (Drugs Consultative Committee for ASU drugs). Schedule T – GMP requirements for ASU drugs. Schedule E1 – Poisonous drugs listed under AYUSH. Drugs and Cosmetics Act – Regulatory provisions relevant to herbal/ASU medicines, procedures for registration, trade, and export. Concept of Phytopharmaceuticals and Ayush Aahara in bridging Indian traditional knowledge with modern science.

Textbooks

1. Waldesch, F. G. Herbal Medicinal Products. CRC Press.
2. Indian Herbal Pharmacopoeia. Indian Drug Manufacturers' Association.
3. World Health Organization. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants.
4. Drugs and Cosmetics Act and Rules (India). Government of India.

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26PY2221P: Herbal Drug Technology (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Perform seed germination and plant tissue culture of medicinal plants.	PO1, PO3, PO8	3
CO2	Apply official guidelines to prepare and standardize herbal extracts and enriched phytoconstituent fractions.	PO1, PO3, PO6	3
CO3	Analyse natural-origin excipients and evaluate their suitability for herbal formulations.	PO1, PO2	4
CO4	Apply pharmacopoeial standards to formulate and evaluate herbal cosmetics, dosage forms, and novel drug delivery systems.	PO2, PO3, PO5	3
CO5	Analyse and compare marketed herbal medicines and cosmetics for quality, compliance, and performance	PO1, PO2, PO6	4

Syllabus

1. To establish seed germination and plant tissue culture of a medicinal plant.
2. Preparation and standardization of extracts of Phenol-rich fraction of Green Tea.
3. Preparation and standardisation of Aqueous and hydro-alcoholic extracts of Ashwagandha or Haritaki (as per IP procedure).
4. Preparation and standardization of Flavonoid-enriched fraction of Sweet lime peel.
5. Preparation and standardization of Terpenoid-rich fraction of Bacopa.
6. Preparation and standardization of Steroid-rich fraction of Tribulus.
7. Preparation and standardization of Alkaloid-rich fraction of Vasaka.
8. Evaluation of excipients of natural origin.
9. To develop and evaluate herbal cosmetics in form of gel, cream, lotion using standardized herbal extract.
10. To develop and evaluate herbal shampoo using standardized herbal extract.
11. To develop herbal formulations in form of syrups and mixtures using standardized herbal extract and their evaluation as per Pharmacopoeial guidelines.
12. To develop herbal tablets using standardized herbal extract and their evaluation as per Pharmacopoeial guidelines.
13. Preparation of botanicals-based new herbal medicinal product delivery systems (phytosomes).
14. Experiential learning-based experiments involving collection of herbal formulations/ extracts from the market and their quality evaluation as per Pharmacopoeial guidelines.
15. Survey on different commercialized marketed herbal cosmetics.
16. Survey on different commercialized marketed herbal medicine.

Textbooks

1. Evans, W. C. Trease and Evans' Pharmacognosy. Elsevier.
2. Harborne, J. B. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Springer.
3. Houghton, P. J. and Raman, A. Laboratory Handbook for the Fractionation of Natural Extracts. Chapman & Hall.
4. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Indian Pharmacopoeia Commission.

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26PY2222T: Medicinal Chemistry (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the physicochemical properties of drug molecules to their biological activity and pharmacokinetic behavior.	PO1	2
CO2	Analyse drugs affecting the autonomic nervous system and evaluate their therapeutic outcomes.	PO1, PO2	4
CO3	Analyse and interpret the structure-activity relationships of selected drug classes	PO1, PO2	4
CO4	Understand the synthetic routes of selected drugs, identifying key intermediates and reactions involved in their preparation.	PO1	2
CO5	Analyse structure–activity relationships to correlate drug structures with therapeutic effects, adverse effects, and drug discovery principles.	PO1, PO2	4

Syllabus

Fundamentals of Medicinal Chemistry: Introduction: History and scope of medicinal chemistry. Physicochemical properties in relation to biological action: Ionization, solubility, partition coefficient, hydrogen bonding, Chelation, Bioisosterism and protein binding. Drug metabolism: Phase I & II reactions. **Drugs Acting on the Autonomic Nervous System**: Adrenergic or Sympathomimetic agents: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline, Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine, Metaraminol. Anti-adrenergic or Sympatholytic agents: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetalol, Carvedilol. SAR of beta adrenergic blockers. Cholinergic or Parasympathomimetic agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine, Physostigmine, Neostigmine, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion. Pralidoxime chloride. Anti-Cholinergic or Parasympatholytic agents: Atropine, Hyoscyamine, Scopolamine, Homatropine, Ipratropium*, Tropicamide, Cyclopentolate, Clidinium Glycopyrrolate, Dicyclomine*, Methantheline, Propantheline, Benztropine mesylate, Orphenadrine, Biperidine, Procyclidine, Tridihexethyl, Isopropamide, Ethopropazine, SAR of cholinergic blockers. Local anesthetic agents: Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine. Benzocaine, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate, Lignocaine, Mepivacaine, Prilocaine, Etidocaine, Phenacaine, Diperodon, Dibucaine.* SAR of Local anesthetics. **Drugs Acting on the Cardiovascular System:** Anti-anginals: Amyl nitrite, Nitroglycerin, Pentaerythritol, Isosorbide dinitrite*, Dipyridamole, Verapamil, Bepridil hydrochloride, Diltiazem, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine. Anti-hypertensives: Timolol, Captopril, Lisinopril, Enalapril, Benazepril, Quinapril, Methyldopate,* Clonidine, Guanethidine, Guanabenz, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine. Drugs to treat Congestive Heart Failure (CHF): Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan. Anti-arrhythmics (Class I–IV): Quinidine sulphate, Procainamide, Disopyramide*, Phenytoin, Lidocaine, Tocainide, Mexiletine, Lorcainide, Amiodarone, Sotalol.

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Drugs acting on blood and Renal System: Antihyperlipidemic Agents: Fenofibrate*, Lovastatin, Cholesteramine and Cholestipol. Coagulants and Anti-Coagulants: Menadione, Acetomenadione, Warfarin, Anisindione, clopidogrel. Diuretics: Acetazolamide*, Methazolamide, Dichlorphenamide, Chlorthiazide, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, Furosemide*, Bumetanide, Ethacrynic acid, Spironolactone, Triamterene, Amiloride. Mannitol. SAR of Thiazides. **Autacoids and related drugs: Antihistamines:** H1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines, Clemastine, Diphenylphyraline, Tripelenamine, Chlorcyclizine, Meclizine, Buclizine, Chlorpheniramine, Triprolidine, Phenindamine, Promethazine*, Trimeprazine, Cyproheptadine, Azatidine, Astemizole, Loratadine, Cetirizine, Levocetrizine Cromolyn. H2-antagonists: Cimetidine*, Famotidine, Ranitidine. Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), Antipyretics: Sodium salicylate, Aspirin, Diflunisal, Mefenamic acid*, Niflumic acid, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone, Celecoxib, Etoricoxib, SAR of representative agents by class.

Textbooks

1. Lemke, T. L., Williams, D. A. and Roche, V. F. Foye's Principles of Medicinal Chemistry. Lippincott Williams & Wilkins.
2. Beale, J. M., Thomas, J. T. and Duckett, M. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry. Lippincott Williams & Wilkins.
3. Abraham, D. J. and Griffin, J. L. Burger's Medicinal Chemistry and Drug Discovery. Wiley.
4. Patrick, G. L. An Introduction to Medicinal Chemistry. Oxford University Press.
5. Lednicer, D. The Organic Chemistry of Drug Synthesis. Wiley.

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26PY2222P: Medicinal Chemistry (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply standard laboratory procedures to synthesize drug molecules and pharmaceutical intermediates.	PO1, PO3	3
CO2	Apply qualitative and quantitative analytical methods to accurately assay pharmaceutical substances.	PO1, PO3	3
CO3	Analyse and interpret drug monographs according to pharmacopeial standards.	PO1, PO2	4
CO4	Apply appropriate analytical instruments and techniques for drug preparation, assay, and monograph analysis.	PO1, PO3, PO4	3
CO5	Apply scientific documentation practices to record and report experimental procedures and results accurately.	PO1, PO3, PO7	3

Syllabus

Preparation of Drugs / Intermediates: Aspirin, Benzotriazole, Benzocaine, Phenytoin, Dibenzalacetone and Paracetamol.

Assay of Drugs: Aspirin, Ibuprofen, Furosemide and Paracetamol.

Monograph Analysis: Paracetamol, Aspirin, Phenobarbital, Diclofenac and Phenytoin

Textbooks

1. Abraham, D. J. and Rotella, D. P. Burger's Medicinal Chemistry, Drug Discovery and Development. John Wiley & Sons.
2. Beckett, A. H. and Stenlake, J. B. Practical Pharmaceutical Chemistry. CBS Publishers & Distributors.
3. Furniss, B. S., Hannaford, A. J., Smith, P. W. G. and Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry. Pearson Education.
4. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Indian Pharmacopoeia Commission.
5. Kar, A. Advanced Practical Medicinal Chemistry. New Age International Publishers.
6. Lednicer, D. The Organic Chemistry of Drug Synthesis. John Wiley & Sons.

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26PY2223T: Pharmaceutical Biotechnology (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the role of biotechnology in pharmaceutical sciences, including monoclonal antibodies and enzyme immobilization.	PO1, PO4	2
CO2	Apply genetic engineering and recombinant DNA technology for the production of biopharmaceuticals such as insulin, interferons, and vaccines.	PO1, PO3, PO4	3
CO3	Understand the microbial biotransformation and Analyse fermentation processes used in pharmaceutical industries.	PO1, PO2, PO4	2
CO4	Analyse the role of bioinformatics and artificial intelligence in the Human Genome Project and personalized medicine.	PO1, PO2, PO4	4
CO5	Understand the principles, development, evaluation, standardization, regulatory requirements, and emerging approaches in vaccines and sera.	PO1, PO2, PO4	2

Syllabus

Introduction to Pharmaceutical Biotechnology: Introduction to biotechnology in pharmaceutical sciences; protein therapeutics; analytical characterization of proteins; monoclonal antibodies; antigens; enzyme immobilization; cell culture and immobilization techniques; pharmaceutical applications. **Genetic Engineering and Recombinant DNA Technology:** Principles of genetic engineering; recombinant DNA technology; production of interferons, hepatitis-B vaccine, and insulin; polymerase chain reaction (PCR) and its applications; mutations and types of mutants. **Microbial Biotransformation and Fermentation Technology:** Microbial biotransformation; fermentation principles and process control; industrial production of alcohol, penicillins, citric acid, and vitamin B_{12}; blood products—collection, processing, and storage. **Gene Therapy, Genomics and Personalized Medicine**: Gene therapy—types and methodologies; delivery systems; ethical concerns and challenges; Human Genome Project; role of bioinformatics and artificial intelligence in personalized medicine. **Immunology, Vaccines and Sera:** Basics of immunology; types and generations of vaccines; immunization strategies; vaccine preparation, evaluation, and standardization; regulatory aspects; sera therapy; marketed products; challenges and newer approaches.

Textbooks

1. Crommelin, D. J. A., Sindelar, R. D. and Meibohm, B. Pharmaceutical Biotechnology: Fundamentals and Applications. Springer.
2. Walsh, G. Biopharmaceuticals: Biochemistry and Biotechnology. Wiley-Blackwell.
3. Brown, T. A. Gene Cloning and DNA Analysis: An Introduction. Wiley-Blackwell.
4. Glick, B. R., Pasternak, J. J. and Patten, C. L. Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press.
5. Doran, P. M. Bioprocess Engineering Principles. Academic Press.
6. Vogel, H. C. and Todaro, C. L. Fermentation and Biochemical Engineering Handbook. William Andrew.

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26PY2223P: Pharmaceutical Biotechnology (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles of biotechnology, genetic engineering, and recombinant DNA technology in pharmaceutical sciences.	PO1, PO3, PO4	2
CO2	Understand the production and applications of biopharmaceutical products such as protein therapeutics and monoclonal antibodies.	PO1, PO4	2
CO3	Understand the principles, delivery systems, and ethical considerations associated with gene therapy.	PO1, PO6	2
CO4	Apply fermentation technology for the large-scale production of vaccines, recombinant hormones, and blood-derived therapeutic proteins.	PO1, PO4	3
CO5	Apply the principles of active and passive immunization in selecting appropriate vaccines or sera.	PO1, PO6	3

Syllabus

1. Understanding Good microbiological laboratory practices while working in Microbiology laboratory aseptic handling in microbiology lab: growth and isolation of microbes using streaking, spreading and subculturing techniques: microbial staining, study of various equipments such as loop, straight wire, spreader, forceps, pipette, test tube, petridish, burner etc and apparatus used in microbiology lab- BOD incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer and microscopes.
2. Handling of biological spill, decontamination procedures and hygiene while handling microorganisms and disposal
3. Sterilization and evaluation of glassware and apparatus using hot air oven
4. Preparation and sterilization of solid and liquid culture medium using different techniques
5. Determination of microbiological efficacy of disinfectant/ preservative efficacy test
6. Tests for sterility of ophthalmic or parenteral marketed formulation according to IP.
7. Analysis of Biotechnological product (Protein, nucleic acid materials) by UV Vis and FTIR spectrophotometer
8. Production of alcohol using Fermentation process
9. Practice Whole cell immobilization technique (any one)
10. Practice Enzyme immobilization technique and its kinetics
11. Isolation and estimation of DNA and RNA
12. Isolation of plasmids and expression of protein
13. Agarose gel electrophoresis of DNA/ RNA
14. SDS – polyacrylamide gel electrophoresis for proteins.
15. Microbiological assay of antibiotics.

Textbooks

1. Baltz, R. H., Davies, J. E. and Demain, A. L. Manual of Industrial Microbiology and Biotechnology. ASM Press.
2. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. CBS Publishers & Distributors.
3. Chou, S. L. M. Practical Biotechnology: A Guide to Biochemical Engineering. Springer.
4. Denyer, S. P., Hodges, N. A. and Gorman, S. P. Hugo and Russell's Pharmaceutical Microbiology. Wiley-Blackwell.

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26PY2224T: Social Pharmacy And Public Health (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the scope of social pharmacy and the pharmacist's role in the public health system.	PO1, PO9	2
CO2	Understand the influence of socio-cultural and behavioral factors on health, illness, and medication adherence.	PO1	2
CO3	Understand the various national health programs and the pharmacist's contribution to their success.	PO1, PO9	2
CO4	Apply basic principles of epidemiology to understand disease distribution and control.	PO1, PO3, PO4	3
CO5	Analyse and develop health education materials to counsel patients on preventive healthcare and rational drug use.	PO1, PO7	4

Syllabus

Introduction to Social Pharmacy and Public Health: Social Pharmacy: Definition, scope, historical development, and importance. Social pharmacy as a multidisciplinary field. Public Health: Definition, concepts, history, core functions, and ethical considerations. Interplay between Social Pharmacy and Public Health: The evolving role of the pharmacist in the public health arena. Concept of Health and Disease: WHO definition of health; dimensions of health – physical, mental, social, spiritual, and environmental. Determinants of Health: Social, economic, environmental, lifestyle, and healthcare service determinants and their impact on population health. Health Indicators: Indicators used to measure health status and health outcomes in a population. **Health Systems, Policy, and Pharmacoepidemiology:** Healthcare Delivery Systems: Overview of global healthcare systems. Indian Healthcare System: Structure, public and private sectors, primary, secondary, and tertiary levels of care. Health Policy: Introduction to health policy formulation and analysis; objectives of India's National Health Policy. National Health Mission (NHM): NRHM and NUHM – goals, strategies, and impact on public health indicators. Pharmacoepidemiology: Definition, aims, scope, and applications. Measures of Disease Frequency and Distribution: Incidence, prevalence, endemic, epidemic, pandemic; morbidity and mortality rates, Odds ratio and relative risk. Introduction to Biostatistics: Role in public health; types of data; basic data presentation methods. **Preventive Healthcare, Health Promotion, and Communicable Diseases:** Levels of Prevention: Primordial, primary, secondary, and tertiary prevention with examples. Role of Pharmacists in Disease Prevention and Health Promotion: Immunization services, screening programs, lifestyle counselling. Health Education: Definition, principles, methods, and importance; development of effective health education materials. Mother and Child Health (MCH): Antenatal care, postnatal care, breastfeeding, immunization schedules. Communicable Diseases: Modes of transmission, prevention, and control of tuberculosis, HIV/AIDS, malaria, dengue, typhoid, influenza; pharmacist's role.

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Non-Communicable Diseases, Nutrition, Mental Health, and National Programs: Non-Communicable Diseases (NCDs): Diabetes, hypertension, cardiovascular diseases, chronic respiratory diseases, cancer; prevention and management. Nutrition and Health: Balanced diet, macro- and micronutrients, malnutrition, nutritional deficiency disorders, food safety, and adulteration. Mental Health: Common mental disorders, stigma, promotion of mental well-being; pharmacist's role. National Health Programs in India: Programs related to MCH, NCDs, communicable diseases, tobacco control, and deafness prevention. **Pharmacoeconomics, Rational Use of Medicines, Professional Roles, and Future Trends:** Pharmacoeconomics: Introduction, significance; Cost-Benefit Analysis (CBA), Cost-Effectiveness Analysis (CEA), Cost-Utility Analysis (CUA). b) Rational Use of Medicines (RUM): Definition, importance, problems of irrational drug use; pharmacist's role. Medication Adherence: Factors affecting adherence, consequences of non-adherence, improvement strategies. Drug Misuse and Abuse: Alcohol, tobacco, opioids, prescription drug abuse; pharmacist's role. Professionalism and Ethics in Social Pharmacy: Ethical dilemmas in public health pharmacy. Disaster Management: Role of pharmacists. Emerging Trends: Telepharmacy, digital health, personalized medicine, expanding public health responsibilities of pharmacists.

Textbooks

1. Anderson, S., Dedrick, R. and Tiffany, B. Community Pharmacy Practice for Public Health. McGraw-Hill Education.
2. Desselle, S. Public Health and Pharmacy Practice. McGraw-Hill Education.
3. Donyai, P. Social and Cognitive Pharmacy: Theory and Case Studies. Pharmaceutical Press.
4. Gillam, S., Yates, J. and Badrinath, P. Essential Public Health: Theory and Practice. Cambridge University Press.
5. Levin, B. L. and Hanson, A. Essentials of Public Health Pharmacy. Jones & Bartlett Learning.

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26PY2224P: Social Pharmacy And Public Health (Practical)

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Perform basic health screening and first aid procedures using appropriate techniques.	PO1, PO3, PO4	3
CO2	Analyse, develop, and disseminate health promotion and disease prevention materials for effective community education.	PO1, PO9	4
CO3	Apply mental health screening tools and demonstrate patient assessment skills using role plays and relevant psychological scales	PO1, PO3, PO4	3
CO4	Demonstrate vaccination techniques using appropriate models and standard immunization protocols	PO1, PO3, PO4	3
CO5	Understand the pharmacoeconomic principles and recognize irrational drug use in healthcare scenarios	PO1, PO3, PO4	2

Syllabus

1. Training on health screening services (Blood pressure, body mass index (BMI), blood glucose levels, heart rate (pulse rate), respiratory rate, body temperature, oxygen saturation (SpO_2), hemoglobin levels (basic anemia screening)).
2. Develop health promotion material for the prevention of communicable diseases.
3. Role play- usage of different mental scales in patient screening.
4. Case study on calculation of prevalence; incidence, odds ratio and relative risk.
5. Design and demonstrate preventive strategies for major communicable diseases (group activity)
6. Present a case study highlighting cost-benefit analysis in healthcare.
7. Perform cost-effectiveness analysis for selected health interventions.
8. Conduct cost-utility analysis to assess health program efficiency.
9. Perform basic first aid techniques.
10. Design informational leaflet on lifestyle modifications for disease prevention.
11. Identify and illustrate irrational drug use with a real-world example.
12. Prepare an immunization chart, interpret the vaccination schedule and perform patient counselling for vaccination*.
13. Hand wash and hand sanitizing techniques*.
14. Demonstration and practice of wound dressing in first aid and basic suturing techniques*.
15. Practical training on routes of drug administration-oral, and other non-parenteral routes*.
16. Practical training on routes of drug administration- parenteral routes*.
17. Training on basic life support (BLS)*

Textbooks

1. Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L. and Torrance, G. W. Methods for the Economic Evaluation of Health Care Programmes. Oxford University Press.
2. Harding, G. and Taylor, K. Social Pharmacy. Pharmaceutical Press.
3. Park, K. Park's Textbook of Preventive and Social Medicine. Banarsidas Bhanot Publishers

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26PY2225T: Systemic Pharmacology I (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand neurotransmitters and describe neurohumoral transmission, autonomic nervous system organization, functions, and pharmacological modulation	PO1	2
CO2	Understand the mechanisms, pharmacological actions, and therapeutic uses of drugs used in the management of cardiovascular disorders.	PO1	2
CO3	Understand the pharmacology and therapeutic uses of drugs acting on blood and kidney, including anticoagulants, antiplatelet agents, hematinics, and diuretics	PO1	2
CO4	Understand the physiological roles of autacoids and the pharmacological actions and therapeutic uses of drugs that modulate autacoid pathways	PO1, PO2	2
CO5	Evaluate the mechanisms of action, therapeutic uses, and adverse effects of drugs acting on the respiratory and immune systems.	PO1, PO2	5

Syllabus

Pharmacology of drugs acting on the peripheral nervous system: Organization and functions of PNS. Neurohumoral transmission, co-transmission. Neurotransmitters and their receptors, including non-adrenergic and non-cholinergic (NANC) neurotransmitters. Parasympathomimetic and Parasympatholytic drugs. Sympathomimetic and sympatholytic drugs. Skeletal muscle relaxants (peripheral and central). Drugs used in the treatment of myasthenia gravis and glaucoma. **Pharmacology of drugs acting on the cardiovascular system:** Introduction to cardiovascular hemodynamic and cardiac electrophysiology. Drugs used in congestive cardiac failure. Anti-arrhythmic drugs. Anti-anginal and newer anti-ischemic drugs. Anti-hypertensive drugs. Shock, types of shocks and drugs used in their management. Stroke, types of strokes and drugs used in their management. **Pharmacology of drugs acting on blood and kidney:** Pharmacology of drugs acting on blood: Anti-platelet agents, Coagulants and anticoagulants, Fibrinolytics and Plasma expanders, Haematinics and Anti-hyperlipidaemic drugs. Pharmacology of drugs acting on kidney: Diuretics and Anti-diuretics. **Pharmacology of autacoids and related drugs:** Introduction to autacoids and their classification. Therapeutic significance of important agonists and antagonists of prostaglandins, thromboxane, leukotrienes, angiotensin, bradykinin and substance P. Histamine and antihistamines. 5-HT, its agonists and antagonists, drugs used in migraine. Non-steroidal anti-inflammatory drugs, antipyretics and analgesics. Anti-gout and Antirheumatic drugs including Disease Modifying Antirheumatic Drugs (DMARDs). **Pharmacology of Drugs acting on respiratory system:** Drugs used in the treatment of bronchial asthma and COPD. Definitions, classification and therapeutic uses of nasal decongestants, mucolytics, expectorants and antitussives. Respiratory stimulants. Pharmacology of Drugs acting on immune system: Mechanism of action, adverse effects and therapeutic uses of important classes of immune stimulants and immunosuppressants.

Textbooks

1. Brunton, L., Hilal-Dandan, R. and Knollmann, B. Goodman and Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill Education.
2. Craig, C. R. and Stitzel, R. E. Modern Pharmacology with Clinical Applications. Lippincott Williams & Wilkins.

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26PY2225P: Systemic Pharmacology I (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the effects of drugs on blood pressure and heart rate and their relevance to cardiovascular pharmacotherapy using virtual simulations.	PO1, PO4	2
CO2	Evaluate the pharmacological management of asthma, analyse drug actions on the respiratory system, and correlate them with clinical data.	PO1, PO2, PO8	5
CO3	Understand the interpretation of experimental data, PA_2 values, standard curves, and drug effects using computer simulations	PO1, PO2, PO4	2
CO4	Understand drug interactions and rational drug therapy in cardiovascular disorders and asthma through case-based learning	PO1, PO3, PO4	2
CO5	Apply pharmacological techniques to measure intraocular pressure, plasma nitric oxide, and pulmonary function using spirometry	PO1, PO3	3

Syllabus

1. To demonstrate Langendorff's heart assembly and its applications in pharmacology (only video demonstration/or charts and illustrations).
2. Recording of the effects of different electrolytes, agonists and antagonists on the isolated and perfused frog heart preparation using interactive computer simulation experiment.
3. To study the effect of various drugs on blood pressure and heart rate anaesthetized dog using interactive computer simulation experiment.
4. Demonstration of the estimation of intraocular pressure on rabbit eye and human eye by using conventional Schiotz tonometer and non-contact tonometer.
5. To evaluate the muscle relaxant activity of drugs on Rota-rod apparatus using interactive computer simulation experiment.
6. Demonstration of the effect of spasmogens and spasmolytic using rabbit jejunum using interactive computer simulation experiment.
7. Determination of PA2 value of Atropine using a suitable isolated tissue preparation by Schild plot method with the help of hypothetical data using interactive computer simulation experiment.
8. Determination of PA2 value of Prazosin using a suitable isolated tissue preparation by Schild plot method with the help of hypothetical data using interactive computer simulation experiment.
9. To study the antiallergic effects of drugs using mast cell degranulation assay using interactive computer simulated experiment.
10. Evaluation of diuretic activity of drugs in rats using metabolic cages (simulation) and estimation of electrolytes in the urine samples/serum using flame photometer/commercially available kits
11. Evaluation of effects of antihistaminic drugs on the histamine-induced bronchospasm in guinea pigs using interactive simulated experiment.

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12. To study and analyse drug-drug interaction/ rational drug management of asthma with the help of Case Study/ hypothetical data/ any clinical report.
13. To study clinical pharmacology of the plasma volume expanders and their importance (using charts/open sources videos).
14. Demonstration of evaluation of anti-inflammatory activity in paw oedema model using plethysmometer using simulations.
15. Concept of Biobanking and its significance in drug screening.
16. Isolation of Polymorphonuclear cells from blood and evaluation of endotoxin-induced oxidative stress in them using Nitrobluetetrazolium dye method by colourimetry.
17. Determination of viability of cells (using isolated polymorphonuclear cells) by Trypan blue dye exclusion assay to determine cell viability using microscopy method.
18. Determination of anti-inflammatory activity of durgs in vitro using RBC membrane stabilization assay
19. Determination of protein concentrations using Bradford reagent and plotting of standard curve of bovine serum albumin.
20. Estimation of anticholinesterase inhibitory activity of drugs using Ellman's reagent (DTNB)
21. Determination and and plotting of standard curve for LPO, Nitric oxide and GSH.

Textbooks

1. Ghosh, M. N. Fundamentals of Experimental Pharmacology. Hilton & Company.
2. Hofmann, F. B. Handbook of Experimental Pharmacology (HEP Series). Springer Nature.
3. Computer Assisted Learning (CAL) software packages for experimental pharmacology simulations.

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26PY2226: Internship

L-T-P-S: 0-0-8-0 **Credits: 4** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply pharmaceutical knowledge and skills in a real professional (industry, hospital or community) setting.	PO1, PO6, PO9	3
CO2	Perform assigned workplace tasks in compliance with standard operating procedures and quality/safety norms.	PO1, PO4, PO7	3
CO3	Analyse and reflect on professional practices, workflows and problem-solving in the organisation.	PO1, PO3, PO4	4
CO4	Communicate the internship experience through a structured report and presentation with professional conduct.	PO1, PO7, PO8	3
CO5	Analyse the impact of internship training on professional competency, ethical practice, and lifelong learning in pharmacy.	PO1, PO7, PO8	4

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26PY3127T: Biomedicinal Chemistry (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the chemistry, therapeutic uses, and SAR of central nervous system drugs.	PO1	2
CO2	Understand the classification, mechanisms, and SAR of major anti-infective agents	PO1	2
CO3	Analyse the SAR of antibiotics and sulfonamides in relation to their antimicrobial activity and spectrum.	PO1, PO2, PO4	4
CO4	Understand the chemistry, therapeutic uses, and SAR of antineoplastic and endocrine drugs.	PO1	2
CO5	Understand the chemistry, pharmacological relevance, and SAR of antidiabetic agents and narcotic analgesics.	PO1, PO2	2

Syllabus

Drugs Acting on the Central Nervous System: General Anaesthetics: Halothane, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane, Methohexital, Thiamylal, Thiopental, Ketamine*, Ramelteon, Remimazolam, Fospropofol, Dexmedetomidine. Sedatives and Hypnotics: Barbital, Phenobarbital*, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem, Glutethimide, Meprobamate, Ethchlorvynol, Triclofos, Paraldehyde SAR of Barbiturates and Benzodiazepines. Antipsychotics: Promazine, Chlorpromazine*, Triflupromazine, Thioridazine, Piperacetazine, Prochlorperazine, Trifluoperazine, Chlorprothixene, Thiothixene, Loxapine, Clozapine, Haloperidol, Droperidol, Risperidone, Molindone, Sulpiride, Brexpiprazole, Lumateperone, Pimavanserin, Samidorphan SAR of Phenothiazines. Anticonvulsants: Phenobarbitone, Methabarbital, Phenytoin*, Mephenytoin, Ethotoin, Oxazolidinediones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide Phenacemide, Carbamazepine*, Clonazepam, Primidone, Valproic acid, Gabapentin, Felbamate, Perampanel, Lacosamide, Retigabine SAR of Anticonvulsants. **Anti-Infective Chemotherapeutic Agents:** Antitubercular Agents: Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para-amino salicylic acid*, Rifampicin, Rifabutin, Cycloserine, Streptomycin, Capreomycin, Pretomanid, Clofazimine, Levofloxacin, Bedaquiline, Linezolid, Delamanid. Antimalarials: Quinine, Chloroquine*, Amodiaquine, Primaquine, Pamaquine, Quinacrine, Mefloquine, Cycloguanil pamoate, Proguanil, Pyrimethamine, Artesunate, Artemether, Atovaquone SAR of Quinoline derivatives. Antiprotozoals: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine isethionate, Atovaquone, Eflornithine, Paromomycin, Nitazoxanide. Antivirals: Amantadine, Rimantadine, Idoxuridine, Acyclovir*, Ganciclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir, Valganciclovir, Peramivir, Lenacapavir. Antifungals: Amphotericin-B, Nystatin, Natamycin, Griseofulvin, Clotrimazole, Econazole, Butoconazole, Oxiconazole, Tioconazole, Miconazole, Ketoconazole*, Terconazole, Itraconazole, Fluconazole, Naftifine, Tolnaftate, Posaconazole, Isavuconazole. Anthelmintics: Diethylcarbamazine, Thiabendazole, Mebendazole, Albendazole*, Niclosamide, Oxamniquine, Praziquantel, Ivermectin. Urinary Tract Anti-infective Agents: Nalidixic acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Furazolidone, Nitrofurantoin, Methenamine, Moxifloxacin SAR of Quinolones.

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Antibiotics and Sulfa Drugs: Antibiotics: Penicillins, Cephalosporins, β-Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin, Tetracyclines: Tetracycline, Oxytetracycline, Minocycline, Doxycycline, Macrolides: Erythromycin, Clarithromycin, Azithromycin Chloramphenicol*, Clindamycin, Clavulanic acid SAR of Penicillins, Tetracyclines, and Cephalosporins. Sulfa Drugs: Sulphamethizole, Sulfisoxazole, Sulphapyridine, Sulphathiazole, Sulfacetamide, Sulphamethoxazole, Sulphadiazine, Mefenide, Sulfasalazine, Trimethoprim, Cotrimoxazole, Dapsone* SAR of Sulfonamides. **Antineoplastic Agents:** Mechlorethamine, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa, Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine, Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin, Etoposide, Vinblastine, Vincristine, Paclitaxel, Camptothecin, Cisplatin, Mitotane, Carboplatin. **Endocrine Drugs, Antidiabetic Agents and Narcotic Analgesics:** Endocrine Drugs: Sex hormones: Testosterone, Nandrolone, Progesterone, Oestriol, Oestradiol, Oestrone, Diethylstilbestrol Drugs for erectile dysfunction: Sildenafil, Tadalafil Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole. Antidiabetic Agents: Insulin and preparations, Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride Biguanides: Metformin Thiazolidinediones: Pioglitazone, Rosiglitazone Repaglinide, Nateglinide, Acarbose, Voglibose. Narcotic Analgesics: Morphine, Codeine, Meperidine, Anilerdine, Diphenoxylate, Loperamide, Fentanyl*, Methadone, Propoxyphene, Pentazocine, Levorphanol Nalorphine, Levallorphan, Naloxone SAR of Morphine analogues.

Textbooks

1. Abraham, D. J. and Griffin, J. L. Burger's Medicinal Chemistry and Drug Discovery. Wiley.
2. Brunton, L., Hilal-Dandan, R. and Knollmann, B. Goodman and Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill Education.
3. Kar, Ashuthosh. Medicinal Chemistry. New Age International.
4. Lednicer, D. The Organic Chemistry of Drug Synthesis. Wiley.
5. Vogel, A. I. Vogel's Textbook of Practical Organic Chemistry. Pearson Education.
6. Williams, D. A., Lemke, T. L. and Roche, V. F. Foye's Principles of Medicinal Chemistry. Lippincott Williams & Wilkins.

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KL College of Pharmacy
Koneru Lakshmaiah Educational Foundation
(Deemed to be University)
Green Feilds, Vaddeswaram-522502
Guntur District, Andhra Pradesh.

26PY3127P: Biomedicinal Chemistry (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Synthesize specified drug molecules and intermediates in the laboratory.	PO1, PO3	3
CO2	Apply microwave irradiation techniques for efficient chemical synthesis.	PO1, PO3	3
CO3	Perform drug assays to determine the concentration and purity of drug samples.	PO1, PO2, PO3	3
CO4	Analyse physicochemical and ADME properties of drug candidates using computational tools.	PO1, PO2, PO4	4
CO5	Perform and interpret molecular docking studies to evaluate drug–receptor interactions.	PO1, PO2, PO4	3

Syllabus

Preparation of Drugs / Intermediates: 7-Hydroxy-4-methyl coumarin, Thiobarbituric acid, 2,3-Diphenylquinoxaline, Sulphanilamide, Triphenyl imidazole. Perform synthesis of intermediate/drug using microwave irradiation or green chemistry techniques.

Assay of Drugs: Sulpha drugs, Metronidazole, Isoniazid, Phenobarbitone, Benzyl penicillin and Chloroquine.

Drug Design & Computational Tools: Calculate physicochemical and ADME properties using Swiss ADME (e.g. logP, molecular weight, H-bond donors/acceptors). Perform basic molecular docking studies using any of open-source academic tools.

Textbooks

1. Furniss, B. S., Hannaford, A. J., Smith, P. W. G. and Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry. Pearson Education.
2. Brown, N. Artificial Intelligence in Drug Discovery. Cambridge: Royal Society of Chemistry.
3. Finar, I. L. Organic Chemistry. Pearson Education.
4. Remington. The Science and Practice of Pharmacy. Pharmaceutical Press.
5. Abraham, D. J. and Griffin, J. L. Burger's Medicinal Chemistry and Drug Discovery. Wiley.

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26PY3128T: Industrial Pharmacognosy (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the economic significance, trade potential, and institutional support for medicinal and aromatic plant–based industries	PO1, PO8, PO11	2
CO2	Understand the principles of production, standardization, and quality control of herbal products.	PO1, PO3, PO6	2
CO3	Apply modern spectroscopic and chromatographic techniques for the analysis of herbal drugs and botanicals.	PO1, PO3, PO4	3
CO4	Understand the isolation, characterization, identification, and analysis of important phytoconstituents.	PO1, PO2, PO3	4
CO5	Understand international regulatory guidelines and pharmacopeial requirements for the safety, efficacy, and quality of herbal medicines.	PO1, PO3, PO6	2

Syllabus

General Introduction to Herbal Industries, institutions and trade status of herbals: Role of medicinal and aromatic plants trade in national economy of a country and introduction of Current trade status and potential of some commercially important medicinal plants/natural products like Ashwagandha, Turmeric, Ginseng, Amla and essential oils. A brief account of bioeconomy, biodiversity hot spots and plant based industries and institutions involved in research work on medicinal and aromatic plants in India. Emerging therapeutic categories of Herbal Medicinal Products available in market, their composition with rationale for Aphrodisiac, Antistress, anti-diabetics, antihyperlipidemic, immunomodulator, hepatoprotective and kidney disorders. Emerging Herbal cosmeceuticals: Anti-Aging, Depigmenting, anti acne, sunscreen, detoxifying, anti-irritant, nutricosmetics. **Commercial Production and Standardization of botanicals:** Significance of AYUSH/ WHO-GMP, GLP and USFDA compliant facility in production of quality herbal products. Commercial production of standardized herbal extracts with clinical relevance: Coleus, Amla, Turmeric, Ashwagandha and Senna. Commercial production and standardization of volatile oils: Eucalyptus oils, Lavender oil and Peppermint oil, Rosemary oil Preparation and standardization of Ayush formulations viz Aristas and Asawas, Ghutika/Habb, Churna/ Shafoof Arq, Sharbat, Tincture and Bhasma. **Modern methods of analysis of Plants and Plant-based products:** Basic principles and applications in analysis of botanicals: Spectroscopic methods: UV-Visible spectroscopy, IR Spectroscopy, NMR spectroscopy and Mass spectroscopy, Atomic Absorption Scpectroscopy Chromatographic methods: HPTLC, HPLC, UPLC, GC. **Isolation, Characterization, Commercial Production and analysis of bioactive phytoconstituents:** Isolation, characterization with commercial production, identification and analysis of bioactive phytoconstituents: Artemisinin, Sennosides, Withanolids, Boswellic acid, Atropine, and Lycopene.

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International Regulatory Perspectives: Overview of global regulations for herbal products (e.g., World Health Organization, United States Food and Drug Administration – Dietary Supplement Health and Education Act, European Medicines. Agency, TGA-ARG Therapeutic Goods Administration – Australian Regulatory Guidelines for Complementary Medicines, Natural Health Products (Canada). Harmonization challenges and mutual recognition of traditional medicine. Importance of safety, efficacy and pharmacovigilance in herbal product regulation. Study of Monographs on herbal drugs and botanicals related to Indian Pharmacopoeia, United States Pharmacopoeia Herbal Medicine and Dietary Supplement, Ayurvedic Pharmacopoeia of India and Unani Pharmacopoeia of India.

Textbooks

1. Ayurvedic Pharmacopoeia Committee. Ayurvedic Pharmacopoeia of India. Government of India, Ministry of AYUSH.
2. European Medicines Agency. Herbal Monographs and Regulatory Guidelines.
3. Indian Drug Manufacturers' Association. Indian Herbal Pharmacopoeia.
4. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Government of India.
5. International Council for Harmonisation. ICH Guidelines on Quality, Safety, Efficacy and Multidisciplinary Topics.
6. Natural Health Products Directorate. Regulatory Framework for Natural Health Products.
7. World Health Organization. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants.

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26PY3128P: Industrial Pharmacognosy (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply chromatographic techniques for isolation and analysis of phytoconstituents	PO1, PO3, PO4	3
CO2	Apply phytochemical techniques to isolate and identify key phytoconstituents from medicinal plants.	PO1, PO3, PO8	3
CO3	Apply standardization techniques to evaluate Ayurvedic formulations and determine alcohol content.	PO1, PO2, PO3	3
CO4	Apply monograph preparation and evaluation techniques for herbal drugs and traditional formulations.	PO1, PO2, PO3	3
CO5	Analyse marketed and community-used traditional formulations through case studies and experiential learning	PO1, PO2, PO9	4

Syllabus

1. To perform column chromatography for isolation of phytochemicals.
2. Preparative TLC of curcuminoids.
3. Isolation and identification of Piperine.
4. Isolation and identification of Sennoside.
5. Isolation and identification of Withanolide.
6. Isolation and identification of Lycopene.
7. Acid – base purification process for the separation of alkaloids.
8. Chemoprofiling of purified alkaloidal fraction.
9. Separation of amino acid by paper chromatography.
10. TLC/HPTLC/HPLC of herbal extracts/ botanicals.
11. Isolation and determination of total aldehyde content in volatile oil.
12. Preparation of monographs on herbal drugs wrt IP, API, IHP.
13. Determination of the alcohol content of Asava and Arista.
14. Standardization of any two Ayurvedic formulations using UV-spectroscopy.
15. Preparation and evaluation of Ayurvedic churna.
16. Experiential learning-based experiments focused on the preparation and practical applications of folkloric or region-specific traditional formulations within the community.
17. Case studies analysing community awareness and usage patterns of various traditional formulations.

Textbooks

1. Mukherjee, P. K. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons.
2. Sinha, D., Mukherjee, S. and Chowdhury, S. Methods of Extraction of Phytochemicals. IGI Global.
3. Zhang, J., Wen, C., Zhang, H., Duan, Y. and Ma, H. Extraction of Bioactive Compounds with Subcritical Water. Elsevier.

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26PY3129T: Innovation and Startup Ecosystem (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the concepts of innovation, entrepreneurship, and the startup ecosystem.	PO1, PO5, PO8	2
CO2	Understand problem identification, market opportunities, and feasibility analysis for entrepreneurial ventures.	PO1, PO2, PO3	3
CO3	Apply lean startup principles to develop and validate a minimum viable product (MVP).	PO1, PO5, PO8	3
CO4	Apply the Business Model Canvas to develop and evaluate startup business models.	PO4, PO6, PO8	3
CO5	Apply startup pitching and ecosystem engagement skills to present innovative business ideas.	PO1, PO3, PO5	3

Syllabus

Introduction to Innovation and Entrepreneurship: Defining Innovation and Entrepreneurship: What is Innovation. Types of Innovation: Product, Process, Business Model, Social. What is Entrepreneurship. Characteristics of an Entrepreneur. Invention vs Innovation: Distinction between Invention and Innovation. Importance of Innovation in the 21st Century - Economic growth and job creation and Solving societal problems. Disruptive technologies and their impact. Case Studies: Innovative companies (e.g., Apple, Google, Tesla). Introduction to the Startup Ecosystem: Key components - Entrepreneurs, Incubators/Accelerators, Mentors, Investors, Government, Academia and Support Services. Role of each component in fostering innovation. Practical Aspect: Participation in National Innovation Day and National Startup Day. **Ideation and Opportunity Identification:** Identifying Problems and Market Gaps: Problem-solving approach to entrepreneurship. Techniques for problem identification – Observation, Empathy mapping and User interviews. Market research basics - Understanding customer needs and pain points. Generating Innovative Ideas: Brainstorming techniques – SCAMPER, Mind Mapping and Design Thinking principles for ideation. Lateral thinking and divergent thinking. From problem to solution: developing initial concepts. Opportunity Analysis and Feasibility: Market sizing and potential, Competitive analysis and SWOT analysis for new ventures. Practical Aspect: Participation in Ideation Challenges or Hackathons (e.g., Smart India Hackathon or IIC internal ideation competitions). **Building a Minimum Viable Product (MVP) and Validation:** Lean Startup Methodology: Introduction to Lean Startup principles. Build–Measure–Learn feedback loop. Concept of MVP – Importance, Scope and objectives. Designing and Developing an MVP: Different types of MVPs. Tools and resources for rapid prototyping. User experience basics for MVPs. Validation: Customer interviews and feedback collection. A/B testing and split testing. Pivoting vs Persevering. Practical Aspect: Participation in sessions/workshops on Prototype, MVP, and Product Development. **Business Models and Startup Operations:** Business Model Canvas (BMC): Introduction to the 9 building blocks of BMC. Developing a BMC for a new venture. Value Proposition Design. Legal and Financial Aspects for Startups: Legal structures - Sole Proprietorship, Partnership and Private Limited Company. Intellectual Property Rights (IPR) – Patents, Trademarks and Copyrights. Startup funding – Bootstrapping, Angel investors and Venture capital. Team Building and Mentorship: Importance of a strong founding team. Roles and responsibilities in a startup. Value of mentors and advisors. Practical Aspect: Participation in IPR awareness programs or startup funding sessions.

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Scaling, Ecosystem Engagement, and Future Trends: Growth Strategies and Scaling Up: Marketing and sales for startups. User acquisition and retention. Challenges of scaling and solutions. Exit strategies - Acquisition and IPO. Engaging with the Startup Ecosystem: Networking with investors, mentors, and entrepreneurs. Participation in startup competitions and pitch events. Leveraging incubators and accelerators. Future Trends in Innovation and Entrepreneurship: Emerging technologies - Artificial Intelligence, Blockchain, Internet of Things (IoT) and Sustainable Technologies. Social entrepreneurship and impact investing. Global startup trends. Practical Aspect: Participation in National Innovation Day and student engagement activities to prepare and deliver a concise pitch for their developed idea, simulating a startup pitch event.

Textbooks

1. Eric Ries. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.
2. Thiel, P. and Masters, B. Zero to One: Notes on Startups, or How to Build the Future. Crown Business.
3. Bansal, R. Stay Hungry Stay Foolish. Westland.
4. Dalal, M. Big Billion Startup: The Untold Flipkart Story. Pan Macmillan India.
5. Ivaturi, V. K. The Manual for Indian Start-Ups: Tools to Start and Scale-Up Your New Venture. Notion Press.

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26PY3130T: Pharmaceutical Dosage Form II (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles, formulation, and quality aspects of monophasic and biphasic liquid dosage forms	PO1, PO3	2
CO2	Apply formulation and evaluation techniques for monophasic and biphasic liquid dosage forms.	PO1, PO3	3
CO3	Apply physicochemical principles to design and evaluate stable liquid dosage forms.	PO1, PO3	3
CO4	Apply formulation and evaluation techniques for pressurized and inhalation dosage forms	PO1, PO3	3
CO5	Apply formulation and evaluation techniques for semisolid and advanced drug delivery systems.	PO1, PO2	3

Syllabus

Monophasic Liquids & Pressurised Dosage Forms: Foundations: Need, advantages/limitations; monophasic vs biphasic; solubility-enhancement techniques. Vehicles & solvents: Pharmaceutical waters (types; manufacturing & Quality Control of Purified/Distilled); classes of solvents as per toxicity. Formulation & manufacturing: Raw-material considerations and additives; processing; Quality Control of solutions/syrups/elixirs; powders for reconstitution as solutions. Measuring, filling & packaging: Techniques; container closure integrity; automation in liquid manufacturing. **Biphasic Liquids- Suspensions:** Formulation & manufacturing: Additives; classification of suspending agents; IPQC & Quality Control; instabilities and packaging. Advances: Nanosuspensions; dry powder for reconstitution as suspensions; raft- forming systems. **Biphasic Liquids - Emulsions:** Formulation & manufacturing: Additives; classification of emulsifying agents; IPQC & Quality Control; instabilities and packaging. Advances: Nano-emulsions, micro-emulsions, SMEDDS/SNEDDS (overview, applications). **Pressurized dosage forms (Aerosols/MDIs):** Concepts; propellant classification/selection; valves & containers; formulation, manufacturing, and Quality Control (leak, spray pattern, delivered dose, particle- size/aerodynamic performance). Dry Powder Inhalers: valves & containers; formulation, manufacturing, and Quality Control. **Semisolid Dosage Form:** Theory of Semisolid Dosage Forms: Definition & Purpose, Drug Permeation Pathways through skin, Factors affecting Permeation, Permeation enhancers: Physical and Chemical. Types of semisolid dosage form: Ointments: Base Selection, Formulation, Manufacturing and Evaluation. Creams: Formulation, Manufacturing and Evaluation. Gels/Jellies: Formulation, Manufacturing and Evaluation. Pastes: Formulation, Manufacturing and Evaluation. Suppositories and Pessaries: Formulation, Manufacturing and Evaluation. Advances: Xerogels, emulgels (overview, applications).

Textbooks

1. Aulton, M. E. Aulton's Pharmaceutics: The Science of Dosage Form Design. Elsevier.
2. Gibson, M. Pharmaceutical Preformulation and Formulation. CRC Press.
3. Lachman, L., Lieberman, H. A. and Kanig, J. L. The Theory and Practice of Industrial Pharmacy. CBS Publishers & Distributors.
4. Robinson, J. R. and Lee, V. H. L. Controlled Drug Delivery: Fundamentals and Applications. CRC Press.

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26PY3130P: Pharmaceutical Dosage Form II (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply the fundamentals of solubility enhancement during dosage form development.	PO1, PO3, PO4	3
CO2	Understand the manufacturing processes of monophasic and biphasic liquid dosage forms.	PO1, PO3	2
CO3	Apply manufacturing techniques for semisolid dosage forms.	PO1, PO3	3
CO4	Apply quality evaluation parameters to assess pharmaceutical dosage forms	PO1, PO3	3
CO5	Analyse the effects of formulation parameters on the performance of biphasic and semisolid dosage forms.	PO1, PO2, PO3	4

Syllabus

1. To enhance the solubility of a BCS Class II drug by solid dispersion technique.
2. To enhance the solubility of a BCS Class II drug by cyclodextrin complexation.
3. Preparation and evaluation of medicated syrups using simple and artificial syrup bases.
4. Preparation and evaluation of different types of pharmaceutical emulsions.
5. Preparation and evaluation of an emulsion with a small-dose oily active (e.g., calciferol).
6. Preparation and evaluation of an oral suspension.
7. To study the effect of different suspending agents/concentrations on sedimentation volume.
8. Preparation and evaluation of a dry powder for reconstitution as a suspension.
9. Preparation and evaluation of pharmaceutical creams.
10. Preparation and evaluation of pharmaceutical gels.
11. To study the effect of different gelling agents/concentrations on viscosity of gels.
12. Preparation and evaluation of medicated suppositories.
13. Preparation and evaluation of medicated pessaries.
14. Preparation and evaluation of in-situ gels.
15. Preparation and evaluation of emulgels.

Textbooks

1. Aulton, M. E. Aulton's Pharmaceutics: The Science of Dosage Form Design. Elsevier.
2. Gibson, M. Pharmaceutical Preformulation and Formulation. CRC Press.
3. Lachman, L., Lieberman, H. A. and Kanig, J. L. The Theory and Practice of Industrial Pharmacy. CBS Publishers & Distributors.
4. Robinson, J. R. and Lee, V. H. L. Controlled Drug Delivery: Fundamentals and Applications. CRC Press.
5. Troy, D. B. and Beringer, P. Remington: The Science and Practice of Pharmacy. Pharmaceutical Press.

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26PY3131T: Pharmaceutical Quality Assurance (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the concepts of QA, QC, GMP, GLP and modern Quality Management Systems.	PO1, PO8	2
CO2	Apply TQM, QbD, and ICH guidelines to ensure consistent pharmaceutical quality.	PO1, PO6	3
CO3	Understand the requirements related to personnel, premises, equipment, materials, and documentation.	PO1, PO7	2
CO4	Understand the quality control testing of pharmaceutical products.	PO1	2
CO5	Understand the calibration, qualification, and analytical method validation as per regulatory guidelines.	PO1, PO3, PO6	2

Syllabus

Quality Assurance and Quality Management Systems: Quality Assurance and Quality Management concepts: Definition and concepts of Quality Control, Quality Assurance, and GMP. Total Quality Management (TQM): Definition, elements, and philosophies. ICH Guidelines: Purpose, process of harmonization, overview of QSEM with special emphasis on Q-series guidelines. Quality by Design (QbD): Definition, overview, elements of QbD program, and tools. ISO 9000 and ISO 14000: Overview, benefits, elements, and steps for registration. NABL Accreditation: Principles and procedures. **Organization, Personnel, Premises, and Materials Management:** Organization and Personnel: Responsibilities, training, hygiene, and personal records. Organization and Personnel: Responsibilities, training, hygiene, and personal records. Equipment and Raw Materials: Equipment selection, User Requirement Specifications (URS), handling and maintenance of raw materials. Warehousing: Good warehousing practices and materials management. **Quality Control and Good Laboratory Practices:** Quality Control Tests for Formulations: In-process and finished product quality control tests for tablets, capsules, ointments, creams, ophthalmic and parenteral preparations. Quality Control of Raw Materials and Packaging Materials: Tests for raw materials, containers, rubber closures, and secondary packing materials. Good Laboratory Practices (GLP): General provisions, organization and personnel, facilities and equipment, ALCOA principles, reference standards, testing facility operations, records and reports, and disqualification of testing facilities. **Documentation, Complaints, and Product Recall:** Documentation in the Pharmaceutical Industry: Batch Formula Record, Master Formula Record, Drug Master File, SOPs, quality audits, preparation, handling, archival, and distribution of records. Complaints and Product Recall: Handling of complaints, evaluation of complaints, returned goods, recalls, and waste disposal. **Calibration and Validation:** Calibration and Validation: Introduction, definitions, importance, and general principles Calibration of weights and measures, pH meter Qualification of UV-Visible spectrophotometer, electronic balance, IR spectrophotometer, and HPLC. Analytical Method Validation: General principles of analytical method validation as per ICH Q2 guidelines.

Textbooks

1. Godfrey, A. B. and Juran, J. M. Juran's Quality Handbook. McGraw-Hill Education.
2. Organisation of Pharmaceutical Producers of India. Quality Assurance Guide. OPPI.
3. Weinberg, S. Good Laboratory Practice Regulations. Marcel Dekker.
4. World Health Organization. Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials. World Health Organization.

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26PY3132T: Systemic Pharmacology II (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the role of neurotransmitters and the pharmacology of drugs acting on central neurotransmission.	PO1	2
CO2	Apply principles of chemotherapy to explain mechanisms and uses of chemotherapeutic agents.	PO1, PO3, PO4	3
CO3	Understand the pharmacology of hormones and drugs used in endocrine disorders	PO1	2
CO4	Understand the mechanisms and therapeutic uses of drugs acting on the gastrointestinal tract	PO1	2
CO5	Understand the concepts of drug abuse, addiction, dependence, and their management	PO1, PO8	2

Syllabus

Pharmacology of Drugs Acting on Central Nervous System: Neurohumoral transmission in the CNS; physiological roles of GABA, glutamate, glycine, serotonin, and dopamine. General anesthetics, pre-anaesthetic medications, and local anaesthetic agents. Sedative–hypnotics. Alcohol and disulfiram. Opioids, opiate analgesics, and antagonists. Drugs used in epilepsy. Drugs used in Parkinson's and Alzheimer's diseases. **Pharmacology of Drugs Used in Psychiatry:** Antipsychotics, antidepressants, anti-anxiety drugs, mood stabilizers, CNS stimulants, and hallucinogens. Substance abuse, drug addiction, and general principles of de addiction. **Chemotherapy:** Introduction: Definitions of chemotherapy, chemotherapeutic index, antibiotics, and antimicrobial agents. Concept of selective targeting in chemotherapy. Classification of antimicrobial agents based on mechanism of action. Concept of superinfection, chemoprophylaxis, and combined use of antibiotics. Antimicrobial resistance: causes, mechanisms, and preventive measures. Antimicrobial Agents: Classification, mechanism of action, adverse drug reactions, and therapeutic uses of - Sulphonamides and cotrimoxazole, Fluoroquinolones, Penicillin's and cephalosporins, Macrolides and tetracyclines, Linezolid, Carbapenems and monobactam and Chloramphenicol and aminoglycosides. Chemotherapy of Diseases: Drugs used in the treatment of - Fungal infections, Viral infections, Helminthiasis, Urinary tract infections, Tuberculosis, Leprosy, Malaria, Amoebiasis and Neoplastic diseases. **Pharmacology of Drugs Acting on Endocrine System:** Introduction to basic concepts of endocrinology. Thyroid and antithyroid agents. Parathormone, calcitonin, and vitamin D. Insulin and oral hypoglycaemic agents. ACTH and corticosteroids. Oral contraceptives. Drugs acting on the uterus. PCOD. **Drugs Acting on Gastrointestinal Tract:** Drugs used in peptic ulcer. Drugs used for constipation and diarrhoea. Emetics and anti-emetics. Digestants, carminatives, appetizers, and anorectics – definitions and examples.

Textbooks

1. Brunton, L., Hilal-Dandan, R. and Knollmann, B. Goodman and Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill Education.
2. Craig, C. R. and Stitzel, R. E. Modern Pharmacology with Clinical Applications. Lippincott Williams & Wilkins.
3. DiPiro, J. T., Talbert, R. L., Yee, G. C. and Matzke, G. R. Pharmacotherapy: A Pathophysiologic Approach. McGraw-Hill Education.
4. Katzung, B. G. and Trevor, A. J. Basic and Clinical Pharmacology. McGraw-Hill Education.

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26PY3132P: Systemic Pharmacology II (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the mechanisms and pharmacological principles of CNS and antiulcer drugs using computer-based models	PO1, PO4, PO7	2
CO2	Apply experimental and simulation-based models to evaluate pharmacological drug activity	PO1, PO3, PO4	3
CO3	Analyse experimental pharmacological data using bioassay and dose–response methods	PO2, PO3, PO4	4
CO4	Apply advanced biomedical and laboratory techniques in pharmaceutical and biomedical research.	PO1, PO3, PO5	3
CO5	Apply bioinformatics and network pharmacology tools to predict drug targets and ADME/toxicity profiles	PO1, PO2, PO4	3

Syllabus

1. Evaluation of analgesic activity of centrally and peripherally acting analgesics using Eddie's hot plate, tail-flick, tail immersion, and acetic acid-induced writhing methods through interactive computer simulation.
2. Evaluation of antiepileptic activity using maximal electroconvulsive shock (MES) induced seizures through interactive computer simulation.
3. Demonstration of the antiepileptic activity using pentylenetetrazol-induced seizures through interactive computer simulation.
4. Evaluation of antidepressant activity of drugs using the tail suspension test through interactive computer simulation.
5. Demonstration and study of locomotor activity using actophotometer through interactive computer simulation.
6. Evaluation of antianxiety activity using the elevated plus maze or zero maze model through interactive computer simulation.
7. Evaluation of antipsychotic activity of drugs using inhibition of conditioned response on Cook's pole climbing apparatus through interactive computer simulation.
8. Study of the effect of drugs on learning and memory using the Morris water maze test through interactive computer simulation.
9. Study of antiulcer activity using indomethacin-induced or pylorus ligation-induced ulcer models.
10. Estimation of the concentration of oxytocin on isolated rat uterus preparation using a suitable method through interactive computer-based simulation.
11. Estimation of drug concentration by 3-point or 4-point bioassay through interactive computer simulation.

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12. Bioassay of histamine using matching, bracketing, or interpolation methods on suitable isolated tissue preparation with the help of interactive computer simulation.
13. Study of cell culture techniques, including types of cell culture, laboratory instruments/equipment, culture media, and growth of cell cultures in laboratory facilities.
14. Study of antibacterial sensitivity testing of urine culture using techniques such as the disc diffusion method (theoretical details/case studies).
15. Demonstration using databases and software packages for predicting drug activity, ADME properties, and toxicity.
16. Study of electrophoresis of protein and DNA samples and gel visualization techniques.
17. Construction of pharmacological networks using predicted drug targets and disease genes with activity prediction databases, disease gene databases, and suitable software.

Textbooks

1. Ghosh, M. N. Fundamentals of Experimental Pharmacology. Hilton & Company.
2. Vogel, H. G. Drug Discovery and Evaluation: Pharmacological Assays. Springer.
3. Hofmann, F. B. Handbook of Experimental Pharmacology (HEP Series). Springer Nature.

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26PY3233T: Advanced Pharmacognosy (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the reverse pharmacology, traditional knowledge databases, and bioprospecting strategies.	PO1, PO4	2
CO2	Analyse herbal drugs using metabolomics, spectral libraries, and chemoinformatics tools.	PO1, PO2, PO4	4
CO3	Apply modern in-silico and AI techniques in lead identification and optimization from natural products.	PO1, PO3, PO4	3
CO4	Apply preclinical methods to assess the safety, pharmacokinetics, and efficacy of bioactive leads.	PO1, PO2, PO9	3
CO5	Understand the global IP frameworks and develop strategies for patenting herbal products and protecting traditional knowledge.	PO1, PO2	2

Syllabus

Reverse Pharmacology and Integrative Approaches: Reverse pharmacology and integrative approaches from the AYUSH perspective. Ethnopharmacological approach to bioprospecting. Traditional medicine databases: AYUSH Research Portal, ICMR Standards on Indian Medicinal Plants, TKDL, NAPRALERT, Super Natural, etc. Molecular docking and ADMET screening of bioactives. Concept of adjuvant therapy with herbals in metabolic and non-communicable diseases. **Metabolomics and Systems Biology:** Introduction to metabolomics and its tools: applications of NMR and HRMS in metabolomics, Metabolomics profiling and dereplication studies, Role of metabolomics in quality control, scientific, validation of traditional claims and pharmacological evaluation, Network pharmacology and systems biology approaches to herbal medicine, Significance of spectral libraries and chemoinformatics databases in drug discovery. **Modern Techniques in Natural Product Discovery:** Role of artificial intelligence (AI), Machine learning and big data in Drug discovery from natural Products. Molecular docking, Virtual Screening and Pharmacophore modelling, Use of Genomic and transcriptomic tools in medicinal plant research, High-throughput screening (HTS) and bioautography. **Validation and Development of Herbal Leads:** Bioactivity Guided Fractionation, characterization /Structure Elucidation, Optimization of lead compounds for better efficacy, safety, and stability through SAR and QSAR modelling for semi-synthetic compounds of Salicin, Artemisinin, Piperine, Papaverine and Andrographolides. Preclinical, Clinical Evaluation and New Drug approvals: Testing for toxicity as per OECD guidelines, pharmacokinetics, and bioavailability of herbal products, extracts and lead compounds, assessment of safety and efficacy, clinical trials with or without placebo for clinical endpoints based on assessment of quality of life reporting adverse events if any, filing IND application, NDA submission, Regulatory review and post marketing surveillance. **Patenting of Natural Products:** Key Terminologies and Concepts: Definitions and distinctions: Patent, Intellectual Property Rights (IPR) Farmers' Rights and Breeders' Rights, Bioprospecting and Biopiracy Patenting Aspects of Natural Products and Traditional Knowledge: Legal frameworks and challenges in patenting natural substances, Traditional Knowledge Digital Library (TKDL) and its role in protecting indigenous knowledge. Role of National Biodiversity Authority in patenting natural products and NAGOYA protocol. Case Studies: Turmeric– U.S. patent on wound healing and its revocation, Neem– Biopiracy issue and patent cancellation.

Textbooks

1. Bhat, S. V., Nagasampagi, B. A. and Sivakumar, M. Chemistry of Natural Products. Springer.

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26PY3234T: Biopharmaceutics and Pharmacokinetics (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand pharmacokinetic and pharmacodynamic principles and their application to patient-centered care.	PO1, PO4, PO9	2
CO2	Apply physicochemical and biological principles to evaluate drug absorption, distribution, and protein binding	PO1, PO3, PO9	3
CO3	Apply bioavailability principles to develop bioequivalence study protocols	PO1, PO2, PO6	3
CO4	Apply compartment models and numerical techniques to solve pharmacokinetic problems.	PO1, PO2, PO3	3
CO5	Apply dosing regimen design and PK/PD simulation techniques for pharmacokinetic analysis	PO1, PO2, PO4	3

Syllabus

Introduction to Biopharmaceutics and pharmacokinetics: Introduction to various Pharmacokinetic parameters (using Plasma drug Concentration vs Time curve) and Pharmacodynamic parameters and drug delivery index. Absorption; Mechanisms of drug absorption through GIT, Physicochemical, Biological and Dosage form related factors influencing drug absorption though GIT, methods of Assessment of GIT absorption, Distribution Tissue permeability of drugs, binding of drugs, apparent volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs. **Elimination (Metabolism and Elimination):** Drug metabolism and basic understanding of metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, non renal routes of drug excretion of drugs. Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, Introduction to BCS and biopharmaceutical drug disposition classification system, methods of measurement of bioavailability (Plasma data, Urinary excretion data), Protocol for assessment of bioavailability and bioequivalence studies. in vitro drug dissolution methods (test apparatus I-VII), biorelevant dissolution mediums, in-vitro in-vivo correlations: Concept and Applications, Biowaivers, Methods of enhancement of bioavailability. **Pharmacokinetic Models: Compartment Models:** Definition, Basis of classification, Properties of compartment, Advantages and disadvantages of compartment modelling. Kinetic considerations of One compartment open model. (a). Intravenous Injection (Bolus/rapid) (b). Intravenous infusion and (c) Extra-vascular administration. (with emphasis on Curve Fitting, Wagner –Nelson, Loo Riegelman) Introduction to non - compartment model: Principles, estimation of PK parameters (AUC, AUMC, MRT, MAT statistical moment theory). **Multicompartment models:** Multiple dosage regimen: dosing interval, drug accumulation, loading dose, maintenance dose, PK Parameters Kinetic consideration of two compartment open model (a) Intravenous Injection (Bolus/rapid) and (b) Extra vascular administrations (oral administration). Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their clinical significance. Multiple dosage regimen. Introduction to pharmacokinetic consideration of Modified release drug products.

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Nonlinear Pharmacokinetics: Introduction, Reasons for Non-linearity, Michaelis-menton method of estimating parameters, Explanation with example of drugs. Application of PK software: Introduction of various in -silico methods for calculating various PK parameters.

Textbooks

1. Shargel, L. and Yu, A. B. C. Applied Biopharmaceutics and Pharmacokinetics. McGraw-Hill Education.
2. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. Lea & Febiger.
3. Rowland, M. and Tozer, T. N. Clinical Pharmacokinetics and Pharmacodynamics: Concepts and Applications. Wolters Kluwer.
4. Bonate, P. L. Pharmacokinetic-Pharmacodynamic Modeling and Simulation. Springer.
5. Brahmankar, D. M. and Jaiswal, S. B. Biopharmaceutics and Pharmacokinetics: A Treatise. Vallabh Prakashan.
6. Eddy, D. M. Modeling and Simulation in the Medical and Health Sciences. Springer.

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26PY3234P: Biopharmaceutics and Pharmacokinetics (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental concepts, types, and applications of NDDS in modern therapeutics and precision medicine.	PO1, PO4	2
CO2	Analyse the formulation and performance of advanced drug delivery systems.	PO1, PO3, PO5	4
CO3	Understand the selection of excipients and techniques for developing NDDS based on drug properties and target site requirements.	PO1, PO3, PO4	2
CO4	Apply evaluation and quality control techniques to assess novel formulations for efficacy, stability, and patient compliance	PO3, PO5, PO6	3
CO5	Analyse the role of NDDS strategies in optimizing targeted and individualized therapeutic approaches	PO1, PO8	4

Syllabus

1. To calculate MRT from the given data.
2. To assess the effect of protein binding of a drug
3. To report relative bioavailability of given drug product using urinary excretion data
4. To report relative bioavailability of given drug product using plasma data
5. Establish IVIVC from the given in vitro and in vivo data.
6. To calculate pharmacokinetic parameters of a drug using given plasma level data.
7. To report bioequivalence of drug products using given urinary excretion data administered
8. To calculate absorption rate constant, elimination rate constant and elimination half life of given excretion data by sigma minus method.
9. To calculate absorption rate constant, elimination rate constant and elimination half life of the given drug data administered by IV bolus injection represented by one compartment model.
10. To calculate the absorption rate constant by using curve fitting method.
11. To calculate various pharmacokinetic parameters using in silico methods.

Textbooks

1. Bonate, P. L. Pharmacokinetic-Pharmacodynamic Modeling and Simulation. Springer.
2. Brahmankar, D. M. and Jaiswal, S. B. Biopharmaceutics and Pharmacokinetics: A Treatise. Vallabh Prakashan.
3. Eddy, D. M. Modeling and Simulation in the Medical and Health Sciences. Springer.
4. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. Lea & Febiger.
5. Rowland, M. and Tozer, T. N. Clinical Pharmacokinetics and Pharmacodynamics. Wolters Kluwer.
6. Shargel, L. and Yu, A. B. C. Applied Biopharmaceutics and Pharmacokinetics. McGraw Hill Education.

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26PY3235T: Intellectual Property Rights (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basic concepts and significance of intellectual property rights with respect to pharmaceutical industries.	PO1, PO6	2
CO2	Understand the types of intellectual property rights such as patents, copyrights, trademarks, and trade secrets.	PO1, PO6	2
CO3	Understand the procedure for patent filing in India and abroad.	PO1	2
CO4	Understand the key provisions of the Indian Patent Act.	PO1	2
CO5	Analyze strategies for intellectual property management and product commercialization.	PO1, PO2, PO8	4

Syllabus

Introduction to Intellectual Property: Definition and scope of Intellectual Property (IP), Importance and types of IP: Patents, Trademarks, Copyrights and Trade Secrets, Overview of the origin and progression of intellectual property rights in India and internationally, Role of IP in the pharmaceutical industry. **Patents – Fundamentals and Process:** Definition and objectives of patents, Criteria for patentability such as Novelty/innovations, Non-obviousness, Utility, Types of patents and non-patentable inventions in India, Procedure for filing a patent in India, Rights of a patent holder and term of patent protection. **Patent Laws and Acts:** Overview of Indian Patent Act, 1970 (latest amendments and key provisions under the act), TRIPS Agreement and its implications on the Indian pharmaceutical sector, Compulsory licensing, patent opposition, and revocation, Indian pharmaceutical patents: Case studies. **Other Forms of Intellectual Property:** Trademarks, Copyrights, Industrial designs: Definition, importance, registration process, Basics and protection in scientific work, Importance and legal framework, Trade secrets and geographical indications in pharma industry. **IPR Management and Commercialization:** Valuation and strategies for commercialization of intellectual property; processes of technology transfer, licensing agreements, and collaborative ventures; issues related to IP infringement and available legal remedies; management practices of IPR in the pharmaceutical industry supported by relevant case studies.

Textbooks

1. World Intellectual Property Organization. Introduction to Intellectual Property. WIPO
2. Ahuja, V. K. Law Relating to Intellectual Property Rights. LexisNexis.
3. Bouchoux, D. Intellectual Property. Cengage Learning.
4. Ganguli, P. Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw-Hill.
5. Narayanan, P. Intellectual Property Law. Eastern Law House.
6. Ramakrishna, T. Basic Principles and Acquisition of Intellectual Property Rights. CIPRA.

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26PY3236T: AI Applications in Pharmaceutical Sciences (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the pharmaceutical data from various domains can be structured for machine learning applications.	PO1, PO4	2
CO2	Understand the regression and classification models used in natural products and medicinal chemistry.	PO1, PO2, PO4	2
CO3	Analyse predictive modelling approaches in formulation, release, and stability studies.	PO1, PO2, PO4	4
CO4	Apply the AI applications in manufacturing process monitoring and quality prediction.	PO2, PO4	2
CO5	Analyse the analytical modelling and chemometric applications in pharmaceutical quality control.	PO1, PO2, PO4	4

Syllabus

AI in Natural Products & Pharmacognostic Data Modelling: Overview of ML applications in natural products: Representation of crude drug data (morphological, microscopic, phytochemical, chromatographic features). Structuring herbal datasets for predictive modelling. Classification models for authentication of crude drugs (authentic vs adulterated). Regression models for prediction of secondary metabolite yield. Application of AI in phytochemical screening and prioritization. Herb-drug interaction prediction using database-driven approaches. Limitations of predictive modeling in natural products. **AI in Medicinal & Pharmaceutical Chemistry:** Overview of the role of AI applications in pharmaceutical chemistry with focus on drug discovery concepts: Conversion of molecular structures into numerical descriptors (MW, logP, HBD/HBA, TPSA). Structured chemical datasets and QSAR modelling. Regression and classification models for predicting biological activity (IC_{50}, solubility, ADMET properties), toxicities. Virtual screening and lead optimization concepts. Limitations of ML models and importance of chemical reasoning **AI in Drug Product Design & Performance Prediction:** Overview of AI models across formulation development stages, with emphasis on the applications and limitations: Overview of dosage form development and formulation variables. Machine learning in formulation optimization and excipient selection. Regression modelling for solubility and bioavailability enhancement. Time-concentration modelling for drug release interpretation. Stability study design and modelling degradation trends. Shelf-life estimation using regression-based approaches. Practical limitations of extrapolation in formulation science. **AI in Process Monitoring & Production Systems:** Overview of introduces multivariate analysis in pharmaceutical analytical techniques with focus on the different models and their applications: Digital data acquisition in pharmaceutical production. Critical Quality Attributes (CQAs) and Critical Process Parameters (CPPs). Correlation analysis for identifying process variability. Logistic regression models for batch pass/fail prediction. Feature importance in process monitoring, predictive maintenance concepts. Ethical and regulatory considerations in automated decision making, and limitations of predictive models in manufacturing environments.

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AI in Pharmaceutical Analysis & Chemometrics: Overview of multivariate analysis in pharmaceutical analytical techniques with focus on the different models and their applications: Introduction to chemometrics and multivariate analytical data. Spectroscopic data modelling (UV/IR interpretation). Regression analysis in quantitative pharmaceutical analysis. Chromatographic peak modelling and interpretation. Classification models for genuine vs counterfeit detection. Handling noise and variability in analytical datasets. Limitations of AI models in analytical decision-making.

Textbooks

1. Bakeev, K. A. Process Analytical Technology: Spectroscopic Tools and Implementation Strategies for the Chemical and Pharmaceutical Industries. Wiley.
2. Brown, N. Artificial Intelligence in Drug Discovery. Royal Society of Chemistry.
3. Chavda, V., et al. Bioinformatics Tools for Pharmaceutical Drug Product Development.
4. Gibson, M. Pharmaceutical Preformulation and Formulation. CRC Press.
5. Hanessian, S. Natural Products in Medicinal Chemistry. Wiley.

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26PY3237T: Pharmaceutical Analysis (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles of electrochemical and spectroscopic analytical techniques used in pharmaceutical analysis.	PO1, PO3	2
CO2	Understand the instruments involved in electroanalytical and spectroscopic methods.	PO1, PO3, PO4	2
CO3	Understand the principles, instrumentation, and applications of various chromatographic and electrophoretic techniques.	PO1, PO3, PO4	2
CO4	Understand the analytical techniques for specific pharmaceutical analysis requirements.	PO1, PO3	2
CO5	Analyse, interpret, and report analytical data accurately and draw meaningful conclusions.	PO1, PO2, PO4	4

Syllabus

Electrochemical Methods of analysis: Potentiometry: Electrode potential, electrochemical cell, construction and working of reference and indicator electrodes including membrane electrodes, measurement of potential and pH, potentiometric titrations, methods of detecting end point and Karl Fischer titration. Conductometry: Introduction, conductivity cell, conductometric titrations and applications. Polarography: Introduction, residual current, migration current, diffusion current and limiting current, DME, polarographic wave, Ilkovic's equation (Statement Only), and applications. **Spectroscopy:** Fundamentals of Spectroscopy: Properties of electromagnetic radiation, electromagnetic spectrum. UV Visible spectroscopy: Beer and Lambert's law, Derivation and deviations. Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors (Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode). Applications - single and multi-component analysis of pharmaceuticals. IR spectroscopy: Introduction, fundamental modes of vibrations in poly atomic molecules, factors affecting vibrations, Instrumentation of dispersive Infrared spectrophotometer (including sample handling Techniques) and FTIR. Pharmaceutical applications. **Fluorometric Analysis:** Theory, luminescence, factors affecting fluorescence, quenching. Instrumentation and pharmaceutical applications. Flame Photometry and Atomic Absorption Spectrometry: Theory, nebulisation, flame and flame temperature, interferences, instrumentation and pharmaceutical applications. Nepheloturbidometry: Principle, instrumentation and applications. **Introduction to Chromatographic Techniques:** Principle, various stationary and mobile phases, diverse development and detection techniques and applications of column, paper and thin layer chromatography. Ion-exchange chromatography: Introduction, principles, types of ions exchange resins, factors affecting ion exchange, methodology and applications. Gel filtration and affinity chromatography: Principles and applications. Electrophoresis: Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications. **Gas chromatography:** Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications. High performance liquid chromatography: Introduction, theory, instrumentation, advantages and applications. HPTLC: Principle, instrumentation and applications.

Textbooks

1. Braun, R. D. Analytical Chemistry: A Modern Approach to Analytical Science. McGraw-Hill.

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26PY3237P: Pharmaceutical Analysis (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply potentiometric and conductometric titration techniques to determine acid–base reaction endpoints.	PO1, PO2, PO3	3
CO2	Apply spectrophotometric and colorimetric techniques for analysis of pharmaceutical formulations.	PO1, PO2, PO3	3
CO3	Understand functional group identification by FTIR and quantitative analysis using fluorimetry and flame photometry.	PO1, PO3, PO4	2
CO4	Analyse separation and identification of compounds using chromatographic techniques	PO1, PO3, PO4	4
CO5	Understand the interpretation of spectral and chromatographic data for compound identification and analyte quantification	PO1, PO2, PO4	2

Syllabus

1. Determination of the endpoint of a acid base titration by potentiometric method.
2. Determination of end point of acid base titrations by conductometry.
3. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
4. Assay of APIs by colorimetry.
5. Assay of single component by UV- Spectrophotometer.
6. Simultaneous estimation of multicomponent formulations by UV spectrophotometer.
7. Identification of various functional groups in official compounds by FTIR as per IP.
8. Assay of quinine sulphate by fluorimetry
9. Determination of quenching effect by fluorimetry
10. Assay of sodium chloride by flame photometry
11. Assay of potassium chloride by flame photometry
12. Determination of chlorides and sulphates by nephelo turbidometry
13. Separation of amino acids by paper chromatography
14. Separation of mixture of components by thin layer chromatography
15. Demonstration experiment on GC
16. Determination of official compounds by HPLC (anyone)
17. Demonstration experiment on HPTLC.

Textbooks

1. Vogel, A.I., Textbook of Quantitative Chemical Analysis. Longman Scientific & Technical.
2. Beckett, A.H., and Stenlake, J.B., Practical Pharmaceutical Chemistry: Part II. Athlone Press.
3. Skoog, D.A., Holler, F.J., and Crouch, S.R., Principles of Instrumental Analysis. Cengage Learning.

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26PY3238T: Pharmaceutical Jurisprudence (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply knowledge of pharmaceutical legislations in product development and marketing practices	PO1, PO3, PO8	3
CO2	Understand the provisions of Indian pharmaceutical Acts and laws for regulatory compliance	PO1, PO3, PO4	2
CO3	Understand the roles of regulatory bodies in drug approval, manufacturing, and distribution	PO1, PO3, PO6	2
CO4	Understand ethical awareness by applying the code of ethics in professional pharmaceutical practices.	PO3, PO4, PO6	2
CO5	Analyse regulatory frameworks and assess their impact on public health, industry operations, and compliance requirements.	PO6, PO8, PO9	4

Syllabus

Drugs and Cosmetics Act, 1940 and its rules 1945: Objectives, Definitions, Legal definitions of schedules to the Act and Rules, CDSCO guidelines for Import & export of Pharmaceuticals Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license. **Drugs and Cosmetics Act, 1940 and its rules 1945:** Detailed study of Schedule G, H, H1, M, N, P, T, U, V, X, Y, Sch F, Part XII B. Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties. Labelling & packing of drugs- General labelling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors. **Pharmacy Act –1948:** Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations including ER20, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties. Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Offences and Penalties. Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic &Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties. **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties. Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties. National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM).

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Pharmaceutical Legislations: A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee. Code of Pharmaceutical ethics: Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Medical Termination of Pregnancy Act. Brief Introduction to Right to Information Act. Introduction New Drugs and Clinical Trials Rules, 2019 and amendments. Cosmetic rules 2020. Regulatory guidelines on similar biologics. Overview of Medical Device Regulations, Guidelines on Probiotics, Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food) Regulations, 2016.

Textbooks

1. Government of India. Drugs and Cosmetics Act and Rules. Government of India.
2. Government of India. Drugs and Magic Remedies (Objectionable Advertisements) Act. Government of India.
3. Government of India. Medicinal and Toilet Preparations (Excise Duties) Act. Government of India.
4. Government of India. Narcotic Drugs and Psychotropic Substances Act. Government of India.
5. Government of India. New Drugs and Clinical Trials Rules, 2019. Government of India.

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26PYAEC04: Green Chemistry

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles of green chemistry and provide relevant pharmaceutical examples for each.	PO1, PO10	2
CO2	Understand the selection of green solvents and catalysts for sustainable pharmaceutical synthesis.	PO1, PO10	2
CO3	Understand advanced green synthetic methods using microwave and ultrasonic-assisted techniques for API production	PO1, PO10	2
CO4	Apply waste minimization strategies and continuous-flow reactor techniques in pharmaceutical manufacturing.	PO5, PO10, PO11	3
CO5	Analyse the application of green chemistry principles in industrial pharmaceutical processes	PO2, PO4, PO10	4

Syllabus

Introduction to Green Chemistry in Pharmacy: Definition and scope of green chemistry in pharmaceutical sciences. Principles of Green Chemistry with pharmaceutical examples. **Environmental Aspects and Metrics in Green Pharmacy:** Comparison of traditional vs. green chemical approaches in drug synthesis. Environmental impact of pharmaceutical manufacturing. Overview of pharmaceutical pollutants and their life cycle. Metrics: Atom economy, E-factor, Process Mass Intensity (PMI). **Green Techniques in Pharmaceutical Synthesis – I:** Green Solvents and use of green solvents (e.g. water, supercritical fluids, ionic liquids) in drug synthesis. Solvent-free reactions in pharmaceutical synthesis. Green Catalysis and Reaction Enhancement in pharmaceutical green chemistry – Overview of catalysis in pharmaceutical green chemistry, Photochemical Transformations, Phase Transfer Catalysis. **Green Techniques in Pharmaceutical Synthesis – II:** Microwave assisted reactions: Merit and demerits of its use. Mechanism, superheating effects of microwave. Effects of solvents in microwave assisted synthesis. Microwave technology in process optimization. Applications in various organic reactions and heterocycles synthesis. **Green Chemistry in Industrial and Regulatory Aspects:** Green chemistry in pharmaceutical manufacturing processes. Ultrasound assisted reactions: Types of sonochemical reactions, synthetic applications. Continuous flow reactors: Working principle, advantages and synthetic applications. Waste minimization and pollution control in formulation industries. Role of green chemistry in Good Manufacturing Practices (GMP).

Textbooks

1. Anastas, P.T. and Warner, J.C., 2000. Green chemistry: theory and practice. Oxford university press.
2. Lancaster, M. (2016). Green Chemistry: An Introductory Text (3rd ed.). Royal Society of Chemistry.
3. Green Chemistry in the Pharmaceutical Industry, Edited by Peter J. Dunn, Andrew Wells, and Michael T. Williams, 2010.
4. Scalable Green Chemistry: Case Studies from the Pharmaceutical Industry, Edited by Stefan Koenig, 2013.

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26PYAEC05: Materiovigilance and Hemovigilance

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the concept, scope, and significance of materiovigilance and hemovigilance in ensuring patient and public health safety.	PO1, PO9	2
CO2	Understand the structure, functioning, and adverse event reporting procedures of the Materiovigilance Programme of India (MvPI)	PO1, PO7, PO9	2
CO3	Understand the framework of hemovigilance systems and identify different types of transfusion-related adverse reactions.	PO1, PO9	2
CO4	Analyze national and international vigilance systems for medical devices and blood products through risk assessment, signal detection, and root cause analysis.	PO1, PO2, PO9	4
CO5	Apply documentation and reporting practices to support vigilance activities and enhance patient safety	PO4, PO7, PO9	3

Syllabus

Introduction to Vigilance Systems: Overview of Materiovigilance, Hemovigilance and other vigilance system in Healthcare. Importance of post-marketing surveillance in patient safety. Scope and objectives of materiovigilance and hemovigilance programs. Basic concepts of adverse event reporting and safety monitoring. Historical evolution and global relevance of Materiovigilance, Hemovigilance practices. **Materiovigilance – Principles and Practices:** Introduction to Materiovigilance Programme of India (MvPI). Roles of NCC-MvPI and technical collaborators (e.g., Sree Chitra Tirunal Institute). Classification of medical devices (Class A to D) based on risk. Identification and documentation of Medical Device Adverse Events (MDAEs). Medical device reporting forms, process flow, and responsibilities. Causality assessment of Medical Device Adverse Events. **Hemovigilance – Principles and Practices:** Overview of Hemovigilance Programme of India (HvPI). Organizational structure: NIB, NBTC, hospital-based hemovigilance. Adverse Transfusion Reactions (ATRs): Types and clinical manifestations. Use of TRRF (Transfusion Reaction Reporting Form) and Haemo Vigil software. Responsibilities of blood banks, transfusion officers, and healthcare providers. Case examples along with Causality assessment of Hemolytic reactions, TRALI, TACO, allergic responses. **Global Regulations, Risk Assessment & Root Cause Analysis:** International frameworks: US FDA (MAUDE), EU MDR, SHOT (UK), French Hemovigilance. Comparison of Indian and global materiovigilance/hemovigilance practices. Signal detection and evaluation of adverse events. Root cause analysis (RCA) and implementation of corrective & preventive actions (CAPA). Risk communication and role of healthcare teams in mitigation. **Reporting Systems, Quality Assurance, and Professional Role:** Demonstration: Reporting of MDAEs and ATRs using mock forms. Practical exercises in form-filling and event documentation. Integration of vigilance into hospital quality systems (e.g., NABH, ISO). Strategies to enhance adverse event reporting culture. Ethical considerations and communication with patients/families. Role of pharmacists, nurses, clinicians, biomedical engineers in vigilance programs.

Textbooks

1. Bertil Jacobson - Medical Device Safety: The Regulation of Medical Devices for Public Health and Safety, CRC Press
2. Jack Wong - Handbook of Medical Device Regulatory Affairs in Asia, Pan Stanford Publishing

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26PYAEC06: Scientific Writing

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles of scientific writing.	PO1	2
CO2	Develop clear and concise scientific writing skills.	PO2, PO5, PO7	6
CO3	Apply effective scientific citation techniques	PO1, PO3, PO7	3
CO4	Apply the ethical principles of scientific writing.	PO3, PO4, PO6	3
CO5	Evaluate scientific literature critically.	PO1, PO2	5

Syllabus

Introduction to Scientific Writing: Overview of the course. Principles of scientific writing. Overview of scientific research. Introduction to Microsoft tools and its application. **Writing Literature Reviews and Scientific Papers**: Structure and format of literature reviews. Conducting a literature review. Analyzing literature and developing themes. Writing a compelling introduction. Developing a clear methodology. Results and analysis. **Communicating Results and Data:** Understanding data presentation. Developing tables and figures. Using effective graphic design. **Scientific Citation and Referencing:** Understanding citation styles. Citation and plagiarism. Referencing in scientific writing. **Ethical Issues in Scientific Writing and Peer Review and Revision: Ethical** principles in scientific writing. Misconduct and fraud in scientific writing. Peer review and publication ethics. Providing Constructive feedback. Responding to feedback.

Textbooks

1. Hofmann, A. H. Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford University Press, USA.
2. Schimel, J. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded. Oxford University Press, USA.
3. Alley, M. The Craft of Scientific Writing. Springer, New York, USA.
4. Machi, L. A., McEvoy, B. T. The Literature Review: Six Steps to Success. SAGE Publications, Thousand Oaks, USA.
5. Jesson, J., Matheson, L., Lacey, F. M. Doing a Literature Review in Health and Social Care. SAGE Publications, London, UK.

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26PYAEC07: Drug Store And Business Management

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the different business models and their relevance to pharmaceutical trade.	PO1, PO8	2
CO2	Apply drug store management practices for procurement, storage, and customer service operations.	PO1, PO3, PO8	3
CO3	Apply basic accounting practices to maintain records and interpret financial statements	PO1, PO3, PO8	3
CO4	Apply inventory control techniques and pricing policies for effective drug store management.	PO1, PO3, PO8	3
CO5	Apply marketing principles and legal guidelines for establishing a retail pharmacy.	PO1, PO3, PO8	5

Syllabus

Introduction to Trade and Industry: Objectives and scope of business. Classification of business activities – industry, commerce, trade. Forms of business organization: sole proprietorship, partnership, cooperatives, corporations. Features and merits/demerits of each form Pharmacy business and its legal considerations. **Drug Store Management:** Selection of site, space, and layout of a drug store. Types of drug stores – hospital pharmacy, community pharmacy, chain pharmacy. Procurement of drugs and inventory control. Storage conditions and stock maintenance (cold storage, poisonous drugs, etc.). Records and registers to be maintained. **Inventory Control and Sales Promotion:** Introduction to inventory control: need and methods. Economic Order Quantity (EOQ), Reorder Level (ROL), Lead time. FIFO and LIFO methods. Sales promotion techniques: advertising, displays, discounts. Customer relationship management (CRM) in pharmacy. **Financial Management and Bookkeeping:** Basics of accounting: journal, ledger, trial balance. Introduction to financial statements: profit and loss account, balance sheet. Pricing policies: markup, markdown, break-even analysis. Bank transactions: types of accounts, cheques, drafts. Taxation basics: GST, income tax (as applicable to pharmacies). **Pharmaceutical Marketing and Entrepreneurships:** Definition and scope of pharmaceutical marketing. Elements of marketing mix (4Ps) for pharmacy. Drug distribution channels: wholesale and retail. Entrepreneurship development in pharmacy. Regulatory aspects of retail drug licensing (Drug and Cosmetics Act overview).

Textbooks

1. Elements of Business Management by T.R. Jain & Mukesh Trehan, VK Publications
2. Principles and Practice of Management by L.M. Prasad, Sultan Chand & Sons
3. Business Organization and Management by C.B. Gupta, Sultan Chand & Sons
4. Drug Store and Business Management by R.M. Mehta, Pharma Med Press
5. Pharmaceutical Marketing in India by Subba Rao Chaganti, Excel Books

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26PYAEC08: Career Building in Cultivation Of Medicinal Plants

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the importance and historical development of medicinal plants in traditional and modern healthcare.	PO1, PO9	2
CO2	Understand the importance and historical development of medicinal plants in traditional and modern healthcare.	PO1	2
CO3	Understand the major medicinal plants of India and explain their uses and sources.	PO1	2
CO4	Apply principles of sustainable and organic cultivation practices for medicinal plants.	PO3, PO4, PO10	3
CO5	Analyse entrepreneurship opportunities and value-chain development in the medicinal plant sector.	PO2, PO6, PO8	5

Syllabus

Introduction and Industry Overview: Definition, importance, and cultural background (Ayurveda & ethnobotany). Global and Indian demand, healthcare and pharma role. Key stakeholders: farmers, traders, processors, exporters. Value chain, supply-demand, government/private initiatives (NMPB, AYUSH, NABARD). **Key Medicinal Plants and Cultivation Basics:** Botanical characteristics and uses of major plants: Ashwagandha, Tulsi, Aloe vera, Shatavari, Brahmi, etc. Regional suitability and agro-climatic zones. Factors affecting Cultivation: Soil, propagation, irrigation, pest control, organic inputs. Harvesting, post-harvest management and storage. **Organic Farming and Market Linkages:** Organic certification and sustainable farming practices. Biodiversity conservation and agroforestry integration. Processing, drying, packaging, branding. Market linkages: pharma, cooperatives, online platforms, export guidelines. **Policy, Entrepreneurship and Digital Tools:** Government schemes and legal frameworks (NMPB, AYUSH, forest laws, GACP). Entrepreneurship: starting herbal farms, franchises, consulting, contract farming. Digital tools: farm management software, GIS, mobile apps, e commerce marketing. **Practical Exposure and Project Presentation:** Virtual/shortened farm/nursery visit or guest lecture (can be online). Group/individual project: business plan or herbal enterprise pitch presentation.

Textbooks

1. Kumar, N., Misra, J. B. M., et al. Cultivation of Medicinal and Aromatic Crops. ICAR Publications, New Delhi, India.
2. Shah, B., Seth, A. Textbook of Pharmacognosy and Phytochemistry. Elsevier / Reed Elsevier India, New Delhi, India.
3. Planning Commission / National Medicinal Plants Board. Medicinal Plants Sector in India: Challenges and Opportunities. Government of India, New Delhi, India.
4. Planning Commission (NITI Aayog). Herbal Industry in India. Government of India, New Delhi, India.
5. National Medicinal Plants Board (NMPB). Annual Reports. Ministry of AYUSH, Government of India, New Delhi, India.

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26PYAEC09: Active Pharmaceutical Ingredients And Excipient Sciences

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the classification, properties, and functional roles of APIs and excipients.	PO1	2
CO2	Apply analytical and preformulation methodologies for compatibility and stability evaluation.	PO1, PO3, PO4	3
CO3	Understand the manufacturing, scale-up, and quality control procedures used in industry.	PO1	2
CO4	Apply regulatory documentation and compliance requirements for API and excipient approval.	PO2, PO4, PO9	3
CO5	Understand the current industrial practices and innovation trends in API and excipient sciences.	PO1, PO5, PO11	2

Syllabus

Introduction to APIs and Excipients: Definitions, classifications, and sources (synthetic, natural, biotech APIs; functional excipients). Physicochemical properties: Solubility, polymorphism, hygroscopicity, particle characteristics. Roles in formulations: Bioavailability enhancement, stability, manufacturability. Industry overview: Global market trends, common examples (e.g., paracetamol API, HPMC excipient). **Methodologies for Selection and Pre-formulation:** Excipient selection criteria: Functionality-related characteristics (FRC). Compatibility studies: Binary mixtures via DSC, FTIR, XRD. Analytical methodologies: HPLC/GC for purity, Karl Fischer titration, laser diffraction for PSD. QbD approach: Risk assessment for API-excipient interactions. **Manufacturing Protocols:** API processes: Synthesis routes, crystallization, drying, milling; lab to-pilot scale-up. Excipient handling: Sieving, blending, lubrication protocols. GMP essentials: Equipment qualification, process validation. Unit operations: Wet/dry granulation, direct compression. **Quality Control and Stability Protocols**: QC tests: Assay, dissolution, content uniformity (IP/USP methods). Stability studies: ICH Q1A zones, accelerated/forced degradation. Impurity profiling: Genotoxic impurities (ICH M7), residual solvents. In-process controls: Blend uniformity, weight variation. **Regulatory Compliance and Industry Practices:** ICH Q7 guidelines for APIs. USP-NF excipient monographs and Schedule M requirements. Drug Master File (DMF) for APIs. Certificate of Suitability (COS) for excipients. Process and cleaning validation protocols. Regulatory inspections (USFDA 483, EMA expectations). Emerging trends: green chemistry and bio-based excipients.

Textbooks

1. Gibson, M. Pharmaceutical Preformulation and Formulation. Informa Healthcare, London.
2. Rowe, R. C., Sheskey, P. J., Quinn, M. E. Handbook of Pharmaceutical Excipients. Pharmaceutical Press, London.
3. Aulton, M. E. Aulton's Pharmaceutics: The Design and Manufacture of Medicines. Elsevier, London.
4. ICH Guidelines (Q7, Q8, Q1A). International Council for Harmonisation, Geneva.

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26PYSEC04: Computer-Aided Drug Design

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental concepts and workflow of computer-aided drug design (CADD).	PO1, PO4	2
CO2	Apply bioinformatics tools to retrieve molecular structures and perform molecular visualization.	PO1, PO3, PO4	3
CO3	Apply molecular docking techniques to predict ligand-receptor interactions.	PO1, PO3, PO4	2
CO4	Apply SAR and pharmacophore modeling techniques to analyze drug molecules.	PO1, PO3	3
CO5	Apply CADD tools for lead optimization in drug discovery.	PO1, PO3	2

Syllabus

Target Identification and Preparation: Retrieve protein sequence or structural information from publicly available biological databases. Prepare the target protein by removing unwanted molecules, correcting structural issues, and adding necessary atoms or charges using appropriate molecular visualization or preparation tools. Identify potential binding or active sites using computational methods that analyze structural pockets and cavities. **Ligand Design and Optimization:** Design or sketch candidate molecules using suitable molecular drawing tools. Convert structures into three-dimensional form and optimize their geometry using computational chemistry methods. Generate multiple conformations of the molecule and perform energy minimization to obtain stable structures. **Molecular Docking:** Perform docking simulations using computational docking platforms to predict the interaction between ligands and the target protein. Examine binding orientations and molecular interactions using visualization tools. Rank compounds based on predicted binding affinity and interaction quality. **Pharmacophore Modelling:** Identify essential molecular features responsible for biological activity such as hydrogen bond donors/acceptors, hydrophobic regions, and aromatic centers. Construct pharmacophore models representing these key features. Use these models to screen compound libraries for molecules that match the required feature pattern. **QSAR Modelling:** Calculate molecular descriptors that represent structural and physicochemical properties of compounds. Develop predictive statistical or machine learning models that relate these descriptors to biological activity. Validate models using appropriate validation techniques such as cross-validation and external datasets. **ADMET Prediction:** Evaluate pharmacokinetic and toxicity properties computationally, including Absorption, Distribution, Metabolism, Excretion and Toxicity. Use predictive computational models and online resources to assess drug likeness and safety profiles. **Molecular Dynamics Simulations:** Conduct simulations to study the dynamic behaviour of the protein–ligand complex over time. Analyse parameters such as structural stability, atomic fluctuations, hydrogen bonding, and interaction persistence. Visualize simulation trajectories to understand conformational changes and binding stability.

Textbooks

1. Leach, A.R., Molecular Modelling: Principles and Applications. Harlow: Prentice Hall.
2. Todeschini, R. and Consonni, V., Molecular Descriptors for Chemoinformatics. Weinheim: Wiley-VCH.
3. Gupta, S.P., QSAR and Molecular Modeling. Berlin: Springer.

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26PYSEC05: Analytical Method Development and Validation

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply analytical techniques using UV-Visible spectrophotometry, HPLC, GC, and titrimetry for pharmaceutical analysis.	PO2, PO4, PO5	3
CO2	Construct calibration curves and quantify APIs and formulations using validated analytical methods.	PO3, PO4, PO5	3
CO3	Understand the selection and optimization of chromatographic conditions for pharmaceutical analysis.	PO1	2
CO4	Apply analytical method validation parameters such as LOD, LOQ, and robustness to ensure reliability and regulatory compliance.	PO3, PO4, PO9	3
CO5	Conduct stability-indicating and impurity-related studies, including forced degradation, dissolution testing, and residual solvent analysis.	PO1, PO3	3

Syllabus

1. Development of a UV-Visible spectrophotometric method for the assay of paracetamol API. Construction of calibration curve for a model API using UV-Visible spectrophotometry.
2. Determination of solid dosage form by using dissolution method.
3. Analytical method development and validation of Atenolol/metformin by using HPLC.
4. Investigation of different columns for HPLC separation of a Multi-component Drug Mixture.
5. Optimization of mobile Phase composition for HPLC analysis of a selected drug.
6. Optimization of Flow rate and temperature in HPLC for paracetamol/ caffeine.
7. Selection of wavelength for spectrophotometric analysis by HPLC of Marketed drugs.
8. Determination of λmax and calibration curve for qualitative analysis of paracetamol.
9. Determination of effect of pH on Retention time in RP-HPLC.
10. Validation of HPLC method: Determination of LOD and LOQ for paracetamol by HPLC
11. Preliminary Investigation of forced Degradation studies on Ibuprofen by HPLC.
12. Method development for related substances of a drug substance using HPLC.
13. Determination of residual solvent analysis for ethanol/acetone in API by using Gas Chromatography.
14. Development of titrimetric method for the assay of marketed drugs(Ascorbic acid/sodium bicarbonate).

Textbooks

1. Ahuja S, Dong MW, editors. Handbook of pharmaceutical analysis by HPLC. Amsterdam: Elsevier; 2005.
2. Moldoveanu SC. Method development in analytical HPLC. Amsterdam: Elsevier; 2014
3. Swartz ME, Krull I. Analytical method development and validation. Boca Raton (FL): CRC Press; 2018.
4. Gorog S. Ultraviolet–visible spectrophotometry in pharmaceutical analysis. Boca Raton (FL): CRC Press; 2018.

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26PYSEC06: Principles of Preclinical Studies

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles, stages, and regulatory framework of preclinical drug development.	PO1, PO9	2
CO2	Demonstrate appropriate laboratory animal handling practices in accordance with ethical and regulatory guidelines.	PO4, PO6, PO9	3
CO3	Analyse pharmacokinetic parameters obtained from preclinical animal studies	PO1, PO2	4
CO4	Apply basic toxicological studies to evaluate drug safety and interpret the findings.	PO2, PO5, PO9	3
CO5	Apply preclinical data in assessing drug candidates for progression to clinical trials.	PO1, PO3, PO4	3

Syllabus

1. Handling, restraining, and sex differentiation of laboratory animals (demo/video)
2. Calculation of dose for animals based on body surface area
3. Routes of administration: oral, intraperitoneal, subcutaneous (simulation)
4. Observation of behavioral effects using actophotometer/rotarod (if available)
5. Determination of acute toxicity (LD50 concept) – case-based calculation
6. Planning a 28-day sub-acute toxicity study protocol
7. Pharmacokinetic study: Cmax, Tmax, AUC calculation (sample dataset)
8. Observation of histopathological slides from toxicity studies
9. Demonstration of sampling methods – blood, urine (case or video)
10. Writing an animal study protocol using CPCSEA format
11. Identification of organs for toxicity evaluation – liver, kidney, brain
12. Visit to CPCSEA-approved animal house/laboratory
13. Observation of animal behavior – grooming, nesting (case-based)
14. Simulated ethics committee approval process (IAEC)
15. Group activity: Design of a preclinical study for a hypothetical drug

Textbooks

1. Preclinical and Clinical Research – A Handbook – S. K. Gupta, Jaypee Brothers Medical Publishers
2. Drug Discovery and Clinical Research – B. T. James & M. M. Gupta, CBS Publishers & Distributors
3. Hofmann, F. B. Handbook of Experimental Pharmacology (HEP Series). Springer Nature.
4. Fundamentals of Experimental Pharmacology – M. N. Ghosh, Hilton & Company

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26PYVAC01: Professional Skills

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Demonstrate effective communication and interpersonal skills during interviews and workplace meetings.	PO1, PO3, PO7	3
CO2	Apply professional skills to prepare an industry-standard résumé and online profile.	PO3, PO4, PO7	3
CO3	Understand the effective communication strategies for confidence and clarity in group discussions, presentations, and interviews.	PO1, PO7	2
CO4	Apply time-management, decision-making, and conflict-resolution strategies in professional situations.	PO3, PO4, PO8	3
CO5	Apply workplace ethics, etiquette, and professional conduct in physical and digital environments	PO4, PO6, PO10	3

Syllabus

1. Self-introduction exercise – verbal and written presentation
2. Resume/CV writing – using current industry formats
3. Mock job interview – panel-based or peer-reviewed
4. Group discussion (GD) – on current healthcare or industry topics
5. Public speaking practice – impromptu and prepared speeches
6. Email etiquette and writing professional emails
7. Time management matrix creation (Eisenhower box)
8. Body language analysis – observe and present feedback
9. Conflict resolution role play – team-based activity
10. Creating a LinkedIn profile and optimizing it professionally
11. Debate session – critical thinking and communication
12. Listening skills test – audio-based task with Q&A
13. Workplace scenario simulation – ethics, teamwork, communication
14. Presentation skills – create and deliver PowerPoint presentations
15. Goal-setting and career mapping – using SMART goals

Textbooks

1. Soft Skills: Enhancing Employability by Meenakshi Raman & Sangeeta Sharma, Oxford University Press
2. The 7 Habits of Highly Effective People by Stephen R. Covey, Simon & Schuster
3. Personality Development and Soft Skills by Barun K. Mitra, Oxford University Press
4. Effective Technical Communication by M. Ashraf Rizvi, Tata McGraw-Hill Education
5. The Art of Public Speaking by Stephen E. Lucas, McGraw-Hill Education

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26PYVAC02: Process Analytical Technology (PAT) and QbD in Formulation Science

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the Quality by Design (QbD) framework applied to the pharmaceutical formulation process.	PO1, PO4	2
CO2	Understand the CQAs, CPPs, and potential failure modes of solid dosage forms.	PO1	2
CO3	Apply NIR or FBRM data to assess blend or granulation end points.	PO1, PO3, PO4	3
CO4	Analyse factorial experiments to optimize CQAs within a defined design space.	PO1, PO2, PO5	4
CO5	Apply risk-control strategies using RPN ranking and PAT-based monitoring for RTRT.	PO1, PO3, PO6	3

Syllabus

1. Identify Critical Quality Attributes (CQAs) – Brainstorm and list five tablet CQAs (hardness, dissolution, etc.) and link each to patient safety or efficacy.
2. Ishikawa (Fish-Bone) Diagram – Draw a cause-and-effect diagram for poor tablet dissolution, categorising factors into Materials, Methods, Machines and Manpower.
3. Blend-Uniformity by NIR Probe – Collect in-line near-infrared spectra during 10 min of blender operation and plot real-time API concentration trends.
4. Moisture Tracking with NIR – Use a portable NIR gun to measure LOD in wet granules every 2 min, stopping when the plot hits the 3 % target.
5. Mini DoE for Granulation – Run a 2^2 design varying impeller speed and granulation time; measure granule mean size and create main-effects plots.
6. Real-Time Release Test (RTRT) – Set up an at-line NIR hardness prediction model, test 20 tablets, and compare predicted vs. actual hardness.
7. Control Chart of Particle Size (FBRM) – Stream Focused Beam Reflectance data during milling; plot $\bar{X}$ and R for d_{50} and decide if the process is in control.
8. Multivariate Calibration Model – Build a partial-least-squares (PLS) model correlating NIR spectra to drug content; report R^2 and RMSEP.
9. FMEA Risk-Priority Number – Score severity, occurrence and detectability for three high-risk process variables; rank them by RPN and suggest mitigation.
10. PAT Model Verification Batch – Run the optimised process, capture PAT data, and confirm that all CQAs meet specification without end-product testing.

Textbooks

1. Bakeev KA, editor. Process Analytical Technology: Spectroscopic Tools and Implementation Strategies for the Chemical and Pharmaceutical Industries. 2nd ed. Chichester: Wiley; 2010.
2. Rathore AS, Winkle H. Quality by Design for Biopharmaceuticals. 2nd ed. Hoboken: Wiley; 2019.
3. Kourti T, Bakeev K. Process Analytical Technology: Theory and Applications. 1st ed. Oxford: Butterworth-Heinemann; 2022.
4. Patil AS, Rane VP. Practical Implementation of Quality by Design (QbD) for Pharmaceutical Product Development. 1st ed. Amsterdam: Elsevier; 2019.

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26PY3239: Internship

L-T-P-S: 0-0-8-0 **Credits: 4** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply pharmaceutical knowledge and skills in a real professional (industry, hospital or community) setting.	PO1, PO6, PO9	3
CO2	Perform assigned workplace tasks in compliance with standard operating procedures and quality/safety norms.	PO1, PO4, PO7	3
CO3	Analyse and reflect on professional practices, workflows and problem-solving in the organisation.	PO1, PO3, PO4	4
CO4	Communicate the internship experience through a structured report and presentation with professional conduct.	PO1, PO7, PO8	3
CO5	Analyse the impact of internship training on professional competency, ethical practice, and lifelong learning in pharmacy.	PO1, PO7, PO8	4

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26PY4140T: Biostatistics Research Methodology (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamentals of biostatistics, including variables, sampling methods, descriptive statistics, and graphical data presentation.	PO3, PO4, PO5	2
CO2	Apply probability concepts and statistical distributions in pharmaceutical and healthcare data analysis.	PO1, PO3, PO4	3
CO3	Analyse relationships between variables using correlation and regression techniques and interpret their applications in pharmaceutical research.	PO2, PO3, PO4	4
CO4	Apply inferential statistical methods for research data analysis and decision-making.	PO1, PO3, PO5	3
CO5	Apply appropriate research designs, sampling techniques, statistical methods, and ethical practices in scientific research.	PO3, PO5, PO7	3

Syllabus

Basic concepts of biostatistics: Definition, meaning and type of variables: Data – Meaning and methods of data collection, data preprocessing and cleaning. Population and sample, Importance of sampling, Sampling methods. Probability and non-probability sampling. Probability sampling - Random, systematic, stratified, cluster sampling. Non-probability sampling - Convenience sampling, purposive sampling, snowball sampling. Types of statistics - Descriptive statistics and inferential statistics. Descriptive statistics – Meaning and types of descriptive statistics. Frequency distribution, measures of central tendency. Measures of dispersion – Range, variance and standard deviation. Concept of degrees of freedom, quartiles, skewness and kurtosis Diagrammatic representation of frequency distribution. **Probability and probability distributions:** Probability and probability distributions- Classical probability and statistical probability. Probability of union, intersection and complement of events, conditional probability, marginal probability. Probability distributions- Meaning of a probability distribution Discrete probability distribution- Meaning and examples of discrete probability distribution, meaning of PMF. Continuous probability distribution – Meaning and examples of normally distributed data, meaning of PDF. Normal distribution – Meaning and characteristics of a normal distribution, parameters of a normal distribution, equation for PDF of a normal distribution. Pharmaceutical examples of data which can be modelled with Poisson Normal distribution. Standard normal distribution, Z transformation, reading the table of Z values. Problems based on standard normal distribution, binomial and Poisson distributions Sampling distributions – Meaning of sampling distributions. t distribution – the t statistic, equation for calculating t statistic, meaning of t distribution, meaning of degrees of freedom and their relevance to t distribution, reading and interpreting table of t values, applications of t distribution. F distribution – the F statistic, equation for calculating F statistic, meaning of F distribution, reading and interpreting table of F values. Chi square distribution – the Chi square statistic, meaning of chi square distribution, reading and interpreting the table of chi square values, applications of chi square distribution. **Correlation and regression analysis:** Correlation analysis – Introduction to the concept of correlation between two variables, positive and negative correlation, no correlation, examples of positive, negative and no correlation. Measurement of correlation - Pearson's Correlation Co-efficient – Definition and formula, assumptions, range of Pearson's correlation co-efficient, interpretation of sign and magnitude. Spearman's Rank Correlation Coefficient – Concept and when to use, procedure for calculation Spearman's Rank Correlation Coefficient. Real life applications in pharmaceutical and health sciences Problems on calculation of these two types of correlation co-efficient, use of scatter plot Multiple correlation – Concept and applications.

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Regression analysis – Concept of regression, dependent and independent variables in regression analysis, simple linear regression, simple linear regression equation (method of least squares), calculation of slope and intercept, co-efficient of determination, interpretation of output of regression analysis, applications of regression analysis. Relationship between regression co-efficient and correlation co-efficient Problems on simple linear regression analysis for predicting values of dependent variables (pharmaceutical examples) Multiple linear regression-Concept and applications, meaning of overfitting and underfitting. **Inferential statistics:** Statistical estimation – Point estimates and interval estimate of population parameters from sample statistics Concept of confidence intervals. Confidence intervals for means using t values. Problems on generating confidence intervals. Hypothesis testing – Concept, steps involved, type I and type II error, sample size and power of the test, p values, applications of hypothesis testing Parametric tests - t- tests (single sample t test, two independent samples t test, paired t test) ANOVA (one way and two way). Assumptions, procedure and applications (case studies using t tests and ANOVA) Hypothesis testing in regression analysis and correlation Non-parametric tests - Mann Whitney U test, Wilcoxon Sign Rank test, Kruskal Wallis test, Friedman test, Chi square tests. Assumptions, procedure and applications (problems on non-parametric tests). **Research methodology**: Research – Meaning, importance and types. Types of research designs Research methodology – Based on the research question, selection of research design, defining the population and sample, selecting the sample size and sampling method, method of data collection and data analysis. Decision tree approach for selection of statistical tests on the basis of research question and type of data Descriptive research design – Examples of application Observational research design – Examples of application Experimental research design – Examples of application Scientific report writing, plagiarism, referencing styles, selection of research journals, abstracting services and databases Screening and Optimization – Concept and experimental designs used for screening and optimization including Plackett Burman design, factorial designs, D optimal design, sequential simplex design, central composite design and response surface methodology, blocking and confounding in experimental designs.

Textbooks

1. Bolton, S. Pharmaceutical Statistics: Practical and Clinical Applications. Marcel Dekker.
2. Daniel, W. W. Biostatistics: A Foundation for Analysis in the Health Sciences. Wiley
3. Montgomery, D. C. Design and Analysis of Experiments. Wiley.

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26PY4141T: Cosmetics and Cosmeceuticals (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the classification of cosmetics and cosmeceuticals and the role of formulation excipients.	PO1, PO3, PO4	2
CO2	Understand the formulation, preparation, packaging, and evaluation of cosmetics for skin, hair, and oral care, including herbal products.	PO1	2
CO3	Apply formulation and quality assessment techniques for common cosmetic products.	PO1, PO2, PO3	3
CO4	Understand the functional roles of cosmetic ingredients in managing skin, hair, and oral conditions.	PO1	2
CO5	Understand the regulatory requirements, labelling standards, and AI applications in personalized cosmetic formulation	PO1, PO4, PO6	2

Syllabus

Cosmetics and cosmeceuticals: Classification of Cosmetics (Cosmetics and Cosmeceuticals for Skin Care, Hair Care, Oral Care, foot care, body cavities, Decorative Cosmetics, Cleansing cosmetics, Perfumes and Fragrances.) Types of various dosage forms for Cosmetics, Common excipients for cosmetic. **Common skin problems:** Dry Skin, Oily skin, Pimples and acne, Pigmentation, Prickly heat and Sun burn and general composition, method for preparation, packing and evaluation of the skin Cosmetics and cosmeceuticals. Herbal cosmetics for skin. Types of soaps, syndet bars, general composition, method for preparation, packing and evaluation of soaps. Introduction to Perfumes and toiletries. **Common Hair problems:** Hair Cosmetics and cosmeceuticals: Types of shampoos, general composition, method for preparation, packing and evaluation of shampoos. Introduction to hair oils, hair serums, conditioners, hair colors, Depilatory and shaving products. Herbal hair care products. **Various problems of oral cavity:** Oral Cosmetics, and cosmeceuticals: general composition, method for preparation, packing and evaluation of mouth wash and toothpaste. Herbal oral care cosmetics. Types of Cosmetics for nails, eyes, body odor, lip care and cleansing. Intimate hygiene products for males and females. **Role of Regulatory authorities:** (CDSCO and FDA). Cosmetics regulations 2020 and role of BIS. Role of certifying bodies like ECCERT and COSMOS in herbal cosmetics. Labelling requirement of cosmetics and Packaging of cosmetics. Testing as per BIS specification and analytical methods (including sensory test, sensitivity test).

Textbooks

1. Baki, G. and Alexander, K. S. Introduction to Cosmetic Formulation and Technology. Wiley.
2. Barel, A. O., Paye, M. and Maibach, H. I. Handbook of Cosmetic Science and Technology. CRC Press.
3. Benson, H. A. E. and Watkinson, A. C. Cosmetic Formulation: Principles and Practice. CRC Press.

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26PY4142T: AI in Clinical Applications (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the applications of AI & ML in pharmacokinetics, pharmacodynamics, and clinical decision-making.	PO1, PO4, PO9	2
CO2	Apply regression and classification models to analyse clinical, pharmacokinetic, and pharmacovigilance data.	PO4, PO6, PO9	3
CO3	Understand the predictive model outputs for adverse drug reactions, therapeutic response, and clinical risk assessment.	PO2, PO4, PO9	2
CO4	Analyse machine learning model performance using healthcare evaluation metrics.	PO2, PO3, PO4	4
CO5	Analyse real-world healthcare datasets and assess the ethical and practical implications of AI-based clinical decision support systems.	PO2, PO4, PO9	4

Syllabus

AI in Pharmacokinetics & Dose Optimization: Review of pharmacokinetic parameters (Cmax, Tmax, AUC, clearance). Modelling concentration-time relationships: Linear regression in PK data modelling, multiple regression for dose adjustment based on patient variables (age, weight, renal function). Interpretation of regression coefficients in clinical context. Error metrics (RMSE, R^2) in PK modelling. Limitations of linear modelling in nonlinear pharmacokinetics. **AI in Drug Safety & Pharmacovigilance:** Overview of pharmacovigilance systems. Structure and data formats from real systems (e.g. FAERS, EudraVigilance). Conceptual overview of frequency analysis and signal detection. Logistic regression for ADR risk prediction. Confusion matrix and clinical performance metrics. Sensitivity, specificity, precision, recall. Bias and confounding in observational datasets. **AI in Personalized Medicine & Risk Stratification:** Concept of precision medicine. Patient covariates and therapeutic response. Logistic regression for disease risk prediction. Classification of responders vs non-responders. Evaluation metrics in healthcare prediction. Ethical implications of predictive modelling. **AI in Clinical Decision Support & Real-World Data:** Structure of Electronic Health Records (EHR). AI in Clinical Decision Support Systems (CDSS). Regression models for outcome prediction. Classification models for risk scoring. Real-world data analytics. Limitations of AI in clinical environments. Accountability and interpretability. **Guided Supervised Learning Project – Pharmaceutical and Clinical Applications:** Students will undertake a guided supervised learning project (individually or in groups) applying regression or classification models to pharmaceutical or clinical datasets. The project should include the following steps: Identification and definition of a relevant pharmaceutical or clinical problem. Selection of an appropriate publicly available dataset. Identification of predictor variables and outcome variables. Data preprocessing and preparation for analysis. Application of suitable supervised learning methods (e.g., linear regression or logistic regression). Evaluation of model performance using appropriate metrics. Interpretation of results in the context of pharmaceutical or clinical relevance. Discussion of limitations, potential biases, and ethical considerations. Presentation of findings to faculty mentors or peers.

Textbooks

1. Aggarwal, C. C. and Reddy, C. K. Healthcare Data Analytics. CRC Press.
2. Bonate, P. L. Pharmacokinetic–Pharmacodynamic Modeling and Simulation. Springer.
3. Campbell, M. J., Machin, D. and Walters, S. J. Medical Statistics: A Textbook for the Health Sciences. Wiley-Blackwell.

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26PY4143T: Modern Analytical Techniques (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply the principle of Mass and NMR spectra in the structural elucidation of organic compounds.	PO1, PO3, PO4	3
CO2	Apply thermal, X-ray crystallographic, and microscopic techniques to characterize the physical nature of drugs and excipients.	PO1, PO2, PO3	3
CO3	Apply the basic knowledge on radio immune assays in carrying out the immunological studies.	PO1, PO3, PO4	3
CO4	Understand the theoretical and practical aspects of the latest hyphenated chromatographic techniques used for analysis of drugs.	PO1, PO3	2
CO5	Apply green analytical chemistry techniques for environmental sustainability	PO3, PO4, PO10	3

Syllabus

Spectroscopy Techniques: Nuclear Magnetic Resonance Spectroscopy: Principles of ^{1}H-NMR and ^{13}C-NMR, various solvents used, chemical shift, factors affecting chemical shift, coupling constant, spin–spin coupling, relaxation, instrumentation of FT-NMR and its applications. Mass Spectrometry: Principles, fragmentation and its rules, ionization techniques Electron impact, chemical ionization, MALDI, FAB, API, analyzers – Time of flight and quadrupole, ion trap, detectors and applications. **Crystal Analysis:** X-Ray Diffraction Methods: Origin of X-Rays, basic aspects of crystals, X-Ray crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications. Thermal Analysis: Introduction, instrumentation, factors affecting measurements, applications of TGA, DSC (types) and DTA. **Advanced Chromatography Techniques:** UPLC and Nano LC: Principle, advantages over LC and applications. Principle and applications of hyphenated techniques: GC-MS, LC MS/MS, ICP-MS. Supercritical chromatography and flash chromatography: principles and applications. **Green Analytical Chemistry:** Types of green solvents, various computational tools used to assess the greenness and its applications in sample preparation and analytical method development. Bio-analytical Methods: Introduction to bioanalytical method development, extraction of drugs and metabolites from biological fluids – SPE, LLE, PPE, BCS classification, PK-PD interaction, microsomal assays, MTT assay, BA & BE study protocol, biosimilars. Radio Immune Assays and ELISA: Importance, various components, principle, different methods, limitations and applications of radio immunoassay and ELISA. **Microscopy-Based Analytical Techniques:** Principle, instrumentation, and applications of optical microscopy, scanning electron microscopy and transmission electron microscopy.

Textbooks

1. Brown, M. E. Introduction to Thermal Analysis: Techniques and Applications. Springer.
2. Cullity, B. D. and Stock, S. R. Elements of X-Ray Diffraction. Prentice Hall.
3. Dong, M. W. Modern HPLC for Practicing Scientists. Wiley.

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26PY4143P: Modern Analytical Techniques (Practical)

L-T-P-S: 0-0-3-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Analyse spectral and thermal data to characterize pharmaceutical compounds.	PO1, PO2	4
CO2	Apply UHPLC techniques for quantitative analysis of official pharmaceutical compounds.	PO1, PO3, PO4	3
CO3	Apply green analytical solvents for sustainable pharmaceutical analysis.	PO2, PO5, PO10	3
CO4	Apply USFDA guidelines to construct bioavailability and bioequivalence study protocols.	PO1, PO6	3
CO5	Apply extraction techniques and MTT assay for quantitative analysis and cell viability evaluation.	PO1, PO3, PO4	3

Syllabus

1. Interpretation of Proton NMR spectra of known compound (any two)
2. Interpretation of Carbon NMR spectra of known compound (any two)
3. Interpretation of mass spectrum of known compound (any two)
4. Interpretation of X-Ray diffraction spectrum (any one)
5. Interpretation of DSC Thermogram (any one)
6. Preparation and Evaluation of Green Analytical Solvents
7. Analytical method development by using Green chemistry
8. Quantification of pharmaceuticals in biological fluids using Solid Phase Extraction (SPE)
9. Quantification of pharmaceuticals in biological matrix by PPE
10. Quantification of pharmaceuticals in biological matrix by LLE
11. Demonstration of Cell Viability evaluation using MTT Assay
12. Demonstration on residual solvent analysis using GC
13. Assay of drug using HPLC (any two)
14. Analysis of drug from biological fluid using HPLC/ UV spectroscopy.

Textbooks

1. Beckett, A. H. and Stenlake, J. B. Practical Pharmaceutical Chemistry. CBS Publishers & Distributors.
2. Brittain, H. G. Analytical Profiles of Drug Substances and Excipients. Elsevier.
3. Kemp, W. Organic Spectroscopy. Palgrave Macmillan.
4. Munson, J. W. Pharmaceutical Analysis: Modern Methods. Marcel Dekker.
5. Sharma, Y. R. Organic Spectroscopy. S. Chand.

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26PY4144T: Pharmacovigilance (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the core concepts, objectives, and significance of pharmacovigilance and immunovigilance.	PO1, PO6	2
CO2	Understand the national and global regulatory frameworks for drug and vaccine safety.	PO1, PO2, PO6	2
CO3	Understand the identification, documentation, and reporting of ADRs and AEFIs using pharmacovigilance systems.	PO1, PO4, PO7	2
CO4	Analyze pharmacovigilance data to identify safety signals, trends, and risk factors associated with medicinal products.	PO2, PO4, PO6	4
CO5	Apply risk management strategies to improve patient safety and public health outcomes.	PO1, PO8, PO9	3

Syllabus

Fundamentals of Pharmacovigilance: Concept, history, and importance of pharmacovigilance. Basic drug classification systems (introductory overview only). ATC classification, ICD - ATC system and ICD. Drug-related problems and medication safety. Drug safety considerations in special populations: Paediatrics, Geriatrics, Pregnancy and lactation. **Pharmacovigilance Systems and Regulatory Framework:** Objectives and functions of pharmacovigilance. Methods of pharmacovigilance data collection: Spontaneous reporting, Cohort and case-control studies. Global pharmacovigilance systems: WHO International Drug Monitoring Programme. Role of CIOMS and major regulatory agencies (e.g., USFDA, EMA). Pharmacovigilance Programme of India (PvPI). Establishment and role of ADR Monitoring Centres. **Adverse Drug Reactions (ADRs):** Classification and types of ADRs. Mechanisms and risk factors for ADRs. Methods of ADR monitoring, detection, and reporting. Assessment of causality, severity, predictability, and preventability of ADRs. Management of ADRs. Online reporting mechanisms and databases (WHO-ART, VigiBase, Vigiflow, Oracle Argus, OpenVigil software). MEDRA. **Immunovigilance and Other Disciplines of Pharmacovigilance:** Definition, scope, and significance of immunovigilance, cosmetovigilance, nutraceutical-vigilance, materiovigilance, herbovigilance, ecopharmacovigilance, and hemovigilance. Vaccination failure and vaccine pharmacovigilance (vaccinovigilance). Overview of adverse events following immunization (AEFIs). Immunization safety monitoring systems in India. **Risk Communication, Evaluation, Management, and ICH Guidelines:** Risk evaluation and management strategies in pharmacovigilance and immunovigilance. Communication in drug safety crisis management. Communication with regulatory agencies, business partners, and healthcare facilities. Analysis of real-world case studies and lessons learnt. Emerging trends and challenges in pharmacovigilance and immunovigilance. Overview of safety data generation. Objectives of ICH guidelines. Expedited and aggregate reporting. Individual Case Safety Reports (ICSRs). Periodic Safety Update Reports (PSURs). Post-approval expedited reporting. Good Clinical Practices (GCPs) regulation 2019. Application of pharmacogenomics and pharmacometrics in pharmacovigilance.

Textbooks

1. Andrews, E. B. and Moore, N. Mann's Pharmacovigilance. Wiley Blackwell.
2. Cobert, B. Cobert's Manual of Drug Safety and Pharmacovigilance. World Scientific Publishing.
3. Jose, J., Cox, A. R. and Paudyal, V. Principles and Practice of Pharmacovigilance and Drug Safety. Springer.

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26PY4145T: Pharmacy Practice (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the evolution, scope, and settings of pharmacy practice, including roles of pharmacists in various levels of healthcare	PO1, PO3, PO9	2
CO2	Understand the organization and functions of hospital and community pharmacies, including drug distribution systems and regulatory standards	PO1, PO6, PO9	2
CO3	Apply clinical pharmacy services for drug therapy monitoring, drug information, and medication-related problem management	PO2, PO3, PO9	3
CO4	Apply clinical pharmacy services for drug therapy monitoring, drug information, and medication-related problem management	PO3, PO4, PO7	3
CO5	Understand the clinical pharmacy services for drug therapy monitoring, drug information, and medication-related problem management.	PO1, PO2, PO3	2

Syllabus

Introduction to Pharmacy Practice: Definition, scope and evolution of: Hospital and clinical pharmacy. Pharmacist's role from dispenser to healthcare provider. WHO and FIP guidelines on pharmacy practice. Pharmacy practice regulations in India. Role of pharmacy in public health and policymaking. Promoting rational use of medicines. Concepts of Good Pharmacy Practice. Pharmacy practice settings: inpatient, outpatient. Concept of healthcare delivery system and interprofessional collaboration. Primary (PHC), Secondary (CHC), Tertiary (District Hospitals, Medical Colleges) – role of pharmacists at various levels of care. **Hospital and Community Pharmacy:** Hospital and its Organization Classification of hospitals, organizational structure of a hospital, healthcare staff involved in hospital services and their functions. Hospital Pharmacy and its Organization Definition, organization structure, location, layout, and staff requirements, responsibilities and functions of hospital pharmacists. Pharmacy and Therapeutic Committee Organization, functions, and policies, drug inclusion into formulary, inpatient and outpatient prescriptions, automatic stop order, emergency drug list preparation. Hospital Formulary Definition of hospital formulary, contents of hospital formulary, differentiation between hospital formulary and drug list, preparation and revision of hospital formulary. Drug Distribution System in a Hospital Drug procurement and inventory control, dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labeling, dispensing of drugs to ambulatory patients, dispensing of controlled drugs, outpatient medication dispensing, NABH standards for medication management in hospital settings. Community Pharmacy Organization and structure of retail and wholesale drug stores, types and design of a drug store, legal requirements for establishment and maintenance of a drug store, dispensing of proprietary products, maintenance of records of retail and wholesale drug stores, prescription handling, labelling, and patient counselling, introduction, definition, sale, and OTC medication list, vaccination services. Clinical Pharmacy Services: Introduction to clinical pharmacy and its concept. Drug therapy monitoring: Medication chart review, Clinical review, Pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Drug information services. Drug/Medication related problems. Drug and poison information services. Therapeutic drug monitoring (TDM).

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Patient-Oriented Services: Medication Adherence and Non-Adherence: Definition. Factors influencing non-adherence. Pharmacist's role in medication adherence. Monitoring of patient medication adherence. Tools used to assess medication adherence. Strategies to overcome non-adherence. Patient Counselling Techniques and Communication Skills: Definition of patient counselling. Steps involved in patient counselling. Communication skills – communication with prescribers and patients Types of educational materials used in patient counselling Barriers to effective counselling – types and strategies to overcome barriers. Health Screening Services: Definition and importance. Methods for screening: Blood pressure, Blood sugar, Body Mass Index, Lung function test. Role of pharmacist in health screening services Telemedicine. **Prescribing Guidelines, Essential Drug Concept and Rational Drug Therapy**: Prescribing Guidelines: Paediatrics, geriatrics, pregnant and lactating women. ISMP guidelines for high risk medicines. Essential Drug Concept: WHO definition. Core principles and key features. Procedure involved in adding a drug into the essential drug list. Rational Use of Medications: Antibiotics, Antibiotic stewardship program, Injections, OTC drugs and Consequences of irrational drug use. Dose calculations in chemotherapy, renal and hepatic failure patients.

Textbooks

1. Hassan, W. E. Hospital Pharmacy. Lea & Febiger.
2. Harman, R. J. Handbook of Pharmacy – Health Care. Pharmaceutical Press.
3. Merchant, S. H. and Qadry, J. S. A Textbook of Hospital Pharmacy. CBS Publishers & Distributors.
4. Parmar, N. S. Health Education and Community Pharmacy. CBS Publishers & Distributors.
5. Parthasarathi, G., Hansen, K. N. and Nahata, M. C. A Textbook of Clinical Pharmacy Practice. Universities Press.



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26PY4146T: Regulatory Affairs (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental concepts of regulatory affairs and the organizational structure of global regulatory authorities governing pharmaceutical products.	PO1, PO6	2
CO2	Understand the drug discovery and development process, including preclinical, clinical, and regulatory documentation requirements.	PO1, PO7, PO9	2
CO3	Understand the regulatory framework, approval procedures, and legal requirements for pharmaceuticals in India.	PO1, PO4, PO6	2
CO4	Analyse regulatory approval processes and submission formats across major international markets	PO1, PO4, PO6	4
CO5	Understand the clinical trial requirements, ethics committee roles, informed consent, GCP guidelines, and pharmacovigilance requirements	PO1, PO6, PO9	2

Syllabus

Fundamentals of Regulatory Affairs: Introduction to Drug Regulatory Affairs, Overview of regulatory authorities in India and major international markets (US FDA, EMA, PMDA), Role and responsibilities of Regulatory Affairs Professionals, Organizational structure of regulatory bodies. Basic regulatory terminologies: Guidance, Guidelines, Regulations, Laws, Acts. Regulatory reference resources: Orange Book, Purple Book, Federal Register, Code of Federal Regulations (CFR). **Regulatory Requirements in Drug Development:** Drug discovery and development process, Drug development teams and their functions. Non-clinical drug development: Pharmacology, Drug metabolism, Toxicology. Regulatory documentation: Investigational New Drug (IND) application, Investigator's Brochure (IB), Clinical research protocols, Biostatistics in pharmaceutical product development, Bioequivalence (BE) studies, Data presentation for regulatory submissions. **Indian Regulatory Framework and Approval Process:** Central Drugs Standard Control Organization (CDSCO) and State Licensing Authorities: Organization and responsibilities, Regulatory requirements for import, manufacture, and sale of pharmaceuticals in India, Certificate of Pharmaceutical Product (COPP), Regulatory approval procedure for new drugs in India, Clinical trial regulatory requirements in India, phytopharmaceutical regulations, Good Clinical Practice (GCP) guidelines and Schedule Y, Innovator and generic drugs, Generic drug product development. Phytopharmaceutical regulation by AYUSH and CDSCO. **International Regulatory Systems & Global Drug Registration:** Types of regulatory applications: Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Drug Master Files (DMF), Common Technical Document (CTD), electronic CTD (eCTD), ASEAN CTD (ACTD). Registration procedure for Indian drug products in overseas markets, Post-approval changes to NDA and ANDA. **Clinical Trials, Ethics, and Post-Marketing Surveillance:** Clinical research phases (I-IV), Clinical trial documents, Institutional Review Board (IRB) and Independent Ethics Committee (IEC): Formation and functions. Informed consent process and documentation, Good Clinical Practice (GCP) obligations of investigators, sponsors, and monitors, Management and monitoring of clinical trials, Pharmacovigilance: Safety monitoring during clinical trials and post- marketing,

Textbooks

1. Berry, I. R. and Martin, R. P. The Pharmaceutical Regulatory Process. Informa Healthcare.
2. Gallin, J. I. and Ognibene, F. P. Principles and Practice of Clinical Research.

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26PYAEC10: Current Good Manufacturing Practices (cGMP)

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the structure of SOPs and the process of personnel training, development, and training-needs identification and evaluation	PO1	2
CO2	Understand the major FDA guidelines applicable to regulated and semi-regulated markets.	PO1, PO4	2
CO3	Understand the manufacturing assurance, analytical assurance, and engineering assurance systems, and handling of non-conformances.	PO1	2
CO4	Analyse market complaints and their investigation and closure procedures.	PO1, PO2	4
CO5	Apply regulatory audit practices for report handling and compliance report preparation	PO3, PO4, PO9	3

Syllabus

Standard Operating Procedures (SOP), Systems for Training & Development in Pharmaceuticals: Introduction to SOPs, SOP on SOP, Contents of a standard SOP, Writing a good SOP, Distribution and control of SOPs. Introduction to Training and development, Training needs identification, Training and evaluation. **A comprehensive review of cGMP and various important FDA guidelines:** List of major guidelines referred in pharmaceuticals. Effectively reading and understanding the guidelines. **Important Quality Assurance and cGMP systems adopted in Pharmaceuticals: Introduction** to Quality Management Systems (QMS), Manufacturing Assurance, Analytical Assurance, Developments Quality Assurance, Engineering Assurance. Concepts of corrective and preventive actions (CAPA), Deviations and Incidents handling. Handling of non-conforming materials. **Handling of Customer Complaints:** Introduction to complaints, Types of complaints. Understanding Manufacturing defects and Quality issues. Handling and investigation of customer complaints. **Regulatory Audits:** Introduction to audits and Types of audits. Preparation for a successful audit, Audit teams and internal audits. Handling of FDA inspections: FDA observations, Compliance and replying to an audit report.

Textbooks

1. Good Manufacturing Practices for Pharmaceuticals – Joseph D. Nally, CRC Press
2. Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials (Vol. 1 & 2) – World Health Organization (WHO), WHO Press
3. Guidance for Industry: Quality Systems Approach to Pharmaceutical CGMP Regulations – U.S. FDA, CDER/CDRH Guidance Document
4. Pharmaceutical Production and Packaging Technologies – Michael J. Groves, CRC Press
5. Pharmaceutical Quality by Design: A Practical Approach – Walkiria S. Schlindwein & Mark Gibson, Wiley

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26PYAEC11: Pharmaceutical Automation

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles and advantages of automation in pharmaceutical processes.	PO1, PO4	2
CO2	Understand the automated systems used in pharmaceutical production and quality control.	PO1	2
CO3	Apply knowledge of instrumentation and control systems like SCADA and PLC in pharma environments.	PO3, PO4, PO10	3
CO4	Analyze the role of automation in enhancing data integrity, regulatory compliance, and productivity.	PO3, PO6, PO9	4
CO5	Analyze new trends like Industry 4.0, IoT, and AI applications in pharmaceutical automation.	PO1, PO2, PO4	4

Syllabus

Introduction to Automation in Pharmaceuticals: Definition and scope of automation in pharmaceutical industry. Importance and benefits: accuracy, efficiency, cost-effectiveness, compliance. Types of automation: fixed, programmable, flexible. Application areas: production, packaging, quality control, warehousing. Challenges and limitations of automation. **Automated Manufacturing Systems:** Principles of automated tablet compression, capsule filling, liquid filling, and coating machines. PLC-based machinery in granulation and drying. Robotics in sterile product manufacturing (isolators, RABS). Continuous manufacturing vs. batch processing. Automation in aseptic processing and lyophilization. **Process Control and Instrumentation:** Sensors and transducers: temperature, pressure, flow, pH, conductivity. Introduction to SCADA (Supervisory Control and Data Acquisition) systems. Distributed Control Systems (DCS) in pharma. Process Analytical Technology (PAT) – definition and applications. Basics of automation programming (ladder diagrams, logic gates – overview only). **Quality Control and Laboratory Automation:** Automation in analytical laboratories: HPLC, UV, FTIR, dissolution testers. Laboratory Information Management System (LIMS). Integration of instruments with software and data loggers. Automated sampling and testing methods. Role of AI/ML in predictive quality assurance. **Regulatory Aspects and Emerging Trends:** Regulatory expectations: USFDA, WHO, EMA on automation & electronic systems. 21 CFR Part 11 – electronic records and signatures. Data integrity and ALCOA. Emerging trends: IoT, Industry 4.0, cloud-based manufacturing, AI in pharma. Case studies: automated systems in top pharma companies.

Textbooks

1. Automation and Control in the Pharmaceutical Industry by Burton H. Sage, CRC Press
2. Pharmaceutical Engineering by K. Sambamurthy, New Age International Publishers
3. Process Automation Handbook by Jonathan Love, Springer-Verlag London Ltd.
4. Industrial Automation and Robotics by Mikell P. Groover, Pearson Education
5. Instrumentation and Process Control by Terry L.M. Bartelt, Cengage Learning

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26PYAEC12: Modern Techniques in Cellular Biology

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the key principles of CRISPR editing, flow cytometry/FACS, live-cell imaging, single-cell RNA-seq, and advanced fluorescence microscopy.	PO1	2
CO2	Apply basic protocols for advanced biomedical and bioanalytical techniques.	PO1, PO2, PO5	3
CO3	Understand the biological conclusions from plots, images, and cluster maps generated from experimental data.	PO1	2
CO4	Understand the selection of appropriate techniques for cellular biology investigations with technical justification.	PO1, PO4	2
CO5	Apply essential safety, ethical, and data-quality guidelines while performing and reporting every experiment.	PO3, PO7, PO9	3

Syllabus

CRISPR & Genome Editing: CRISPR-Cas9 mechanics, guide-RNA design and DNA repair outcomes, contrasts knock-outs, knock-ins and base-editing, and shows how dCas9 fusions enable gene activation or repression. Students compare delivery routes—plasmid, ribonucleoprotein, viral and lipid-nanoparticle—then evaluate off-target detection strategies before a mini-lab in which they design a gRNA and screen predicted off-targets. **Flow Cytometry & Cell Sorting:** Learners review flow-cytometer fluidics, optics and fluorochrome chemistry, interpret forward/side scatter plots for cell size and granularity, and build multi-colour antibody panels with compensation. They perform cell-cycle, apoptosis and immunophenotyping assays, study FACS sorting logic and viability checks, and finish with a hands-on run of a four-colour immunophenotyping panel. **Live-Cell Imaging:** This unit covers phase-contrast, DIC and fluorescence time-lapse microscopy, stressing environmental control through on-stage incubators and microfluidic perfusion. Students deploy fluorescent reporters such as GFP fusions and calcium biosensors to track motility, division and signalling, learn to minimise phototoxicity and manage large image datasets, then conduct a 12-hour GFP-cell time-lapse demo. **Single-Cell RNA-Seq & Multi-Omics:** Participants examine single-cell isolation by droplets, microwells or FACS, walk through barcoding, library preparation and sequencing, and run a basic bioinformatics pipeline for quality control, normalisation, clustering and UMAP/t-SNE visualisation. They identify cell types, trajectories and rare populations, glimpse CITE-seq and spatial transcriptomics and explore a public scRNA-seq dataset in R/Python during a workshop. **Advanced Fluorescence & Super-Resolution Microscopy:** Confocal and two-photon fundamentals, followed by super-resolution strategies—STED, SIM and PALM/STORM—plus functional techniques such as FRET, FRAP and FLIM for probing protein interactions and dynamics. Learners plan multiplexed staining with spectral imaging, discuss clinical applications including FISH and diagnostic immunofluorescence, and acquire and process a confocal z-stack in a practical session.

Textbooks

1. Brown TA. Gene Cloning and DNA Analysis: An Introduction. 8th ed. Hoboken: Wiley-Blackwell; 2023.
2. Ormerod MG. Flow Cytometry: A Practical Approach. 4th ed. Oxford: Oxford University Press; 2014.
3. Goldman RD, Swedlow JR, editors. Live Cell Imaging: A Laboratory Manual. 2nd ed. Cold Spring Harbor: CSHL Press; 2010.

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26PYAEC13: Medical Devices

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Analyze market trends and regulatory policies shaping the evolution of the medical device industry across regions	PO1, PO2, PO9	4
CO2	Apply design principles, biomaterials, and emerging technologies to develop safe, effective, and compliant medical devices	PO2, PO4, PO5	3
CO3	Apply ISO 13485 standards and risk management processes to ensure medical device quality and compliance.	PO3, PO4, PO8	3
CO4	Understand the global regulatory approval pathways for medical devices in India, the US, the EU, and other regions.	PO1, PO4, PO9	2
CO5	Apply post-market surveillance strategies to monitor medical device performance, safety, and compliance	PO2, PO5, PO9	3

Syllabus

Introduction to Medical Devices: History and Overview of Medical Device Industry and evolving market Trends. (India + WW). GOI's initiatives and National Medical Device Policy. Regulatory frameworks (CDSCO; State FDA; USFDA; EU-CE, etc.). Medical device design and development process. Definition and Classification of Medical Devices (India; US; EU). **Medical Device Design, Biomaterials and Biocompatibility:** Medical Device Design principles and methodologies, safety analysis. Properties and selection of materials & biomaterials for devices. Tissue engineering and regenerative medicine. Biocompatibility Testing and Standards (ISO 10993). **Manufacturing and Quality Systems:** (based on ISO 13485 Fifth Sch of IMDR 2017): Good Manufacturing Practices (GMP) & Infrastructure requirements. Quality assurance and quality control in Medical Devices. Suppl. y chain management (warehousing distribution). Risk Management (ISO 14971). **Regulatory Affairs, Regulatory strategies for global market access:** Medical device regulations and standards (IMDR 2017). Understanding Regional Differences in Regulatory Pathways. Regulatory submissions and approvals (India). Post-market surveillance and vigilance (India). Global Regulatory Requirements (USFDA, CE Mark, etc.). Case Studies of Global Regulatory Challenges. **Biomedical Engineering; Instrumentation: Emerging Technologies:** Principles of biomedical sensors and transducers. Medical imaging techniques (X-ray, CT, MRI, ultrasound). Telemedicine and remote monitoring. Integration of Electronics and Software in Medical Devices. Wearable Devices and Remote Monitoring. Ethical issues in device development and use.

Textbooks

1. Ramakrishna, S., Mayer, J., Wintermantel, E., Leong, K. W. Biomedical Materials and Devices. Springer, Singapore.
2. Enderle, J. D., Bronzino, J. D., Blanchard, S. M. Introduction to Biomedical Engineering. Academic Press (Elsevier).
3. Bronzino, J. D., Peterson, D. R. (Eds.) The Biomedical Engineering Handbook. CRC Press, Taylor & Francis.

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26PYAEC14: Transformation of Food Waste Into Medicinal Products

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the types, sources, impacts, and regulatory aspects of food waste management.	PO1, PO10	2
CO2	Apply principles and sustainable technologies for effective food waste management.	PO4, PO8, PO10	3
CO3	Understand the conversion of food waste into biofuels, biopolymers, and other value-added products.	PO1, PO6, PO10	2
CO4	Analyze bioactive compounds from food waste and evaluate their industrial and health applications	PO2, PO4, PO10	4
CO5	Understand the role of AI, IoT, and blockchain in smart food waste management systems.	PO4, PO8, PO10	2

Syllabus

Introduction to Food Waste: Food waste: Definition, Types, Sources, Causes, Problems, Impacts Advantages, Challenges, Solutions and Future directions. Indian and International regulations for food waste management. **Sustainable Management of Food Waste:** Principles of Food waste Management. Technologies and Processes: Thermo-chemical Processes, Biological Processes, Green extraction, Pyrolytic and Enzymatic techniques. **Byproducts from Food Waste:** Production of Biohydrogen, Biogas, Organic acids, Vermicompost, and Biopolymers. **Bioactive Compounds from Food Waste:** Antimicrobial, Antioxidants, Anti-inflammatory agents, Antibiotics, Prebiotics, Nutritional Supplements, Cosmetics and Biopolymers. 3D printed medicines: Customized dosages and Scaffolds. **Role of AI in Food waste management:** Machine learning, Internet of Things (IoT) and Blockchain.

Textbooks

1. Ranjna Sirohi et al., 2025. Sustainable Technologies for Food Waste Management. Taylor and Francis Group.
2. Monika Thakur et al., 2020. Sustainable Food Waste Mangement: Concepts and Innovations. Ist ed., Springer.
3. Arvanitoyannis, 2013. Waste management for food industries. Food Science and Technology International series.

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26PYAEC15: Biosimilars, Vaccines and Macromolecules

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental concepts and characteristics of biosimilars and vaccines.	PO1	2
CO2	Apply analytical methodologies for characterization and bioequivalence assessment.	PO1, PO3, PO4	3
CO3	Understand the upstream and downstream processing and formulation protocols	PO1	2
CO4	Understand the quality control, stability testing, and immunogenicity assessment methods used for ensuring the safety and efficacy of biologics and vaccines.	PO1, PO9	2
CO5	Analyse the regulatory compliance requirements across the product lifecycle.	PO1, PO2, PO9	4

Syllabus

Introduction to Biosimilars, Vaccines and Macromolecules: Classes: Monoclonal antibodies (mAbs), cytokines, insulin, growth factors; primary/secondary/tertiary structures. Biosimilars: Definition, rationale, types (e.g., erythropoietin, filgrastim). Vaccines: Generations (live, subunit, viral vector, mRNA); adjuvants and delivery systems. Industry landscape: Blockbuster biologics (Humira, Keytruda), Indian biosimilar market. **Characterization Methodologies:** Physicochemical: SDS-PAGE, SEC-HPLC, peptide mapping, mass spectrometry. Glycosylation analysis: N-linked glycans (HILIC, lectin arrays). Functional assays: Cell-based potency, binding ELISA, ADCC. Comparability for biosimilars: Fingerprinting (ICH Q5E). **Manufacturing Protocols:** Upstream: Cell line development (CHO, HEK), bioreactors, media optimization. Downstream: Harvesting, chromatography (affinity, ion-exchange), viral clearance. Fill-finish: Lyophilization, aseptic processing, cold chain. Process analytical technology (PAT) in biologics. **Quality Control and Stability Protocols:** Release testing: Host cell proteins (HCP), DNA, sterility, endotoxin (LAL). Stability: ICH Q5C for biologics; subvisible particles, aggregation. Immunogenicity assessment: ADA assays, neutralizing antibodies. Vaccine QC: Potency, identity, safety (animal models). **Regulatory Compliances and Case Studies:** Global: USFDA 351(k) biosimilar pathway, EMA guidelines, WHO prequalification. India: CDSCO Biosimilar Guidelines 2021, DCGI vaccine approvals. Documentation: BLA/CMC modules, PK/PD comparability studies. Case studies: COVID-19 mRNA vaccines (Pfizer), Indian trastuzumab biosimilars.

Textbooks

1. Genomic and Precision Medicine by Geoffrey S. Ginsburg & Huntington F. Willard
2. Genomics and Personalized Medicine by Michael Snyder
3. Deep Medicine by Eric Topol

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26PYAEC15: Biosimilars, Vaccines and Macromolecules

L-T-P-S: 1-0-0-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamental concepts and characteristics of biosimilars and vaccines.	PO1	2
CO2	Apply analytical methodologies for characterization and bioequivalence assessment.	PO1, PO3, PO4	3
CO3	Understand the upstream and downstream processing and formulation protocols	PO1	2
CO4	Understand the quality control, stability testing, and immunogenicity assessment methods used for ensuring the safety and efficacy of biologics and vaccines.	PO1, PO9	2
CO5	Analyse the regulatory compliance requirements across the product lifecycle.	PO1, PO2, PO9	4

Syllabus

Introduction to Biosimilars, Vaccines and Macromolecules: Classes: Monoclonal antibodies (mAbs), cytokines, insulin, growth factors; primary/secondary/tertiary structures. Biosimilars: Definition, rationale, types (e.g., erythropoietin, filgrastim). Vaccines: Generations (live, subunit, viral vector, mRNA); adjuvants and delivery systems. Industry landscape: Blockbuster biologics (Humira, Keytruda), Indian biosimilar market. **Characterization Methodologies:** Physicochemical: SDS-PAGE, SEC-HPLC, peptide mapping, mass spectrometry. Glycosylation analysis: N-linked glycans (HILIC, lectin arrays). Functional assays: Cell-based potency, binding ELISA, ADCC. Comparability for biosimilars: Fingerprinting (ICH Q5E). **Manufacturing Protocols:** Upstream: Cell line development (CHO, HEK), bioreactors, media optimization. Downstream: Harvesting, chromatography (affinity, ion-exchange), viral clearance. Fill-finish: Lyophilization, aseptic processing, cold chain. Process analytical technology (PAT) in biologics. **Quality Control and Stability Protocols:** Release testing: Host cell proteins (HCP), DNA, sterility, endotoxin (LAL). Stability: ICH Q5C for biologics; subvisible particles, aggregation. Immunogenicity assessment: ADA assays, neutralizing antibodies. Vaccine QC: Potency, identity, safety (animal models). **Regulatory Compliances and Case Studies:** Global: USFDA 351(k) biosimilar pathway, EMA guidelines, WHO prequalification. India: CDSCO Biosimilar Guidelines 2021, DCGI vaccine approvals. Documentation: BLA/CMC modules, PK/PD comparability studies. Case studies: COVID-19 mRNA vaccines (Pfizer), Indian trastuzumab biosimilars.

Textbooks

1. Genomic and Precision Medicine by Geoffrey S. Ginsburg & Huntington F. Willard
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26PY4147RP: Research Project

L-T-P-S: 0-0-12-0 **Credits: 6** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Formulate a research problem and design an appropriate methodology through a critical review of the literature.	PO1, PO3, PO11	4
CO2	Carry out experimental or investigative work using suitable tools, techniques and good research practice.	PO1, PO4, PO11	3
CO3	Analyse and interpret results to draw valid, evidence-based conclusions.	PO1, PO3, PO4	4
CO4	Communicate the research through a written dissertation and an oral presentation, observing research ethics.	PO1, PO8, PO11	3
CO5	Critically evaluate research findings and integrate scientific evidence to identify implications and future research directions.	PO1, PO8, PO11	4

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26PY4248T: Ethical Considerations and Translational Applications of AI in Pharmacy (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the lifecycle of AI systems in pharmaceutical settings.	PO1, PO4	2
CO2	Analyse the model performance, bias, and validation requirements.	PO2, PO3, PO4	4
CO3	Understand the regulatory and governance frameworks applicable to AI in pharmacy	PO1, PO4, PO6	2
CO4	Analyse AI applications in automation and public health analytics	PO2, PO4, PO9	4
CO5	Analyse the ethical considerations in AI applications for pharmaceutical sciences and healthcare	PO2, PO4, PO6	4

Syllabus

AI Lifecycle, Validation & Model Auditing: Overview of AI system lifecycle: data collection, preprocessing, modelling, validation, deployment, and monitoring. Importance of data quality in healthcare datasets. Training vs testing vs validation datasets. Cross-validation (conceptual understanding). Model drift and performance degradation, data leakage in modelling. Documentation practices: Documentation and reproducibility. Basics of model auditing. **Regulatory Framework & Explainable AI:** Overview of AI in regulatory submissions. Explainable AI (XAI) concept. Transparency and interpretability. Overview of regulatory guidance on AI (EU AI Act, FDA/ CDSCO frameworks). Accountability in automated decision systems. Risk-based classification of AI systems. **AI in in Pharmacy Automation & Supply Chain:** Overview of AI in automated dispensing systems. Inventory prediction models. Case studies on regression-based demand forecasting, different forecasting methods. Medication adherence monitoring systems. AI in supply chain risk prediction. Predictive analytics in pharmaceutical logistics. Advantages, limitations, legal & privacy considerations of AI in pharmacy automation. **AI in in Public Health & Real-World Data Analytics:** Overview of real-world data sources (EHR, claims, surveillance systems). Conceptual knowledge of AI in outbreak prediction, Population-level risk modelling. Regression models in epidemiology. AI in vaccination forecasting. Case studies: AI applications in epidemiological trend analysis (e.g. COVID-19 vaccination hesitancy, diabetes prevalence forecasting, antibiotic resistance trends etc.). **Guided Project - Translational AI in Pharmacy:** Students implement a supervised ML model (regression, logistic regression, or others) using real-world pharmacy data from domains like formulation, pharmacokinetics (PK), ADR detection, quality control (QC), automation, or public health. They validate the model, analyze regulatory implications, identify ethical risks (e.g., bias, privacy), and present a structured AI implementation plan for peer/faculty review.

Textbooks

1. Germanakos, P. Human-Centered AI: An Illustrated Scientific Quest.
2. Matheny, M., et al. Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril. National Academy of Medicine.
3. Mittal, M. and Bhushan, B. Generative AI in Healthcare: Concepts, Methodologies, Tools, and Applications.
4. Steyerberg, E. W. Clinical Prediction Models: A Practical Approach to Development, Validation, and Updating. Springer.
5. Steyerberg, E. W. Practical Predictive Analytics and Decisioning Systems for Medicine.

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26PY4249T: Clinical Pharmacotherapeutics (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the subjective and objective parameters and risk factors for common disease conditions.	PO1	2
CO2	Understand the general therapeutic approach in management of selected diseases	PO1, PO8	2
CO3	Understand the patient-specific parameters relevant in initiating the drug therapy	PO1	2
CO4	Understand the rationale for drug therapy of the selected disease	PO1	2
CO5	Understand the methods of non-pharmacological management.	PO1, PO3, PO8	2

Syllabus

Definition, etiopathogenesis, clinical manifestations, overview of management of the diseases associated with

Ischemic Heart Disease: Hypertension, heart failure, myocardial infarction, hyperlipidaemia, arrhythmia.

Respiratory System: Asthma, COPD

Renal System: acute renal failure, chronic renal failure, renal replacement therapy

Endocrine System: diabetes, thyroid disorders

Nervous System: epilepsy, stroke, parkinsonism

Gastrointestinal System: peptic ulcer disease, GERD

Diseases of bones and joints: rheumatoid arthritis, osteoarthritis

Infectious Diseases: tuberculosis, pneumonia, UTI, malaria, HIV

Haematological Diseases: Anaemia

Textbooks

1. Bauer, L. A. Applied Clinical Pharmacokinetics. McGraw-Hill Education.
2. DiPiro, J. T., Yee, G. C., Posey, L. M., Haines, S. T., Nolin, T. D. and Ellingrod, V. Pharmacotherapy: A Pathophysiologic Approach. McGraw-Hill Education.
3. Herfindal, E. T. and Gourley, D. R. Clinical Pharmacy and Therapeutics. Williams & Wilkins.
4. Walker, R. and Whittlesea, C. Clinical Pharmacy and Therapeutics. Elsevier.
5. Zeind, C. S. and Carvalho, M. G. Applied Therapeutics: The Clinical Use of Drugs. Wolters Kluwer.

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26PY4250T: Industrial Pharmacy and Facility Design (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the regulatory guidelines for pharmaceutical development, stability, and manufacturing	PO1, PO2, PO3	2
CO2	Understand the pilot plant operations and scale-up strategies for the development of solid, liquid, and semi-solid pharmaceutical dosage forms.	PO1, PO3, PO8	2
CO3	Understand the technology transfer processes, documentation, and quality management principles	PO1, PO7, PO8	2
CO4	Apply cGMP and cleanroom standards to design pharmaceutical manufacturing facility layouts and utility systems	PO1, PO2, PO3	3
CO5	Analyse modern pharmaceutical facility design approaches to ensure efficient and compliant manufacturing operations	PO2, PO3, PO4	4

Syllabus

Regulatory guidelines for formulation Development: ICH Q8, QbD and optimization (Fundamental terminologies, process and applications) ICH guidelines of stability testing. Industrial aspects of Product development: Pilot Plant and Scale up: General considerations including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology. **Technology development and transfer:** WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control and analytical method transfer. TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues. **Facility Considerations: Non-sterile:** Facility design according to schedule M for various dosage forms, Water purification system: design and operation, Storage, distribution, and validation of water systems. Different types of waters. Steam systems and Clean Steam, Compressed air, Vacuum, CIP. Industry standards for water and steam systems. Effluent testing facility: Design and significance. Layout design for various non- sterile dosage forms (Process flow) Cleaning and disinfection protocols, cleaning types (Type A, B and C), Cleaning validation methods and acceptance criteria. **Facility considerations: Sterile:** Overview of sterile pharmaceutical manufacturing: layout as per schedule M and cGMP, clean room concept -Importance of sterility and contamination control, SIP. efficient material and personnel flow to maintain sterility, zoning and segregation, Guidelines, standards and Cleanroom classifications from FDA, EMA, WHO and ISO. Heating, ventilation and air conditioning system (HVAC): Significance, components, testing (including efficiency and integrity testing of HEPA). Parameters for qualification and validation (routine monitoring) of clean area. **Advances in facility design:** Modular concept of manufacturing facilities with significance and suitable examples, Advances in clean room technology: pass- through chambers, isolators, Modular cleanrooms Automation and robotics in pharmaceutical manufacturing operations.

Textbooks

1. Akers, M. J. Sterile Product Development: Formulation, Process and Regulatory Considerations. CRC Press.

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26PY4251T: Pharmaceutical Management (Theory)

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply knowledge of pharmaceutical industry practices in drug development, regulation, manufacturing, and distribution.	PO1, PO3, PO8	3
CO2	Understand the role of pharmaceutical companies in healthcare and their impact on society at large.	PO1, PO9	2
CO3	Apply strategic management principles to address market entry, competitive advantage, and business growth in the pharmaceutical industry	PO1, PO3, PO8	3
CO4	Apply strategic planning principles to formulate business plans for pharmaceutical companies considering global and local market dynamics.	PO2, PO3, PO8	3
CO5	Apply pharmaceutical marketing and sales strategies aligned with business goals, regulatory guidelines, and market needs	PO3, PO4, PO8	4

Syllabus

Introduction to Pharmaceutical Management: Introduction to management. Overview of Indian & Global pharmaceutical industry, Role and responsibilities of a pharmaceutical manager. Functions and importance of Key Management Principles: Planning, organizing, leading, controlling, Decision-making and Time management. **Marketing Management in Pharmaceuticals:** Definition and uniqueness of pharmaceutical marketing, Pharmaceutical Marketing Overview; Global & Indian Scenario, Marketing Mix, 4 Ps of Marketing: Product, Price, Place, Promotion, Strategic marketing and competitive analysis, Pharmaceutical Sales: Role of a medical representative, Digital marketing of pharmaceutical products, Ethical considerations in pharmaceutical marketing and promotion, E pharmacies. **Pharmaceutical Product Management:** Introduction to Pharmaceutical Product Management, role of product management in the pharmaceutical industry, Key responsibilities of a pharmaceutical product manager, Product Lifecycle Management, Branding and Promotional Strategies in pharmaceutical sector, Importance of market segmentation, targeting, and positioning in product management, Market Research and Analysis in pharmaceutical sector: Techniques for conducting market research. **Financial planning and Human Resource Management:** Budgeting, financial forecasting, cost control, Pricing of Pharmaceuticals as per DPCO, Importance of human resource management in pharmaceutical organizations, Recruitment, selection, and training of pharmaceutical professionals, Performance appraisal and employee motivation, Behaviour, Leadership styles and their impact on the pharmaceutical industry, Team building and conflict resolution. **Operations & Supply Chain Management in Pharmaceuticals:** Operations Management, Production planning and control in pharmaceutical manufacturing, Inventory management and optimization, Lean manufacturing and Six Sigma in the pharmaceutical industry, Supply Chain Management, Logistics management and drug distribution channels, Cold chain management and the role of technology in SCM, E commerce and its role in pharmaceutical distribution, Risk Management and Sustainability.

Textbooks

1. Dessler, G. Human Resource Management. Pearson.
2. Drucker, P. F. Principles of Management. Harper Business.
3. Joseph, A. S. Pharmaceutical Management and Marketing. CBS Publishers & Distributors.
4. Pandey, I. M. Financial Management. Vikas Publishing House.
5. Stevenson, W. J. Operations Management. McGraw-Hill Education

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26PY4252T: Sterile Dosage Forms and Novel Drug Delivery System (Theory)

L-T-P-S: 3-0-0-0 **Credits: 3** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the types of NDDS and their role in overcoming the limitations of conventional drug delivery.	PO1	2
CO2	Understand the appropriate pharmaceutical ingredients for designing site-specific or controlled-release delivery systems.	PO1, PO4	2
CO3	Apply formulation principles to design oral, mucosal, parenteral, and transdermal NDDS	PO1, PO2	3
CO4	Apply QbD principles and preclinical evaluation tools to assess NDDS quality and safety.	PO1, PO2	3
CO5	Apply the principles of precision medicine in modern pharmacotherapy	PO1, PO2	3

Syllabus

Fundamentals, Polymers & Materials for NDDS: Limitations of conventional dosage forms (e.g., solubility, permeability, toxicity, first-pass metabolism). Classification of NDDS: Controlled Release, Targeted, Stimuli Responsive (Smart), Chronotherapeutic, Transdermal and Mucosal, Implantable and Injectable Depot Systems, Vesicular, Polymeric, Ocular, Pulmonary, and Nasal Drug Delivery Systems. Biodegradable and biocompatible polymers: PLA, PLGA, PCL, chitosan, gelatin. Lipids and surfactants: lecithin, phospholipids, Span/Tween, SLNs. Inorganic systems: silica, gold nanoparticles, iron oxide, MOFs. Excipients in NDDS: GRAS substances, IIG database, regulatory constraints. **Oral and Mucosal Delivery Systems**: Gastro-retentive systems: floating, bioadhesive, expandable systems. Colon-targeted systems: pH-triggered, microbially-triggered, time dependent systems. Buccal, nasal, and pulmonary carriers: films, sprays, DPIs, liposomes. IVIVC and biorelevant dissolution testing. **Transdermal NDDS:** Introduction to Transdermal drug delivery: Need, advantages disadvantages, basic structure and components. Formulation aspects including permeation enhancers. Long-acting systems: in-situ gels, microspheres, implants, ocular inserts. Transdermal and microneedle technologies: iontophoresis, sonophoresis, micro needles. Aseptic manufacturing, scale-up challenges, and process analytical tools (PAT). **Evaluation, Quality, and Translation:** Preformulation and QbD: QTPP, CQAs, CPPs. Characterization methods: particle size, zeta potential, SEM/TEM, in-vitro release, permeability assays (PAMPA, Caco-2). Non-clinical evaluation: PK/PD modeling, biodistribution, toxicology. Regulatory pathways: 505(b)(2), complex generics, ICH Q8–Q10, EMA pathways. Case studies: Liposomal Amphotericin B for Fungal Infections, mRNA-Lipid Nanoparticle Vaccines (e.g., COVID-19 Vaccines), Depot Antipsychotic Injections (e.g., Risperidone Microspheres), Transdermal Patch for Hormone Replacement Therapy, Ocular Inserts for Glaucoma Management, Oral Colon-Targeted Delivery for Inflammatory Bowel Disease, Inhalable Insulin for Diabetes Mellitus, Dendrimers for Targeted Cancer Therapy, Chronotherapeutic Drug Delivery in Hypertension. Nanosystems and precision medicine: Liposomes, niosomes, transferosomes, polymeric nanoparticles, solid-lipid nanoparticles, dendrimers. Precision medicine: definition and scope, evolution from" one size-fits-all" to personalized approaches.

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Sterile Dosage Forms (Parenteral & Ophthalmic): Introduction & classification: SVP vs LVP; routes; Advantages/limitations. Water for Injection (WFI): Types, preparation, storage/distribution; pharmacopoeial requirements. Formulation components: Vehicles, buffers, co-solvents, surfactants, antioxidants, preservatives, chelators; isotonicity & osmolality. Manufacturing: Aseptic vs terminal sterilisation; filtration; lyophilisation principles; environmental controls. Containers & closures: Glass/Plastic systems; elastomers; selection factors; evaluation & container– closure integrity. Form fill Seal and Blow Fill Seal Technology. Ophthalmics: Solutions/suspensions/ointments/gels/inserts; physiological factors (pH, tonicity, viscosity); residence-time enhancers; preservative-free systems (e.g., BFS). Quality control & compliance: Sterility tests, LAL/endotoxins, particulate matter, clarity, extractable volume; labelling & documentation; overview of cGMP/cleanrooms and environmental monitoring.

Textbooks

1. Aulton, M. E. and Taylor, K. Aulton's Pharmaceutics: The Design and Manufacture of Medicines. Elsevier.
2. Banga, A. K. Transdermal and Intradermal Delivery of Therapeutic Agents. CRC Press.
3. Dash, A. K. and Cudworth, G. C. Therapeutic Proteins and Peptides: Formulation, Processing and Delivery Systems. CRC Press
4. Jain, N. K. Drug Delivery Systems. CBS Publishers & Distributors.
5. Martin, A., Sinko, P. J. and Singh, Y. Martin's Physical Pharmacy and Pharmaceutical Sciences. Lippincott Williams & Wilkins.

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26PY4252P: Sterile Dosage Forms and Novel Drug Delivery System (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the principles and significance of impurity profiling in pharmaceutical analysis.	PO1	2
CO2	Understand the principles and significance of impurity profiling in pharmaceutical analysis.	PO1, PO3	2
CO3	Apply the ICH and pharmacopeial guidelines for impurity limits and documentation.	PO1, PO6, PO7	3
CO4	Apply HPLC, GC, UV, and IR techniques for pharmaceutical impurity analysis.	PO1, PO3, PO4	3
CO5	Evaluate and interpret impurity data for regulatory submissions and quality assurance.	PO2, PO4, PO6	5

Syllabus

1. Preparation and evaluation of orodispersible tablets
2. Preparation and evaluation of fast dissolving tablets
3. Preparation and evaluation of bilayer tablets
4. Preparation and evaluation of osmotic tablets
5. Preparation and evaluation of microspheres by coacervation phase separation technique
6. Preparation and evaluation of microcapsules
7. Preparation and evaluation of bioadhesive buccal patches
8. Preparation and evaluation of sublingual tablets
9. Preparation and evaluation of buccal tablets
10. Preparation and evaluation of transdermal patches
11. Preparation and evaluation of floating tablets
12. Preparation and evaluation of gastro retentive drug delivery systems
13. Preparation and evaluation of liposomes
14. Preparation and evaluation of niosomes
15. Preparation and evaluation of a parenteral preparation.
16. Preparation and evaluation of nasal spray
17. Evaluation of pharmaceutical waters: Purified & Distilled Water as per IP; review of WFI specifications (conductivity/ TOC limits-demo / simulation).

Textbooks

1. Allen, L. V., Popovich, N. G. and Ansel, H. C. Pharmaceutical Dosage Forms and Drug Delivery Systems. Lippincott Williams & Wilkins.
2. Ansel, H. C., Allen, L. V. and Popovich, N. G. Pharmaceutical Calculations. Wolters Kluwer.
3. Banker, G. S. and Rhodes, C. T. Modern Pharmaceutics. CRC Press.
4. Chien, Y. W. Novel Drug Delivery Systems. CRC Press.
5. Jain, N. K. Controlled and Novel Drug Delivery Systems. CBS Publishers & Distributors.

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26PYAEC17: Pharmaceutical Packaging

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the functions and types of primary, secondary, and tertiary pharmaceutical packaging.	PO1	2
CO2	Understand pharmaceutical packaging materials and their interactions with dosage forms	PO1	2
CO3	Apply packaging principles to select appropriate packaging materials for product development	PO2, PO4, PO5	3
CO4	Apply quality control and regulatory principles to packaging processes.	PO3, PO4, PO9	3
CO5	Understand advancements in pharmaceutical packaging technologies, including child-resistant, tamper-evident, and automated packaging	PO1, PO4	2

Syllabus

General Information on Packaging: Introduction: Purpose of packaging, selection of the ideal package (primary, secondary and tertiary), hazards encountered by the package, various types of inner and outer packages, selection of a suitable package. Packaging materials: Detailed study with regard to composition packaging characteristics, advantages, economics and limitations of various packaging materials with special emphasis on glass, plastics, metals and rubber. Child resistant package, Tamper Evident Packaging, Anti Counterfeit Packaging, Environmental considerations of packaging (Recycling). **Pharmaceutical Packaging – Design and Development:** Selection and Design of Packaging during Product Development Process (Parameters). Packaging Process: Significance of Strip, Blister, Pouch Packaging, advantages, economics and limitation, Packing machinery and recent advances, films employed in Packing (Video based learning). **Formulation Packaging Interaction:** Polymer Chemistry Science and Stability Aspects. Extractable and Leachables. Methods to study formulation packaging interaction. Suitability considerations for pharmaceutical packaging. **Quality Assurance, Control and Regulatory Aspects:** Total Quality management, Good Manufacturing Practice, Quality Risk Management related to Packaging Department, Specification Testing and Shelf-life testing as per Pharmacopeial Guidelines for Packaging Material in-process and finished Package Products. Standard Operating Procedures (SOPs)/Documentation for Solid/Semi Solid/Liquid/Parenteral Formulation Packaging. Packaging waste and Waste policies for packaging materials. **Advances in Pharmaceutical Packaging:** Labelling- Types of label (including Bar code, Hologram, RF, structured program, in- mould and decorative labelling) – Use of Software, Legal requirements of Labelling, packaging inserts and outserts. Adhesives and Machinery Employed for Labelling - Pharmacy Accessory Label Printers (PALP), Concept of paperless labelling. Logistics Packaging - Block Chain Technology in Supply Traceability, Transparency and Credibility. Review on Automated Packaging System for Oral Solids (Auto-Print), Oral Liquid (Fluidose), and overwrapping (PABS).

Textbooks

1. Brody, A. L., Marsh, K. S. The Wiley Encyclopedia of Packaging Technology. John Wiley & Sons, New York, USA.
2. Lachman, L., Lieberman, H. A., Kanig, J. L. The Theory and Practice of Industrial Pharmacy. Lea & Febiger, Philadelphia, USA.
3. KacChesney, T. C. Packaging of Cosmetics and Toiletries. Newness-Butterworth, London, UK.

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26PYAEC18: Supply Chain Management

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Analyse and design efficient pharmaceutical supply chains.	PO1, PO2, PO8	4
CO2	Apply procurement and supplier management strategies for efficient pharmaceutical operations	PO1, PO3, PO8	3
CO3	Apply logistics and distribution strategies to optimize pharmaceutical supply chain operations.	PO2, PO5, PO8	3
CO4	Apply technology-based solutions for supply chain innovation.	PO4, PO5, PO8	3
CO5	Apply sustainable and resilient supply chain practices, including cold-chain management	PO5, PO8, PO10	3

Syllabus

Introduction to Supply Chain Management: Introduction to SCM: Definition, scope, Importance of SCM, in global business, Key components and stakeholders, Supply Chain Strategies, Process and barriers of supply chain management. Supply Chain Models: SCOR Model (Plan, Source, Make, Deliver, Return). CSCMP Supply Chain Process Standards: Supply Chain Network Design, Facility location and layout, Transportation planning. Supply Chain Performance Metrics, Key Performance Indicators (KPIs). Performance measurement tools. Case Study: SCM in Practice with Real-world examples. **Procurement and Supplier Management:** Procurement Fundamentals, Role of procurement in SCM, sourcing strategies. Supplier selection criteria, supplier performance evaluation, Collaboration and communication. Global Sourcing, Challenges and opportunities, Cultural considerations, Legal and ethical issues. E-Procurement, Electronic procurement systems, Benefits and challenges. Case Study: Procurement Excellence, Best practices. **Logistics and Distribution Management:** Logistics Fundamentals, Definition and scope, Importance in SCM. Transportation Management, Modes of transportation, Routing and scheduling, Freight cost analysis. Inventory Management of pharmaceuticals, Inventory types and functions, Inventory control techniques, Economic Order Quantity (EOQ). Introduction to warehouse functions, Management and Distribution channels and distribution strategies for vaccines and biologicals. Case Study: Logistics and transportation Optimization process, Knowledge and skill sets needed for optimization. **Technology and Innovation in SCM:** Information Technology in SCM, Role of IT in SCM planning and operations management for pharmaceuticals. Enterprise Resource Planning (ERP) systems, operations 6system, Supply Chain Management Softwares. Big Data and Analytics, Importance of data in SCM. Artificial Intelligence and Machine Learning, AI/ML applications in SCM, smart logistics. Demand forecasting, Autonomous vehicles. Security and transparency with special emphasis to cybersecurity.

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Sustainability and Risk Management in SCM: Sustainable Supply Chain Management, Green logistics, Circular economy Environmental impact assessment. Ethical Sourcing, Fair trade practices, Labor standards, Supplier audits. Risk Management in SCM, Risk identification and assessment, Risk mitigation strategies, Crisis management with special emphasis to Pharmaceutical products. Regulatory Compliance, International trade regulations, Customs and import/export laws, Compliance standards. Cold chain management, its need, challenges and opportunities in Pharmaceutical products. Case Study: Risk and Sustainability Challenges.

Textbooks

1. Chopra, S., & Meindl, P. (2019). Supply Chain Management: Strategy, Planning, and Operation (7th ed.). Pearson.
2. Christopher, M. (2016). Logistics & Supply Chain Management (5th ed.). Pearson.
3. Lambert, D. M., & Cooper, M. C. (2000). Issues in Supply Chain Management. Industrial Marketing Management, 29(1), 65-83.
4. Coyle, Bardi, Longley, The Management of Business Logistics- A Supply Chain Perspective, Thompson Press, 2006.

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26PYAEC19: Industrial Safety and Waste Management

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand industrial hazards and preventive safety measures	PO1, PO4, PO9	2
CO2	Apply risk assessment and control strategies to ensure workplace safety	PO1, PO3, PO9	3
CO3	Understand the different types of industrial waste generated in pharmaceutical sectors	PO1, PO10	2
CO4	Apply suitable treatment and disposal methods for hazardous and non-hazardous waste.	PO3, PO4, PO10	3
CO5	Understand and follow safety and environmental regulations applicable to industrial practices.	PO4, PO9, PO10	2

Syllabus

Introduction to Industrial Safety: Importance of industrial safety in pharmaceutical and chemical industries. Types of industrial hazards: physical, chemical, biological, mechanical, electrical. Accident prevention techniques. Safety signs, symbols, and personal protective equipment (PPE). OSHA guidelines and ISO safety standards **Risk Assessment and Hazard Management:** Hazard identification methods (HAZOP, FMEA). Risk analysis and evaluation. Safety audit and checklist. Fire hazards and fire-fighting systems. Role of safety officer and disaster management planning. **Waste Management – Fundamentals:** Classification of industrial waste: hazardous, non-hazardous, solid, liquid. Sources of pharmaceutical and chemical waste. Waste minimization strategies. Recycling, reuse, and resource recovery. Environmental impact assessment (EIA) basics. **Waste Treatment Technologies:** Physical, chemical, and biological methods of waste treatment. Treatment of effluents, emissions, and solid waste. Common Effluent Treatment Plants (CETP). Biomedical waste disposal and rules (BMW Rules – India). Guidelines from CPCB, WHO, and MOEFCC. **Regulatory and Sustainable Practices:** Environmental Protection Act, Factories Act, Hazardous Waste Rules. Good Manufacturing Practices (GMP) related to waste and safety. International guidelines: US EPA, EU regulations, WHO. Sustainable development goals (SDGs) related to waste and health. Case studies of safe and green pharma manufacturing.

Textbooks

1. Industrial Safety Management by L.M. Deshmukh, McGraw-Hill Education
2. Waste Management Practices: Municipal, Hazardous, and Industrial by John Pichtel, CRC Press
3. Safety, Health and Environment for Engineers and Scientists by Michel W. First, John Wiley & Sons
4. Industrial Waste Management Handbook by Kanti L. Shah, McGraw-Hill Education
5. Biomedical Waste Management in India by Sunil Kumar, Elsevier

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26PYAEC20: Traditional Healing Practices of India

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the historical background and scope of traditional healing systems of India.	PO1	2
CO2	Analyse the various regional healing practices and their sociocultural relevance.	PO1, PO2	4
CO3	Analyse the integration of traditional and modern healthcare systems.	PO1, PO2, PO9	4
CO4	Apply indigenous knowledge systems in health and healing practices	PO2, PO4, PO5	3
CO5	Apply scientific approaches to validate and integrate traditional health knowledge into policy	PO2, PO4, PO5	3

Syllabus

Introduction to Traditional Medicine: Definition and scope of traditional healing Historical evolution of traditional medicine in India Indigenous knowledge systems and oral traditions Health and disease in Indian philosophical thought Integrating Traditional Healing with Modern Medicine What is a traditional healing practice. Traditional healing practice in India. Socio-Scientific Validation and Knowledge Integration Preservation of Socio-Cultural Health Knowledge Ethnoveterinary Empowerment and Rural Health Equity. **Basic principles:** Ayurveda, Panchamahabhuta, Tridosha, Dhatu, Mala Diagnosis and treatment: Pulse diagnosis, Panchakarma, Rasayana, Nadi Parikshan, Marma therapy, Chiropathic treatment, Materia medica (Dravyaguna) and formulation (Rasa Shastra) Current relevance and institutionalization (AYUSH) The study seeks to integrate traditional healing practices into contemporary healthcare systems. Contemporary usage and debates Fostering Transdisciplinary Collaboration Economic Viability and Grassroots Entrepreneurship. **Siddha and Unani Systems:** Siddha: Origin, principles, and therapeutic techniques Unani: Greek-Arabic foundations, four humors, pharmacopoeia Role in South Indian and Indo-Islamic medical heritage Role of traditional healing practice in homeopathy and naturopathy Role of traditional healing practice in homeopathy and naturopathy Development and acceptance in India Role of traditional healing practice in homeopathy and naturopathy Development and acceptance in India. **Folk and Tribal Healing Practices:** Holistic approach to the traditional system, natural methods of healing practices, and cultural significance of the traditional system of medicine. Difference between Indian traditional system of medicine and traditional Chinese medicinal system. Regional practices: Snake stones, ritual healing, herbal knowledge Role of healers: Vaidya, Ojha, Bhopa, Bonesetters, Dai (traditional midwives) Ethnomedicine and ethnobotany: Case studies from North East of India, Chhattisgarh, Himalaya etc. Multidisciplinary longitudinal study to comprehensively document, scientifically validate, and integrate traditional healing systems

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Spiritual and Religious Healing: Role of Yoga, Pranayama, and meditation Healing through Mantras, rituals, and astrology. Use of temples and sacred groves in mental health and well-being Computational studies will complement laboratory investigations by revealing molecular interactions and mechanisms of action, thereby providing scientific rigor to traditional claims. Legal and policy frameworks (AYUSH, WHO recognition) Role of NGOs and community health programs Challenges in validation, standardization, and commercialization Case studies of integration in rural/urban healthcare Protection of Intellectual Property and Cultural Sovereignty Documentation of Indigenous Knowledge System (IKS). Prevention of the Traditional system of medicine.

Textbooks

1. The Roots of Ayurveda: Selections from Sanskrit Medical Writings – Dominik Wujastyk, Penguin Classics
2. Indian Medicine in the Classical Age – D. N. Jha, Munshiram Manoharlal Publishers
3. A History of Indian Medical Literature – Gerrit Jan Meulenbeld, Egbert Forsten Publishing
4. The Ayurveda Encyclopedia: Natural Secrets to Healing, Prevention, and Longevity – Swami Sadashiva Tirtha, Ayurvedic Holistic Center Press
5. The Science of Medicine and Surgery in Ancient India – K. R. Srikantha Murthy, Chaukhambha Orientalia

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26PYAEC21: Futuristic Pharma Through AR/VR: Pharma 4.0

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the core principles of Pharma 4.0 and immersive technologies for pharmaceutical applications	PO1, PO4	2
CO2	Apply AR/VR hardware and software tools to create basic immersive pharmaceutical experiences.	PO1, PO3, PO4	3
CO3	Apply AR/VR technologies in drug discovery, molecular modelling, and collaborative virtual research environments	PO4, PO5, PO10	3
CO4	Apply AR/VR technologies to design training simulations and SOP overlays for pharmaceutical manufacturing, GMP, and quality control.	PO2, PO4, PO5	3
CO5	Apply immersive technologies to develop compliant Pharma 4.0 solutions.	PO4, PO5, PO7	3

Syllabus

Introduction to AR/VR and Tools: Understanding AR and VR: Concepts, Tools, and Devices. Hands-on demo of Google Cardboard, Oculus, or similar headsets. Difference between AR, VR, and Mixed Reality (MR). Exploring AR/VR Platforms for Life Sciences. Overview of software: Unity 3D, Vuforia, WebAR, JigSpace, ARKit. Demo of existing pharma-related AR/VR apps (e.g., Human Anatomy VR). **AR/VR in Pharmaceutical Education and Training:** Use of apps for visualizing drug-receptor interaction. Virtual dissection and interactive physiology. Simulated tablet compression and coating machines. Training modules on aseptic techniques using VR. Counselling Patients in a Virtual Pharmacy Setup. Use of avatars and scenarios for OTC counselling, prescription explanation. Emphasis on communication and empathy in virtual settings. **AR/VR in Manufacturing and Pharma 4.0:** Digital Twin Concept & Virtual Plant Walkthrough. Create mock layouts of pharma production plants in AR. Navigate a cleanroom and observe equipment placement virtually. Smart Maintenance and SOP Training via AR Integrating AR with Sensors and QR-based Inventory. Real-world temperature/humidity sensors. Live monitoring of warehousing systems Pharma 4.0 Compliance and Regulatory Perspectives. Virtual audit readiness. Documentation and equipment validation trails using AR mock ups, **AR/VR for Patient-Centric Applications:** Patient Leaflets and Drug Delivery Tutorials. Creating content showing how to use inhalers, injectables, or devices. Overlay content on medicine boxes or instruction cards AR/VR for Mental Health, Pain, and Rehabilitation Therapy. Case studies: VR for phobia therapy, chronic pain, relaxation therapy. Digital Adherence Tools with AR Guidance. Real-time AR reminders linked to prescription schedules. AI avatars for personalized patient nudges. **Project-Based Integration and Evaluation:** Mini Project: Create an AR/VR-Based Solution. Example: VR tour of GMP plant, AR-based patient education module. Demo Unity or online tools like CoSpaces / ZapWorks

Textbooks

1. Schmalstieg D, Hollerer T. Augmented Reality: Principles and Practice. 1st ed. Boston: Addison-Wesley Professional; 2016.
2. Craig AB. Understanding Augmented Reality: Concepts and Applications. 2nd ed. Burlington: Morgan Kaufmann; 2018
3. Umeda B, Thompson KK, editors. Virtual and Augmented Reality in Medical and Pharmaceutical Applications. 1st ed. Cambridge: Elsevier; 2022.
4. Huang Y, Jiang P, editors. Digital Twin-Driven Smart Manufacturing. 1st ed. Amsterdam.

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26PYAEC22: Herbal Cosmetics for Industry Perspective

L-T-P-S: 2-0-0-0 **Credits: 2** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the materials, capital, infrastructure, and entrepreneurial fundamentals for herbal cosmetics manufacturing	PO1, PO8	2
CO2	Understand the specifications and importance of adhering to Good Manufacturing Practices (GMP) for herbal cosmetics.	PO1	2
CO3	Understand he guidelines and testing requirements for ensuring the quality and safety of herbal cosmetics.	PO1, PO9	2
CO4	Understand the legal and regulatory requirements for the manufacturing and marketing of herbal cosmetics	PO2, PO7, PO9	2
CO5	Understand the requirements for herbal cosmetics manufacturing and the fundamentals of entrepreneurship	PO1, PO8	2

Syllabus

Introduction to the requirements for an herbal cosmetics industry: Market trends, worldwide trade and consumer demand for herbal cosmetics. Advantages and challenges of the herbal cosmetics industry. Requirements for factory location, premises, plant layout and infrastructure and materials. **Fundamentals of Entrepreneurship:** Characteristics and skills of successful entrepreneurs. Types of entrepreneurships: product, process, and quality testing entrepreneurship. Developing Entrepreneurial mind-set. Case studies Success Stories of some successful herbal cosmetic brands (e.g., Forest Essentials, Biotique, Khadi Naturals). Steps involved in setting up a start-up: Identifying gaps in the herbal cosmetics market, Business plan development for a herbal cosmetic product, SWOT analysis for herbal cosmetics start-ups, Technical, financial, and market feasibility study and Planning for scalability and sustainability. **Financial Management and Marketing Strategies**: Budgeting and cost estimation. Sources of finance: loans, grants, angel investors, venture capital. Government schemes (STARTUP INDIA) and support for MSMEs and herbal industries. Overview on branding essentials – positioning and brand identity. Distribution channels: retail, e-commerce, exports. Digital marketing: social media, Search Engine Optimization (SEO) influencer marketing. **Legal and Regulatory Framework:** Licensing and registration for herbal cosmetics as per the Drugs and Cosmetics Act (1940) and rules (1945) of India. The role of CDSCO, AYUSH ministry, FSSAI, ISO, GMP in the herbal cosmetics industry Labelling and packaging norms (Schedule S and role of Bureau of Indian Standards –BIS) Advertising regulation for herbal cosmetics IP rights: patents, trademarks, and protection of herbal knowledge. **Quality and safety evaluation of herbal cosmetics:** Importance of quality assurance in herbal cosmetics. Key safety concerns (contamination, allergens, microbial growth). Quality evaluation of herbal raw material. Product-Specific Quality Parameters - Quality standards for creams, lotions, shampoos, oils, face packs, etc. Specific marker compounds and their quantification in herbal products. Toxicological and Safety Evaluation: In vitro and in vivo safety testing (skin irritation, sensitization, eye irritation). Patch testing, Draize test, and OECD guidelines. Use of alternative non-animal testing methods (3D skin models, in silico models)

Textbooks

1. Barel, A. O., Paye, M., Maibach, H. I. (Eds.) Handbook of Cosmetic Science and Technology. CRC Press, Taylor & Francis.
2. Nema, R. K., Rathore, K. S. Herbal Cosmetics: Formulation, Characterization and Standardization. CBS Publishers & Distributors, New Delhi, India.
3. Mitsui, T. (Ed.) New Cosmetic Science. Elsevier Science, Amsterdam, Netherlands.

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26PY4253P: Pharmaceutical Marketing Skills (Practical)

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand pharmaceutical market dynamics and the factors influencing sales	PO6, PO8, PO10	2
CO2	Apply marketing strategies for pharmaceutical products based on market needs and target audiences.	PO1, PO5, PO8	3
CO3	Apply ethical and legal principles to ensure compliance in pharmaceutical marketing	PO3, PO6, PO8	2
CO4	Apply digital marketing strategies to promote pharmaceutical products	PO1, PO4, PO8	3
CO5	Apply interpersonal and communication skills to build professional relationships in the pharmaceutical industry	PO3, PO7, PO8	3

Syllabus

1. Conduct a comparative study of Indian and global pharmaceutical marketing approaches.
2. Study and classify different marketing communication styles in the pharmaceutical industry.
3. Design and conduct primary market research on prescription pharmaceutical products and analyse the data.
4. Design and conduct primary market research on OTC products and analyze the data.
5. Create and deliver a product detailing presentation for healthcare professionals.
6. Design a patient education program or presentation for pharmaceutical products targeting consumers.
7. Develop and present communication strategies for OTC products for both healthcare professionals and consumers.
8. Design a product promotion scheme and create a brand strategy for a pharmaceutical product.
9. Develop a sales strategy for a pharmaceutical product focusing on distribution channels and promotional tactics for retailers/distributors.
10. Design a mock-up or prototype of an e-commerce website for pharmacy.
11. Design a digital marketing campaign for a pharmaceutical or cosmetic product using social media, email marketing, and SEO techniques.
12. Create a product positioning statement including the Unique Selling Proposition (USP) for a new pharmaceutical product.

Textbooks

1. Crompton, J. L. and Lamb, C. W. Marketing Government and Social Services. Wiley
2. Herger, M. Pharma Marketing Excellence: Strategy, Tactics and Implementation. CRC Press.
3. Jain, S. K. Pharmaceutical Marketing Management. CBS Publishers & Distributors.
4. Kotler, P. and Keller, K. L. Marketing Management. Pearson.
5. Kotler, P., Shalowitz, J. and Stevens, R. J. Strategic Marketing for Health Care Organizations. Jossey-Bass.

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26PYVAC03: Cleaning Validation

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the purpose and importance of cleaning validation.	PO1	2
CO2	Apply cleaning validation protocols and methods for pharmaceutical equipment.	PO1, PO2, PO5	3
CO3	Apply residue detection techniques such as HPLC and TOC.	PO1, PO3, PO4	3
CO4	Evaluate cleaning effectiveness and compliance with regulatory standards.	PO1, PO2, PO9	5
CO5	Apply cleaning validation principles to prepare validation reports and perform revalidation	PO1, PO3, PO7,	3

Syllabus

1. Preparation of a cleaning validation protocol for a tablet machine
2. Calculation of MACO (Maximum Allowable Carry Over)
3. Swab sampling technique demonstration using stainless steel surface
4. Rinse sampling technique for equipment residue detection
5. Visual inspection for equipment cleanliness (case photos/videos)
6. Preparation of recovery study protocol using a known contaminant
7. Demonstration of Total Organic Carbon (TOC) analysis (video/simulation)
8. HPLC method development for residue analysis (demo dataset)
9. Interpretation of swab analysis results and comparison with acceptance limits
10. Preparation of cleaning log sheet and checklists
11. Validation of cleaning agents: detergent effectiveness and rinsibility
12. Determining dirty hold time and clean hold time experimentally (conceptual)
13. Designing a matrix approach for multi-product equipment
14. Simulated deviation report and CAPA for cleaning failure
15. Preparation of a final cleaning validation summary report

Textbooks

1. Cleaning Validation: A Practical Approach – David M. Blenkinsopp & Roy T. Harvey, CRC Press
2. Cleaning Validation in Pharmaceutical Manufacturing – Trevor Deeks, CRC Press
3. Pharmaceutical Cleaning Validation: The Basics – Andrew Walsh, Interpharm Press
4. Cleaning and Cleaning Validation: Volume 1 – Syed Imtiaz Haider, Informa Healthcare
5. Validation of Cleaning Processes in Pharmaceuticals and Biopharmaceuticals – Jeanne Moldenhauer, DHI Publishing

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26PYVAC04: Basic Training in Aseptic Handling Techniques

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the key concepts of asepsis, clean-room classifications, and contamination control	PO1	2
CO2	Apply sterile gowning and hand-washing techniques to maintain aseptic conditions.	PO1, PO3	3
CO3	Apply aseptic techniques to operate a laminar airflow workstation and perform sterile liquid transfers.	PO1, PO3	3
CO4	Apply aseptic techniques to perform media-fill tests meeting sterility acceptance criteria	PO1, PO3	3
CO5	Apply environmental and personnel monitoring techniques to record and interpret contamination data	PO3, PO6, PO10	3

Syllabus

1. Gown-up / Gown-down Drill – correct sequencing of coverall, hood, mask, goggles, gloves, and sterile boots.
2. Hand-washing Verification – surgical scrub with UV lotion; inspect under UV lamp for missed spots.
3. Clean-room Entry & Flow Simulation – air-shower pass, unidirectional walking, and material air-lock transfer.
4. LAF Hood Preparation – wipe-down with sporicidal, set airflow, place sterile tools in first-air zone.
5. Smoke-pattern Test – visualize HEPA downflow with smoke to confirm laminar, turbulence-free air.
6. Aseptic Liquid Transfer – pipette or syringe transfer of TSB between vials without touching non-sterile surfaces.
7. Sterile Filtration & Filter Integrity Check – filter a buffer through 0.22 µm unit and perform bubble-point test.
8. Mini Media-Fill – fill 20 sterile vials with TSB under LAF, incubate, and record turbidity for 14 days.
9. Environmental & Personnel Monitoring – deploy settle/contact plates, take glove-fingertip prints, run an air sampler.
10. Cleaning & ATP Validation – full hood wipe-down, then ATP swab pre- and post-clean to verify < 200 RLU residue.

Textbooks

1. Akers J, Moldenhauer J, editors. Aseptic Processing: A Review of Current Industry Practice. 2nd ed. Boca Raton: CRC Press; 2022.
2. Smith C. Sterile Drug Products: Formulation, Packaging, Manufacturing, and Quality. 2nd ed. New York: Springer; 2020.
3. Vanderhaegen B. Cleanroom Design: Concepts and Practice. 3rd ed. London: Wiley; 2019.
4. Sandle T. Cleanroom Microbiology. 1st ed. Boca Raton: CRC Press; 2021.

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26PYVAC05: Impurity Profiling

L-T-P-S: 0-0-2-0 **Credits: 1** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the sources, classification, and significance of impurities in pharmaceutical analysis.	PO1	2
CO2	Understand the methods for detection and quantification of organic, inorganic, and residual impurities	PO1	2
CO3	Apply ICH and pharmacopeial guidelines for impurity evaluation and documentation.	PO1, PO3	3
CO4	Apply HPLC, GC, UV, and IR techniques for impurity analysis	PO1, PO3, PO4	3
CO5	Evaluate and interpret impurity data for regulatory submissions and quality assurance.	PO1, PO2, PO9	5

Syllabus

1. Identification of organic impurities in bulk drugs using TLC
2. Quantification of impurities using HPLC
3. Determination of residual solvents by GC (as per ICH Q3C)
4. UV-spectrophotometric analysis of degradation products
5. Preparation of forced degradation samples (acid/base/hydrolytic)
6. Identification of degradation products via IR spectroscopy
7. Extraction a
8. nd analysis of impurities from finished dosage forms
9. Impurity profiling of marketed paracetamol tablet using HPLC
10. Qualification of impurities as per ICH Q3A/Q3B guidelines
11. Limit test for heavy metals (as per IP)
12. Estimation of elemental impurities by ICP-MS or simulated method
13. Determination of related substances in antibiotics (e.g., cephalosporins)
14. Use of LC-MS data interpretation for impurity identification (demo/simulated)
15. Impurity profiling of herbal products using HPTLC
16. Report preparation on impurity profiling as per regulatory requirements

Textbooks

1. Gorog, S. Impurities Evaluation of Pharmaceuticals. Marcel Dekker Inc., USA.
2. Teasdale, A. ICH Quality Guidelines: An Implementation Guide. John Wiley & Sons, USA.
3. Kar, A. Pharmaceutical Analysis. New Age International Publishers, New Delhi, India.
4. Connors, K. A. A Textbook of Pharmaceutical Analysis. Wiley India Pvt. Ltd., New Delhi, India.
5. Ahuja, S. Handbook of Isolation and Characterization of Impurities in Pharmaceuticals. Academic Press (Elsevier), USA

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26PY4254RP: Research Project

L-T-P-S: 0-0-12-0 **Credits: 6** **Pre-Requisite: Nil**

CO#	Course Outcome	PO/PSO	BTL
CO1	Formulate a research problem and design an appropriate methodology through a critical review of the literature.	PO1, PO3, PO11	4
CO2	Carry out experimental or investigative work using suitable tools, techniques and good research practice.	PO1, PO4, PO11	3
CO3	Analyse and interpret results to draw valid, evidence-based conclusions.	PO1, PO3, PO4	4
CO4	Communicate the research through a written dissertation and an oral presentation, observing research ethics.	PO1, PO8, PO11	3
CO5	Critically evaluate research findings and integrate scientific evidence to identify implications and future research directions.	PO1, PO8, PO11	4

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M. Pharmacy Y26 Structure focused on Focused on Employability/Entrepreneurship/Skill Development

SNO	COURSE CODE	COURSE NAME	Category	L	T	P	S	CR	Pre-Requisite	New Course/ Revised Course/ Retained Course	Changes Proposed by	EES
1	26PY5101	Modern Pharmaceutical Analytical Techniques	PCC	4	0	0	0	4	Nil	Retained	Nil	Entrepreneurship
2	26PY5102	Drug Delivery System	PCC	4	0	0	0	4	Nil	Retained	Nil	Employability
3	26PY5103	Modern Pharmaceutics	PCC	4	0	0	0	4	Nil	Retained	Nil	
4	26PY5104	Regulatory Affair	PCC	4	0	0	0	4	Nil	Retained	Nil	Employability
5	26PY5105	Pharmaceutics Practical I	PCC	0	0	12	0	6	Nil	Retained	Nil	Skilling
6	26PY5106	Seminar/ Assignment	SDC	0	0	8	0	4	Nil	Retained	Nil	
7	26PY5107	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	PCC	4	0	0	0	4	Nil	Retained	Nil	Employability
8	26PY5108	Advanced Biopharmaceutics & Pharmacokinetics	PCC	4	0	0	0	4	Nil	Retained	Nil	Employability
9	26PY5109	Computer Aided Drug Delivery System	PCC	4	0	0	0	4	Nil	Retained	Nil	Entrepreneurship
10	26PY5110	Cosmetic and Cosmeceuticals	PCC	4	0	0	0	4	Nil	Retained	Nil	Employability
11	26PY5111	Pharmaceutics Practical II	PCC	0	0	12	0	6	Nil	Retained	Nil	Skilling
12	26PY5112	Seminar/ Assignment	SDC	0	0	8	0	4	Nil	Retained	Nil	Skilling
13	26PY5113	Research Methodology and Biostatistics*	PCC	4	0	0	0	4	Nil	Retained	Nil	Employability
14	26PY5114	Journal club	SDC	0	0	2	0	1	Nil	Retained	Nil	Skilling
15	26PY5115	Discussion / Presentation (Proposal Presentation)	SDC	0	0	4	0	2	Nil	Retained	Nil	Skilling
16	26PY5116	Research Work	PRI	0	0	28	0	14	Nil	Retained	Nil	Skilling

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17	26PY5117	Journal Club	SDC	0	0	2	0	1	Nil	Retained	Nil	Skilling
18	26PY5118	Research Work	PRI	0	0	33	0	16	Nil	Retained	Nil	Skilling
19	26PY5119	Discussion/Final Presentation	SDC	0	0	6	0	3	Nil	Retained	Nil	Skilling
20	26PY5120	Co-curricular Activities (Attending Conference, Scientific Presentations and Other Scholarly Activities)	SDC	0	0	8	0	4	Nil	Retained	Nil	Skilling

Percentage of Syllabus Revision= 0%

Percentage of Courses focusing on Employability= 30%

Percentage of Courses focusing on Entrepreneurship= 10%

Percentage of Courses focusing on Skill Development = 50%

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Pharm. D Y26 Structure Focused on Employability/Entrepreneurship/Skill Development

SNO	COURSE CODE	COURSE NAME	Course Category	L	T	P	S	Pre-Requisite	New Course/Revised Course/ Retained Course	Changes Proposed by	EES
1	26PY6101T	Human Anatomy and Physiology	PCC	3	1	0	0	Nil	Retained	-	
2	26PY6101P	Human Anatomy and Physiology	PCC	0	0	3	0	NIL	Retained	-	Skilling
3	26PY6102T	Pharmaceutics	PCC	2	1	0	0	Nil	Retained	-	
4	26PY6102P	Pharmaceutics	PCC	0	0	3	0	NIL	Retained	-	Skilling
5	26PY6103T	Medicinal Biochemistry	PCC	3	1	0	0	Nil	Retained	-	
6	26PY6103P	Medicinal Biochemistry	PCC	0	0	3	0	NIL	Retained	-	Skilling
S	26PY6104T	Pharmaceutical Organic Chemistry	PCC	3	1	0	0	Nil	Retained	-	
8	26PY6104P	Pharmaceutical Organic Chemistry	PCC	0	0	3	0	NIL	Retained	-	Skilling
9	26PY6105T	Pharmaceutical Inorganic Chemistry	PCC	2	1	0	0	Nil	Retained	-	
10	26PY6105P	Pharmaceutical Inorganic Chemistry	PCC	0	0	3	0	NIL	Retained	-	Skilling
11	226PY610B6T/ 26PY610M6T	Remedial Biology/Remedial Mathematics	BSC	3	1	0	0	Nil	Retained	-	
12	26PY610B6P	Remedial Biology	BSC	0	0	3	0	Nil	Retained	-	Skilling
13	26PY6201T	Pathophysiology	PCC	3	1	0	0	Nil	Retained	-	Employability
14	26PY6202T	Pharmaceutical Microbiology	PCC	3	1	0	0	Nil	Retained	-	Employability
15	26PY6202P	Pharmaceutical Microbiology	PCC	0	0	3	0	Nil	Retained		Skilling
16	26PY6203T	Pharmacognosy& Phytopharmaceuticals	PCC	3	1	0	0	Nil	Retained	-	Employability

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17	26PY6203P	Pharmacognosy& Phytopharmaceuticals	PCC	0	0	3	0	NIL	Retained	-	Skilling
18	26PY6204T	Pharmacology-I	PCC	3	1	0	0	Nil	Retained	-	Employability
19	26PY6205T	Community Pharmacy	PCC	2	1	0	0	Nil	Retained	-	Entrepreneurship
20	26PY6206T	Pharmacotherapeutics-I	PCC	3	1	0	0	Nil	Retained	-	Employability
21	26PY6206P	Pharmacotherapeutics-I	PCC	0	0	3	0	NIL	Retained	-	Skilling
22	26PY6301T	Pharmacology-II	PCC	3	1	0	0	Nil	Retained	-	Employability
23	26PY6301P	Pharmacology-II	PCC	0	0	3	0	NIL	Retained	-	Skilling
24	26PY6302T	Pharmaceutical Analysis	PCC	3	1	0	0	Nil	Retained	-	Employability
25	26PY6302P	Pharmaceutical Analysis	PCC	0	0	3	0	NIL	Retained	-	Skilling
26	26PY6303T	Pharmacotherapeutics-II	PCC	3	1	0	0	Nil	Retained	-	Employability
27	26PY6303P	Pharmacotherapeutics-II	PCC	0	0	3	0	NIL	Retained	-	Skilling
28	26PY6304T	Pharmaceutical Jurisprudence	PCC	2	0	0	0	Nil	Retained	-	Employability
29	26PY6305T	Medicinal Chemistry	PCC	3	1	0	0	Nil	Retained	-	Employability
30	26PY6305P	Medicinal Chemistry	PCC	0	0	3	0	NIL	Retained	-	Skilling
31	26PY6306T	Pharmaceutical Formulations	PCC	2	1	0	0	Nil	Retained	-	Entrepreneurship
32	26PY6306P	Pharmaceutical Formulations	PCC	0	0	3	0	NIL	Retained	-	Skilling
33	26PY6401T	Pharmacotherapeutics-III	PCC	3	1	0	0	Nil	Retained	-	Employability
34	26PY6401P	Pharmacotherapeutics-III	PCC	0	0	3	0	NIL	Retained	-	Skilling
35	26PY6402T	Hospital Pharmacy	PCC	2	1	0	0	Nil	Retained	-	Entrepreneurship
36	26PY6402P	Hospital Pharmacy	PCC	0	0	3	0	NIL	Retained	-	Skilling
37	26PY6403T	Clinical Pharmacy	PCC	3	1	0	0	Nil	Retained	-	Entrepreneurship

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38	26PY6403P	Clinical Pharmacy	PCC	0	0	3	0	NIL	Retained	-	Skilling
39	26PY6404T	Biostatistics & Research Methodology	PCC	2	1	0	0	Nil	Retained	-	Employability
40	26PY6405T	Biopharmaceutics & Pharmacokinetics	PCC	3	1	0	0	Nil	Retained	-	Employability
41	26PY6405P	Biopharmaceutics & Pharmacokinetics	PCC	0	0	3	0	NIL	Retained	-	Skilling
42	26PY6406T	Clinical Toxicology	PCC	2	1	0	0	Nil	Retained	-	Employability
43	26PY6501T	Clinical Research	PCC	3	1	0	0	Nil	Retained	-	Entrepreneurship
44	26PY6502T	Pharmacoepidemiology and Pharmacoeconomics	PCC	3	1	0	0	Nil	Retained	-	Employability
45	26PY6503T	Clinical Pharmacokinetics &Pharmacotherapeutic Drug Monitoring	PCC	2	1	0	0	Nil	Retained	-	Employability
46	26PY650N4	Clerkship	PCC	0	1	0	0	NIL	Retained	-	Skilling
47	26PY650E5	Project work (Six Months)	PRI	0	0	20	0	NIL	Retained	-	Skilling
48	26PY660N1	Internship	PCC	0	0	40	0	NIL	Retained	-	Skilling

Percentage of Syllabus Revision= 0%
Percentage of Courses focusing on Employability= 34.04%
Percentage of Courses focusing on Entrepreneurship= 10.63%
Percentage of Courses focusing on Skill Development = 42.55%

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Annexure IV

Summary of Stakeholders Feedback: 2026-2027

PROGRAM NAME (PHARAMCY)

S.NO	Stake Holders	Count
1	**Academic Peers**	21
2	**Industry**	22
3	**Alumni**	26
4	**Faculty**	43
5	**Parents**	20
6	**Students**	180

Academic Peers

S.NO	Name	Qualification	Designation	Organization	Recommendation/Suggestion received
1.	Dr. K. Swathi	M. Pharm and Ph. D	Assoc Professor	Sri Padmavathi Mahila Vishwavidyalayam	Has given feedback to implement the new PCI curriculum for the B. Pharmacy programme.

Industry

S.NO	Name	Qualification	Designation	Organization	Recommendation/Suggestion received
1	Dr. K. Sivacaharan	MS, PhD	Head and Vice President	Dr. Reddy's Laboratories, Biopharmaceutics division	Has given the feedback to strengthen industry collaborations and enhance practical exposure for students.

Alumni

S.NO	Name	Qualification	Designation	Organization	Recommendation/Suggestion received
1	Mr. Abdullah Akim	B. Pharmacy	Sales Advisor	All States Insurance Company, Uganda	Has given the feedback to include more advanced certification courses to the students.

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Faculty

S.NO	Name	Qualification	Designation	Organization	Recommendation/Suggestion received
1	Dr. Sivadasu Praveen	M. Pharm and Ph. D	Asst Professor	KL College of Pharmacy, KLEF	Has given feedback to implement the new PCI curriculum for the B. Pharmacy programme.

Students

S.NO	Name	Reg. No	Program of study	Year of Study	Recommendation/Suggestion received
1	Mr. K. Vineeth Kumar	2300530002	B. Pharmacy	IV	Has given the feedback to conduct more industrial visits to the students.

Stake Holder Feedback Analysis and Action Taken report.

S.No	Department-Program Name	Recommendation/Suggestion received	Analysis (Justification on what basis this feedback was taken for discussion)	Action Taken	Date of DAC meeting Minutes where it has been discussed along with agenda point number	Date of BoS meeting Minutes where it has been discussed along with agenda point number
1	Pharmacy-B. Pharmacy	To implement the new PCI curriculum for the B. Pharmacy programme.	The implementation of the new AI-driven B. Pharmacy curriculum recommended by the PCI equips students with enhanced skills, improving their industry readiness and professional competence.	It is recommended to implement the new B. Pharmacy curriculum proposed by the PCI.	19th DAC, 13-07-2026, Agenda No: 2	19th BoS, 03-08-2026 Agenda No: 4

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2	Pharmacy- B. Pharmacy, M. Pharmacy and Pharm. D	To strengthen industry collaborations and enhance practical exposure for students.	Strengthening industry collaborations will provide students with greater internship opportunities and enhance their employability.	It is recommended to strengthen industry collaborations to enhance students' employability.	19th DAC, 13-07-2026, Agenda No: 2	19th BoS, 03-08-2026 Agenda No: 4
3	Pharmacy- B. Pharmacy, M. Pharmacy and Pharm. D	To include more advanced certification courses to the students.	Providing advanced certification programmes will equip students with specialized skills, thereby enhancing their employability.	It is recommended to introduce advanced certification courses in the upcoming academic year.	19th DAC, 13-07-2026, Agenda No: 2	19th BoS, 03-08-2026 Agenda No: 4
4	Pharmacy-B. Pharmacy.	To implement the new PCI curriculum for the B. Pharmacy programme.	The implementation of the new AI-driven B. Pharmacy curriculum recommended by the PCI equips students with enhanced skills, improving their industry readiness and professional competence.	It is recommended to implement the new B. Pharmacy curriculum proposed by the PCI.	19th DAC, 13-07-2026, Agenda No: 2	19th BoS, 03-08-2026 Agenda No: 4
5	Pharmacy- B. Pharmacy, M. Pharmacy and Pharm. D	To conduct more industrial visits to the students.	By providing industrial visits students and faculty will gain insights in the recent developments happening in the pharmaceutical industries	It is recommended to provide more industrial visits for the upcoming A.Y.	19th DAC, 13-07-2026, Agenda No: 2	19th BoS, 03-08-2026 Agenda No: 4

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Annexure V

Y25 B. Pharmacy Course Structure

S. No	Course Code	Course Title	L	T	P	S	Cr	Ch	Pre-Requisite
SEMESTER-1									
1	25PY1101T	HUMAN ANATOMY AND PHYSIOLOGY I (THEORY)	3	1	0	0	4	4	
2	25PY1101P	HUMAN ANATOMY AND PHYSIOLOGY I (PRACTICAL)	0	0	4	0	2	4	
3	25PY1102T	PHARMACEUTICAL ANALYSIS (THEORY)	3	1	0	0	4	4	
4	25PY1102P	PHARMACEUTICAL ANALYSIS (PRACTICAL)	0	0	4	0	2	4	
5	25PY1103T	PHARMACEUTICS (THEORY)	3	1	0	0	4	4	
6	25PY1103P	PHARMACEUTICS (PRACTICAL)	0	0	4	0	2	4	
7	25PY1104T	PHARMACEUTICAL INORGANIC CHEMISTRY (THEORY)	3	1	0	0	4	4	
8	25PY1104P	PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)	0	0	4	0	2	4	
9	25PY1105T	COMMUNICATION SKILLS (THEORY)	2	0	0	0	2	2	
10	25PY1105P	COMMUNICATION SKILLS (PRACTICAL)	0	0	2	0	1	2	
11	25PY1106RMT/ 25PY1106RBT	REMEDIAL BIOLOGY/ REMEDIAL MATHEMATICS (THEORY)	2	0	0	0	2	2	
12	25PY1106RBP	REMEDIAL BIOLOGY (PRACTICAL)	0	0	2	0	1	2	
SEMESTER-2									
1	25PY1207T	HUMAN ANATOMY AND PHYSIOLOGY II (THEORY)	3	1	0	0	4	4	HAP I-T
2	25PY1207P	HUMAN ANATOMY AND PHYSIOLOGY II (PRACTICAL)	0	0	4	0	2	4	HAP I-P
3	25PY1208T	PHARMACEUTICAL ORGANIC CHEMISTRY I (THEORY)	3	1	0	0	4	4	
4	25PY1208P	PHARMACEUTICAL ORGANIC CHEMISTRY I (PRACTICAL)	0	0	4	0	2	4	
5	25PY1209T	BIOCHEMISTRY (THEORY)	3	1	0	0	4	4	
6	25PY1209P	BIOCHEMISTRY (PRACTICAL)	0	0	4	0	2	4	
7	25PY1210T	PATHOPHYSIOLOGY (THEORY)	3	1	0	0	4	4	
8	25PY1211T	COMPUTER APPLICATIONS IN PHARMACY (THEORY)	3	0	0	0	3	3	
9	25PY1211P	COMPUTER APPLICATIONS IN PHARMACY (PRACTICAL)	0	0	2	0	1	2	
10	25PY1212T	ENVIRONMENTAL SCIENCES (THEORY)	3	0	0	0	3	3	
11	25UC1103	LANGUAGE SKILLS	0	0	4	0	2	4	
SEMESTER-3									
1	25PY2113T	PHARMACEUTICAL ORGANIC CHEMISTRY II (THEORY)	3	1	0	0	4	4	POC I-T
2	25PY2113P	PHARMACEUTICAL ORGANIC CHEMISTRY II (PRACTICAL)	0	0	4	0	2	4	POC I-P
3	25PY2114T	PHYSICAL PHARMACEUTICS I (THEORY)	3	1	0	0	4	4	

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4	25PY2114P	PHYSICAL PHARMACEUTICS I (PRACTICAL)	0	0	4	0	2	4	
5	25PY2115T	PHARMACEUTICAL MICROBIOLOGY (THEORY)	3	1	0	0	4	4	
6	25PY2115P	PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)	0	0	4	0	2	4	
7	25PY2116T	PHARMACEUTICAL ENGINEERING (THEORY)	3	1	0	0	4	4	
8	25PY2116P	PHARMACEUTICAL ENGINEERING (PRACTICAL)	0	0	4	0	2	4	
9	22UC1203	DESIGN THINKING AND INNOVATION	0	0	4	0	2	4	
10		OPEN ELECTIVE-1	3	0	0	0	3	3	
SEMESTER-4									
1	25PY2217T	PHARMACEUTICAL ORGANIC CHEMISTRY III (THEORY)	3	1	0	0	4	4	POC II-T
2	25PY2218T	MEDICINAL CHEMISTRY I (THEORY)	3	1	0	0	4	4	
3	25PY2218P	MEDICINAL CHEMISTRY I (PRACTICAL)	0	0	4	0	2	4	
4	25PY2219T	PHYSICAL PHARMACEUTICS II (THEORY)	3	1	0	0	4	4	PP I-T
5	25PY2219P	PHYSICAL PHARMACEUTICS II (PRACTICAL)	0	0	4	0	2	4	PP I-P
6	25PY2220T	PHARMACOLOGY I (THEORY)	3	1	0	0	4	4	
7	25PY2220P	PHARMACOLOGY I (PRACTICAL)	0	0	4	0	2	4	
8	25PY2221T	PHARMACOGNOSY AND PHYTOCHEMISTRY I (THEORY)	3	1	0	0	4	4	
9	25PY2221P	PHARMACOGNOSY AND PHYTOCHEMISTRY I (PRACTICAL)	0	0	4	0	2	4	
10		OPEN ELECTIVE-2	3	0	0	0	3	3	
SEMESTER-5									
1	25PY3122T	MEDICINAL CHEMISTRY II (THEORY)	3	1	0	0	4	4	MC I-T
2	25PY3123T	INDUSTRIAL PHARMACY I (THEORY)	3	1	0	0	4	4	
3	25PY3123P	INDUSTRIAL PHARMACY I (PRACTICAL)	0	0	4	0	2	4	
4	25PY3124T	PHARMACOLOGY II (THEORY)	3	1	0	0	4	4	PCOL I-T
5	25PY3124P	PHARMACOLOGY II (PRACTICAL)	0	0	4	0	2	4	PCOL I-P
6	25PY3125T	PHARMACOGNOSY AND PHYTOCHEMISTRY II (THEORY)	3	1	0	0	4	4	PCOG I-T
7	25PY3125P	PHARMACOGNOSY AND PHYTOCHEMISTRY II (PRACTICAL)	0	0	4	0	2	4	PCOG I-P
8	25PY3126T	PHARMACEUTICAL JURISPRUDENCE (THEORY)	3	1	0	0	4	4	
9	25PY3123S	PRODUCTION PROCESS FOR API/BULK DRUG/INTERMEDIATES	0	0	0	4	1	4	
SEMESTER-6									
1	25PY3227T	MEDICINAL CHEMISTRY III (THEORY)	3	1	0	0	4	4	MC II-T
2	25PY3227P	MEDICINAL CHEMISTRY III (PRACTICAL)	0	0	4	0	2	4	
3	25PY3228T	PHARMACOLOGY III (THEORY)	3	1	0	0	4	4	PCOL II-T
4	25PY3228P	PHARMACOLOGY III (PRACTICAL)	0	0	4	0	2	4	PCOL II-P
5	25PY3229T	HERBAL DRUG TECHNOLOGY (THEORY)	3	1	0	0	4	4	

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6	25PY3229P	HERBAL DRUG TECHNOLOGY (PRACTICAL)	0	0	4	0	2	4	
7	25PY3230T	BIOPHARMACEUTICS AND PHARMACOKINETICS (THEORY)	3	1	0	0	4	4	
8	25PY3231T	PHARMACEUTICAL BIOTECHNOLOGY (THEORY)	3	1	0	0	4	4	
9	25PY3232T	QUALITY ASSURANCE (THEORY)	3	1	0	0	4	4	
10		OPEN ELECTIVE-3	3	0	0	0	3	3	
SEMESTER-7									
1	25PY4133T	INSTRUMENTAL METHODS OF ANALYSIS (THEORY)	3	1	0	0	4	4	
2	25PY4133P	INSTRUMENTAL METHODS OF ANALYSIS (PRACTICAL)	0	0	4	0	2	4	
3	25PY4134T	INDUSTRIAL PHARMACY II (THEORY)	3	1	0	0	4	4	
4	25PY4135T	PHARMACY PRACTICE (THEORY)	3	1	0	0	4	4	
5	25PY4136T	NOVEL DRUG DELIVERY SYSTEM (THEORY)	3	1	0	0	4	4	
6	25PY4137PS	PRACTICE SCHOOL	0	0	12	0	6	12	
7	25UC0026	HUMAN VALUES, GENDER EQUALITY & PROFESSIONAL ETHICS	2	0	0	0	2	2	
8	25PY4133S	OPERATION OF ANALYTICAL INSTRUMENTS	0	0	0	4	1	4	
SEMESTER-8									
1	25PY4238T	BIOSTATISTICS AND RESEARCH METHODOLOGY (THEORY)	3	1	0	0	4	4	
2	25PY4239T	SOCIAL AND PREVENTIVE PHARMACY (THEORY)	3	1	0	0	4	4	
3		PROFESSIONAL ELECTIVE - 1	3	1	0	0	4	4	
4		PROFESSIONAL ELECTIVE - 1	3	1	0	0	4	4	
5	25PY4250PW	PROJECT WORK	0	0	12	0	6	12	

G. Chelleswari
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Y25 M. Pharmacy Course Structure

S. No	Course Code	Course Title	L	T	P	S	Cr	Ch	Pre-Requisite
SEMESTER-1									
1	25PY5101	MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES	4	0	0	0	4	4	
2	25PY5102	DRUG DELIVERY SYSTEMS	4	0	0	0	4	4	
3	25PY5103	MODERN PHARMACEUTICS	4	0	0	0	4	4	
4	25PY5104	REGULATORY AFFAIR	4	0	0	0	4	4	
5	25PY5105	PHARMACEUTICS PRACTICAL I	0	0	12	0	6	12	
6	25PY5106	SEMINAR/ASSIGNMENT	0	0	8	0	4	8	
SEMESTER-2									
1	25PY5107	MOLECULAR PHARMACEUTICS (NANO TECH AND TARGETED DDS)	4	0	0	0	4	4	
2	25PY5108	ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS	4	0	0	0	4	4	
3	25PY5109	COMPUTER AIDED DRUG DELIVERY SYSTEM	4	0	0	0	4	4	
4	25PY5110	COSMETIC AND COSMECEUTICALS	4	0	0	0	4	4	
5	25PY5111	PHARMACEUTICS PRACTICAL II	0	0	12	0	6	12	
6	25PY5112	SEMINAR/ASSIGNMENT	0	0	8	0	4	8	
SEMESTER-3									
1	25PY5113	RESEARCH METHODOLOGY AND BIOSTATISTICS	4	0	0	0	4	4	
2	25PY5114	JOURNAL CLUB	0	0	2	0	1	2	
3	25PY5115	DISCUSSION / PRESENTATION (PROPOSAL PRESENTATION)	0	0	4	0	2	4	
4	25PY5116	RESEARCH WORK	0	0	28	0	14	28	
SEMESTER-4									
1	25PY5117	JOURNAL CLUB	0	0	2	0	1	2	
2	25PY5118	RESEARCH WORK	0	0	32	0	16	32	
3	25PY5119	DISCUSSION/FINAL PRESENTATION	0	0	6	0	3	6	
4	25PY5120	CO-CURRICULAR ACTIVITIES (ATTENDING CONFERENCE, SCIENTIFIC PRESENTATIONS AND OTHER SCHOLARLY ACTIVITIES)	0	0	8	0	4	8	

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Y25 Pharm. D Course Structure

S. No	Course Code	Course Title	L	T	P	S	Cr	Ch	Pre-Requisite
YEAR-1									
1	25PY6101T	HUMAN ANATOMY AND PHYSIOLOGY	3	1	0	0	0	4	
2	25PY6101P	HUMAN ANATOMY AND PHYSIOLOGY	0	0	3	0	0	3	
3	25PY6102T	PHARMACEUTICS	2	1	0	0	0	3	
4	25PY6102P	PHARMACEUTICS	0	0	3	0	0	3	
5	25PY6103T	MEDICINAL BIOCHEMISTRY	3	1	0	0	0	4	
6	25PY6103P	MEDICINAL BIOCHEMISTRY	0	0	3	0	0	3	
7	25PY6104T	PHARMACEUTICAL ORGANIC CHEMISTRY	3	1	0	0	0	4	
8	25PY6104P	PHARMACEUTICAL ORGANIC CHEMISTRY	0	0	3	0	0	3	
9	25PY6105T	PHARMACEUTICAL ORGANIC CHEMISTRY	2	1	0	0	0	3	
10	25PY6105P	PHARMACEUTICAL ORGANIC CHEMISTRY	0	0	3	0	0	3	
11	25PY610B6T/25PY610M6T	REMEDIAL BIOLOGY/ REMEDIAL MATHEMATICS	3	1	0	0	0	4	
12	25PY610B6P	REMEDIAL BIOLOGY	0	0	3	0	0	3	
YEAR-2									
1	25PY6201T	PATHOPHYSIOLOGY	3	1	0	0	0	4	
2	25PY6202T	PHARMACEUTICAL MICROBIOLOGY	3	1	0	0	0	4	
3	25PY6202T	PHARMACEUTICAL MICROBIOLOGY	0	0	3	0	0	3	
4	25PY6203T	PHARMACOGNOSY & PHYTOPHARMACEUTICALS	3	1	0	0	0	4	
5	25PY6203P	PHARMACOGNOSY & PHYTOPHARMACEUTICALS	0	0	3	0	0	3	
6	25PY6204T	PHARMACOLOGY-I	3	1	0	0	0	4	
7	25PY6205T	COMMUNITY PHARMACY	2	1	0	0	0	3	
8	25PY6206T	PHARMACOTHERAPEUTICS-I	3	1	0	0	0	4	
9	25PY6206P	PHARMACOTHERAPEUTICS-I	0	0	3	0	0	3	
YEAR-3									
1	25PY6301T	PHARMACOLOGY-II	3	1	0	0	0	4	PCOL I-T
2	25PY6301P	PHARMACOLOGY-II	0	0	3	0	0	3	
3	25PY6302T	PHARMACEUTICAL ANALYSIS	3	1	0	0	0	4	
4	25PY6302P	PHARMACEUTICAL ANALYSIS	0	0	3	0	0	3	
5	25PY6303T	PHARMACOTHERAPEUTICS-II	3	1	0	0	0	4	TPR I-T
6	25PY6303P	PHARMACOTHERAPEUTICS-II	0	0	3	0	0	3	TPR I-P
7	25PY6304T	PHARMACEUTICAL JURISPRUDENCE	2	0	0	0	0	2	
8	25PY6305T	MEDICINAL CHEMISTRY	3	1	0	0	0	4	
9	25PY6305P	MEDICINAL CHEMISTRY	0	0	3	0	0	3	

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Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
❖ Approved by AICTE ❖ ISO 21001:2018 Certified
Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.
Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

ANNEXURE-VII

List of Value-added courses offered for the R 26 Batch Students

Sl.	Name of the value-added courses (with 40 or more contact hours) offered	Level (1-Basic, 2-Intermediate, 3-Advanced)	Mode of offering (Online/Offline)	Offering body Name (Industry / Academia / Research)	Category: Employability / Career Advancement/ Entrep reneurship
1.	Drug Safety Foundations	L0	Online	NIPER	Employability
2.	ICH-GCP	L1	Online	TransCelerate	Employability
3.	Argus Safety	L2	Online	Oracle PV	Employability
4.	DIA Pharmacovigilance Cert	L3	Online	DIA	Employability
5.	CDSAP GCP Foundations	L0	Online	CDSAP	Employability
6.	ICH-GCP	L1	Online	TransCelerate	Employability
7.	SOCRA / ACRP CCRC	L2	Online	Society of Clinical Research Associates	Employability

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10	25PY6306T	PHARMACEUTICAL FORMULATIONS	2	1	0	0	0	3	
11	25PY6306P	PHARMACEUTICAL FORMULATIONS	0	0	3	0	0	3	
YEATR-4									
1	25PY6401T	PHARMACOTHERAPEUTICS-III	3	1	0	0	0	4	TPR II-T
2	25PY6401P	PHARMACOTHERAPEUTICS-III	0	0	3	0	0	3	TPR II-P
3	25PY6402T	HOSPITAL PHARMACY	2	1	0	0	0	3	
4	25PY6402P	HOSPITAL PHARMACY	0	0	3	0	0	3	
5	25PY6403T	CLINICAL PHARMACY	3	1	0	0	0	4	
6	25PY6403P	CLINICAL PHARMACY	0	0	3	0	0	3	
7	25PY6404T	BIOSTATISTICS & RESEARCH METHODOLOGY	2	1	0	0	0	3	
8	25PY6405T	BIOPHARMACEUTICS & PHARMACOKINETICS	3	1	0	0	0	4	
9	25PY6405P	BIOPHARMACEUTICS & PHARMACOKINETICS	0	0	3	0	0	3	
10	25PY6406T	CLINICAL TOXICOLOGY	2	1	0	0	0	3	
YEAR-5									
1	25PY6501T	CLINICAL RESEARCH	3	1	0	0	0	4	
2	25PY6502T	PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS	3	1	0	0	0	4	
3	25PY6503T	CLINICAL PHARMACOKINETICS & PHARMACOTHERAPEUTIC DRUG MONITORING	2	1	0	0	0	3	
4	25PY650N4	CLERKSHIP	0	1	0	0	0	1	
5	25PY650E5	PROJECT WORK	0	0	20	0	0	20	
YEAR-6									
1	25PY660N1	INTERNSHIP	0	0	40	0	0	40	

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Annexure VI: Placements and Higher Education Analytics for A.Y. 2025-26

S NO	Registration Number (College ID No.)	Branch	Status	Placed in Companies	Full name (in Capitals)	Gender	Placed In highest Company	Highest CTC (LPA)
1	2200530001	B.Pharmacy	SELECTED	Divis Labs; Hetero Drugs	SAMUEL JYOTHILAL TANGUDU	Male	Hetero Drugs	3
2	2200530002	B.Pharmacy	SELECTED	Hetero Drugs	GADE HEMA LATHA	Female	Hetero Drugs	3
3	2200530004	B.Pharmacy	SELECTED	Divis Labs; Hetero Drugs	DOREDLA HEMAMBIKA SRI SAI PUJITHA	Female	Hetero Drugs	3
4	2200530006	B.Pharmacy	SELECTED	Divis Labs	NADELLA SIVA SAHITYA	Female	Divis Labs	3
5	2200530009	B.Pharmacy	SELECTED	Hetero Drugs	VAMSI KARTHIKEYA KROTHAPALLI	Male	Hetero Drugs	3
6	2200530011	B.Pharmacy	SELECTED	Hetero Drugs, Larus Labs	KUNDAN KUMAR	Male	Larus Labs	3
7	2200530013	B.Pharmacy	SELECTED	Divis Labs; Hetero Drugs	SHAIK TOUFEEQ HUSSAIN	Male	Hetero Drugs	3
8	2200530015	B.Pharmacy	SELECTED	Hetero Drugs, Larus Labs	MD FAIZULLAH ZUBAIR	Male	Larus Labs	3
9	2200530016	B.Pharmacy	SELECTED	Hetero Drugs	SANSKRITI .	Female	Hetero Drugs	3
10	2200530019	B.Pharmacy	SELECTED	Hetero Drugs	ROHIT KUMAR MAHATO	Male	Hetero Drugs	3
11	2200530023	B.Pharmacy	SELECTED	Divis labs	BESTHA LOKA TEJA	Male	Divis Labs	3
12	2200530025	B.Pharmacy	SELECTED	Indchemie	SHIVAM KUMAR	Male	Indchemie	3
13	2200530031	B.Pharmacy	SELECTED	Divis Labs; Hetero Drugs	JAYAMANGALA HEMANTH SOMASEKHAR	Male	Hetero Drugs	3
14	2200530033	B.Pharmacy	SELECTED	Hetero Drugs	BAKKA NAGA VARSHINI	Female	Hetero Drugs	3
15	2200530036	B.Pharmacy	SELECTED	Divis Labs	YARRAMAREDDY VENKATA RASMITHA	Female	Divis Labs	3
16	2200530041	B.Pharmacy	SELECTED	Divis Labs	MOHAMMAD SHADAAB ZAKATEE	Male	Divis Labs	3
17	2200530042	B.Pharmacy	SELECTED	Divis Labs	VENKATA SATY NARAYANA	Male	Divis Labs	3
18	2200530044	B.Pharmacy	SELECTED	Hetero Drugs	SURAJ KUMAR SHARMA	Male	Hetero Drugs	3
19	2200530046	B.Pharmacy	SELECTED	Indchemie	NITISH KUMAR	Male	Indchemie	3
20	2200530049	B.Pharmacy	SELECTED	Hetero Drugs	V. HARSHA VARDHAN REDDY	Male	Hetero Drugs	3
21	2200530050	B.Pharmacy	SELECTED	Hetero Drugs	ASIF ANSARI	Male	Hetero Drugs	3
22	2200530052	B.Pharmacy	SELECTED	Hetero Drugs, Larus Labs	M SURYAJOTI	Male	Larus Labs	3
23	2200530053	B.Pharmacy	SELECTED	Divis Labs	URA SRIRAM	Male	Divis Labs	3
24	2200530055	B.Pharmacy	SELECTED	Divis Labs; Hetero Drugs	TALLURI BALA LIKHITH	Male	Hetero Drugs	3
25	2200530061	B.Pharmacy	SELECTED	Hetero Drugs	RAJESH KUMAR	Male	Hetero Drugs	3
26	2200530067	B.Pharmacy	SELECTED	Divis Labs	SUJEET KUMAR	Male	Divis Labs	3
27	2200530073	B.Pharmacy	SELECTED	Hetero Drugs	SANJAY KUMAR KRISHNA	Male	Hetero Drugs	3
28	2200530078	B.Pharmacy	SELECTED	Divis Labs	RAJ VINEETH TAMBABATTULA	Male	Divis Labs	3
29	2200539002	B.Pharmacy	SELECTED	Divis Labs	NAWAL SHARIFF	Male	Divis Labs	3
30	2200530051	B.Pharmacy	SELECTED	ZIFO RnD	KONDAPAVULURI SIRI	Female	ZIFO RnD	4.7

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8.	ACRP Certified Professional	L3	Online	Association of Clinical Research Professionals	Employability
9.	cGMP & Schedule M Foundations	L0	Online	Current Good Manufacturing Practices Certified Professional	Employability
10.	CDSCO eCTD Submission Pro	L1	Online	CDSCO	Employability
11.	RAPS Regulatory Foundations	L2	Online	RAPS	Employability
12.	RAC (RAPS Drug)	L3	Online	RAPS	Employability
13.	ASQ Six Sigma Green Belt	L1	Online	American Society for Quality	Employability
14.	ASQ CQA (Quality Auditor)	L2	Online	American Society for Quality	Employability
15.	ISO 9001 Lead Auditor	L3	Online	CQI & IRCA	Employability
16.	HPLC / Empower Foundations	L0	Online	Waters Corporation	Employability
17.	Analytical Method Validation Pro	L1	Online	Fusion QbD	Employability
18.	USP Analytical Specialist	L2	Online	United States Pharmacopeia (USP)	Employability
19.	NPTEL Pharma Foundations	L0	Online	NPTEL	Employability
20.	Healthcare Analytics Foundations	L0	Online	Healthcare Information and Management Systems Society	Employability

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21.	Power BI (PL-300)	L1	Online	Microsoft	Employability
22.	Tableau Healthcare Analyst	L2	Online	Tableau	Employability
23.	SAS Clinical Programming	L3	Online	SAS	Employability
24.	CNPR Pharma Sales Cert	L1	Online	National Association of Pharmaceutical Sales Representatives	Employability
25.	Digital Pharma Marketing Pro	L2	Online	Digital Marketing Institute	Employability
26.	CMPP Medical Affairs Pro	L3	Online	Certified Medical Publication Professional	Employability

G. Chakravarthy
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Annexure VIII: Course Closure Report AY: 2025-2026- Even Semester

25PY1207T	25PY1208T	25PY1209T	25PY1210T	25PY1211T	22PY1212T	22PY2217T	22PY2218T	22PY2219T	22PY2220T
HUMAN ANATOMY AND PHYSIOLOGY II	PHARMACEUTICAL ORGANIC CHEMISTRY I	BIOCHEMISTRY	PATHOPHYSIOLOGY	COMPUTER APPLICATIONS IN PHARMACY	ENVIRONMENTAL SCIENCES	PHARMACEUTICAL ORGANIC CHEMISTRY III	MEDICINAL CHEMISTRY I	PHYSICAL PHARMACEUTICS II	PHARMACOLOGY I
Dr.P. Rajeswari	Dr. B. Sridevi	Dr. K. Ramakrishna	Dr. K. Devaki	Dr. V. Meghana	Mr. K. Rajesh Kumar	Dr. Manikanta Murahari	Dr. J. Risy Namratha	Ms. Md. Jahasultana	Dr. P. Rajeswari
5999	8721	7476	9055	6259	6541	7167	6265	6259	5999
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
85	85	85	85	85	85	85	85	85	85
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nil	Nil	Nil	Nil	Nil	Nil	30	13	25	5
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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22PY2221T	22PY3227T	22PY3228T	22PY3229T	22PY3230T	22PY3231T	22PY3232T	22PY4238T	22PY4239T	22PY4242ET
PHARMACOGNOSY AND PHYTOCHEMISTRY I	MEDICINAL CHEMISTRY III	PHARMACOLOGY III	HERBAL DRUG TECHNOLOGY	BIOPHARMACEUTICS AND PHARMACOKINETICS	PHARMACEUTICAL BIOTECHNOLOGY	QUALITY ASSURANCE	BIOSTATISTICS AND RESEARCH METHODOLOGY	SOCIAL AND PREVENTIVE PHARMACY	PHARMACOVIGILANCE
Dr. Reehana Shaik	Dr. N. Srilakshmi	Dr. G. Prasad Chowdari	Dr. N. V. K. Chenchu Lakshmi	Dr. A.V. Surendra	Dr. Mobeen Shaik	Dr. S. Praveen	Dr. P. Bindu	Dr. P. Ranakishor	Dr. K. Ramakrishna
9013	5306	8709	9006	6472	7922	6775	5110	8725	7476
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
85	85	85	85	85	85	85	85	85	85
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nil	24	10	Nil	20	Nil	11	Nil	Nil	Nil
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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22PY4247ET	22PY4248ET	25PY5107	25PY5105	25PY5109	25PY5110	25PY5111	22PY5112	22PY5117	22PY5118	22PY5119	22PY5120
EXPERIMENTAL PHARMACOLOGY	ADVANCED INSTRUMENTATIO N TECHNIQUES	MOLECULAR PHARMACEUTICS (NANO TECH AND TARGETED DDS)	ADVANCED BIOPHARMA CEUTICS & PHARMACOK INETICS	COMPUTER AIDED DRUG DELIVERY SYSTEM	COSMETIC AND COSMECEU TICALS	PHARMACEUTICS PRACTICAL II	SEMINAR/ASSIG NMENT	JOURNAL CLUB	RESEARCH WORK	DISCUSSION/FIN AL PRESENTATION	CO-CURRICULAR ACTIVITIES (ATTENDING CONFERENCE, SCIENTIFIC PRESENTATIONS AND OTHER SCHOLARLY ACTIVITIES)
Dr. A. Narayana Rao	Dr. Reehana Shaik	Dr. M. Kasi Viswanadh	Dr. A. Ankarao	Dr. M. Kasi Viswanadh	Dr. S. Praveen	Dr. M. Kasi Viswanadh	Dr. A.V. Surendra	Dr. A.V. Surendra	Dr. A. Ankarao	Dr. S. Praveen	Dr. M. Kasi Viswanadh
5925	9013	7997	5922	7997	6775	7997	6472	6472	5922	6775	7997
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
85	85	85	85	85	85	85	85	85	85	85	85
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

G. Challaraj
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