

HNB Garhwal University (A Central University)
Srinagar Garhwal, Uttarakhand



DEPARTMENT OF PHARMACEUTICAL SCIENCES
SCHOOL OF SCIENCES

SYLLABI
FOR
BACHELOR OF PHARMACY (B. PHARM.)
Under Choice Based Credit System (CBCS)
(w.e.f. academic session 2015-16)

Ordinance for
Bachelor of Pharmacy Programme under Choice Based Credit System (CBCS)
w.e.f session 2015 onwards
H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand

1. Admission

Admission to the B. Pharm. I semester will be made through Pharmacy Entrance test conducted by the University all India level.

Eligibility for admission in

B. Pharm. I sem.: As per the directions/ norms of the University/ regulatory bodies fixed for particular batch of admissions. However, generally eligibility condition is: Should have passed 10+2 (Intermediate) examination or equivalent with Physics, Chemistry as compulsory subjects along with one of the subjects - Mathematics/ Chemistry/ Biotechnology / Biology. Obtained at least 50% marks (45% in case of candidate belonging to reserve category) in the above subjects taken together. Those appearing in 10+2 or equivalent examination may also apply.

B. Pharm. II Year (Lateral Entry): As per the directions/ norms of the University/ regulatory bodies fixed for particular batch of admissions. However, generally eligibility condition is: Should have passed D. Pharmacy in a programme from a board/ University approved institution, with at least 55% marks (45% in case of candidates belonging to reserved category) and 10+2 with Physics, Mathematics, Biology and Chemistry with 55% marks (45% in case of candidate belonging to reserve category). Candidate appearing for D. Pharm. final examination may also apply.

2. Attendance

As per the norms of University for the four year undergraduate programme.

3. Duration

Total duration of the B. Pharm. course shall be four years, each year comprising of two semesters. Maximum time allowed for completing the B. Pharm. course shall be as per general provision of the university ordinances for UG course.

4. Curriculum

The course shall consist of eight semesters. Each semester will include lectures, tutorials, practical and seminars as defined in the scheme of instructions and examinations. Lateral entry candidates will have to clear the following subjects of B. Pharm. I and IV semesters. The subject selection is as per Education regulation 1991, Pharmacy council India, New Delhi.

B. Pharm. Subjects compulsory for lateral entry	B. Pharm subjects exempted for lateral entry
Environmental Studies (Ability Enhancement Compulsory Course, AECC-1) (I semester)	Pharmacognosy-I (Theory) (III semester) Pharmacognosy-I (Practicals) (III semester)
Mathematics and Statistics (I semester)	Hospital & Community Pharmacy (III semester)
Organic Chemistry-I (Theory) (I semester) Organic Chemistry-I (Practicals) Theory (I semester)	Pharmacognosy-II (Theory) (IV semester) Pharmacognosy-II (Practicals) (IV semester)
English Communication (Ability Enhancement Compulsory Course, AECC-2) (II semester)	Forensic Pharmacy (Pharmaceutical Jurisprudence) (IV semester)
Organic Chemistry-II (Theory) (II semester) Organic Chemistry-II (Practicals) Theory (II semester)	
Computer Science and Application (Skill Enhancement Course, SEC-1) (II semester)	

The subjects of Lateral entry will be as follows:

THIRD SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/AECC-1	Environmental Studies * (Ability Enhancement Compulsory Course, AECC-1)	3	1	-	4	30	70	100
SOS/BPH/LC-101	Mathematics & Statistics	2	1	-	3	30	70	100
SOS/BPH/LC-102	Organic Chemistry-I	2	1	-	3	30	70	100
SOS/BPH/LC-301	Pharmaceutical Analysis- II	2	1	-	3	30	70	100
SOS/BPH/LC-302	Physical Pharmacy	2	1	-	3	30	70	100
SOS/BPH/SEC-2	Pharmaceutical Engineering (Skill Enhancement Course, SEC-2)	3	1	-	4	30	70	100
Practicals								
SOS/BPH/PC-105	Organic Chemistry-I	-	-	2	2	30	70	100
SOS/BPH/PC-305	Pharmaceutical Analysis- II	-	-	2	2	30	70	100
SOS/BPH/PC-306	Physical Pharmacy	-	-	2	2	30	70	100
SOS/BPH/ SEC-3P	Pharmaceutical Engineering (Skill Enhancement Course, SEC-3 Practical)	-	-	4	4	30	70	100
Total Credits					30	Total Marks		1000

FOURTH SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/AECC-2	English Communication* (Ability Enhancement Compulsory Course, AECC-2)	3	1	-	4	30	70	100
SOS/BPH/SEC-1	Computer Science and Application (Skill Enhancement Course, SEC-1)	3	1	-	4	30	70	100
SOS/BPH/LC-203	Organic Chemistry-II	2	1	-	3	30	70	100
SOS/BPH/LC-401	Pharmaceutical Technology-I	2	1	-	3	30	70	100
SOS/BPH/LC-402	Medicinal Chemistry-I	2	1	-	3	30	70	100
SOS/BPH/LC-403	Pharmacology –I	2	1	-	3	30	70	100
Practicals								
SOS/BPH/PC-207	Organic Chemistry-II	-	-	2	2	30	70	100
SOS/BPH/PC-406	Pharmaceutical Technology-I	-	-	2	2	30	70	100
SOS/BPH/PC-407	Medicinal Chemistry-I	-	-	2	2	30	70	100
SOS/BPH/PC-408	Pharmacology –I	-	-	2	2	30	70	100
Total Credits					28	Total Marks		1000

5. Examination

Sessional Test: One sessional test of 30 marks of one to two hours duration may employ one or more assignment tools such as objective test, assignments, paper presentation, lab works etc. Suitable to the course.

End Semester Examination Pattern: The End Semester Examination will be of **two hours with 70 MM**. The question paper will consist of two sections A and B.

In section A the examinee will have to attempt 5 (five) questions within 50 (fifty) words limit out of 7 (seven). Each question shall carry 5 (five) marks.

In Section B the examinee will have to attempt 3 (three) questions out of 6 (six). The question will be of descriptive nature carrying 15 (fifteen) marks each.

The candidate will have to attempt all the questions in the given Answer Sheet (A). Additional Answer Sheet (B Copy) will not be provided.

However, the practical sessional marks shall be awarded on the basis of their day to day performance including viva-voce, attendance and laboratory works. There shall be an examination at the end of each semester in theory, practical and project (if any). In addition to these, University norms for the UG four year courses shall be applicable.

6. Promotion Rules

The University norms for the promotion of candidate in the UG course shall be applicable.

7. Promotion under carry-over system:

The University norms for the promotion of candidate in the UG course shall be applicable.

8. Ex-studentship, Result and Scrutiny

The University norms in the UG course shall be applicable.

9. Fee

The fee for the course shall be prescribed by the University from time to time assessing the requirements of the course. The examination fee etc. shall also be notified from time to time.

Outline of Credits Scheme in B. Pharm I to VIII Semester

SEMESTER- I	Credits	SEMESTER - II	Credits	SEMESTER - III	Credits	SEMESTER -IV	Credits
Environmental Studies* (Ability Enhancement Compulsory Course, AECC-1)	04	English Communication* (Ability Enhancement Compulsory Course, AECC-2)	04	Pharmaceutical Analysis- II	03	Pharmaceutical Technology-I	03
Mathematics & Statistics	03	Inorganic Medicinal Chemistry	03	Physical Pharmacy	03	Medicinal Chemistry-I	03
Organic Chemistry-I	03	Pharmaceutical Analysis- I	03	Pharmacognosy-I	03	Pharmacology –I	03
Anatomy Physiology & Health Education- I	03	Organic Chemistry-II	03	Hospital & Community Pharmacy	03	Pharmacognosy– II	03
General and Dispensing Pharmacy	03	Anatomy Physiology & Health Education- II	03	Pharmaceutical Engineering (Skill Enhancement Course, SEC-2)	04	Pharmaceutical Jurisprudence	03
		Computer Science and Application (Skill Enhancement Course, SEC-1)	04				
PRACTICALS							
Organic Chemistry-I	02	Inorganic Medicinal Chemistry	02	Pharmaceutical Analysis- II	02	Pharmaceutical Technology-I	02
Anatomy Physiology & Health Education- I	02	Pharmaceutical Analysis- I	02	Physical Pharmacy	02	Medicinal Chemistry-I	02
General and Dispensing Pharmacy	02	Organic Chemistry-II	02	Pharmacognosy-I	02	Pharmacology –I	02
				Pharmaceutical Engineering (Skill Enhancement Course, SEC-3 Practical)	04	Pharmacognosy– II	02
22		26		26		23	

*Common UGC syllabus applicable to all UG courses viz. B. Tech., B. Sc. BA etc. of the University.

SEMESTER- V	Credits	SEMESTER- VI	Credits	SEMESTER- VII	Credits	SEMESTER- VIII	Credits
Pharmaceutical Technology- II	03	Medicinal Chemistry –III	03	Pharmaceutical Technology-III	03	Pharmacology- III	03
Medicinal Chemistry- II	03	Pharmacology- II	03	Biopharmaceutics & Pharmacokinetics	03	Pharmacognosy- V	03
Pharmacognosy – III	03	Pharmacognosy IV	03	Pharmaceutical Analysis – III	03	Pharmaceutical Analysis – IV	03
Pharmaceutical Biochemistry (Discipline Centric Elective, DSE-1)	03	Pharmaceutical Microbiology (Discipline Centric Elective, DSE-3)	03	Chemistry of Natural Products (Discipline Centric Elective, DSE-5)	03	Novel Drug Delivery System (Discipline Centric Elective, DSE-7)	03
Pharmaceutical Industrial Management (Skill Enhancement Course, SEC-4)	04	Pharmaceutical Biotechnology (Skill Enhancement Course, SEC-5)	04	Clinical Pharm. & Drug Interaction (Skill Enhancement Course, SEC-6)	04	Drug Design (Discipline Centric Elective, DSE-8)	03
						Discipline Centric Elective, DSE-9 (Select one from list of electives)	03
PRACTICALS							
Pharmaceutical Technology- II	02	Medicinal Chemistry –III	02	Pharmaceutical Technology-III	02	Pharmacology- III	02
Medicinal Chemistry- II	02	Pharmacology- II	02	Biopharmaceutics & Pharmacokinetics	02	Pharmacognosy- V	02
Pharmacognosy – III	02	Pharmacognosy IV	02	Pharmaceutical Analysis – III	02	Pharmaceutical Analysis – IV	02
Pharmaceutical Biochemistry (Discipline Centric Elective, DSE-2P)	02	Pharmaceutical Microbiology (Discipline Centric Elective, DSE-4P)	02	Chemistry of Natural Products (Discipline Centric Elective, DSE-6P)	02		
24	24		24		24		24

FIRST SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/AECC-1	Environmental Studies * (Ability Enhancement Compulsory Course, AECC-1)	3	1	-	4	30	70	100
SOS/BPH/LC-101	Mathematics & Statistics	2	1	-	3	30	70	100
SOS/BPH/LC-102	Organic Chemistry-I	2	1	-	3	30	70	100
SOS/BPH/LC-103	Anatomy Physiology & Health Education- I	2	1	-	3	30	70	100
SOS/BPH/LC-104	General and Dispensing Pharmacy	2	1	-	3	30	70	100
Practicals								
SOS/BPH/PC-105	Organic Chemistry-I	-	-	2	2	30	70	100
SOS/BPH/PC-106	Anatomy Physiology & Health Education- I	-	-	2	2	30	70	100
SOS/BPH/PC-107	General and Dispensing Pharmacy	-	-	2	2	30	70	100
Total Credits					22	Total Marks		800

* Common UGC syllabus applicable to all UG courses viz. B. Pharm., B. Tech., B. Sc. B.A etc. of the University.

SECOND SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/AECC-2	English Communication* (Ability Enhancement Compulsory Course, AECC-2)	3	1	-	4	30	70	100
SOS/BPH/LC-201	Inorganic Medicinal Chemistry	2	1	-	3	30	70	100
SOS/BPH/LC-202	Pharmaceutical Analysis- I	2	1	-	3	30	70	100
SOS/BPH/LC-203	Organic Chemistry-II	2	1	-	3	30	70	100
SOS/BPH/LC-204	Anatomy Physiology & Health Education- II	2	1	-	3	30	70	100
SOS/BPH/SEC-1	Computer Science and Application (Skill Enhancement Course, SEC-1)	3	1	-	4	30	70	100
Practicals								
SOS/BPH/PC-205	Inorganic Medicinal Chemistry	-	-	2	2	30	70	100
SOS/BPH/PC-206	Pharmaceutical Analysis- I	-	-	2	2	30	70	100
SOS/BPH/PC-207	Organic Chemistry-II	-	-	2	2	30	70	100
Total Credits					26	Total Marks		900

* Common UGC syllabus applicable to all UG courses viz. B. Pharm., B. Tech., B. Sc. BA etc. of the University.

THIRD SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/LC-301	Pharmaceutical Analysis- II	2	1	-	3	30	70	100
SOS/BPH/LC-302	Physical Pharmacy	2	1	-	3	30	70	100
SOS/BPH/LC-303	Pharmacognosy-I	2	1	-	3	30	70	100
SOS/BPH/LC-304	Hospital & Community Pharmacy	2	1	-	3	30	70	100
SOS/BPH/SEC-2	Pharmaceutical Engineering (Skill Enhancement Course, SEC-2)	3	1	-	4	30	70	100
Practicals								
SOS/BPH/PC-305	Pharmaceutical Analysis- II	-	-	2	2	30	70	100
SOS/BPH/PC-306	Physical Pharmacy	-	-	2	2	30	70	100
SOS/BPH/PC-307	Pharmacognosy-I	-	-	2	2	30	70	100
SOS/BPH/ SEC-3P	Pharmaceutical Engineering (Skill Enhancement Course, SEC-3P)	-	-	4	4	30	70	100
Total Credits					26	Total Marks		900

FORTH SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/LC-401	Pharmaceutical Technology-I	2	1	-	3	30	70	100
SOS/BPH/LC-402	Medicinal Chemistry-I	2	1	-	3	30	70	100
SOS/BPH/LC-403	Pharmacology –I	2	1	-	3	30	70	100
SOS/BPH/LC-404	Pharmacognosy–II	2	1	-	3	30	70	100
SOS/BPH/ LC-405	Pharmaceutical Jurisprudence	2	1	-	3	30	70	100
Practicals								
SOS/BPH/PC-406	Pharmaceutical Technology-I	-	-	2	2	30	70	100
SOS/BPH/PC-407	Medicinal Chemistry-I	-	-	2	2	30	70	100
SOS/BPH/PC-408	Pharmacology –I	-	-	2	2	30	70	100
SOS/BPH/PC-409	Pharmacognosy–II	-	-	2	2	30	70	100
Total Credits					23	Total Marks		900

FIFTH SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/LC-501	Pharmaceutical Technology- II	2	1	-	3	30	70	100
SOS/BPH/LC-502	Medicinal Chemistry- II	2	1	-	3	30	70	100
SOS/BPH/LC-503	Pharmacognosy –III	2	1	-	3	30	70	100
SOS/BPH/DSE-1	Pharmaceutical Biochemistry (Discipline Centric Elective, DSE-1)	2	1	-	3	30	70	100
SOS/BPH/SEC-4	Pharmaceutical Industrial Management (Skill Enhancement Course, SEC-4)	3	1	-	4	30	70	100
Practicals								
SOS/BPH/PC-504	Pharmaceutical Technology- II	-	-	2	2	30	70	100
SOS/BPH/PC-505	Medicinal Chemistry- II	-	-	2	2	30	70	100
SOS/BPH/PC-506	Pharmacognosy –III	-	-	2	2	30	70	100
SOS/BPH/DSE-2P	Pharmaceutical Biochemistry (Discipline Centric Elective, DSE-2 Practical)	-	-	2	2	30	70	100
Total Credits					24	Total Marks		900

SIXTH SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/LC-601	Medicinal Chemistry –III	2	1	-	3	30	70	100
SOS/BPH/LC-602	Pharmacology- II	2	1	-	3	30	70	100
SOS/BPH/LC-603	Pharmacognosy IV	2	1	-	3	30	70	100
SOS/BPH/DSE-3	Pharmaceutical Microbiology (Discipline Centric Elective, DSE-3)	2	1	-	3	30	70	100
SOS/BPH/SEC-5	Pharmaceutical Biotechnology (Skill Enhancement Course, SEC-5)	3	1	-	4	30	70	100
Practicals								
SOS/BPH/PC-604	Medicinal Chemistry –III	-	-	2	2	30	70	100
SOS/BPH/PC-605	Pharmacology- II	-	-	2	2	30	70	100
SOS/BPH/PC-606	Pharmacognosy IV	-	-	2	2	30	70	100
SOS/BPH/DSE-4P	Pharmaceutical Microbiology (Discipline Centric Elective, DSE-4 Practical)	-	-	2	2	30	70	100
Total Credits					24	Total Marks		900

SEVENTH SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/LC-701	Pharmaceutical Technology-III	2	1	-	3	30	70	100
SOS/BPH/LC-702	Biopharmaceutics & Pharmacokinetics	2	1	-	3	30	70	100
SOS/BPH/LC-703	Pharmaceutical Analysis – III	2	1	-	3	30	70	100
SOS/BPH/DSE-5	Chemistry of Natural Products (Discipline Centric Elective, DSE-5)	2	1	-	3	30	70	100
SOS/BPH/SEC-6	Clinical Pharm. & Drug Interaction (Skill Enhancement Course, SEC-6)	3	1	-	4	30	70	100
Practicals								
SOS/BPH/PC-704	Pharmaceutical Technology-III	-	-	2	2	30	70	100
SOS/BPH/PC-705	Biopharmaceutics & Pharmacokinetics	-	-	2	2	30	70	100
SOS/BPH/PC-706	Pharmaceutical Analysis – III	-	-	2	2	30	70	100
SOS/BPH/DSE-6P	Chemistry of Natural Products (Discipline Centric Elective, DSE-6 Practical)	-	-	2	2	30	70	100
Total Credits					24	Total Marks		900

EIGHTH SEMESTER

Course Code	Subjects	Evaluation – Scheme						
		Period				Sessional 30	Examination	
		L	T	P	Credits		ESE 70	Sub. Total 100
SOS/BPH/LC-801	Pharmacology- III	2	1	-	3	30	70	100
SOS/BPH/LC-802	Pharmacognosy- V	2	1	-	3	30	70	100
SOS/BPH/LC-803	Pharmaceutical Analysis – IV	2	1	-	3	30	70	100
SOS/BPH/DSE-7	Novel Drug Delivery System (Discipline Centric Elective, DSE-7)	2	1	-	3	30	70	100
SOS/BPH/DSE-8	Drug Design (Discipline Centric Elective, DSE-8)	2	1	-	3	30	70	100
SOS/BPH/DSE-9-11	Elective * (Discipline Centric Elective, DSE-9, 10, 11) Select one from the list of electives	2	1	-	3	30	70	100
Practicals								
SOS/BPH/PC-804	Pharmacology- III	-	-	2	2	30	70	100
SOS/BPH/PC-805	Pharmacognosy- V	-	-	2	2	30	70	100
SOS/BPH/PC-806	Pharmaceutical Analysis – IV	-	-	2	2	30	70	100
Total Credits					24	Total Marks		900

List of Elective Subjects

Sl. No.	Course Code	Subject
1	SOS/BPH/DSE-9	GMP, Quality Assurance and Validation
2	SOS/BPH/DSE-10	Packaging Technology
3	SOS/BPH/DSE-11	Herbal Drug Technology

SOS/BPH/ AECC-1: ENVIRONMENT STUDIES
(Ability Enhancement Compulsory Course)

4 Credits (3-1-0)

Unit -1: Introduction to Environmental Studies

Multidisciplinary nature of environmental studies;
Scope and importance; Concept of sustainability and sustainable development.

Unit- 2: Ecosystems

What is An ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains food webs ecological succession. Case studies of the following ecosystems :

- a) Forest ecosystem
- b) Grassland ecosystem
- c) Desert ecosystem
- d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit -3: Natural Resources : Renewable and Non-renewable Resources

Land resources and land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water : Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit- 4: Biodiversity and Conservation

Levels of biological diversity :genetic, species and ecosystem diversity; Biogeographic zone of India; Biodiversity patterns and global biodiversity hot spots

India as a mega-biodiversity nation; Endangered and endemic species of India

Threats to biodiversity : Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit- 5: Environmental Pollution

Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution

Nuclear hazards and human health risks

Solid waste management : Control measures of urban and industrial waste.

Pollution case studies.

Unit- 6: Environmental Policies & Practices

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture

Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).

Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit- 7: Human Communities and the Environment

Human population growth: Impacts on environment, human health and welfare.

Resettlement and rehabilitation of project affected persons; case studies.

Disaster management : floods, earthquake, cyclones and landslides.

Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.

Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.

Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit- 8: Field work

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site---Urban/Rural/Industrial/Agricultural.

Study of common plants, insects, birds and basic principles of identification.

Study of simple ecosystems---pond, river, Delhi Ridge, etc.

Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. Of California Press.
3. Gleeson, B. And Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36-37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

SOS/BPH/LC-101: MATHEMATICS & STATISTICS

3 Credits (2-1-0)

Unit – I

Trigonometry: T-ratios, addition, subtraction and transformation formulae. T-ratios of multiple, sub- multiple and allied angles. Simple T-identities based on above concept.

Differential Calculus: Continuity and limit, differentiation of algebraic, trigonometric, exponential, logarithmic and inverse functions. Right and left hand derivatives. Elementary maxima and minima.

Unit – II

Integral Calculus: Definite Integration of algebraic, trigonometric, exponential, logarithmic and inverse functions, integration by parts and by substitution, Simple cases of area and volume

Differential Equations: General formation of differential equation. Variable separable differential equation, Homogeneous linear equation, first order and first degree differential equation.

Matrices: Simple definition of matrices, addition, subtraction and multiplication of matrices

Unit – III

Frequency distribution: Graphical representation of data, frequency polygon, frequency curve and cumulative frequency curve, histogram, diagrams and types of graphs.

Measures of central tendency: Mean, median, mode, quartiles and partitions values. Comparison to frequency distribution

Unit – IV

Measures of dispersion and skewness: Dispersion, range, quartile dispersion, measures of deviation, mean deviation, standard deviation and root mean square deviation.

Correlation Regression: Correlation of samples, Karl Pearson's coefficients of correlation. Line of regression X on Y and Y on X and regression coefficient

Unit – V

Sampling: Sampling distribution, confidence interval, non-probability and probability samples, computing 99% and 95% fiducial limits from tables of areas and normal curve probability rules, Z score computing, t' test and analysis of variance. All calculations should be illustrated with examples from true laboratory biological experimental models.

Books recommended:

1. P.N. Arora, Biostatistics, Himalaya Publishing House, Mumbai, 2003.
2. B.K. Mahajana, Methods in Biostatistics, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, 2003.
3. S. Narayan, Integral Calculas and Differential Calculus, S. Chand Publisher (P) Ltd. Delhi, 2003.
4. M.Ray and S.S. Seth. Integral Calculus and Differential Calculus, Shiv lal Aggarwal and company, Agra.
5. A.R. Vashishtha, Matrices, Krishna Prakashan, Meerut.

SOS/BPH/LC-102: ORGANIC CHEMISTRY-I

3 Credits (2-1-0)

Unit – I

Structure and Bonding – Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interaction, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions – curved arrow notation, drawing electron movements with arrows, half headed and double headed arrows, homolytic and heterolytic bond breaking, types of reagents-electrophiles and nucleophiles, types of organic reaction. Reactive intermediates-carbocations, carbanions, free radicals, carbenes, arynes and nitrenes.

Unit – II

Stereochemistry of organic compounds – Concept of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature

Geometric isomerism- determination of configuration of geometric isomerism in oximes and alicyclic compounds, Conformational Isomerism – conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, conformation of monosubstituted cyclohexane derivatives, Newman projection and sawhorse formulae, Fischer and flying wedge formulae, difference between configuration and conformation.

Unit – III

Alkanes: IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, isomerism in alkanes, methods of formation (with special references to Wurtz reaction, Kolbe reaction, Corey-Gouse reaction and decarboxylation of carboxylic acids), Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes-nomenclature, methods of formation, chemical reaction, Baeyer's strain theory and its limitation Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings

Alkenes – nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration, the Saytzeff rule, Hoffmann elimination, physical properties and relative stabilities of alkenes. Chemical reaction of alkenes-mechanism involved in hydrogenation electrophilic and free radical additions, Markownikoff's rule, free radical additions, hydroxylation and oxidation with KMnO_4 , polymerization of alkenes, substitution at the allylic and vinylic positions of alkenes.

Unit – IV

Arenes and Aromaticity –nomenclature of benzene derivatives, aryl group, aromatic nucleus and side chain. Structure of benzene - molecular formula and Kekulé structure, stability and carbon-carbon bond length of benzene, resonance structure,

Aromaticity- the Huckel rule, aromatic ions. Aromatic electrophilic substitution - general pattern of the mechanism, role of σ π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction. Activating and deactivating substituents, orientation and ortho/para ratio, side chain reactions of benzene derivatives. Birch reduction.

Unit – V

Alkyl and Aryl halides – nomenclature and classes of alkyl halides, methods of formation, chemical reaction, mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reaction with energy profile diagrams, methods of formation of aryl halides, nuclear and side chain reaction. Mechanism of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs. allyl, vinyl and aryl halides.

Books recommended

1. Organic Chemistry by R.L. Morrison and R.N. Boyd.
2. Organic Chemistry by I.L. Finar Vol. I and II.
3. Organic Chemistry by P.L. Soni.
4. Textbook of Organic Chemistry by B.S. Bahl and Arun Bahl.
5. Reaction and reagents by O.P. Agarwal.
6. Vogel's Practical Organic Chemistry, Vol I, II and III.
7. Stereo Chemistry of Organic Compounds by E.I. Eliel.
8. Advanced Organic Chemistry by Arun Bahl.
9. Bentley and Driver's, Textbook of Pharmaceutical Chemistry.
10. Indian Pharmacopoeia (I.P.) , 1985, 1996 and 2007.
11. Organic chemistry – J.M.Cram and D.J.Cram
12. Organic chemistry- Brown
13. Organic chemistry- Cram and Hammered, Pine Hendrickson

SOS/BPH/LC-103: ANATOMY, PHYSIOLOGY & HEALTH EDUCATION-I

3 Credits (2-1-0)

Unit – I

Introduction to anatomy and Physiology: Definition, anatomical terms, organs and systems (only introductory knowledge).

The cell: Structure, physiology of plasma membrane, transport across cell membrane (Active and passive transport).

The Tissue: Classification, distribution, properties of epithelial, connective, muscular and nervous tissue, bone and cartilage.

Unit – II

Haemopoietic system: Composition and function of blood, blood groups, mechanism of blood coagulation, disorders of blood.

Lymph and lymphatic system: Composition, formation, circulation and function of lymph, structure and function of spleen, disorders of lymph and lymphatic system.

Unit – III

Cardiovascular system: Heart-structure and dynamics of heart, cardiac cycle, Circulation-systemic, pulmonary, portal and coronary, blood pressure and its regulation, ECG, disorders of CVS (hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias).

Unit – IV

Respiratory system: Organs of respiration, physiology and control of respiration.

Osseous system: Structure, composition and functions of skeleton, classification of joints, types of movements of joints, disorders of joints.

Unit – V

Concepts of health and disease: Disease causing agents and prevention of disease.

Classification of food requirements: Balanced diet, nutritional deficiency disorders, their treatment and prevention, specification for drinking water.

Demography and family planning: Pregnancy and its maintenance, Medical termination of pregnancy, contraceptives, different methods of contraception

Books recommended

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

SOS/BPH/LC-104: GENERAL & DISPENSING PHARMACY

3 Credits (2-1-0)

Unit – I

Pharmaceutical Literature: History and scope of Pharmacy & Introduction to the Indian Pharmacopoeia, British Pharmacopoeia, United state Pharmacopoeia and International Pharmacopoeia.

Extraction Process: Infusion, Decoction, Maceration & Percolation process & preparations involving them.

Unit – II

Filtration: Definition, theory, factor effecting & mechanism of filtration. Filter media & filter aids, study of filter press, leaf filter and rotary filter

Size reduction & size separation: Objectives, factors effecting, methods of size reduction, construction & working of hammer mill, ball mill, fluid energy mill & colloid mill.

Unit – III

Formulation methods of Pharmaceutical Dosage forms: suspensions, emulsions, ointments, suppositories, with special reference to closures & containers required to dispense the above dosage forms.

Laboratory preparation and dispensing of dosage forms: Syrups, elixirs, infusions, decoctions, tinctures, spirits, extracts, jellies, lotions, liniments, douches, gargles, enemas, inhalations, sprays, eye drops, ear drops & nasal drops, water.

Unit – IV

Principles of dispensing and posology: Definition of prescription & its parts, handling, pricing of the prescription, detection of overdose in prescription, common Latin terms & abbreviations for prescription.

Pharmaceutical Calculations: Weights & measures of pharmaceutical importance & their interrelationships. Percentage calculation, allegation method, isotonicity adjustments, proof spirit.

Unit – V

Incompatibility: Type of incompatibilities and their correction (where ever possible) with examples

Posology: Introduction to posology & factors affecting doses, Calculation of paediatric doses

Books recommended

1. E.A. Rawlins, Bentley's TextBook of Pharmaceutics, 8th ed., BailliereTindall, London, 2002.
2. S.J. Carter, Cooper & Gunn's Dispensing for Pharmaceutical students, 12th ed. CBS Publishers & Distributors, Delhi, 1987.
3. J.W. Cooper & C. Gunn, General Pharmacy.
4. Indian Pharmacopoeia 1996, Vol. I & II, Controller of Publications, Govt of India, 1996.
5. British Pharmacopoeia 1993, Vol. I & II, HMSO, UK, 1993.

6. The United States Pharmacopoeia USP 24 and the National Formulary, NF 19, Asian Ed. Tata Donnelley Limited, India 1999.
7. Walter Lund, The Pharmaceutical Codex, 12th ed., The Pharmaceutical Press, London 1994.
8. M. J. Stoklosa, H.C. Ansel, Pharmaceutical Calculations, 10th ed., B.I. Waverly Pvt. Ltd. N. Delhi, 1996.
9. N.K. Jain & S.N. Sharma, A Text Book of Professional Pharmacy 3rd ed. Vallabh Prakashan, Delhi 1994.
10. A.J. Winfield, R.M.E. Richards, Pharmaceutical Practice, 2nd ed. Churchill Livingstone, London 1998.
11. S.J. Carter, Copper and Gunn's Tutorial Pharmacy 6th ed., CBS Publishers & Distributors, New Delhi, 2000.

PRACTICALS

SOS/BPH/PC-105: ORGANIC CHEMISTRY-I (PRACTICAL)

2 Credits (0-0-2)

Practical shall be based on theoretical concept

1. Assay of organic compounds.
2. Systematic qualitative analysis of organic compounds.
3. Determination of melting point of organic compounds.

**SOS/BPH/PC-106: ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-I
(PRACTICAL)**

2 Credits (0-0-2)

Practical shall be based on theoretical concept

1. Study of microscope.
2. Study of human skeleton.
3. Study of different systems of body with the help of charts & models.
4. Microscopic study of different tissues.
5. Blood typing, estimation of haemoglobin in blood, determination of bleeding time, clotting time, RBC counts, TLC, DLC & ESR.
6. Recording of body temp, pulse rate, and blood pressure, basic understanding of ECG.

SOS/BPH/PC-107: GENERAL & DISPENSING PHARMACY (PRACTICAL)

2 Credits (0-0-2)

1. Dispensing of various dosage forms mentioned in theory.
2. Experiments based on theory i.e., Preparation of Waters, Solutions, Syrups, Elixirs, Infusions, Decoctions.
3. Spirits, Jellies, Mucilages, Lotions, Liniments, Gargles, Enemas, Eye, Ear & Nasal Drops
4. Practice in Pharmaceutical Calculations. Experiments based on Size Reduction, Size Separation, Filtration, Extraction.

SOS/BPH/ AECC-2: English Communication
(Ability Enhancement Compulsory Course)

4 Credits (3-1-0)

1. Introduction: Theory of Communication, Types and modes of Communication

2. Language of Communication:

Verbal and Non-verbal
(Spoken and Written)
Personal, Social and Business
Barriers and Strategies
Intra-personal, Inter-personal and Group communication

3. Speaking Skills:

Monologue
Dialogue
Group Discussion
Effective Communication/ Mis- Communication
Interview
Public Speech

4. Reading and Understanding

Close Reading
Comprehension
Summary Paraphrasing
Analysis and Interpretation
Translation(from Indian language to English and vice-versa)
Literary/Knowledge Texts

5. Writing Skills

Documenting
Report Writing
Making notes
Letter writing

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.
4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr Brati Biswas

SOS/BPH/LC-201: INORGANIC MEDICINAL CHEMISTRY

3 Credits (2-1-0)

Following inorganic topics will be treated covering outline of methods of preparations, limits, chemical properties, assays and use of compounds listed in IP & BP

Unit – I

Major intra and extra cellular electrolytes: Major physiological ions, electrolytes used in replacement therapy (sodium chloride and potassium chloride), electrolyte used in combination therapy.

Gastrointestinal agents

Acidifying agents: Dilute Hydrochloric acid

Antacids: Aluminium hydroxide, magnesium carbonate, Magnesium trisilicate, magnesium oxide.

Saline cathartics: Sodium potassium tartarate & magnesium sulphate

Unit – II

Topical Agents

Protective: Talc, zinc oxide, calamine, titanium dioxide.

Antimicrobials: Hydrogen peroxide, potassium permanganate, chlorinated lime, iodine.

Astringents: Alum, zinc sulphate

Dental Products

Anticaries agents: Sodium fluoride, stannous fluoride.

Dentifrices: Calcium carbonate, dicalcium phosphate, Sodium metaphosphate, zinc chloride

Unit – III

Pharmaceutical Aids & Necessities

Anti-Oxidants : Hypophosphorus acid, sodium bisulphite, sodium thiosulphate, sodium nitrite.

Water : Official waters

Unit – IV

Impurities: Sources, type and control of impurities

Limit tests: Limit test for iron, heavy metals, chloride and sulphate.

Unit – V

Miscellaneous inorganic pharmaceutical agents

Inhalants: Oxygen, carbon dioxide, nitrous oxide.

Respiratory stimulants: Ammonium carbonate.

Expectorants & emetics: Ammonium chloride, potassium iodide.

Antidotes: Sodium nitrite

Book recommended

1. Indian Pharmacopoeia 1996, vol. I & II, Controller of Publications, Govt of India, 1996.
2. British Pharmacopoeia 1993, Vol. I & II, HMSO, UK, 1993.

3. John H. Block, Edward B. Roche, Taito O. Soine and Charles O. Wilson, Inorganic Medicinal and Pharmaceutical Chemistry, 1st ed. (Indian ed.), Varghese Publishing house, Mumbai, 1986.
4. N. C. Chaudhry, & N. K. Gurbani, Pharmaceutical Chemistry- I, 1st ed., VallabhPrakashan, Delhi, 1995.
5. G.R. Chatwal, Pharmaceutical Chemistry Inorganic, vol. I, 2nd ed. Himalaya Publishing house, Mumbai, 1996.

SOS/BPH/LC-202: PHARMACEUTICAL ANALYSIS - I

3 Credits (2-1-0)

Unit – I

Introduction: Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, calibration of volumetric apparatus, computation of analytical results, statistical treatment of analytical data, mean deviation, standard deviation, concept of errors, significant figures, rules for retaining significant figures, accuracy and precision,

Titration - concepts and different types of titration, Fundamentals of volumetric analysis, methods of expressing concentrations, primary and secondary standards, Electrolytic dissociations, chemical equilibrium, pH, buffer solutions and actions, hydrolysis of salts and amphoteric substances.

Unit – II

Neutralization titrations: Modern concept of acids and bases, role of solvent, relative strengths of acids and bases, ionization, law of mass action, ionic product of water, neutralization curves, acid base indicators, theory of indicators, choice of indicators, mixed indicators. Application in assay of benzoic acid, boric acid and aspirin.

Unit – III

Non aqueous titrations:, Theory, Scopes and limitations, Types of solvents: aprotic, protophillic, protogenic and amphiprotic solvents, differentiating and levelling effect of solvents, Titrations with perchloric acid, potassium methoxide and tetrabutyl ammonium hydroxide, titration of weak acid and weak bases with suitable examples and choice of indicators. Application in assay of sod benzoate and Norfloxacin.

Unit – IV

Oxidation reduction titrations: Concepts of oxidation–reduction, standard oxidation potential, Nernst equation, theory of redox titrations, redox indicators, preparation, standardization and titrations involving ceric ammonium sulphate, potassium permanganate, titanous chloride, sodium thiosulphate 2,6–dichlorophenol– indophenol, iodimetry, iodometry. Application in assay of ascorbic acid and isoniazid.

Unit – V

Electrochemistry: Introduction, dielectric cell, electrode potential, Nernst's equation, salt bridge, standard potential, reference and indicator electrode, measuring the relative voltage of cell. potentiometry, conductometry and their applications in analysis of drugs.

Book recommended

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

SOS/BPH/LC-203: ORGANIC CHEMISTRY -II

3 Credits (2-1-0)

Unit – I

Alcohols – classification and nomenclature, monohydric alcohols - nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters, hydrogen bonding, acidic nature, reactions of alcohols.

Phenols – Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion, Reactions of phenols - electrophilic aromatic substitution, acylation and carboxylation, mechanism of Fries rearrangement, claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Unit – II

Aldehydes and ketones – nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular references to the synthesis of aldehydes from acid halides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids, physical properties, mechanism of nucleophilic addition to carbonyl group with particular emphasis on benzoin, aldol, perkin and knoevenagel condensation, condensation with ammonia and its derivatives, witting reaction, mannich reaction. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, cannizzaro reaction, Clemmensen, Wolff-Kishner, LAH, NaBH₄ reductions.

Unit – III

Carboxylic acids – nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zerlinsky reaction, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids. Mechanism of decarboxylation. Hydroxy acids malonic, tartaric and citric acids, Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids-methods of formation and effect of heat and dehydrating agents.

Carboxylic acid derivatives – Structure and nomenclature of acid chlorides, esters, amides (Urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, Preparation of carboxylic acid derivatives, chemical reaction. Mechanism of esterification and hydrolysis (acidic and basic).

Unit – IV

Organic compounds of nitrogen – preparation of nitroalkanes and nitroarenes, chemical reaction of nitroalkanes, mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.

Structure and nomenclature of amines, physical properties, separation of a mixture of primary, secondary and tertiary amines, structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehyde and ketonic compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid, synthetic transformations of aryl diazonium salts, azo coupling

Unit – V

Heterocyclic compounds – Introduction: aromatic characteristics of pyrrole, furan, thiophene and pyridine, methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives, comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six membered heterocycles. Preparation and reaction of quinolone and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis, mechanism of electrophilic substitution reactions of quinolone and isoquinoline.

Books recommended

1. Adv.Org. Chemistry Carey 4th Edition, 2000 Plenum Press .
2. Organic Chemistry Morrison, R. T 6th Edition, 2006 Pearson Education.
3. Organic Chemistry Finar 6th Edition, 1973 Longman Group Ltd.
4. Organic Reaction Mechanism M. Gomer Gallego 2004 Springer Privt. Ltd.
5. Adv.Org. Chemistry Jerry March 4th, 2003 John Wiley & Sons, Inc.
6. Bentley and Driver's, Textbook of Pharmaceutical Chemistry.
7. Indian Pharmacopoeia (I.P.) , 1985, 1996 and 2007.
8. Organic Chemistry by P.L. Soni.
9. Textbook of Organic Chemistry by B.S. Bahl and Arun Bahl.
10. Reaction and reagents by O.P. Agarwal.
11. Vogel's Practical Organic Chemistry, Vol I, II and III.
12. Advanced Organic Chemistry by Arun Bahl.
13. Organic chemistry – J.M.Cram and D.J.Cram.
14. Organic chemistry- Brown.
15. Organic chemistry- Cram and Hammered, Pine Hendrickson

SOS/BPH/LC-204: ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-II

3 Credits (2-1-0)

Unit – I

Nervous system: Structure and functions of neuron, impulse generation, impulse conduction and transmission.

ANS: Neurotransmission in ANS, physiology and function

CNS: Neurotransmission in CNS, parts and functions (Brain, spinal cord and reflex arc)

Unit – II

Skeletal muscles: Gross anatomy, physiology of muscles contraction, physiological properties of skeletal muscles and their disorders.

Urinary system: Structure of kidney, nephron, physiology of urine formation, role of kidney in maintaining extra cellular fluid volume and composition, acid-base balance, osmoregulation

Unit – III

Special senses: Anatomy and physiology of ear, eye, nose, tongue and skin (hearing and equilibrium, vision, olfaction, gustation)

Reproductive system: Male and female reproductive system, physiology of menstruation, spermatogenesis & oogenesis.

Unit – IV

Endocrine glands and physiology: Thyroid, parathyroid, pancreas, pituitary, adrenals and gonads.

Digestive system: Digestive organs, movements of alimentary tract, gastric secretions, role of enzymes in digestive process.

Unit – V

Communicable disease: Brief outline, their causative agents, modes of transmission and prevention (chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea and AIDS).

First aids: Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

Books recommended

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

SOS/BPH/SEC-1: COMPUTER SCIENCE AND APPLICATIONS
(Skill Enhancement Course)

4 Credits (3-1-0)

Unit – I

Introduction, Definition, Generation, Types, Parts of Computers, Central Processing Unit, Memory, Input/Output Devices. Computer Languages and their Hierarchy (Machine Level, Assembly Language, High Level Language). Microcomputers and their Applications, Software and Hardware.

Unit – II

Operating System concept, elements of DOS/UNIX, etc, DOS commands, Introduction to Networking, Network communication and Internet
Introduction to software likes MS-Word, MS Excel, etc.

Unit – III

Flow Charting and Algorithm Development.

Definition and properties of algorithm, pseudo code, flowcharting, Application and, Conversion of algorithm/flow chart to high level language.

Unit – IV

Introduction to C programming: History of 'C', difference between C and C++, basic data types and operators in 'C', conditional statements [if –else, nested if], looping (for loop, while and do-while loop). Introduction to arrays (single and double dimension).

Unit – V

A. Introduction to DATABASES: Concept of database, fields, records, data files, table. Database Management System, Table manipulation (addition, deletion etc.), Introduction to MS- ACCESS

B. Computer application to pharmaceutical and clinical studies

Books Recommended

1. P. K. Sinha, Fundamental of Computer, BPB Publication New Delhi, 2003.
2. Y. Kanetkar, Programming in C, C++, BPB Publication New Delhi ed. 2003.

BACHELOR OF PHARMACY (SEMESTER-II)
Under Choice Based Credit System (CBCS)

PRACTICALS

SOS/BPH/PC-205: INORGANIC MEDICINAL CHEMISTRY (PRACTICAL)

2 Credits (0-0-2)

Practical shall be based on theoretical concepts of subjects

1. Limit test for chloride, sulphate, iron, arsenic, and heavy metals.
2. Identification tests, Preparation and purification of some I.P. / B.P. inorganic compounds.

SOS/BPH/PC-206: PHARMACEUTICAL ANALYSIS-I (PRACTICAL)

2 Credits (0-0-2)

Practical shall be based on theoretical concepts of subjects

1. Calibration of volumetric apparatus.
2. Perform following assays as per I.P. including preparation and standardization of titrant such as HCl, NaOH, Potassium permanganate, silver nitrate, HClO₄, Disodium EDTA, Sod acetate, Iodine, Oxalic acid, Hydrogen ion concentration.
3. Estimation by Kjeldal method.

SOS/BPH/PC-207: ORGANIC CHEMISTRY-II (PRACTICAL)

2 Credits (0-0-2)

Practical shall be based on theoretical concepts of the subjects

1. Assay of organic compounds
2. Systematic qualitative analysis of organic compounds

SOS/BPH/LC-301: PHARMACEUTICAL ANALYSIS - II

3 Credits (2-1-0)

Unit – I

Precipitation titrations: Precipitation reactions, solubility products, effect of acids, temperature and solvent upon the solubility of the precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, Mercuric nitrate and barium sulphate, Indicators, Gaylussac method, Mohr's method, Volhard's method and Fajan's method. Application in assay of Potassium chloride, Ammonium chloride and Sodium Chloride.

Gravimetric analysis: Precipitation techniques, solubility products, the colloidal state, supersaturation, co-precipitation, post-precipitation, digestion, washing of the precipitate, filtration, filter papers and crucibles, ignition, thermo-gravimetric curves, specific examples like barium as barium sulphate, aluminium as aluminium oxide, organic precipitants.

Unit – II

Complexometric titrations: Complexation, chelation, Werner's co-ordination number, stability of complexes, titration curves, importance of buffer, types of complexometric titration, methods of end point detection, pH indicators, masking and demasking agents. Application in assay of Magnesium sulphate, Lead nitrate and calcium gluconate.

Miscellaneous methods of analysis: Principle of diazotization titrations using sodium nitrite, Kjeldahl method of nitrogen estimation, Karl Fischer titrations.

Unit – III

Separation techniques: Solvent extraction: Distribution law, technique for solvent extraction, classification of solvent extraction systems, advantages of solvent extraction.

Chromatography: Principle, general procedure and applications of thin layer chromatography (TLC), paper chromatography (PC), Column chromatography and gel chromatography.

Unit – IV

Thermal methods: Instrumentation and applications of Thermogravimetric analysis (TGA), differential thermal analysis (DTA), Differential scanning calorimeter (DSC).

Optical methods of analysis: Principle, instrumentation and applications of refractometry and polarimetry

Unit – V

Quality Assurance: GLP, ISO 9000, TQM, Quality Review and Quality Documentation.

Regulatory Control, Regulatory Drug Analysis, Interpretation of Analytical Data.

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Books recommended:

1. R.M. Silverstein, G. C. Bassler and T. C. Morrill, Spectrometric Identification of Organic Compounds, 5th ed., Wiley Interscience, Singapore, 1991.
2. A.H. Beckett and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.

3. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5th ed., ELBS, U.K., 1989.
4. Keneth & A. Connors, A Text Book of Pharmaceutical Analysis, 3rd ed., Wiley Interscience, Singapore, 1982.
5. D.A. Skoog, F.J.Holler and T. A. Nieman, Principle of Instrumental analysis, 5th edition, Saunders College publishing, Philadelphia.
6. T. Higuchi, E. Brochmann and H. Hanssen, Pharm. Analysis, 1st edition, 1997, CBS Publisher, New Delhi.

SOS/BPH/LC-302: PHYSICAL PHARMACY

3 Credits (2-1-0)

Unit – I

State of matter: State of matter, gaseous state, liquid state, solid and crystalline state, liquid crystalline state, phase equilibrium and phase rule (one component, two component system containing liquid phase and solid & liquid phase), thermal analysis.

Kinetics and drug stability: Rate and order of reactions, factors affecting rate of reaction, decomposition and stabilization of medicinal agents, kinetics in the solid state, accelerated stability analysis

Unit – II

Diffusion and Dissolution: Steady state diffusion, procedures and apparatus, dissolution and drug release, diffusion principles in biologic systems, vapour sorption and transmission, thermodynamics of diffusion, diffusion and ecology.

Micromeritics: Particle size and size distribution, methods for determining particle size, particle shape and surface area, methods for determining surface area, pore size, derived properties of powders.

Unit – III

Rheology: Introduction, Newtonian system, Non Newtonian system, thixotropy, determination of rheologic properties, viscoelasticity, psychorheology, applications to Pharmacy.

Surface and interfacial phenomena: Liquid interfaces, adsorption at liquid interfaces, adsorption at solid interfaces, electrical properties of interfaces.

Colloids: Introduction, Types of colloidal systems, optical, kinetic and electric properties of colloids, solubilization.

Unit – IV

Coarse Dispersions: Suspensions, interfacial properties of suspended particles, settling in suspensions, emulsions, theories of emulsification, physical stability of emulsions, preservation of emulsions, rheologic properties of emulsions, phase equilibria and emulsion formulation, special emulsion systems.

Complexation and Protein Binding: Metal complexes, organic molecular complexes, inclusion compounds, methods of analysis, protein binding, complexation and drug action, crystalline structure of complexes, thermodynamic treatment of stability constants.

Unit – V

Solubility and Distribution Phenomenon: Solute-solvent interactions, Solubility of gases in liquids, solubility of liquids in liquids, solubility of solids in liquids, factors affecting solubility

Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Books recommended:

1. Physical Pharmacy - Martin, Swarbrick & Cammarata.
2. Physical Pharmaceutics – Schotton.
3. Remington's Pharmaceutical Sciences.
4. An introduction to Chemical Engineering - Badger and Banchero.
5. Chemical Engineering - Richardson and Coulson.
6. Introduction to Unit Operation - McCabe and Smith.
7. Theory and Practice of Industrial Pharmacy-Lachman, Lieberman and Kanig.
8. Bentley's Text Book of Pharmaceutics - Rowlin.

SOS/BPH/LC-303: PHARMACOGNOSY- I

3 Credits (2-1-0)

Unit – I

Definition, History, present status and future scope of Pharmacognosy.

Classification of Crude Drugs: Alphabetical, Morphological, Taxonomical, Pharmacological, Chemical and chemotaxonomic classification.

Unit – II

Sources of Drugs: Plants, Animals, Mineral, Marine and Plant Tissue Culture as source of drugs.

Plant Taxonomy: Distinguishing features of the following Families with the special reference to the medicinally important medicinal plants like Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Compositae, Papaveraceae, Scrophulariaceae, Cruciferae.

Unit – III

Cultivation, Collection and Processing of Herbal Drugs.

Analytical Pharmacognosy: Drug adulteration and their detection by Organoleptic, Microscopic, Physical, Chemical and Biological methods.

Unit – IV

An introduction, classification and properties of following groups of phyto constituents: Carbohydrate, Alkaloids, Glycosides, Saponins, Steroids, Flavonoids, Lignan, Coumarin, Tannins, Phenols, Lipid, Volatile oil, Gum, Mucilage and Resins.

Unit – V

Biological source, chemical constituents and uses of the following: Agar, Alginic acid, Ergot, Yeast, Male fern, Starch and Cellulose.

Study of plant tissue and ergastic cell inclusions with a view to identify and authenticate powdered crude drugs.

Preparation of Herbarium specimens of plants drugs.

Books recommended:

1. W.C.Evans, Trease & Evans, Pharmacognosy, WB Saunders Ltd., London. 16th Edition.
C.K. Kokate, Pharmacognosy, nirali Prakashan, 36th Edition.
2. Edward P., Claus, Pharmacognosy, 6th ed., Lea & Febiger, Philadelphia, 1970.
3. T.E. Wallis, Text Book of Pharmacognosy, 5th ed., CBS Publishers and Distributors, Delhi, 1985.
4. C.S. Shah & J.S. Quadry, Text Book of Pharmacognosy, 7th ed., B.S. Shah Prakashan, Ahmedabad, 1989-90.
5. Mohammad Ali, Text Book of Pharmacognosy, 7th ed. CBS Publishers & Distributors, Delhi, 1994.
6. S.S. Handa & V.K. Kapoor, Pharmacognosy, 2nd ed., Vallabh Prakashan, Delhi, 1989.
7. C.K. Kokate, Practical Pharmacognosy, 4th ed., Vallabh Prakashan, Delhi, 1994.
8. Rasheeduz Zafar & Neerja Gandhi, Practical Pharmacognosy, 1st ed., CBS Publishers & Distributors, Delhi.
9. S.H. Ansari, Essential of Pharmacognosy, 1st ed., Birla Publication Pvt.Ltd. Delhi.
10. Tylor VE, Brady LR, Robbers JE. Pharmacognosy. KM Varghese Compony, Bombay, 9th ed.

SOS/BPH/LC-304: HOSPITAL & COMMUNITY PHARMACY

3 Credits (2-1-0)

HOSPITAL PHARMACY

Unit – I

Organization & Structure: Organization of a hospital & hospital pharmacy, responsibilities of a hospital pharmacist, pharmacy & therapeutic committee, budget preparation & implementation.

Hospital formulary: Contents, preparation and revision of hospital formulary.

Unit – II

Drug store Management & inventory control: Organization of drug store, types of materials stocked, storage conditions.

Purchase and inventory control: Principles, purchase procedure, purchase order, procurement and stocking.

Drug Distribution Systems in Hospitals: Out-patient dispensing, Dispensing of drugs to inpatients, Dispensing of drugs to ambulatory patients, Dispensing of controlled drugs.

Unit – III

Central sterile supply unit & its management: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments & supply of sterile materials.

Surgical products: Definition, primary wound dressing, absorbents: surgical, cotton, surgical gauze etc, bandages, adhesive tapes, protectives, cellulosic haemostates, official dressing, absorbable sutures, catgut & other non absorbable sutures & other medical prosthetics & organ replacement materials.

Unit – IV

Blood products and plasma substitutes: Collection, processing and storage of whole human blood, concentrated human RBC, dried human plasma, protein fraction, dried human serum, human fibrinogen, human thrombin.

Plasma substitutes: Ideal requirements, PVP, Dextran

Biological Pharmacy: Glandular products, preparation of extracts or isolation of pure substances & their dosage forms- pituitary, adrenal, pancreas, thyroid, parathyroid, ovary, liver, stomach, urine

COMMUNITY PHARMACY

Unit – V

Organization and Structure: Organization & structure of retail & wholesale drug store, types of drug stores & their design, legal requirements for establishment, maintenance of drug store, dispensing of proprietary products, maintenance of records of retail & wholesale.

Books Recommended:

1. P. Nand & R.K. Khar, A Text Book of Hospital & Clinical Pharmacy, 1st ed., Birla Publications, Delhi 2003-2004.
2. S.J. Carter, Cooper & Gunn's, Dispensing for Pharmaceutical students, 12th ed. CBS. Publishers & Distributors, Delhi 1987.
3. W.E. Hassan, Hospital Pharmacy, 5th ed., Lea & Febiger, Philadelphia, 1986.

4. S.H. Merchant, J.S. Qadry, A Text Book of Hospital Pharmacy, 2nd ed. Shah Prakashan, Ahmedabad 1998.
5. P.C. Dandiya, Z.Y.K. Zafer, Afifa Zafer, Health Education & Community Pharmacy, 2nd ed., Vallabh Prakashan, Delhi 1997.
6. A. R. Gennaro, Remington, The Science & Practice, of Pharmacy vol. I & II 20th ed. (International students Edi) Lippincot-Williams & Wilkins, Philadelphia, 2000.

SOS/BPH/SEC-2: PHARMACEUTICAL ENGINEERING
(Skill Enhancement Course)

4 Credits (3-1-0)

Unit – I

Unit Operations: Introduction, basic laws, material balance

Material for construction of Pharmaceutical Plant: The nature, properties and uses of important materials employed in the construction of plants. Corrosion heat and corrosion resistant alloys and other materials, methods of reducing corrosion, protective coating.

Unit – II

Drying: Moisture content and mechanism of drying, rate of drying, classification and type of dryers, dryers for pharmaceutical industries and special drying methods, lyophilisation.

Dehumidification and Humidity Control: Basic concepts and definitions, wet bulb temperature, dry bulb temperature and adiabatic saturation temperature, psychometric chart and measurement of humidity, equipments for humidification operations.

Unit – III

Fluid Flow: Types of flow, Reynolds's number, viscosity, concept of boundary layer, valves, flow meters and measurement of flow and pressure

Material Handling Systems: air lift pump, reciprocating pump, centrifugal pump.

Unit – IV

Crystallization: Importance of crystal purity, size, shape, geometry, habit, forms and types, solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Super saturation theory and its limitations. Nucleation mechanism, crystal growth. Classification of crystallizers, tanks, agitated batch, Swenson Walker, single vacuum, circulating magma and crystal crystallizer, caking of crystals and its prevention.

Evaporation :Basic concepts of phase equilibrium, factors affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators ,accessories of evaporator

Unit – V

Distillation: Raoult's law, phase diagrams: simple, steam and flash distillations, principle of equipments for rectification, azeotropic and extractive distillation, molecular distillation

Centrifugation: Principles of centrifugation, industrial centrifuge and centrifugal sedimenters, zonal centrifuges.

Books recommended

1. W.L. McCabe, J.C. Smith & Peter Harriott, Unit Operations of Chemical Engineering, 5th ed., International Students Edition, McGraw Hill International Book Co., New Delhi, 1993.
2. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th ed., CBS Publishers & Distributors, New Delhi, 1999.

3. R.H. Perry & Don Green, Chemical Engineer's Handbook, 6th ed. McGraw Hill Inc., New Delhi, 1984.
4. Water L. Badger & Julius T. Banchero, Introduction to chemical engineering, McGraw Hill Book Company, New Delhi, 1955.
5. K. Sambamurthy, Pharmaceutical Engineering, New Age International Pvt. Ltd., New Delhi, 1997.
6. Salil K. Ghosal, Shyamal K. Sanyal & Siddhartha Datta, Introduction to chemical Engineering, Tata McGraw Hill Publishing Company Ltd., New Delhi- 1998.
7. George Granger Brown, Unit operations, I ed., CBS Publishers & Distributors, New Delhi, 1995.
8. C.V.S. Subramanian, Pharmaceutical Engineering, Vallabh Prakashan, Delhi, 2001.

BACHELOR OF PHARMACY (SEMESTER-III)
Under Choice Based Credit System (CBCS)

SOS/BPH/PC-305: PHARMACEUTICAL ANALYSIS-II (PRACTICALS)

2 Credits (0-0-2)

Titration based on theory.

SOS/BPH/PC-306: PHYSICAL PHARMACY (PRACTICALS)

2 Credits (0-0-2)

Experiments based on following topics shall be performed: Micrometrics, surface tension, rheology disperse systems, complexation, HLB value, critical micellar concentration, and kinetics- (rate constant determinations, order of reaction, Accelerated stability testing)

SOS/BPH/PC-307: PHARMACOGNOSY-I (PRACTICALS)

1. Credits (0-0-2)

1. Taxonomic study of some medicinal plants with at least one representative of each of the families covered in theory.
2. Use, care and focusing practice of microscope.
3. Microscopic measurements of cells and cell content: starch grains, calcium oxalate crystals and phloem fibres.
4. Determination of leaf constant such as stomatal index, stomatal numbers, vein-islet number, vein termination number and palisade ratio.
5. Chemical identification test of crude drugs belonging to carbohydrate and lipids.
6. Preparation of herbarium sheets.

SOS/BPH/SEC-3P: PHARMACEUTICAL ENGINEERING (PRACTICALS)
(Skill Enhancement Course)

4 Credits (0-0-4)

Experiments based on flow of fluids, evaporation, distillation, centrifugation, crystallization, drying, and humidity. Exercises on engineering drawing shall also be done.

SOS/BPH/LC-401: PHARMACEUTICAL TECHNOLOGY-I

3 Credits (2-1-0)

Unit – I

Pre-formulation study:

- a. Biopharmaceutical classification system of drugs and preformulation, Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability.
- b. Study of chemical properties of drugs like hydrolysis, oxidation-reduction, racemisation, polymerization etc. and their influence on formulation and strength of products, stabilization and stability testing protocol provision pharmaceutical products.
- c. Study of pro-drugs in solving problems related to stability, bioavailability and elegance of formulation.

Unit – II

Liquid Dosages Forms: Introduction, type, additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors etc. Manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in IP.

Semisolid Dosage Forms: Definitions, types, mechanism of drug penetration through skin, factors influencing penetration, semisolid bases and their selection, General formulation of semisolids, manufacturing procedure, evaluation and packaging.

Unit – III

Tablets: Formulation of different types of tablets, granulation methods, technology of production of granules on large-scale by various techniques, physics of tablets making, tablets compression machinery of different types and the equipments employed, evaluation of tablets.

Coating of tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process evaluation of coated tablets.

Unit – IV

Capsules: Advantage and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, methods of capsule production, soft gelatin capsule shell and capsule content, importance of base absorption and minim/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

Unit – V

SOP for different dosage forms Introduction and purpose of SOPs, benefits and types of SOPs, SOP development and format. SOP of oral liquids, tablet and capsule manufacturing

cGMP: Brief introduction of cGMP and GLP, practice of GMP and WHO guidelines. Quality assurance and quality audit.

Optimization techniques in pharmaceutical operation and processes: Introduction, optimization parameters, methods used for optimization, applications of optimization

Books recommended:

1. G. S. Banker and C. T. Rhodes. Modern Pharmaceutics. 4th edition. 2002. Maecell Dekker.
2. Syad Imtiaz Haider. Pharmaceutical Master Validation Plan. Special Indian edition. 2001, CRC Press.
3. P.P. Sharma. How to Pracitise GMPs. A plan for total quality control. 2nd edition, Vandana Publication.
4. Sidney H. Willig, Murray M. Tuckerman and William S. Hitchings IV. Good Manufacturing Practices for Pharmaceutics: A Plan for Total Quality Control. 2nd edition. Marcel Dekker.
5. A.R. Gennaro. Remington's Pharmaceutical Sciences. 18th edition. Mack Publishing Co. Pennsylvania, USA 1990.
6. Gilbert S. Banker and Cristopher T. Rhodes. Modern Pharmaceutics Drugs and Pharmaceutical Science. Series vol. 7. 1979. M&D Inc. New York.
7. Leon Lachman. The Theory and Practice of Industrial Pharmacy. 2nd edition, Indian Edition, 1976, K.M. Varghese Co., Bombay.
8. E.A. Rawlins. Bentley's Textbook of Pharmaceutics,, 8th edition, 1977, Bailliere Tindall, London, England.
9. S.J. Carter-Cooper and Gun's Tutorial Pharmacy, VI Ed., 1072, Pitman Medical.
10. Pharmacopoeia of India, 2014, Controller of Publication. Ministry of Health and Family Welfare, Govt. of India. Delhi.
11. British Pharmacopoeia, 2001.
12. A. Martin, J. Swarbrick and A. Cammarata. Physical Pharmacy. Lea and Febiger, Philadelphia.
13. D.H. Shah. SOP guidelines. 2004. Published by Business Horizons.
14. J.I.Wells, Pharmaceutical Preformulation : The Physico-chemical Properties of Drug Substances, Ellis Horwood, Chiechester (UK), 1998

SOS/BPH/LC-402: MEDICINAL CHEMISTRY- I

3 Credits (2-1-0)

The following categories shall cover general study, nomenclature of drugs, classification, structure activity relationship (SAR) (Chemical classes wherever applicable), Mode/Mechanism of action, therapeutic uses and syntheses of individually mentioned drugs

Unit – I

Hypnotics and Sedatives: Introduction, classification, SAR, barbiturates, amides and imides, alcohols, and their carbamate derivatives, aldehydes and their derivatives, mode of action, pharmacological properties and side effects. Synthesis of barbitone, phenobarbitone, cyclobarbitone, pentobarbitone sodium, thiopentone sodium.

Anticonvulsants: Introduction, classification of epilepsy, SAR, barbiturates, hydantoins, oxazolidinediones, succinamides, miscellaneous drugs. Syntheses of Phenytoin, Paramethadone and Ethosuximide

Antipsychotics: Syntheses of Chlorpromazine and Haloperidol

Unit – II

Adrenergic and cholinergic agents: Syntheses of Epinephrine, Isoproterenol, Salbutamol and Dicyclomine

Central Nervous System Stimulants: Syntheses of Nikethamide

Unit – III

Cardiac glycosides: Introduction, cardiac glycosides, SAR and mechanism of action.

Antiarrhythmic and antifibrillic drugs: classification of antiarrhythmic drugs, mechanism of action

Anti-lipemic drugs

Unit – IV

Antianginals and vasodilators: introduction, mechanism of smooth muscle vasodilatation, esters of nitrous and nitric acid, side effects. Synthesis of nitroglycerine

Antihypertensive agents: Syntheses of Propanolol, Prazocin and Hydralazine hydrochloride

Unit – V

General anaesthetic agents: Introduction, medicinal aspects of anaesthetics, mode of action, gases and volatile liquid anaesthetics, intravenous anaesthetics. Synthesis of divinyl ether, ethyl chloride, cyclopropane, thiopentone sodium, ketamine

Local anaesthetic agents: Introduction, SAR, benzoic acid derivatives, aminobenzoic acid derivatives, lidocaine derivatives, miscellaneous, mode of action. Synthesis of benzocaine, procaine hydrochloride, mepivacaine, lidocaine, cinchocaine hydrochloride

Books recommended:

1. Foye, W.C. "Principles of Medicinal Chemistry" Lea and Febiger, Philadelphia.
2. Wilson and Giswold's "Textbook of Organic, Medicinal and Pharmaceutical Chemistry" J. Lippincott Co., Philadelphia.
3. Burger's Medicinal Chemistry, Wiley-Interscience, John Wiley and Sons, New York.
4. Malone, Dyson and Purey, May's Chemistry of Synthetic Drugs.
5. Kar, A., Medicinal Chemistry, Willey Eastern Ltd., New Delhi.
6. Singh H.K., Kapoor, V. K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi

SOS/BPH/LC-403: PHARMACOLOGY- I

3 Credits (2-1-0)

Unit – I

Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, Pharmacokinetics: ADME studies

Pharmacodynamics: mechanism of drug action, dose-response relationship, bioavailability, therapeutic index, combined effect of drugs, Factors modifying drug action

Unit – II

Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, Discovery and development of new drugs.

Unit – III

Drugs acting on Autonomic Nervous System: Neurohumoral transmission, cholinergic and anti-cholinergic agents, adrenergic agonist and agonists, Neuromuscular blocking Agents. Local anesthetic agents

Unit – IV

Pharmacology of Central Nervous System: Neurohumoral transmission in the C.N.S. Pre-anaesthetic medications, General Anesthetics, Aliphatic Alcohols and disulfiram, Sedatives & hypnotics, Narcotic analgesics, NSAIDs, anti gout agents.

Unit – V

Psychopharmacological agents: anti psychotics, antidepressants, anti manics and hallucinogens, Anti-epileptics drugs. Anti-Parkinsonian drugs.

Suggested Readings/ Books:

1. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's the pharmacological Basis of therapeutics. Latest edition. Publisher Mc Graw Hill, Pergamon press.
2. Craig, C.R.&Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown.Co.
3. Katzung B.G. Basic & Clinical Pharmacology, Latest Edition. Churchill Livingstone New York.
4. Tripathi, K. D. Essentials of medical pharmacology. Latest Edition, Publisher: Jaypee, Delhi.
5. Rang, H.P. & Dale, M.M. Pharmacology. Latest edition, Publisher: Churchill living stone.
6. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. Latest edition (single volume), Publisher: Popular, Dubai.
7. S.D Seth, Textbook of Pharmacology. Latest Edition, Elsevier: New Delhi

BACHELOR OF PHARMACY (SEMESTER-IV)
Under Choice Based Credit System (CBCS)

SOS/BPH/LC-404: PHARMACOGNOSY -II

3 Credits (2-1-0)

Unit – I

Carbohydrates: Study of carbohydrate containing drugs dealing with biological sources, geographical distribution, collection, commercial production, chemical constituents, chemical test for identification, substituents, adulterants and uses of the following: Acacia, Tragacanth, Sterculia, Xanthan, Guar gum and Plantago.

Lipids: Study of lipids containing drugs dealing with biological sources, commercial production, chemical constituents, chemical test for identification and uses of the following: Arachis oil, Castor oil, Chaulmoogra oil, Sesame oil, Cotton seed oil, Almond oil, Olive oil.

Unit – II

Study of the biological sources, chemical constituents and uses of the following selected drugs from animal sources: Cantharides, Bees wax, Wool fat, Shark liver oil, Cod liver oil, Honey and Gelatin.

Source, chemical test for identity and salient microscopic features of the following fibres: Cotton, Jute, Flax, Silk, Wool, Rayon, Nylon and Asbestos.

Unit – III

Tannins: Study of tannin and tannin containing drugs like Gambir, Black catechu, Myrobalan.

Resins: Study of drugs containing Resins and Resins combination like Colophony, Podophyllum, Jalap, Cannabis, Capsicum, Myrrh, Asafoetida, Tolu balsam, Peru balsam, Benzoin and Ginger.

Unit – IV

Volatile oil: General methods of obtaining volatile oils from plants. Study of volatile oil of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Caraway, Dill, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian.

Pharmaceutical aids: Study of pharmaceutical aids like Talc, Bentonite, gelatin, Prepared Chalk and Natural colours.

Unit – V

Genetics as applied to Medicinal Herbs: Mutation, Polyploidy, Chemodemes, Hybridization.

Primary and Secondary Metabolites: Biogenesis of Carbohydrates, Volatile oil, Lipids and steroids.

Books recommended:

1. W.C.Evans, Trease & Evans, Pharmacognosy, WB Saunders Ltd., London. 16th Edition.
2. C.K. Kokate, Pharmacognosy, nirali Prakashan, 36th Edition.
3. Edward P., Claus, Pharmacognosy, 6th ed., Lea & Febiger, Philadelphia, 1970.
4. T.E. Wallis, Text Book of Pharmacognosy, 5th ed., CBS Publishers and Distributors, Delhi, 1985.

5. C.S. Shah & J.S. Quadry, Text Book of Pharmacognosy, 7th ed., B.S. Shah Prakashan, Ahmedabad, 1989-90.
6. Mohammad Ali, Text Book of Pharmacognosy, 7th ed. CBS Publishers & Distributors, Delhi, 1994.
7. S.S. Handa & V.K. Kapoor, Pharmacognosy, 2nd ed., Vallabh Prakashan, Delhi, 1989.
8. C.K. Kokate, Practical Pharmacognosy, 4th ed., Vallabh Prakashan, Delhi, 1994.
9. K.R. Khandelwal, Practical Pharmacognosy, 5th ed., Nirali Prakashan, Pune, 1998.
10. Rasheeduz Zafar & Neerja Gandhi, Practical Pharmacognosy, 1st ed., CBS Publishers & Distributors, Delhi.
11. S.H. Ansari, Essential of Pharmacognosy, 1st ed., Birla Publication PVT.LTD. Delhi.
12. Robinson T, The Organic Constituents of Higher Plants, Burge Publishing Co., Latest ed.
13. Tylor VE, Brady LR, Robbers JE. Pharmacognosy. KM Varghese Compony, Bombay, 9th ed.

BACHELOR OF PHARMACY (SEMESTER-IV)
Under Choice Based Credit System (CBCS)

SOS/BPH/ LC-405: PHARMACEUTICAL JURISPRUDENCE

3 Credits (2-1-0)

Unit – I

Pharmaceutical legislation- a brief view
Drug and pharmaceutical industry- a brief view
Pharmaceutical education- a brief view

Unit – II

An elaborate (practical oriented) study of the following
Pharmaceutical ethics
Pharmacy Act 1948
Drugs & cosmetic Act 1940 & Rules 1945

Unit – III

Medicinal & Toilet Preparations (Excise duty) Act 1940 & Rules 1955
Narcotic Drugs & Psychotropic Substances Act 1985 & Rules
Drugs Price Control Order

Unit – IV

A brief study of following with special reference to the main provision
Poison Act 1919
Drugs & Magic Remedies (objectionable advertisement) Act 1954
The Medical Termination of Pregnancy Act 1970 and Rules 1975

Unit – V

Prevention of cruelty to Animal Act 1960
Insecticides Act 1968
Patents Act 1970
Factory Act 1948
Note: The teaching of all the above acts should cover the latest amendments.

Books recommended

1. B.M. Mithal, A text Book of Forensic Pharmacy, 10th ed., Vallabh Prakashan, Delhi, 1999.
2. N.K. Jain, A textbook of Forensic Pharmacy, 3rd ed., Vallabh Prakashan, Delhi, 1995.
3. The patents Act, 1970, Published by Universal land Publishing to Pvt. Ltd, New Delhi, 2000.
4. V. Malik, Drug and Cosmetics Act, 1940. 11th ed., Eastern Book Company, Lucknow, 1998.
5. N. B. Zaveri, Patents for Future, 1st ed., Vakils Feffer and Simms Ltd., Mumbai, 2001.
6. Bare Acts & Rules and Amendments Published by Govt. of India

BACHELOR OF PHARMACY (SEMESTER-IV)
Under Choice Based Credit System (CBCS)

PRACTICALS

SOS/BPH/PC-406: PHARMACEUTICAL TECHNOLOGY-I (PRACTICAL)

2 Credits (0-0-2)

Practical pertaining to theory: formulation of tablets, suspension, emulsion, semisolids; solubility and partition coefficients.

SOS/BPH/PC-407: MEDICINAL CHEMISTRY-I (PRACTICAL)

2 Credits (0-0-2)

Synthesis of selected drugs

Books recommended

1. A.A. Siddiqui & Mohd. Ali: Practical Pharmaceutical Chemistry, New Delhi.
2. Vogel's Text Book of practical Organic Chemistry, Longman, London. New York.
3. F.G. Mann & B.C. Saunders: Practical Organic Chemistry, Longman, London and New York.

SOS/BPH/PC-408: PHARMACOLOGY- I (PRACTICAL)

2 Credits (0-0-2)

1. Study of some commonly used instrument in experimental pharmacology.
2. Preparation of different physiological solutions for experimental Pharmacology.
3. Study of the common laboratory animals use in pharmacology practical.
4. Study of different routes of administration of drugs in mice/rats.
5. Study of the pentobarbitone effect on loss of righting reflex in mice.
6. Study of the chlorpromazine effect on the locomotor activity of mice using Actophotometer.
7. Study of the apomorphine induced compulsive behavior in mice.
8. Study of the muscle relaxant property of diazepam in mice using rotarod.
9. Study of the analgesic effect of morphine in mice using tail-flick method.
10. Study of the analgesic effect of morphine in mice using hot plate method.
11. Study of the analgesic effect of morphine against acetic acid induced writhing in mice.
12. Study of the anti-convulsant activity of phenytoin against maximal electro shock induced in rats.
13. Study of the anti-convulsant property of diazepam against pentylenetetrazol-induced convulsions in mice.
14. Study of the anti-anxiety effect of diazepam in mice using elevated plus maze apparatus.
15. Study of the anxiolytic effect of diazepam in mice using mirrored chamber apparatus.
16. Study of the phenothiazine-induced catatonia in rats.
17. Study of the mydriatic effect of topically applied atropine on rabbit eye

Suggested Readings/ Books:

1. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
2. Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition, Publisher: Black well Scientific.
3. Ghosh, M.N. Fundamentals of Experimental Pharmacology. Scientific Book Agency, Kolkatta.
4. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
5. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
6. Goyal R.K., Practical in pharmacology, B.S. Shah Prakasan, Ahmedabad Punjab Technical University/B.Pharmacy/Batch 2011-12

SOS/BPH/PC-409: PHARMACOGNOSY- II (PRACTICAL)**2 Credits (0-0-2)**

1. Submission of herbarium sheets and report on common medicinal plants collected.
2. Chemical tests of fixed oils studied in theory.
3. General chemical tests for alkaloids, glycosides, steroids, flavonoids and tannins.
4. Microscopic and chemical examination of drugs containing gums, mucilage, resins and resin combinations.
5. Microscopic and physico-chemical examination of fibres and filtering aid.
6. Microscopic study of crude drugs and their powder: Mentha, Eucalyptus, Coriander, Fennel, Caraway, Dill, Linseed, Cinnamon, Ginger.

SOS/BPH/LC-501: PHARMACEUTICAL TECHNOLOGY-II

3 Credits (2-1-0)

Unit – I

Fundamentals of cosmetic science, structure and functions of skin and hair, Factors affecting health of skin and hair, Skin creams and lotions, classification of skin creams, cold, vanishing, all purpose and emollient creams, cleansing creams, foundation creams, hand creams, protective and barrier creams.

Unit – II

Preservation, performance and evaluation of cosmetic materials.

Cosmetic colours: Natural and synthetic colours including plant and animal origin colours, lakes, pigments and inorganic colours.

Dental Products: Dentifrices and mouth washes. Astringents and skin tonics.

Unit – III

Hair preparations: Shampoos, hair setting lotions, conditioners, hair tonics, hair bleaches, hair colouring dyes, permanent waving, hair straighteners, antidandruff preparations.

Face powders and makeup: Face powders, compact powder, cake make up, make up cream, Liquid make up, stick make up and liquid powder, beauty masks.

Coloured make up: Lipsticks, rouges and eye make up.

Manicure preparations: Cuticle remover, nail bleach, nail whites, nail creams, nail lacquer and enamel remover.

Unit – IV

Packaging of Pharmaceutical Products Packaging components, types of specifications and methods of evaluation, stability aspects of packaging, packaging equipments, Factors influencing choice of containers, legal and other official requirements for containers, package testing of glass, rubber closures and plastic as per IP and USP.

Unit – V

Process validation: Introduction and definitions of prospective, concurrent, retro-prospective and revalidation, Process capability and statistical evaluation of process validation data. Salient features of Process validation of Uncoated tablets, capsules, sterile process, oral liquids, ointment/cream.

Books recommended:

1. M.S. Balsam & E. Sagarin "Cosmetics and Toiletries" 2nd ed. vol. 1-3, John Wiley and Sons, New York, 1974.
2. E. Sagarin- Cosmetic Science and Technology, vol. 1-3, 2nd ed., 1974.
3. J.S. Jellinek - Formulation and Function of Cosmetics, 1970.
4. G. S. Banker and C. T. Rhodes: Modern Pharmaceutics, Second Edition, Volume 40, Marcel Dekker, Inc., New York, 1990.
5. L. Lachman, H. A. Lieberman and J. L. Kaing: The Theory and practice of Industrial Pharmacy, Vargheese Publishing House, Mumbai, 1987.
6. M. E. Aulton: Pharmaceutics, Science of Dosage Form Design.
7. E.A. Rawlins: Bentley's Textbook of Pharmaceutics, University Printing House, Oxford, 1988. D.F. Williams and W.H. Schmitt: Chemistry and Technology of the cosmetics and Toiletries Industry.

8. W.A. Poucher: Perfumes, Cosmetics and Soaps Vol. I, II and III Chapman and Hall London.
9. Packaging Pharmaceutical and Health Care, H. Lockhard.
10. Quality Control of Packaging Materials in Pharmaceutical Industry, Kharburn, Marcel Dekker, NY.
11. J.C. Mac Chesney "Packaging of Cosmetics and Toiletries" Newness-Butterworth, London, 1974.
12. Juran's Quality Control Handbook J.M. Jupron.4th Ed. Good design practices for GMP Pharmaceutical facilities. Andrew A Signature, Marcel Dekker.
13. cGMP for Pharmaceuticals. Pharma. Med. Press, I st edition by Manohar H. Potdar

SOS/BPH/LC-502: MEDICINAL CHEMISTRY -II

3 Credits (2-1-0)

The following categories shall cover general study, nomenclature of drugs, classification, structure activity relationship (SAR) (Chemical classes wherever applicable), Mode/Mechanism of action, therapeutic uses and syntheses of individually mentioned drugs.

Unit – I

Antihistaminics: Syntheses of Dimenhydrate, Antazoline, Pyrilamine maleate, Promethazine and Diphenhydramine.

Opioid analgesics: Morphine and related drugs, synthetic modifications of morphine, codeine, thebaine. Totally synthetic analgesics, morphinans. 6,7- benzomorphans, 4-phenylpiperidines, endogenous opioid peptides, opioid antagonists. Synthesis of N-methylmorphinan, pethidine, methadone and isomethadone, nalorphine

Analgesics and Anti-inflammatory agents: Syntheses of Codiene, Nalorphine, Aminopyrine, Paracetamol, Mefenamic acid, Indomethacin and Aspirin.

Unit – II

Antiamoebic agents: Emetine hydrochloride, quinoline derivatives, metal free substances, diloxanide furoate, metronidazole, organometallic compounds, acetarsol (diodohydroxyquinoline, diloxanide).

Trypanosomiasis: Drugs used for trypanosomiasis and other protozoal diseases.

Antifilarial agents: niclosamide, hexylresorcinol, diethylcarbamazine citrate, thiabendazole

Unit – III

Antifungal agents: antibiotics, griseofulvin, amphotericin, candicidine, nystatin, synthetic antifungal agents, salicyclic acid, miconazole elcomazole, tolanflate, flucotosine, dithranol and chlorphenesin

Anthelmintics drugs used in cestide infections, drugs used in trematode infections, drugs for intestinal nematode infections

Expectorants and Antitussive agents: Synthesis of Guaiphenesin

Unit – IV

Drug metabolism: General pathways of drug metabolism, phase I and phase II reactions, Phase I: oxidation, reduction and hydrolysis. Phase II: glucuronic acid conjugation, sulphate conjugation, amino acid conjugation, glutathione conjugation, acetyl and methyl conjugation.

Unit –V

Antispasmodic and anti ulcer drugs: cyclopentolate, propantheline bromide, benzhexol.

Antiparkinsonism drugs: apomorphine.

Neuromuscular blocking agents: succinylcholine chloride

Books recommended:

1. Foye, W.C. "Principles of Medicinal Chemistry" Lea and Febiger, Philadelphia.
2. Wilson and Giswold's "Textbook of Organic, Medicinal and Pharmaceutical Chemistry" J. Lippincott Co., Philadelphia.
3. Burger's Medicinal Chemistry, Wiley-Interscience, John Wiley and Sons, New York.
4. Malone, Dyson and Purey, May's Chemistry of Synthetic Drugs.
5. Kar, A., Medicinal Chemistry, Willey Eastern Ltd., New Delhi.

SOS/BPH/LC-503: PHARMACOGNOSY- III

3 Credits (2-1-0)

Unit – I

Glycoside I: Study of the biological sources, cultivation, collection commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs:

Saponins: Liquorice, Ginseng, Diocorea, Sarsaparilla and Senega.

Cardioactive drugs: Digitalis, Squill, Strophanthus, Thevetia.

Glycoside II: Study of the biological sources, cultivation, collection commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs:

Anthraquinone drugs: Aloe, Senna, Rhubarb and Cascara.

Other: Psoralea, Ammi majus, Gentian, Chirata and Quassia.

Unit – II

Biological source, preparation, identification tests and uses of the enzymes viz. Papain, Pepsin, Pancreatin, Urokinase, Penicillinase and Trypsin.

Biological source, preparation, identification tests and uses of proteins viz. Casein, Gelatin, Malt extract, Collagen, Kavach and Protamine Sulphate.

Unit – III

Primary and Secondary Metabolites: Shikimic acid pathways, Biosynthesis of cardiac glycoside, cyanogenetic glycoside, Isothiocyanate glycoside, lactone, phenol, alcohol, and aldehyde glycoside.

Introduction to different classes of plant growth regulators and their physiological role.

Unit – IV

Plant derived insecticide.

Introduction to edible vaccines and bioenhancers.

Unit – V

Drug Molecules of Marine organism: Introduction, Classification, collection and storage of marine organism, Anti viral compound, Cardio-Vascular active compound, Antitumor compound, Anti parasitic compound, Antibiotic substances, Anti-inflammatory and Antispasmodic agents and Marine toxins.

An overview of steroidal drug precursor from plants.

Books recommended:

1. W.C.Evans, Trease & Evans, Pharmacognosy, WB Saunders Ltd., London. 16th Edition.
2. C.K. Kokate, Pharmacognosy, nirali Prakashan, 36th Edition.
3. Edward P., Claus, Pharmacognosy, 6th ed., Lea & Febiger, Philadelphia, 1970.
4. T.E. Wallis, Text Book of Pharmacognosy, 5th ed., CBS Publishers and Distributors, Delhi, 1985.

SOS/BPH/DSE-1: PHARMACEUTICAL BIOCHEMISTRY
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit – I

Biochemistry and its importance in pharmaceutical Sciences.

Cell: Biochemical organization of the cell, production of cell energy, ATP and its biological significance, Donnan Effect.

Liver and Kidney function tests of biochemical importance.

Unit – II

Enzymes: Classification, nomenclature, factors affecting enzyme action, enzyme kinetics, mode and mechanism of enzyme action and inhibition, isozymes and their importance in diagnosis, enzyme immobilization.

Vitamins: Vitamins as co-enzyme and their significance, metals as co-factors.

Unit – III

Bioenergetics: Biological oxidation and reduction, respiratory chain, oxidative phosphorylation, enzyme and co-enzyme of bio-redox system.

Carbohydrate: Metabolism, Classification, glycolysis, citric acid cycle, glycogenesis, glycogenolysis, hexose monophosphate shunt (HMP), uronic acid pathway, blood sugar and its regulation, abnormalities of carbohydrate metabolism.

Unit – IV

Lipid Metabolism: Oxidation of fatty acids, biosynthesis of fats, ketogenesis and ketosis, metabolism of cholesterol, essential fatty acids, eicosanoids, phospholipids, sphingolipids, abnormalities of lipid metabolism

Metabolism of Amino Acids and Proteins: General biochemical reactions of amino acids like transamination, deamination, and decarboxylation, metabolism of sulphur containing amino acids, urea cycle, nitrogen balance.

Unit – V

Metabolism of Nucleic Acids and Protein Biosynthesis

a. Biosynthesis and catabolism of purines and pyrimidines containing nucleotide, abnormalities of nucleic acid metabolism.

b. Biosynthesis of DNA and its replication, mutation and repair mechanism, genetic diseases.

c. An introduction to genetic engineering, biosynthesis of RNA, genetic code and protein synthesis.

Books recommended

1. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, Harper's Biochemistry, 25th ed. McGraw Hill health Professions Division, New York, USA, 1998.
2. A.V.S.S. Rama Rao, Text Book of Biochemistry, 6th ed., L. K. & S. Publishers, Visakhapatnam, 1991.
3. Melson David L. Lehninger Principles of Biochemistry, 3rd ed. Macmillan worth Publishers, N. Y. USA, 2001.
3. StryerLubert, Berg Jeremy M., Tymoczko Johan L, Biochemistry, 5th ed. W. H. Freeman & Company New York, 2002.
4. M. C. Pant, Essentials of Biochemistry, 8th ed., KedarnathRamnath& Co. Publishers, Meerut, 1996.

5. C.S. Shah & J.S. Quadry, Text Book of Pharmacognosy, 7th ed., B.S. Shah Prakashan, Ahmedabad, 1989-90.
6. Mohammad Ali, Text Book of Pharmacognosy, 7th ed. CBS Publishers & Distributors, Delhi, 1994.
7. S.S. Handa & V.K. Kapoor, Pharmacognosy, 2nd ed., Vallabh Prakashan, Delhi, 1989.
8. C.K. Kokate, Practical Pharmacognosy, 4th ed., Vallabh Prakashan, Delhi, 1994.
9. K.R. Khandelwal, Practical Pharmacognosy, 5th ed., Nirali Prakashan, Pune, 1998.
10. Rasheeduz Zafar & Neerja Gandhi, Practical Pharmacognosy, 1st ed., CBS Publishers & Distributors, Delhi.
11. S.H. Ansari, Essential of Pharmacognosy, 1st ed., Birla Publication Pvt. Ltd, Delhi.
12. Robinson T, The Organic Constituents of Higher Plants, Burge Publishing Co., Latest ed.
13. Tylor VE, Brady LR, Robbers JE. Pharmacognosy. KM Varghese Compony, Bombay, 9th ed.
14. Dewick PM, Medicinal Natural Products, John Wiley & Sons Ltd., West Sussex. 3rd ed.

SOS/BPH/SEC-4: PHARMACEUTICAL INDUSTRIAL MANAGEMENT
(Skill Enhancement Course)

4 Credits (3-1-0)

Unit – I

Plant Location and layout of an Industry: Various factors affecting locational aspects, layout of building and equipment, product layout vs. process layout, compliance of pollution control measures. Elementary knowledge of Factories act.

Unit – II

Planning and Decision making: Definition, importance of planning, step involved in decision making, objectives, strategies, policies and programme.

Management by objectives: MBO process, objectives, multiplicity.

Personnel Management: Basic/ Brief idea of recruitment, placement, training, transfer, promotion and demotion, remuneration, job evaluation, human relation.

Unit – III

Production Planning and Control: Scientific purchasing, transportation, storage quality control, problems of productivity, stores organization, location of store, receiving, inspection and issue of materials: control of stores and stocks, store accounting and record.

Unit – IV

Pharmaceutical Marketing: Introduction to marketing, Channel of Distribution: wholesale, retail, departmental store, multiple shop and mail order business.

Personal selling & sales promotions: Sales forecasting: Various methods, analysis, limitations and advantages.

Principles of sales promotion, advertising, ethics of sales, merchandising, detailing.

Unit – V

Finance & Accounting: Principles and definitions of account, ledger posting and journal entries, preparation of trial balance, columns of a cash book, bank reconciliation statement, rectification of errors, profit and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes and hundies, documentary bills.

Books recommended:

1. M.C. Shukla, Business Organisation and Management, 18th ed., S. Chand & Company Ltd., New Delhi, 1995.
2. A.F. James Stones, Management, 6th ed., Prentice Hall of India Private Ltd., New Delhi, 1999.
3. Economics, 2nd ed., Tata McGraw-Hill Publishing Company Ltd., 1996.
4. H. Koontz, Heenz Weihrich, Essentials of management, 5th ed., Tata McGraw, Hill Publishing Company Ltd., New Delhi, 1998.
5. Philip Kotler, Marketing management, 9th ed., Prentice Hall of India Pvt. Ltd., New Delhi, 1999.
6. S.V.R. Subba Rao, Handbook of Pharmaceutical Marketing in India, 2nd ed., Panther Publishers Pvt. Ltd., Bangalore, 1997.
7. Mohammed Ali and Jyoti Gupta, Drug store and Business Management, 1st ed., CBS Publishers and Distributors, New Delhi, 1996.

PRACTICALS

SOS/BPH/PC-504: PHARMACEUTICAL TECHNOLOGY-II (PRACTICAL)

2 Credits (0-0-2)

Preparation of following types of cosmetic preparation based on the theory:

Creams: Cold cream, Vanishing cream, Cleansing cream, Emollient cream, All purpose cream, Foundation cream

Face powders and make-up: Face powder, Dusting powder, Compact powder, Liquid make up, Stick make up, Cake make up, Face mask, All purpose mask

Body Cosmetics: Hand & Body lotion, Hand protective cream, Peeling lotion, Corn callus preparation, Foot cream, Sunscreen Lotion

Hair Preparation: Liquid Shampoo, Cream Shampoo, Gel Shampoo, Brilliantine

Shaving Preparations: Lather shaving cream, Brushes shaving cream, After shave powder

Coloured make up: Lipstick, Lipslave, Pressed rouge, Wax based rouge, Cake mascara, Cream mascara, Eye shadow stick, Cream eye shadow, Liquid liner,

Manicure Preparations: Lacquer, Nail enamel remover,

Dental Product: Mouth wash, tooth paste

Astringent and skin tonics: Astringent stick astringent cream skin toner

Official evaluation of glass containers, plastic and rubber closures.

Books Recommended

1. E. Sagarin- Cosmetic Science and Technology, vol. 1-3, 2nd ed., 1974.
2. B. M. Mittal. Textbook of Pharmaceutical formulation. W. A. Poucher: Perfumes, Cosmetics and Soa

SOS/BPH/PC-505: MEDICINAL CHEMISTRY-II (PRACTICAL)

2 Credits (0-0-2)

Synthesis of selected drugs

Books recommended

1. A. A. Siddiqui & Mohd. Ali: Practical Pharmaceutical Chemistry, New Delhi.
2. Vogel's Text Book of practical Organic Chemistry, Longman, London. New York.
3. F.G. Mann & B.C. Saunders: Practical Organic Chemistry, Longman, London and New York.

BACHELOR OF PHARMACY (SEMESTER-III)
Under Choice Based Credit System (CBCS)

SOS/BPH/PC-506: PHARMACOGNOSY-III (PRACTICAL)

2 Credits (0-0-2)

Microscopic study of crude drugs and their powder: Senna, Rhubarb, Liquorice, Digitalis
Chemical identification test of crude drug belonging to glycoside.
Quantitative Microscopy of the crude drugs.

SOS/BPH/DSE-2P: PHARMACEUTICAL BIOCHEMISTRY (PRACTICAL)
(Discipline Centric Elective Course)

2 Credits (0-0-2)

Simple experiments on enzymes, proteins and amino acids, lipids, carbohydrates, nucleic acids
Urine analysis, blood analysis, food analysis, water analysis.

Books recommended:

1. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, Harper's Biochemistry, 25th ed. McGraw Hill health Professions Division, New York, USA, 1998.
2. A.V.S.S. Rama Rao, Text Book of Biochemistry, 6th ed., L. K. & S. Publishers, Visakhapatnam, 1991.
3. Melson David L. Lehninger Principles of Biochemistry, 3rd ed. Macmillan worth Publishers, N. Y. USA, 2001.
4. StryerLubert, Berg Jeremy M., Tymoczko Johan L, Biochemistry, 5th ed. W. H. Freeman & Company New York, 2002
5. M. C. Pant, Essentials of Biochemistry, 8th ed., KedarnathRamnath& Co. Publishers, Meerut, 1996.

SOS/BPH/LC-601: MEDICINAL CHEMISTRY- III

3 Credits (2-1-0)

The following categories shall cover general study, nomenclature of drugs, classification, structure activity relationship (SAR) (Chemical classes wherever applicable), Mode/Mechanism of action, therapeutic uses and syntheses of individually mentioned drugs

Unit – I

Steroids: Nomenclature, classification, SAR (wherever applicable) and therapeutic uses. Steroidal sex hormones and adrenal cortex hormones, oral contraceptives. Syntheses of Estradiol, Diethylstilbestrol, Hexestrol, Testosterone and Dienesterol

Unit – II

Antineoplastic agents: A study of alkylating agents and antimetabolites in therapy of neoplastic diseases. Syntheses of Methotrexate, Mephalan and Chlormabucil

Unit – III

Antitubercular agents: Nomenclature, chemical classification and mode of action. Syntheses of Isoniazid, Ethionamide and Ethambutol.

Antimalarials: Nomenclature, chemical classification and mode of action, Syntheses of Primaquin, Pyrimethamine, Dapsone and Trimethoprim.

Unit – IV

Antibiotics: Nomenclature and mode of action. Study of drugs under the following classes: Penicillin, Cephalosporin, Tetracycline (SAR included), Aminoglycosides, Chloramphenicol (SAR included).

Sulphonamides: Nomenclature, classification, mode/mechanism of action, physicochemical parameters and bacteriostatic activity and therapeutic uses. Syntheses of Sulphadiazine, Sulfacetamide and Sulfioxazole.

Unit – V

Antiviral agents: Introduction to DNA, RNA and retroviruses, viral replication, amantidine hydrochloride, interferones, acyclovir, idoxuridine, trifluorothymidine, vidarabine, cytarabine, ribavirin, methisazone, zidovudine.

Thyroid hormones and anti-thyroid drugs (L-thyroxine, propylthiouracil)

Books recommended:

1. Hansch, C., Comprehensive Medicinal Chemistry Vol I to VI, Pergarnon Press, Oxford.
2. Foye, W.C. "Principles of Medicinal Chemistry" Lea and Febiger, Philadelphia
3. Wilson and Giswold's "Textbook of Organic, Medicinal and Pharmaceutical Chemistry" J. Lippincott Co., Philadelphia.
4. Burger's Medicinal Chemistry, Wiley-Interscience, John Wiley and Sons, New York
5. Malone, Dyson and Purey, May's Chemistry of Synthetic Drugs.
6. Kar, A., Medicinal Chemistry, Willey Eastern Ltd., New Delhi.

SOS/BPH/LC-602: PHARMACOLOGY-II

3 Credits (2-1-0)

Unit – I

Pharmacology of Cardiovascular System: Digitalis and cardiac glycosides. Antihypertensive drugs, Antianginal and Vasodilator drugs, Antiarrhythmic drugs.

Unit – II

Drugs Acting on the Hemopoietic System: Hematinics Anticoagulants, Vitamin K and hemostatic agents. Fibrinolytic and anti-platelet drugs, hypolipidemic agents

Unit – III

Drugs acting on urinary system: Fluid and electrolyte balance, Diuretics

Drugs Acting on the Respiratory System: Anti-asthmatic drugs including bronchodilators. Anti-tussives and expectorants, Respiratory stimulants.

Unit – IV

Drugs Acting on Gastrointestinal Systems: Laxatives, Anti-diarrhoeal agents, antiemetics, emetics, agents controlling gastric acidity and treatment of peptic ulcers.

Unit – V

Bioassays of ADH, Digitalis, insulin, oxytocin, d-tubocurarine

Suggested Readings/ Books:

1. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. Latest Edition. Publisher Mc Graw Hill, Pergamon press.
2. Craig, C.R. & Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown.Co.
3. Katzung B.G. Basic & Clinical Pharmacology, Latest edition. Churchill Livingstone New York
4. Tripathi, K. D. Essentials of medical pharmacology. Latest Edition, Publisher: Jaypee, Delhi.
5. Rang, H.P. & Dale, M.M. Pharmacology. Latest edition, Publisher: Churchill Living stone.
6. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. Latest edition (single volume), Publisher: Popular, Dubai.
7. S.D Seth, Textbook of Pharmacology. Latest Edition, Elsevier: New Delhi

Unit – I

Alkaloids I: Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitute, adulterants, uses, diagnostic macroscopic and microscopic features of following:

Indole alkaloids: Ergot, Nux-vomica, Rauwolfia, Catharanthus.

Tropane alkaloids: Stramonium, Hyocyamus, Datura, Belladonna, Duboisia.

Quinoline and Isoquinoline alkaloids: Cinchona, Ipecac, Opium.

Pyridine alkaloids: Areca, Nicotiana, Lobelia.

Alkaloids II: Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitute, adulterants, uses, diagnostic macroscopic and microscopic features of following:

Imidazole alkaloids: Pilocarpus.

Quinazoline alkaloids: Vasaka.

Steroidal alkaloids: Ashwagandha, Kurchi.

Proto-alkaloids: Ephedra, Colchicum.

Terpenoids alkaloids: Aconite.

Unit – II

Primary and Secondary Metabolites: Biosynthesis of alkaloid like Atropine, Reserpine, Morphine.

Plant Sweeteners

Unit – III

Introduction and significance of natural antioxidants with reference to Vitamin c, Tocopherol, Flavonoids and Catechin.

Plant Bitters: Introduction, classification of bitter principle, uses of plant bitters.

Unit – IV

Role of medicinal and aromatic plants in National Economy.

Description of common terms related to medicinal plants e.g. Traditional Medicinal Plants, Indigenous Drug, Folklore medicine, botanicals, Herbal drugs, Ethnopharmacology, Phytomedicine.

Unit – V

Introduction to phytopharmaceuticals with special reference to nutraceuticals and cosmetics.

Introduction to Ayurvedic Dosage forms, classification of various dosage form, Preparation and standardization of Ayurvedic preparations such as Asavas, Arishta, Avaleha and Churna.

Books Recommended:

1. W.C.Evans, Trease & Evans, Pharmacognosy, WB Saunders Ltd., London. 16th Edition.
2. C.K. Kokate, Pharmacognosy, nirali Prakashan, 36th Edition.
3. Edward P., Claus, Pharmacognosy, 6th ed., Lea & Febiger, Philadelphia, 1970.

4. T.E. Wallis, Text Book of Pharmacognosy, 5th ed., CBS Publishers and Distributors, Delhi, 1985.
5. C.K. Kokate, Practical Pharmacognosy, 4th ed., Vallabh Prakashan, Delhi, 1994.
6. K.R. Khandelwal, Practical Pharmacognosy, 5th ed., Nirali Prakashan, Pune, 1998.
7. Rasheeduz Zafar & Neerja Gandhi, Practical Pharmacognosy, 1st ed., CBS Publishers & Distributors, Delhi.
8. S.H. Ansari, Essential of Pharmacognosy, 1st ed., Birla Publication PVT.LTD. Delhi.
9. Robinson T, The Organic Constituents of Higher Plants, Burge Publishing Co., Latest ed.
10. Tylor VE, Brady LR, Robbers JE. Pharmacognosy. KM Varghese Company, Bombay, 9th ed.
11. Dewick PM, Medicinal Natural Products, John Wiley & Sons Ltd., West Sussex. 3rd ed.
12. Ayurvedic Pharmacopoeia of India (Different Volumes).
13. Henry TA, The Plant Alkaloids, McGraw Hill, New York.
14. A.N. Kalia, Industrial Pharmacognosy.

SOS/BPH/DSE-3: PHARMACEUTICAL MICROBIOLOGY
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit – I

General Microbiology: Importance of pharmaceutical microbiology. Eukaryotes & prokaryotes (Structure of bacterial cell). Morphology and classification of bacteria, viruses, and fungi Nutrition, cultivation, isolation and identification of bacteria

Unit – II

Methods of Sterilization:

- Physical Methods: Dry heat and moist heat, design of equipment, Testing efficiency of sterilizers and their applications
- Mechanical Methods: Bacteria proof filtration. Different devices used to retain bacteria and mechanisms of bacterial filtration. Pore size determination and Bubble pressure technique
- Chemical Methods: Gaseous sterilization and factors affecting gaseous sterilization
- Radiation Methods: Ultra violet and ionization radiations. Advantages and Disadvantages,
- Sterility indicator

Aseptic Techniques: Sources of contamination and its methods of prevention. Design of aseptic area, clean area classification, laminar flow benches.

Unit – III

Immunology: Principles, antigens, antibody and haptens, immune system, cellular and humoral immunity, Antigen-antibody reactions and their applications. Active and passive immunization,

Antiseptics and Disinfectants: Definition, classification and mode of action of disinfectant, factors influencing disinfectants, evaluation of Antiseptics and Disinfectants

Unit –IV

Microbiological Assay of antibiotics & vitamins as per I.P., Sterility testing of pharmaceutical products (injectable) as per I.P., Microbial limit test for pharmaceutical products.

Unit –V

Fermentation and Industrial Microbiology: Fermentation and its design, Control of Different parameters in Fermentation process, preparation and isolation of fermentation products with special reference to Penicillins, Streptomycines, Tetracyclines, Alcohol, and Citric acid

BOOKS RECOMMENDED

- R. C Dubey, A Text Book of Microbiology, S. Chand, Publisher New Delhi.
- S. J. Carter, Cooper and Gunn's Tutorial Pharmacy. Sixth edition, pitman publishing co, London
- M. Furbisher, Fundamentals of Microbiology, 8th Edition, W. B. Saunders Company Philadelphia, USA.
- W. B. Hugo and A. D. Russell, Pharmaceutical Microbiology, Blackwell Scientific Publications, Oxford.
- Presscot and Donn, Industrial Microbiology, CBS, Publishers, Delhi.
- K. K. Kieslich (Editor). Biotechnology, Vol. 6a, Verlag chemic, Basel, Switzerland
- M. J. Pcelzar, Reid and Chan, Microbiology, TATA Mc-Graw Hill Publishing, New Delhi.

7. Prescott and Dunn, "Industrial Microbiology", McGraw Hill Book Company Inc.
8. S. J. Carter, Cooper and Gunn's dispensing for pharmaceutical students, 12th Edition CBS Publisher & Distributors, 485, Bhola Nath Nagar, Shahdara, Delhi-32
9. A. Osal, Remington's Pharmaceutical Sciences, Mack publishing company, Pennsylvania, U.S.A.

SOS/BPH/SEC-5: PHARMACEUTICAL BIOTECHNOLOGY
(Skill Enhancement Course)

4 Credits (3-1-0)

Unit –I

Immunology and Immunological Preparations. Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen–antibody reactions and their applications. Active and passive immunization, vaccines, their preparations, standardization and storage.

Unit –II

Genetic recombination: Transformation Conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal anti bodies. Study of drugs produced by biotechnology such as insulin, GH, Hbs Ag, streptokinase etc.

Unit –III

Antibiotics, Historical development of antibiotics, Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters; isolation of mutants, factors affecting rate of mutation; Design of fermentation process; Isolation of fermentation products with special reference to penicillin or vitamin B12.

Unit –IV

Enzyme immobilization, techniques of enzyme immobilization, factors affecting enzyme kinetics; Study of some of the immobilized enzymes; Immobilization of bacteria and plant cells.

Unit –V

Tissue culture (Elementary knowledge) – Animal and plant tissue culture techniques.

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. Pharmaceutical Biotechnology by S.P. Vyas and V.K. Dixit, CBS Publishers, New Delhi.
2. A Textbook of Biotechnology, 6TH edn, by R C Dubey, S. Chand Publishing, New Delhi

SOS/BPH/PC-604: MEDICINAL CHEMISTRY-III (PRACTICAL)

2 Credits (0-0-2)

Determination of partition coefficient
Synthesis of selected drugs
Spectral analysis of the drugs synthesized

Books recommended

1. A.A. Siddiqui & Mohd. Ali: Practical Pharmaceutical Chemistry, New Delhi.
2. Vogel's Text Book of practical Organic Chemistry, Longman, London. New York.
3. F.G. Mann & B.C. Saunders: Practical Organic Chemistry, Longman, London and New York.

SOS/BPH/PC-605: PHARMACOLOGY- II (PRACTICAL)

2 Credits (0-0-2)

Study of some basic instruments used for isolated tissue experiments.
To prepare the physiological salt solution used in isolated tissue experiments.
Study (identification, isolation and preparation) of some commonly used standard isolated muscle preparations used for various isolated tissue experiments.
Effect of various agonists and antagonists and their characterization using Isolated preparations like frog's
Rectus abdomens muscle and isolated ileum preparations of rat, guinea pig tracheal chain and rabbit jejunum.
To record CRC of acetylcholine using guinea pig ileum / rat intestine.
To record the CRC of histamine on guinea pig ileum/ rat intestine preparation.
To study the Anti- secretory and anti- ulcer activity using pylorus ligated rats.
Determination of pA₂ value.
To demonstrate study the ionotropic and chronotropic effects of drugs on isolated Rat/Rabbit/frog heart.
To demonstrate study the effects of drugs on normal and hypodynamic Rat/Rabbit/frog heart.
Demonstrate Blood Pressure of anaesthetized Dog/Cat/Rat: To demonstrate the effects of various drugs on the B.P. and respiration including the Vasomotor Reversal of Dale and nicotinic action of acetylcholine.

Suggested Readings/ Books:

1. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
2. Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition, Publisher: Black well Scientific.
3. Ghosh, M.N. Fundamentals of Experimental Pharmacology. Scientific Book Agency, Kolkatta.
4. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
5. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
6. Goyal R. K., Practical in pharmacology, B.S. Shah Prakasan ,Ahmedabad Punjab Technical University/B.Pharmacy/Batch 2011-12

SOS/BPH/PC-606: PHARMACOGNOSY –IV (PRACTICAL)

2 Credits (0-0-2)

Microscopy of crude drugs and their powdered: Vasaka, Vinca, Nux-vomica, Cinchona and Ephedra.

Chemical identification test of some alkaloidal drugs.

Standardization of some traditional drug formulation.

Quantitative Microscopy

SOS/BPH/DSE-4P: PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)
(Discipline Centric Elective Course)

2 Credits (0-0-2)

Preparation and sterilization of media (solid, liquid agar and broth)

Isolation of pure colonies

Staining techniques (Gram's staining, negative and simple staining)

Aseptic transfer techniques

Antibiotic assays

Sterility testing of water for injection and normal saline and other sterile pharmaceutical products

Hanging drop techniques

SOS/BPH/LC-701: PHARMACEUTICAL TECHNOLOGY- III

3 Credits (2-1-0)

Unit – I

Ophthalmic Preparations: Requirements, formulation (eye drops, ocular inserts, ophthalmic ointment), methods of preparation, containers, evaluation.

Pharmaceutical Aerosols: Definition, propellants, general formulation, manufacturing, packaging and evaluation methods, pharmaceutical applications.

Unit – II

Preformulation factors of sterile products, routes of administration, water for injection, pyrogenicity, non- aqueous vehicles, isotonicity and methods of its adjustment.

Environment control for Aseptic Techniques, source of contamination and methods of prevention, Design of aseptic area, Laminar flow bench services and maintenance. Pre-filling treatment, washing of containers and closures, sterile process validation.

Unit – III

Formulation and evaluation of Parenteral Products: Formulation details, containers and closures and selection.

Preparation of solution, suspensions and drypowders, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.

Official Sterility tests: Sterility testing of pharmaceuticals, biological indicators.

Unit – IV

Microencapsulation: Types of microcapsules, importance of microcapsules in pharmacy, microencapsulation by coacervation phase separation, multistage centrifugal process, spray drying, spray congealing, air suspension technique, coating pan and other techniques.

Stability Studies: Purpose of stability studies, determination of order of reactions, Arrhenius equation, accelerated stability studies, shelf life determination methods, ICH guidelines on stability and stability testing protocols.

Unit – V

Oral modified release dosage forms: Official definitions and classifications of modified release dosage forms, Design and development, physico-chemical, biological and pharmacokinetic properties influencing design and performance of controlled release products, material and methods used in their formulation, dose designing, in- vitro and in- vivo evaluation.

Pilot plant scale up techniques. Introduction, need and purpose of pilot plant scale up, salient features of pilot plant scale up for solid, semisolid and liquid dosage forms.

Books Recommended:

1. Gilbert S, Banker and Christopher T. Rhodes - Modern Pharmaceutics Drugs and Pharmaceutical Science Series vol. 7, 1979, M&D Inc. New York.
2. Lachman L, The Theory and Practice of Industrial Pharmacy, 2nd edition, Indian Edition, 1976, K.M.Varghese Co. Bombay.
3. Rawlins EA, Text Book of Pharmaceutics, 8th edition, 1977, Bailliere Tindall.
4. Remington's Pharmaceutical Science, 1985, Mack Publishing Co., Eastern, Pa.
5. Carter SJ, Cooper and Gun's Tutorial Pharmacy, VI Ed., 1972, Pitman Medical

6. Indian Pharmacopoeia
7. British Pharmacopoeia.
8. United state Pharmacopoeia
9. E.A. Rawlins. Bentley's Textbook of Pharmaceutics,, 8th edition, 1977, BailliereTindall, London, England
10. J.I.Wells, Pharmaceutical Preformulation : The Physico-chemical Properties of Drug Substances, Ellis Horwood, Chiechester (UK), 1998
11. S.H. Yalkowsky, Techniques of Solubilization of Drugs, Marcel Dekker, Inc., New York, USA.
12. C. Doornbos, and P. Hann, Optimization Techniques in Formulation and processing, in Encyclopedia of Pharmaceutical technology, Vol. II, J. Swarbrick and J.C. Boylan, Eds., PP. 77-160. Marcel Dekker, N.Y., 1995.
13. J. Swarbrick and J.C. Boylan, Eds., Encyclopedia of Pharmaceutical Technology Vol. 12, Marcell Dekker, N.Y., 1995, PP.1.
14. A Martin, Physical Pharmacy, 3rd Edition. B. I. Waverly Pvt. Ltd., New Delhi, India 1995.
15. R. Berry and R. A. Nash, Pharmaceutical Process Validation, Marcel Dekker, N.Y. (1993) 5. N. K. Jain (Editor), Pharmaceutical Product Development, Ist Edition, CBS Publisers and Distributer, New Delhi.

SOS/BPH/LC-702: BIOPHARMACEUTICS AND PHARMACOKINETICS

3 Credits (2-1-0)

Unit – I

Introduction to biopharmaceutics & pharmacokinetics and their role in formulation development and clinical setting. Distribution, metabolism and elimination of drugs, Biopharmaceutical study of drugs, blood level concentration, biological half life and elimination rate constant. Apparent volume of distribution.

Drug Absorption: Gastrointestinal absorption, membrane physiology, mechanism of solute transport across the cell membrane. Mechanism, physico-chemical, biological and pharmaceutical factors affecting drug absorption through GIT, techniques for GIT absorption assessment.

Unit – II

Drug Distribution: Disposition process, distribution in blood, factors affecting drug distribution (blood pH, drug pK_a and partition coefficient), physiological barriers like plasma membrane, blood barriers, CSF barrier, placental barrier to drug distribution, perfusion rate of tissue, drug tissue binding, protein drug binding (P-D), etc. Plasma protein binding, kinetics of binding, factors affecting P-D binding and therapeutic significance of P-D binding. Tissue redistribution and its significance.

Drug Biotransformation: Drug elimination process, drug metabolizing enzymes, non-microsomal enzymes, chemical pathways of drug metabolism (Phase-I and Phase-II reactions), factors affecting drug metabolism (chemical and biological), first pass/presystemic metabolism, biotransformation reaction and pharmacological activity, Pro-drug to overcome pharmaceutical and pharmacokinetic problems.

Unit – III

Drug Excretion: Renal excretion mechanisms, factors affecting renal clearance of drug, Non renal routes of drug excretion like, biliary, pulmonary, salivary, mammary, skin, etc. Total body clearance, organ clearance, hepatic clearance, renal clearance, blood and urinary excretion data in calculation of various pharmacokinetic parameters.

Bioavailability and Bioequivalence: Definitions, federal requirements, methods of determination of bioavailability using blood and urinary excretion data, Protocol design for bioavailability assessment. Methods for bioequivalence determination. In-Vivo – In- Vitro correlation

Unit – IV

Pharmacokinetics: Introduction to pharmacokinetics, basic and clinical pharmacokinetics, significance of plasma drug concentration measurement, pharmacokinetics of drug absorption (zero order and first order absorption rate constants), volume of distribution, curve fitting (method of residuals), regression procedures.

Compartment Models: Definition, Basis of Classification, Model selection criteria

One compartment open model with first order elimination kinetics, pharmacokinetics of single dose administration as applied to intravenous (rapid/bolus) and oral administration, intravenous infusion, pharmacokinetic basis of sustained release formulation.

Two compartment open model with first order elimination kinetics, pharmacokinetics of single and multiple dose administration as applied to intravenous (rapid/bolus) and oral administration, intravenous infusion, pharmacokinetic basis of sustained release formulation.

Unit – V

Non Compartment Models: Statistical moments, application in bioavailability determination, linear system pharmacokinetics, unit impulse response, Michaelis Menten equation

Dosage Regimen: Dosage regimen adjustment in patients with and without renal failure

Books recommended:

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

SOS/BPH/LC-703: PHARMACEUTICAL ANALYSIS-III

3 Credits (2-1-0)

The theoretical aspects, basic instrumentation and application of the following analytical techniques to be discussed.

Unit – I

Fundamentals and principles of spectroscopy

Validation of analytical instruments: quality of equipment, validation of equipment.

Unit – II

Flame Photometry: Origin of spectra, atomization and ionization, instrumentation, background interferences, qualitative and quantitative applications in pharmaceutical analysis.

Unit – III

X-ray Diffraction: Introduction, production and detection of X rays, Bragg's Law, identification of powder diffraction patterns.

Unit – IV

Chromatography: Basis, instrumentation and applications of GLC and HPLC.

Unit – V

Electrophoresis: Definition, free solution electrophoresis, Tiselius method, moving boundary electrophoresis, density gradient electrophoresis, zone electrophoresis, paper electrophoresis and its applications.

Books Recommended:

1. R.M. Silverstein, G. C. Bassler and T. C. Morrill, Spectrometric Identification of Organic Compounds, 5th ed., Wiley Interscience, Singapore, 1991.
2. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
3. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

SOS/BPH/DSE-5: CHEMISTRY OF NATURAL PRODUCTS
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit – I

Role of spectroscopy and chromatography in the evaluation of important phytoconstituents.

Carbohydrate: Introduction, classification, nomenclature, reaction of monosaccharides like glucose and fructose, ring structure of glucose, mutarotation. Structure determination of disaccharides (Sucrose, Lactose, Maltose), Polysaccharides (Starch and Cellulose).

Unit – II

Chemistry and pharmacological activity of terpenes like Menthol, Citral, Camphor and Limonene.

Flavones and isoflavones: Occurrence and various methods of synthesis.

Unit – III

Glycosides: Chemistry and pharmacological activity of digitoxin, digoxin, helenogenin, sennosides and diosgenin.

Coumarins: Introduction with example.

Unit – IV

Fats and Oils (Phospholipids, Glycolipids and Lipoproteins): Chemistry, hydrolysis, detergents, acid value, iodine value and saponification value etc.

Proteins and Amino acid: Introduction, classification, general methods of preparation and properties of amino acid. General nature of protein and synthesis of peptides. End group analysis.

Unit – V

Alkaloids: Chemistry and pharmacological activity of Atropine, Ephedrine, Nicotine, quinine.

Xanthine base: Structure elucidation of Caffeine, Theophylline, Theobromine, and Uric acid.

Books Recommended:

1. O.P. Agarwal, Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
2. Chatwal: Chemistry of Natural Products.
3. Indian Pharmacopoeia. The Indian Pharmacopoeia Commission, Central Indian Pharmacopoeia Laboratory, Govt. Of India. Ministry of Health and Family Welfare, Ghaziabad. Latest Edition.
4. British Pharmacopoeia. The Stationary Office on behalf of the Medicine and Health care product Regulatory Agency, London, Latest Edition.
5. De Mayo P, The Chemistry of Natural Products, 2-3, Interscience, New York.

SOS/BPH/SEC-6: CLINICAL PHARMACY AND DRUG INTERACTIONS
(Skill Enhancement Course)

4 Credits (3-1-0)

Unit – I

Introduction :Development and scope of clinical pharmacy, concept of health care team, role of clinical pharmacist as a member of health care team and his/her important functions

Clinical Pharmacokinetics and Individualization of Drug Therapy.

Recording of medication history, self medication, non-prescription drug usage, Improving patient compliance and providing patient counseling.

Unit – II

Drug Interactions: Prescription monitoring, documentation and other methods for minimizing clinically relevant drug interactions

Adverse drug reactions (ADR) and the role of clinical pharmacist in their monitoring and prevention (concepts of pharmacoepidemiology and pharmacovigilance).

Unit – III

Principles of pharmacoeconomics.

Drug used in Infancy and Elderly (Pediatrics and Geriatrics), Drug use during Pregnancy, Drug induced diseases, Therapeutic Drug Monitoring, Concept of Essential Drugs and Rational Drug Use.

Unit – IV

General Principles of Clinical Toxicology.

Interpretation of Clinical Laboratory Tests: Hematological, Pathological and biochemical investigations as marker of major organ damage and their effect on drug therapy decision.

Unit – V

Important Disorders of Organ Systems and their Management

Cardiovascular Disorders: Hypertension, Congestive heart failure (CHF).

CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression.

Respiratory Diseases: Asthma.

Gastrointestinal Disorders: Peptic Ulcer, Ulcerative colitis, Hepatitis, Cirrhosis.

Endocrine Disorders: Diabetes Mellitus and Thyroid disorders.

Infectious Diseases: Tuberculosis, Sexually transmitted diseases (STD) and AIDS

Hematopoietic Disorders: Anemias.

Neoplastic Diseases: Acute Leukaemias, Hodgkin's disease and carcinoma of breasts.

Books Recommended:

1. R. Walker, Clinical Pharmacy & Therapeutics, 2nd ed., Churchill Livingstone, N.Y. 1999.
2. D. H. Lawson, Clinical Pharmacy & Hospital Management, 1st ed., Chapman Hall, N.Y., 1980.
3. A.J. Winfield & R.M. E. R. Chards, Pharmaceutical practice, 2nd ed., Churchill livingstone, N.Y. 1999.
4. W.E. Hassan, Hospital Pharmacy, 3rd ed., Lea and Febiger, Philadelphia, USA, 1974.
5. A. R. Gennaro, Remington's the science & Practice of Pharmacy, vol. I & II, 20th ed., Lippincott William and Wilkins, Philadelphia, N.Y. 2000.

SOS/BPH/PC-704: PHARMACEUTICAL TECHNOLOGY -III (PRACTICAL)

2 Credits (0-0-2)

Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like powders, tablets, parenterals, microencapsulation etc.

Other related practical in compliance to theory.

Books recommended:

1. Gilbert S, Banker and Cristopher T. Rhodes - Modern Pharmaceutics Drugs and Pharmaceutical Science Series vol. 7, 1979, M&D Inc. New York.
2. Lachman L, The Theory and Practice of Industrial Pharmacy, 2nd edition, Indian Edition, 1976, K.M.Varghese Co. Bombay.
3. Rawlins EA, Text Book of Pharmaceutics, 8th edition, 1977, BailliereTindall.
4. Remington's Pharmaceutical Science, 1985, Mack Publishing Co., Eastern, Pa.
5. Carter SJ, Cooper and Gun's Tutorial Pharmacy, VI Ed., 1072, Pitman Medical.

**SOS/BPH/PC-705: BIOPHARMACEUTICS & PHARMACOKINETICS
(PRACTICAL)**

2 Credits (0-0-2)

Experiments based on ADME process, bioavailability, bioequivalence, protein binding, compartment models, non-linear pharmacokinetic analysis.

In-vitro evaluation of marketed products

Experiments designed for the estimation of various pharmacokinetic parameters with given data.

Statistical treatment of data

SOS/BPH/PC-706: PHARMACEUTICAL ANALYSIS-III (PRACTICAL)

2 Credits (0-0-2)

Experiment based on paper and thin layer chromatography

Estimation of potassium, sodium and calcium ions using flame photometry

Assay of multidrug formulations

BACHELOR OF PHARMACY (SEMESTER-VII)
Under Choice Based Credit System (CBCS)

SOS/BPH/DSE-6P: CHEMISTRY OF NATURAL PRODUCTS (PRACTICAL)
(Discipline Centric Elective Course)

2 Credits (0-0-2)

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

Laboratory experiments on isolation, separation, purification of caffeine, piperine, nicotine, starch, casein, sennosides etc.

Exercises on paper and thin layer chromatographic evaluation of herbal drugs.

SOS/BPH/LC-801: PHARMACOLOGY-III

3 Credits (2-1-0)

Unit – I

Drugs affecting Endocrine System: Hypothalamic and pituitary hormones. Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D. Insulin, oral hypoglycaemic agents and Glucagon, Drugs acting on the uterus

Unit – II

Chemotherapy: General Principles of Chemotherapy Sulfonamides and cotrimoxazole, Antibiotics- penicillins, cephalosporins, chloramphenicol, erythromycin, Quinolones and miscellaneous antibiotics

Unit – III

Chemotherapy: Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy and immunosuppressive agents.

Unit – IV

Preclinical and clinical Trials (Phase I, II, III and IV)

Unit – V

Autocoids: Histamine, 5-HT and their antagonists, Prostaglandins, thromboxanes and leukotrienes, Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and Substance P.

Suggested Readings/ Books:

1. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. Latest Edition, Publisher Mc Graw Hill, Pergamon press.
2. Craig, C.R.&Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown.Co.
3. Katzung B.G. Basic & Clinical Pharmacology Latest edition. Churchill Livingstone New York.
4. Tripathi, K. D. Essentials of medical pharmacology. Latest Edition, Publisher: Jaypee, Delhi.
5. Rang, H.P. & Dale, M.M. Pharmacology. Latest edition, Publisher: Churchill Living stone.
6. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. Latest edition (single volume), Publisher: Popular, India.
7. S.D Seth, Textbook of Pharmacology. Latest Edition, Elsevier: New Delhi.

SOS/BPH/LC-802: PHARMACOGNOSY-V

3 Credits (2-1-0)

Unit – I

History and development of Plant Tissue Culture, media, latest techniques to improve production of phyto-pharmaceuticals (hairy root culture, immobilization, biotransformation).

Photosensitizing agents including furanocoumarin from plants.

Unit – II

Extraction of plant material in the production of phytopharmaceutical: Maceration, hot extraction, soxhlet extraction, continuous versus batch extraction and commercial versus laboratory scale extraction.

Industrial production and utilization of Morphine, Quinine, Reserpine, Sennosides, Digitalis glycosides, Diosgenin, Menthol, Thymol and Rutin.

Unit – III

Regulatory Controls on Phytomedicine: Introduction, Standardization of phytomedicine and Herbal Dosage Forms, Indian scenario on current regulatory controls of phytomedicine.

Herbs as health food.

Unit – IV

Study of Hallucinogenic and poisonous plants, Mycotoxins and Toxic Mushrooms.

Allergens and Allergenic preparation.

Unit – V

Recent development in natural products with some examples each from anticancer, antihepatotoxic, antiviral, antioxidant, antiprotal and CNS derivative.

World- wide trade in medicinal plants and derived products with special reference to diosgenin, taxol, digitalis, tropane alkaloid containing plants, Papain, Cinchona, Ipecac, Liquorice, Ginseng, Rauwolfia and plants containing laxatives.

Books Recommended:

1. W.C.Evans, Trease & Evans, Pharmacognosy, WB Saunders Ltd., London. 16th Edition.
2. Edward P., Claus, Pharmacognosy, 6th ed., Lea & Febiger, Philadelphia, 1970.
3. S.H. Ansari, Essential of Pharmacognosy, 1st ed., Birla Publication PVT.LTD. Delhi.
4. Robinson T, the Organic Constituents of Higher Plants, Burge Publishing Co., Latest ed.
5. Tylor VE, Brady LR, Robbers JE. Pharmacognosy. KM Varghese Compony, Bombay, 9th ed.
6. Dewick PM, Medicinal Natural Products, John Wiley & Sons Ltd., West Sussex. 3rd ed.
7. Ayurvedic Pharmacopoeia of India (Different Volumes).
8. Ashutosh Kar, Pharmacognosy and Pharmacobiotechnology, New Age International Publishers.
9. WHO monograph on selected medicinal plants, vol. I & II, 1st ed.
10. R.D. Chaudhary, Herbal Drug Industry, 1st ed., Eastern Publishers, New Delhi, 1996.
11. V.D. Rangari, Pharmacognosy and Phytochemistry, Part I & II, 1st ed., Career Publication, Nasik, 2002.

12. Barz W., Reinhard E and Zenk MH, Plant Tissue Culture and its Biotechnological Application, Springer, Berlin.
13. Peach K., and Tracey M V, Modern Methods of Plant Analysis, Narosa Publishing house, New Delhi.
14. Brain K. R. And Turner T.D., The practical evaluation of pharmaceuticals, Wright-Scientechnica, Brisol.
15. Gamborg O.L., and Wetter L.R., Plant Tissue Culture methods, National Research Council of Canada, Saskatchewan.

SOS/BPH/LC-803: PHARMACEUTICAL ANALYSIS-IV

3 Credits (2-1-0)

The theoretical aspects, basic instrumentation, elements of interpretation of spectra and application of the following analytical techniques to be discussed

Unit – I

Ultra-Violet (UV) and Visible Spectrophotometry: Electronic excitation, Lambert-Beer law, deviation from Beer's law, chromophores, instrumentation, single and double beam instruments.

Unit – II

Infrared Spectrophotometry: Theory, characteristic absorbance bands of organic functional groups, interpretation of infrared absorption spectra, preparation of sample, sample cells, IR instrumentation qualitative and quantitative applications in pharmaceutical analysis.

Unit – III

Nuclear Magnetic Resonance spectroscopy: An introduction to the theory of ^1H NMR, chemical shift & spin-spin coupling, brief introduction to ^{13}C NMR.

Unit – IV

Mass Spectrometry: Introduction to mass spectra, molecular ions peak, fragmentation peak, mass spectra of some simple compounds.

Unit – V

Fluorimetry: Theory, quantitative description, experimental factors affecting fluorescence intensity, factors affecting fluorescence intensity, relationship of fluorescence to molecular structure, instrumentation, correction of spectra, pharmaceutical applications.

Books Recommended:

1. R.M. Silverstein, G. C. Bassler and T. C. Morrill, Spectrometric Identification of Organic Compounds, 5th ed., Wiley Interscience, Singapore, 1991.
2. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
3. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

SOS/BPH/DSE-7: NOVEL DRUG DELIVERY SYSTEM
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit – I

Concept & Models for NDDS: Introduction, advantages and disadvantages of novel drug delivery Systems, selection of drugs and polymers.

Polymer sciences: Introduction, classification, properties and pharmaceutical applications of polymers, Biodegradable and Nonbiodegradable polymers.

Unit – II

Drug Targeting: Importance, concept, approaches, biological process and events involved in drug targeting, types and levels of targeting.

Biopharmaceutical classification system of drugs: concept of BCS classification, need and application in novel drug delivery with its role in selection of drugs.

Unit – III

Oral Drug Delivery Systems: Concepts, design and introduction to oral controlled release DDS (including floating and high density systems, osmotic pumps etc.), Mucoadhesive DDS.

Transdermal Drug Delivery Systems: Introduction to transdermal drug delivery systems, basic concept and applications.

Unit – IV

Targeted Drug Delivery Systems: Introduction, definition, advantages, disadvantages and applications of Liposomes, niosomes, pharmacosomes, resealed erythrocytes, magnetic microspheres, nanoparticles, and microspheres.

Unit – V

Methods of improving solubility and dissolution: Need of modifying solubility and dissolution, classification of methods, Importance of phase solubility study, Brief introduction to methods like cyclodextrin complexation, eutectic mixtures, solid dispersions and lipid complexation etc.

Miscellaneous drug delivery systems like implants, IUDs etc.

Recommended books:

1. Robinson, J.R. & Lee, V.H.I.,: Controlled and Novel Drug Delivery Marcel Dekker, New York and Basel.
2. Jain, N.K.: Controlled and Novel Drug Delivery, CBS, New Delhi.
3. Jain, N.K. Advances in Novel and Controlled Drug Delivery.
4. Roseman, T.J.: Controlled Release Drug Delivery Systems, Marcel Dekker New York
5. Goldberg : Targeted Drugs.
6. Bruck, S.D., Controlled Drug Delivery , Vol. I & II.
7. Juliano, R.L. : Drug Delivery Systems.
8. Jain, N.K.: Progress in Controlled and Novel Drug Delivery, CBS Publisher, New Delhi.
9. Y.W. Chein, Novel Drug Delivery System, Vol 50, Marcel Dekker, NY.
10. YW Chein, Transdermal Controlled Systemic Medications, Vol 31, Marcel Dekker, NY.
11. S, E. Mathiowitz, Bioadhesive DD Vol 98, Marcel Dekker, NY.

12. K.S.E. Su, Nasal System Drug Delivery, Vol 39, Marcel Dekker, NY.
13. P Tyle Drug Delivery Devices, Vol 32, Marcel Dekker, NY.
14. P.J. Tarcha, Polymers for Controlled Drug Delivery, CRC Press.
15. Vyas, Pharmaceutical Biotechnology, CBS, Delhi.
16. E.J. Vandamme, Biotechnology of Industrial Antibiotics, Marcel Dekker, NY.
17. E.J. McNally, Protein Formulation & Delivery, Vol 99, Marcel Dekker, NY.
18. M.H. Rubinstein, Drug Targeting, John Wiley, NY.

BACHELOR OF PHARMACY (SEMESTER-VIII)
Under Choice Based Credit System (CBCS)

SOS/BPH/DSE-8: DRUG DESIGN
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit – I

Drug and receptor: Receptor theories, forces involved in drug receptor binding, free energy change, enthalpy change, electrostatic interaction, ionic bond, charge – dipole & dipole, dipole interactions, dispersion forces.

Unit – II

QSAR: History of quantitative structure-activity relationships; hydrophobic parameters, electronic and steric parameter used in QSAR study; Hansch and Free Wilson methods of QSAR analysis. An introduction to recent trends in QSAR.

Unit – III

Molecular modeling: Introduction, methods, design of ligand, receptor structure known, unknown receptors

Unit – IV

Bioinformatics and its role in drug discovery: An introduction

An introduction to structure based drug design

Analog design: An introduction

Unit – V

Design of enzyme inhibitors: dihydrofolate synthetase, dihydrofolate reductase, Introduction to Introduction to Combinatorial synthesis and Antisense oligonucleotides
Introduction to Computational chemistry

Books recommended:

1. Foye, W.C. "Principles of Medicinal Chemistry" Lea and Febiger, Philadelphia.
2. Wilson and Giswold's "Textbook of Organic, Medicinal and Pharmaceutical Chemistry" J. Lippincott Co., Philadelphia.
3. Burger's Medicinal Chemistry, Wiley-Interscience, John Wiley and Sons, New York.
4. Gareth Thomas, Fundamentals of Medicinal Chemistry, John Wiley and Sons, New York.
5. Veerapandian, Structure based drug design, New York Marcel Dekker, Inc., ISBN: 0824798694.
6. David young, Computational Chemistry, Wiley-Inter Science, John Wiley and Sons, New York.

SOS/BPH/DSE-9-11: ELECTIVE SUBJECTS
(Discipline Centric Elective Course)

ELECTIVE SUBJECTS

List of elective subjects

- 1. GMP, Quality Assurance and Validation (SOS/BPH/DSE-9).**
- 2. Packaging Technology (SOS/BPH/DSE-10).**
- 3. Herbal Drug Technology (SOS/BPH/DSE-11).**

Students are required to choose one elective subject from above list.

SOS/BPH/PC-804: PHARMACOLOGY-III (PRACTICAL)

2 Credits (0-0-2)

To calculate the pA₂, value of mepyramine or chlorpheniramine using histamine as agonist on guinea pig / rat ileum.

To estimate the strength of the test sample of agonist/drug (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin, etc.) using a suitable isolated muscle preparation employing Matching bioassay, interpolation bioassay, Bracketing assay and multiple point bioassay.

To study the effect of drug/ drug on intestinal motility in rat/mice.

To carry out bioassay of heparin sodium as per IP (2010)

To carry out bioassay of Streptokinase as per IP (2010)

To carry out bioassay of Insulin as per IP (2010)

To record the CRC of oxytocin using rat uterus preparation

Suggested Readings/ Books:

1. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
2. Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition, Publisher: Black well Scientific.
3. Ghosh, M.N. Fundamentals of Experimental Pharmacology. Scientific Book Agency, Kolkatta.
4. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
5. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
6. Goyal R. K., Practical in pharmacology, B.S. Shah Prakasan, Ahmedabad .
7. Indian pharmacopeia 2010, Govt. of India

SOS/BPH/PC-805: PHARMACOGNOSY -V (PRACTICAL)

2 Credits (0-0-2)

Extraction, isolation of medicinally important phytoconstituents.

Chromatography and Characterization of isolates.

Herbal drug standardization techniques.

Microscopic evaluation of churnas, polyherbal preparations.

WHO standardization methods for herbo-mineral preparations

SOS/BPH/PC-806: PHARMACEUTICAL ANALYSIS-IV (PRACTICAL)

2 Credits (0-0-2)

Experiment based on UV Visible spectrophotometer.

Assay of multi drug formulations.

Books Recommended

1. R.M. Silverstein, G. C. Bassler and T. C. Morrill, Spectrometric Identification of Organic Compounds, 5th ed., Wiley Interscience, Singapore, 1991.
2. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4thed., CBS Publishers & Distributors, New Delhi, 1997.
3. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

BACHELOR OF PHARMACY (SEMESTER-VIII)
Under Choice Based Credit System (CBCS)

ELECTIVE SUBJECTS

SOS/BPH/ DSE-9: GMP, QUALITY ASSURANCE AND VALIDATION
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit- I

Concept of CGMP, Total Quality Management, GLPS, ISO 9000.

Unit- II

Premises, location design, plant layout, construction, maintenance of sterile areas, control of contamination.

Unit- III (12 Hrs.):

Equipment selection.

Unit- IV (12 Hrs.):

Raw material purchase specification.

Unit- V (12 Hrs.):

In process quality controls

BACHELOR OF PHARMACY (SEMESTER-VIII)
Under Choice Based Credit System (CBCS)

ELECTIVE SUBJECTS

SOS/BPH/ DSE-10: PACKAGING TECHNOLOGY
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit- I

Glass containers for pharmaceuticals: Glass types, their manufacture, chemical performance, testing and quality control.

Plastic containers for pharmaceuticals: Classification of plastic, plastic polymers and their physicochemical, mechanical and biological properties; Additives and fabrication processes. Plastic containers for parenterals and transfusion sterile drip kits, quality control testing, biological toxicity.

Unit- II

Paper and paper board: Types of paper, folding cartons, quality control testing of paper and paper board.

Metal containers: Aluminium and tin plate, drums. Collapsible tubes and aerosol containers, lacquering, coating and lining.

Unit- III

Caps and closures: Types of caps, closure, liners, child resistant caps. Elastomeris closures for parenterals, classification of elastomers, physical, chemical and biological properties and their quality control.

Labels and labeling: Types of labels, adhesives, inkjet and bar coding.

Unit- IV

Flexible packaging: types of films, Co-extruded films, foils, coating and laminates, shrink and stretch films.

Corrugated and solid fiber boards and boxes: Types of corrugation methods.

Transit worthiness of package.

Unit- V

Packaging machinery including strip packaging, form, fill and seal machines, liquid and solid filling machines, capping machines.

Product-package compatibility: Stability of product, packaging selection and development criteria.

Tamper evident packaging systems.

BACHELOR OF PHARMACY (SEMESTER-VIII)
Under Choice Based Credit System (CBCS)

ELECTIVE SUBJECTS

SOS/BPH/ DSE-11: HERBAL DRUG
(Discipline Centric Elective Course)

3 Credits (2-1-0)

Unit-I

Chemical and spectral approaches to simple molecules of natural origin.

Concepts of stereoisomerism taking examples of natural products

Unit-II

Chemistry, biogenesis and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes and triterpenoids.

Carotenoids: Carotenes, vitamin A, xanthophylls of medicinal importance.

Unit-III

Glycosides: Chemistry and biogenesis of digitoxin, digoxin, hederagenin, sennosides and diosgenin.

Alkaloids: Chemistry, biogenesis and pharmacological activity of atropine and related compounds, quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids

Unit-IV

Chemistry and biogenesis of medicinally important lignans and quassinoids, flavonoids.

Natural allergens, photosensitizing agents and fungal toxins.

Unit-V

An introduction to plant vaccines, plant bitters and sweeteners.

Herbal constituents in cosmetics.

Marine Pharmacognosy: Novel medicinal agents from marine sources.