FACULTY OF LIFE SCIENCES

SYLLABUS

for

BACHELOR OF PHARMACY

(Under Credit Based Continuous Evaluation Grading System)

(Semester: I - VIII)

Examinations: 2015-16

GURU NANAK DEV UNIVERSITY AMRITSAR

BACHELOR OF PHARMACY (SEMESTER SYSTEM)
(Under Credit Based Continuous Evaluation Grading System)

SCHEME FOR FIRST SEMESTER:

Sr. No	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credit
1.	PHL-101	Pharm. Chem.–I: Organic Chemistry	2	1	0	3
2.	PHL-102	Pharm. Chem.–II: Inorganic Chemistry	2	1	0	3
3.	PHL- 103	Pharmaceutics–I: Introduction to Pharmacy	2	1	0	3
4.	PHL-104	Pharmacology I: Human Anatomy and Physiology	2	1	0	3
5.	PBL-121	Punjabi Compulsory **OR**	2	0	0	2
	PBL-122	Mudhli Punjabi / mFllpj`bl	2	0	0	2
6.	PHL-105	Pharmacognosy–I	2	1	0	3
7.	PHP-106	Pharm Chemsitry–III: Organic Chemsitry	0	0	1.5	1.5
8.	PHP-107	Pharm Chemsitry–IV: Inorganic Chemsitry	0	0	1.5	1.5
9.	PHP-108	Pharmaceutics–II: Introduction to Pharmacy	0	0	1.5	1.5
10.	PHP-109	Pharmacology–II: Human Anatomy and Physiology	0	0	1.5	1.5
11.	PHP-110	Pharmacognosy–II	0	0	1.5	1.5
					Total Credits:	**24.5**

Note: (1) Lecture/tutorial: One lecture hour per week = One Credit
(2) Practical: two hours per week = One credit

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SECOND SEMESTER:

Sr. No	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credit
1.	PHL111	Pharm. Chem.–V: Organic Chemistry	3	1	0	4
2.	PHL112	Pharm. Chem.–VI: Analytical Chemistry	3	1	0	4
3.	PHL113	Computer Applications–I	3	1	0	4
4.	PHL114	Mathematics	3	1	0	4
5.	PBL131	Punjabi Compulsory **OR**	2	0	0	2
	PBL132	Mudhli Punjabi / mFlI pj`bl	2	0	0	2
6.	PHP116	Pharm. Chem.–VII: Organic Chemistry	0	0	2	2
7.	PHP117	Pharm. Chem.–VIII: Analytical Chemistry	0	0	1.5	1.5
8.	PHP118	Computer Applications–II	0	0	1.5	1.5
9.	PHP119	Pharmaceutics III: Engineering Drawing	0	0	2	2
				Total Credits:		**25**

Note: (1) Lecture/Tutorials: One Lecture Hour Per Week = One Credit.
(2) Practical: Two Hrs. Per Week = One Credit.

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THIRD SEMESTER:

S.No	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credit
1.	PHL-120	Pharm. Chem.–IX: Physical Chemistry	2	1	0	3
2.	PHL-121	Pharmaceutics–IV: Engineering Operations	2	1	0	3
3.	PHL- 122	Pharmacology–III: Human Anatomy and Physiology	2	1	0	3
4.	PHL-123	Pharmacology–IV: Pathology	2	1	0	3
5.	PHL-124	Pharmacognosy–III	2	1	0	3
6.	*ESL-220	Environmental Studies (Compulsory)	3	0	0	3
7.	PHP 126	Pharm. Chem.–X: Physical Chemistry	0	0	1.5	1.5
8.	PHP-127	Pharmaceutics–V: Engineering Operations	0	0	1.5	1.5
9.	PHP-128	Pharmacology–V: Human Anatomy and Physiology	0	0	1.5	1.5
10.	PHP-130	Pharmacognosy–IV	0	0	1.5	1.5
					Total Credits	**24**

Note: (1) Lecture/tutorial: One lecture hour per week = One Credit
(2) Practical: two hours per week = One Credit

***Note:** Credits will not be included in SGPA.

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FOURTH SEMESTER:

SR. No:	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credits
1	PHL 131	Pharm. Chem.–XI: Pharmaceutical Analysis	2	1	0	3
2	PHL 132	Pharm. Chem.–XII: Biochemistry	2	1	0	3
3	PHL 133	Pharmaceutics–VI: Cosmeticology and Formulation Development	2	1	0	3
5	PHL 134	Pharmacology–VII	2	1	0	3
6	PHL 135	Pharmacognosy–V	2	1	0	3
7	PHP 136	Pharm. Chem.–XIII: Pharmaceutical Analysis	0	0	1.5	1.5
8	PHP 137	Pharmaceutics–VIII: Cosmeticology and Formulation Development	0	0	1.5	1.5
9	PHP 138	Pharm. Chem.–XIV: Biochemistry	0	0	1.5	1.5
10	PHP 139	Pharmacology–VIII	0	0	1.5	1.5
11	PHP 140	Pharmacognosy–VI	0	0	1.5	1.5
					Total Credits	**22.5**

Note: (1) Lecture/Tutorials: One lecture hour per week = One Credit.
(2) Practical: Two Laboratories per week = One Credit.

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FIFTH SEMESTER

S. No.	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credits
1.	PHL141	Heterocycles, Carbohydrates, Proteins and Nucleic Acids	2	1	0	3
2.	PHL142	Biological Pharmacy	2	1	0	3
3.	PHL143	Physical Pharmacy	2	1	0	3
4.	PHL144	Pharmacognosy	2	1	0	3
5.	PHP145	Heterocycles, Carbohydrates, Proteins and Nucleic Acids	0	0	1.5	1.5
6.	PHP146	Biological Pharmacy	0	0	1.5	1.5
7.	PHP147	Physical Pharmacy	0	0	1.5	1.5
8.	PHP148	Pharmacognosy	0	0	1.5	1.5

***Interdisciplinary Course(s)**					06
				Total Credits	**24**

Note: (1) Lecture/tutorial: One lecture hour per week = One Credit
(2) Practical: two hours per week = One Credit

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SIXTH SEMESTER

S.No.	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credits
1.	PHL149	Medicinal Chemistry	2	1	0	3
2.	PHL150	Pharmaceutical Technology–I	2	1	0	3
3.	PHL151	Hospital Pharmacy	2	1	0	3
4.	PHL152	Pharmacology–II	2	1	0	3
5.	PHL153	Pharmacognosy (Chemistry of Natural Products)	2	1	0	3
6.	PHP154	Medicinal Chemistry	0	0	1.5	1.5
7.	PHP155	Pharmacology–II	0	0	1.5	1.5
8.	PHP156	Pharmacognosy	0	0	1.5	1.5
9	PHP157	Pharmaceutical Technology (Industrial Tour/Industrial Training)	0	0	1.5	1.5

***Interdisciplinary Course(s)**					06
				Total Credits	**27**

Note: (1) Lecture/tutorial: One lecture hour per week = One Credit
(2) Practical: two hours per week = One Credit

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SEVENTH SEMESTER

S. No.	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credits
1.	PHL157	Medicinal Chemistry-II	2	1	0	3
2.	PHL158	Pharmaceutical Technology-II	2	1	0	3
3.	PHL159	Pharmaceutical Management	2	1	0	3
4.	PHL160	Pharmacology	2	1	0	3
5.	PHL161	Pharmaceutical Biotechnology	2	1	0	3
6.	PHP162	Pharmaceutical Technology–II	0	0	1.5	1.5
7.	PHP163	Pharmacology	0	0	1.5	1.5
8.	PHP164	Pharmaceutical Biotechnology	0	0	1.5	1.5

Interdisciplinary Course(s)					06
				Total Credits	**25.5**

Note: Lecture/tutorial: One lecture hour per week = One credit
Practical: two hours per week = One credit

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EIGHTH SEMESTER

S. No.	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credits
1.	PHL164	Medicinal Chemistry-III	2	1	0	3
2.	PHL170	Pharm. Chem. XV: Pharmaceutical analysis	2	1	0	3
3.	PHL166	Pharmacology	2	1	0	3
4.	PHL167	Pharmacognosy	2	1	0	3
5.	PHL168	Pharmaceutical Jurisprudance	2	1	0	3
6.	PHL169	Pharmacokinetics & Biopharmaceutics	2	1	0	3
7.	PHP170	Pharmacology	0	0	1.5	1.5
8.	PHP171	Pharmacokinetics & Biopharmaceutics	0	0	1.5	1.5
9.	PHP172	Pharmacognosy	0	0	1.5	1.5
					Total Credits	22.5

Note: Lecture/tutorial: One lecture hour per week = One credit
Practical: two hours per week = One credit

BACHELOR OF PHARMACY (SEMESTER-I)
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PHL101: Pharmaceutical Chemistry-I: Organic Chemistry

3 Credits (2-1-0)

1. **Structure and Properties:** Electronegativity. Dipole moment, Inductive and field effects. Covalent bonding. Hybridization, Multiple bonds. Bond lengths, bond angles and bond energies. Delocalized chemical bonding. Hyperconjugation. Tautomerism. Hydrogen bonding. Addition compounds. Organic acids.
2. **Stereochemistry (Basic Concepts):** Optical activity, Chirality, Enantiomers, Diastereomers, Relative and absolute configuration. D/L and R/S nomenclature. Racemic mixture and resolution. Geometrical isomerism. E/Z system of nomenclature. Conformations in open chain systems.
3. **Alkanes:** Nomenclature, Physical properties, Industrial source and Preparation. Halogenation, combustion and pyrolitic reactions.
4. **Cycloalkanes:** Nomenclature, Physical properties, Industrial source and Preparation. Bayer's Strain theory, Conformations of cyclohoxanes and its monosubstituted derivatives.
5. **Alkenes, Dienes and Alkynes:** Nomenclature, physical properties, industrial source preparation and Electrophilic, and free radicals addition reactions. Diels-Alder reaction.
6. **Alcohols: Alkyl Halides and Ethers:** Nomenclature, General methods of preparation, physical properties, chemical reactions and applications.
7. **Aldehydes and Ketones :** Structure, nomenclature, physical properties, industrial source, preparation and reactions. Acid/base promoted halogenation of ketenes. Active Methylene compounds: Ethyl acetoacetate and diethyl malonate: synthesis and applications in organic synthesis. Michael, Mannich, Grignard, Reformatsky, Wittig and Perkin reactions. Aldol, Knoevengal and Bonzoin condensations.

Books Recommended (Latest editions unless specified):

1. R.T. Morrison and R.N. Boyd. Organic Chemistry, Allyl and Bacon Inc., Boston, USA.
2. I.L. Finar, Organic Chemistry, Vol. I and II, ELBS, Longman.
3. P. Sykes, A Guidebook to Mechanisms in Organic Chemistry, Orient Longman, New Delhi.

Suggested Readings:

1. J. March, Advanced Organic Chemistry, Reaction, Mechanisms and Structure, Wiley Eastern , New Delhi.
2. G. Solomon and C. Fryhle, Organic Chemistry, John Wiley & Sons, 1992.
3. S.H. Pine, Organic Chemistry, McGraw Hill Book.

BACHELOR OF PHARMACY (SEMESTER-I)
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PHL102: Pharmaceutical Chemistry-II: Inorganic Chemistry

3 Credits (2-1-0)

An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals chloride, sulphate and special test if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia.

1. **Acids and Bases:** Buffers, Water.
2. **Gastrointestinal Agents:** Acidifying agents, Antacids, Protectives and Adsorbents, Cathartics.
3. **Major Intra- and Extra-cellular Electrolytes:** Physiological ions. Electrolytes used for replacement therapy.
4. **Essential and Trace Elements:** Transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements.
5. Cationic and anionic components of inorganic drugs useful for systemic effects.
6. **Topical Agents**: Protectives, Astringents and Anti- infectives.
7. **Gases and Vapours:** Oxygen, Anesthetics and Respiratory stimulants.
8. **Dental Products:** Dentifrices, Anti-caries agents.
9. Complexing and chelating agents used in therapy.
10. **Miscellaneous Agents:** Sclerosing agents, expectorants, emetics, poisons and antidotes, sedatives etc. Pharmaceutical Aids Used in Pharmaceutical Industry. Anti-oxidants,preservatives, filter aids, adsorbents, diluents, excipients, suspending agents, colorants etc.
11. **Inorganic Radio Pharmaceuticals**: Nuclear radio-pharmaceuticals, Reactions, Nomenclature, Methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.

Books Recommended (Latest editions unless specified):

1. J. H. Block, E. Roche, T.O. Soine and C.O. Wilson, Inorganic Medicinal and Pharmaceutical Chemistry, Lea & Febiger, Philadelphia, PA, USA.
2. L. M. Atherton, Bantley and Drivas,S Text Book of Pharmaceutical Chemistry, Oxford University Press, Delhi.

Suggested Studies (Latest Editions):

Pharmacopoeias of India, Ministry of Health, Govt. of India (Latest Edition).
A. H. Beckett and J. B. Stenlake, Practical Pharmaceutical Chemistry, Part-I, The Athlons Press, University of London, London.

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PHL103: Pharmaceutics-I: Introduction to Pharmacy

3 Credits (2-1-0)

1. **Orientation and Historical Background of Pharmaceutical Profession**: Historical background, evolution, practice and future of pharmaceutical profession. Professional ethics and role of pharmacist in community healthcare and new drug development. Official compendia with special reference to Indian Pharmacopoeia.
2. **The Prescription**: Reading and understanding of prescription, modern methods of prescribing, common Latin abbreviations.
3. **Extraction and Galenicals**: Methods of extraction namely maceration, percolation and digestion. Various extractives namely infusions, decoctions, tinctures, soft and dry extract.
4. **Metrology and Posology**: Units of weight and volume in metric system. Simple calculations involved in preparing solutions of solid in liquid or liquids in liquids. Method of alligation. Calculation of dose for children.
5. **Dosage Forms**: Classification of dosage forms. Formulation considerations in preparation of liquid dosage forms like aromatic waters, syrups, elixrs, glycerites, spirits, lotions, mucilages, liniments, applications, mouthwashes, gargles, and enemas. Isotonicity calculations involved in preparation of eye and eardrops. Powder dosage forms: Bulk powders for internal and external use. Insufflations, effervescent powders.
6. **Pharmaceutical Additives**: Brief discussion on diluents, vehicles, ointment bases, preservatives, antioxidants, organoleptic additives and their applications.
7. **Incompatibility in Prescription:** Physical and chemical incompatibilities, inorganic incompatibilities including incompatibilities of metals and their salts, non-metals, acids, and alkalis. Organic incompatibilities including study of structural and chemical factors and factors affecting chemical reaction, study of important specific organic salts, urine bases, alkaloids, pyrazolone derivatives, amino acids, quaternary ammonium compounds, carbohydrates, glycosides, enzymes, narcotics, sulphonamides, antihistamines, local anesthetics, dyes, surface active agents, correction of incompatibilities.

Books Recommended: (Latest editions unless specified):

1. Remington, 21st Edition, Beringer, P., Gupta, P. K. et al. Eds, B. I. Publications Pvt. Ltd. (India Distributors), Lippincott, Williams & Wilkins Publishers.
2. S.J. Carter, Dispensing for Pharmaceutical Students, 12th Edition, CBS Publishers and Distributors, Delhi, India, 1987.
3. Gilbert S. Banker and Christopher T. Rhodes, Modern Pharmaceutics, 2nd Edition, Marcel Dekker Inc., 1990.
4. Pharmacopoeia of India, Government of India, Ministry of Health, Delhi, India, 1996.

5. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th Edition, CBS Publishers and Distributors, Delhi, India, 1986.
6. Howard C. Ansel and Nicholas G. Popvich, Pharmaceutical Dosage Forms and Drug Delivery System, 5th Edition, Lea and Febiger, Pennsylvania, U.S.A., 1990.
7. E.W. Martin, Husa's Dispensing of Medication, 8th Edition, Mack Publishing Co., Pennsylvania, U.S.A. 1982.
8. Stoklosa M J and Ansel H C, Pharmaceutical Calculations, 10th Edition, B.I Waverly Pvt. Ltd., New Delhi, 1996.

PHL104: Pharmacology-I: Human Anatomy & Physiology

3 Credits (2-1-0)

1) Scope of anatomy and physiology and basic medical terminology used in these subjects. Structure of cell, its components and their functions. Elementary Tissues of the Human Body: Epithelial, connective, muscular and nervous tissues, their sub-types and their characteristics.
2) Anatomy and Physiology with emphasis to various systems.
   - 2.1 Osseous System: Structure, composition and functions of skeleton, Classification of joints, types of movements of joints, Disorders of joints.
   - 2.2 Skeletal Muscles: Gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.
   - 2.3 Haemopoietic System: Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.
   - 2.4 Lymph and Lymphatic System: Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.
   - 2.5 Cardiovascular System: Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its' regulation. Brief outline of cardiovascular disorder like hypertension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

Books Suggested: (Latest editions unless specified):

1. Tortora, G.J. and Grabowski, S.R. Principles of Anatomy and Physiology. Collins College Publishers, Luciano, New York.
2. Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. W.B. Sanders Co.
3. Ganong, W.F. Review of Medical Physiology. Prentice Hall.
4. Chatterjee, C.C. Human Physiology, Medical Allied Agency, Calcutta.
5. Eroschenko, V.P. Difore's Atlas of Histology with functional correlations. Lippincott Williams & Williams.
6. Difore, S.H. Atlas of Normal Histology. Lea & Febiger, Philadelphia.
7. Ghai, C.L. A Textbook of Practical Physiology Jay Pee Brothers, New Delhi.

BACHELOR OF PHARMACY (SEMESTER-I)
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PBL121: Punjabi (Compulsory)
ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

p`T-km Eq p`T-psqk~

Credits: 2–0–0

(I) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) grmK isG ms`iPr : gt`r
(E) sj`n isG : pT`x dl Dl
(e) krq`r isG dgl : acl Efl v`ll grg`bl
(kh`xl-s`r, ivS`-vsq, kh`xl-kl`, kh`xlk`r)

2. grmKl ErQgr`Pl dl jgq, (plql; mh`rnl; ibdl, itpl q EDk); ivr`m icn, Sbd jV (SD-ESD)

(II) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) sqK isG Dlr : s~Jl kD
(E) klvq isG ivrk : aj`V
(e) mihdr isG srn` : jQd`r mkd isG
(kh`xl-s`r, ivS`-vsq, kh`xl-kl`, kh`xlk`r)

1. lK rcn` (jlvnl-prk, sm`jk Eq clq iviSE~ aq):
10 lK ilKv`ax (kl`s ivc Eq Gr lel EiBE`s)

(III) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) pm pk`S : m`V` bd`
(E) glz`r isG sD : klCx
(e) mhn Bf`rl : Gtx`
(s) virE`m isG sD : dldl
(kh`xl-s`r, ivS`-vsq, kh`xl-kl`, kh`xlk`r)

2. pr` pV k pSn~ d aqr dx`
(E`qm En`qm psqk d kh`xl B`g ivcl 15 pirE~ d EiBE`s krv`ax)

BACHELOR OF PHARMACY (SEMESTER-I)
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PBL-122: Mudhli Punjabi
ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Punjabi Compulsory)

2–0–0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ,
   ਗੁਰਮੁਖੀ ਲਿਪੀ
   ਗੁਰਮੁਖੀ ਲਿਪੀ : ਬਣਤਰ ਅਤੇ ਤਰਤੀਬ

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ
   ਸੁਰ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ
   ਵਿਅੰਜਨ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ

3. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ
   ਸਾਧਾਰਨ ਸ਼ਬਦ
   ਇਕ ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਾਮਕਰਣ ਅਤੇ ਸੰਖੇਪ ਜਾਣ ਪਛਾਣ, ਗੁਰਮੁਖੀ ਲਿਪੀ : ਨਾਮਕਰਣ, ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ; ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ, ਸੁਰ ਵਾਹਕ (ਓ ਅ ੲ), ਲਗਾਂ ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ।

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ; ਸੁਰਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ (ਲਘੂ–ਦੀਰਘ ਸੁਰ); ਸੁਰ ਅਤੇ ਲਗਾਂ ਮਾਤਰਾਂ; ਵਿਅੰਜਨਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣਾਂ (ਹ, ਰ, ਵ) ਦਾ ਉਚਾਰਨ ; ਲ ਅਤੇ ਲ਼ ਦਾ ਉਚਾਰਨ; ਭ, ਧ, ਢ, ਝ, ਘ ਦਾ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣਾਂ ਦਾ ਉਚਾਰਨ।

3. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ : ਸਾਧਾਰਨ ਸ਼ਬਦ; ਇਕੱਲਾ ਸੁਰ (ਜਿਵੇਂ ਆ); ਸੁਰ ਅਤੇ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਆਰ); ਵਿਅੰਜਨ ਅਤੇ ਸੁਰ (ਜਿਵੇਂ ਪਾ); ਵਿਅੰਜਨ ਸੁਰ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਪਾਰ); ਕੋਸ਼ਗਤ ਸ਼ਬਦ (ਜਿਵੇਂ ਘਰ, ਪੀ); ਵਿਆਕਰਣਕ ਸ਼ਬਦ (ਜਿਵੇਂ ਨੂੰ, ਨੇ); ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ–1; ਲਿੰਗ–ਪੁਲਿੰਗ, ਇਕ ਵਚਨ–ਬਹੁ ਵਚਨ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–1: ਖਾਣ–ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁੱਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ ਆਦਿ ਨਾਲ ਸੰਬੰਧਿਤ।

BACHELOR OF PHARMACY (SEMESTER-I)
(Under Credit Based Continuous Evaluation Grading System)

PHL105: Pharmacognosy-I

3 Credits (2-1-0)

1. Definition, history, scope and development of Pharmacognosy.
2. **Sources of drugs:** Biological, marine, mineral and plant tissue cultures as sources of drugs.
3. **Classification of drugs:** e.g. Alphabetical, morphological, taxonomical, chemical and pharmacological.
4. **Plant taxonomy**: Study of the following families with special reference to medicinally important plants- Apocynacae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Graminae, Libiatae, Cruciferae, Papaveraceae.
5. **Cultivation, collection, processing and storage of crude drugs:** Factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Pest management and natural pest control agents. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.
6. **Quality control of crude drugs:** Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.
7. **An introduction to active constituents of drugs and non living cell inclusions:** Their isolation, classification and properties.
8. **Systematic pharmacognostic study of following:**
   a. **Carbohydrates and derived products:** Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia and Tragacanth.
   b. **Lipids:** Bees wax, Castor oil, Cocoa butter, Cod-liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice-bran oil, shark liver oil and wool fat.

Books Recommended: (Latest editions unless specified)

1. Trease, G.E. and Evans W.C.Pharmacognosy. Baillier , Tindall, Eastbourne, U.K.
2. Wallis, T.E. Textbook of Pharmacognosy. J and A. Churchill Ltd., London.
3. Kokate, C.K., Purohit, A.P. and Gokhale, S.B. Pharmacognosy (Degree). Nirali Prakashan, Pune.

Suggested Books:

1. Atal, C.K. and Kapur, B.M. Cultivation and Utilization of Medicinal Plants. R.R.L, Jammu.
2. Shah, C.S. and Quadry, J.S. Textbook of Pharmacognosy, B.S. Shah Publishers, Ahmedabad.
3. Tyler, V.C. Brady, L.R. and Robers, J.E. Pharmacognosy. Lea and Febiger, Philadelphia.

BACHELOR OF PHARMACY (SEMESTER-I)
(Under Credit Based Continuous Evaluation Grading System)

PHP106: Pharmaceutical Chemistry-III: Organic Chemistry

1.5 Credits (0-0-1.5)

Note: The student can use non-programmable calculator.

- Introduction to various laboratory techniques viz. recrystallization, distillation, sublimation, thin layer chromatography etc.
- Simple organic preparations involving acetylation, benzylation, substitutions, sulphonation, oxidation and reduction reactions.
- Identifications of simple organic compound and preparation of suitable derivatives.

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

PHP107: Pharmaceutical Chemistry-IV: Inorganic Chemistry

1.5 Credits (0-0-1.5)

Note: The student can use non-programmable calculator.

- The background and systematic qualitative analysis of inorganic mixtures containing up to 4 radicals.
- Quantitative analysis of inorganic compounds.
- Limit tests for impurities in Pharmaceutical compounds.
- Preparation and purification of selected Inorganic Pharmaceutical Substances.

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THEORETICAL ASPECTS OF THE COURSE.

BACHELOR OF PHARMACY (SEMESTER-I)
(Under Credit Based Continuous Evaluation Grading System)

PHP108: Pharmaceutics-II: Introduction to Pharmacy

1.5 Credits (0-0-1.5)

1. Preparation of Solution dosage forms including aromatic waters, spirits, glycerines, syrups, elixirs, mucilages, liniments, douches, tintures, lotions and applications.
2. Galenicals including tinctures, infusions by extraction process.
3. Dispensing of prescription
   3.1 Powders
   3.2 Mixtures
   3.3 Emulsions
   3.4 Creams, pastes and ointments
   3.5 Physical and chemical incompatibilities and their correction.

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THEORETICAL ASPECTS OF THE COURSE.

PHP109: Pharmacology-II: Human Anatomy & Physiology

1.5 Credits (0-0-1.5)

1. Study of human skeleton.
2. Study of different systems with the help of charts and models.
3. Microscopic study of different tissues.
4. Estimation of hemoglobin in blood. Determination of bleeding time, clotting time, R.B.C. Count, Total leucocytes count (TLC), Differential leukocyte count (DLC) and Erythrocyte sedimentation rate (ESR).
5. Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram-PQRST waves and their significance

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THEORETICAL ASPECTS OF THE COURSE.

PHP110: Pharmacognosy-II

1.5 Credits (0-0-1.5)

1. Morphological characteristics of plant families mentioned in Theory.
2. Microscopic measurements of cells and cell contents: Starch grains, calcium oxalate crystals and phloem fibres.
3. Determination of leaf constants such as stomatal index, stomatal number, veinislet umber, vein-termination number and palisade ratio.
4. Identification of crude drugs belonging to carbohydrates and lipids.

Books Recommended:

1. Kokate, C.K. Practical Pharmacognosy. Vallabh Prakashan, Delhi.
2. Gibbs, R.D. Chemotaxonomy of Flowering Plants. 4 Volumes, McGill University Press.
3. Schallard, E.J. Practical Plant Chemistry for Pharmacy, Students. Pitman Medical, London.
4. Tyler, V.E. Jr. and Schwarting A.E.Experimental Pharmacognosy. Burgers Pub. Co., Minneapolis, Minnesota.
5. Wallis, T.E. Analytical Microscopy. J and A Churchill Ltd., London.

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PHL111: Pharmaceutical Chemistry-V: Organic Chemistry

4 Credits (3-1-0)

1. **Aromatic Electrophilic Substitution:** Mechanisms orientation and reactivity in monosubstituted benzene rings. Nitration, Sulphonation, Halogenations, Friedel Craft alkylation and acylation, Vilsmeir, Gatterman, Reimer - Tieman, Bischler Napieralski, Haben-Hoesch reactions. Fries rearrangement.
2. **Aromatic Nucleophilic Substitution:** SN_{Ar}, SN_1 and Benzyne mechanisms. Effect of structure, leaving group and nucleophile on reactivity. Nucleophilic displacement in arene diazonium salts. von Richter rearrangement.
3. **Benzene, Arenes and Polynuclear Aromatic Hydrocarbons:** Aromaticity, The Huckle rule. Structure stability and reactions of benzenes.. Structure nomenclature physical properties industrial source and preparation of arenes, 'Halogenation' of alkyl benzenes. Fused ring aromatic compounds structure and reactions of naphthalene, phenanthrene and anthracene, preparation of their derivatives. Carcinogenic hydrocarbons.
4. **Aryl Halides:** Structure, nomenclature, physical properties, industrial source preparation and reactions.
5. **Phenols:** Structure, nomenclature, physical properties, industrial source, preparationand reactions. Acidity of phenols.
6. **Carboxylic Acid:** Structure nomenclature, physical properties, industrial source and preparation. Acidity of carboxylic acids. Conversion to acid chlorides, esters, amides and alcohols. Hell Volhard- Zelinsky reaction.
7. **Amines:** Structure, classification, nomenclature physical properties. Stereochemistry of nitrogen compound. Industrial source and preparation. Basicity of amines. Hoffman elimination, conversion of amines to amides. Halogenations, nitration and sulphonation of aromatic amines,. Benzene-sulphonamide drugs, Hinesburg test.
8. **Oxidations:** Aromatization, dehydrogenations yielding C-C double bonds, aldyhydes, Ketones. Cleavage of C-C bond in glycols, Ozonolysis. Decarboxylations.
9. **Reductions:** Selectivity, reduction of nitro and nitrose compounds, formation of aziridines from oximes, reductive cleavage and reductive coupling reactions. Acyloin condensation and Cannizaro's reaction.
10. **Molecular Rearrangements:** General mechanisms, migratory aptitudes, Wagner-Meerwin, Pinacol-pinacolone, Tiffeneau-Damjanov ring expansion, Benzil - Benzilic acid, Favorskii, Wolf, Hoffman, Curtius, Lossen, Schmidt, Beckmann and Baeyer-villager rearrangements.

Books Recommended (Latest editions unless specified)

1. P. Sykes, A Guidebook to Mechanisms in Organic Chemistry, Orient Longman, New Delhi.

2. R. T. Morison and R. N. Boyd, Organic Chemistry, Allyl and Bacon Inc, Boston, USA.

3. I. L. Finar, Organic chemistry, Vol. I and II, ELBS, Longman.

Suggested Reading (Latest editions)

4. J. March, Advanced Organic chemistry: Reaction, Mechanisms and Structure, Wiley Eastern, New Delhi.

5. S. H. Pine, Organic chemistry, Mc Grew Hill Book Co.

6. G. Solomon and C. Fryhle, Organic Chemistry, John Wiley & Sons.

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PHL112: Pharmaceutical Chemistry VI: Analytical Chemistry

4 Credits (3-1-0)

1. **Evaluation of Analytical Data:** Mean, Median Precision, Accuracy, Classes of Errors, Standard deviation, Primary & Secondary standards, Confidence limits, Correlation coefficients, Q-test, Least Square Method, Significant figures.

2. **Acid Base Titrations:** Acid base concept, Acid base dissociation constant, Role of the solvent, Buffer Solution (Effect of dilution, added acids & bases upon buffer) Henderson Hasselbalch equation, Acid base indicators, Mixed indicators, Acid base titrations (strong acid vs. strong base,weak acids-weak bases and mixtures of strong & weak acids) Polyprotic systems, phosphoric acid system, polyamine and amino acid systems. Titration of sodium carbonate.

3. **Oxidation Reduction Titrations :** Concept of oxidation reduction, oxidising and reducing agents, Balancing equations, Equivalent weights of oxidising and reducing agents, Oxidation reduction reactions in electrochemical cell, Oxidation reduction indicators, oxidation reductions titration, potassium permanganate titrations, Potassium dichromate titrations, Potassium Iodate titration, Potassium bromate titrations, Idiometric & Iodimetric Methods.

4. **Precipitation Titrations:** Precipitation reactions, Solubility products, Factors influencing the sharpness of the end points, Indicators for precipitation titration, Theory of indicator behavior, Precipitation titrations, Mohr Method, Volhard's Method, Applications of Precipitation titrations.

5. **Gravimetric Analysis : Precipitation Techniques:** Colloidal state; Supersaturation; Co- precipitation, Post-precipitation; Digestion; Washing of the precipitate; Filtration; Filter papers and crucibles; Ignition, Thermogravimeteric curves Specific examples like Barium as Barium Sulphate, Aluminium as Aluminium oxide; Calcium as Calcium oxalate and Magnesium as Magnesium pyrophosphate: Organic precipitants.

Books Recommended: (Latest editions unless specified):

1. K. A. Connors, A Text Book of Pharmaceutical Analysis, John Wiley & Sons, 1982.
2. J. Bassett, R. C. Denney, C. H. Jeffery, J. Mendham, Vogol's Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental / Analysis, Fourth Edition, The ELBB and Longman, London.
3. Air Quality, Thad Godish, Lewis Publishers Inc. 121 S. Main Street, P.O. Drawar 519, Cholses, 1985.
4. Chemical and Biological Methods for Water Pollution Studies, R.K. Trivedi and P.K. Goll Environmental Publication Card.

Suggested Studies (Latest Editions):

1. Analytical Chemistry, D. A. Skoog & D.M. West.
2. W. F. Pickoring, Modern Analytical Chemistry, Marcel Dekker, Inc. NY.
3. G.S. Sodhi, Fundamental Concepts of Environmental Chemistry, Narosa Publishing House, 22 Dariya Ganj, Delhi –2,2002.

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PHL113: Computer Applications-I

4 Credits (3-1-0)

Introduction:

1. Block diagram of Computer, characterstics & classification of computer, concept of hardware & software, Transtators, Input / output devices, storage devices (Floppy disk, hard disk, CD-Rom) Memory (RAM, ROM & Cache), Number system (Decimal, binary, octal & Hexadecimal) and their interconversions.

2. Operating system

Definition & function of O.S, Types of O.S (single user & multiuser), MS-DOS, Internal & External commands of MS-DOS, Features of window based O.S. creating, copying moving renaming and deleting files / folders.

3. Programming in 'C'

Features of C language, character set, constants & Variables, General structure of C program, operators and expression, Input & Output statements, Flow control statements, use of arrays.

4. Role of computer in Pharmaceutical Industries

Use of computers for maintaining issue & dispatch record of the stocks in Pharma company, inventory maintenance.

Books Recommended:

1. Introduction to computers by P.K. Sinha, 2nd Edition, BPB Publication.
2. Programming in 'C' by R.S. Salaria, 3rd Edition, Khanna Publishers.
3. Windows based computer courses by Gurvinder Singh & Rachpal Singh 4th Edition, Kalayani Publishers.
4. Programming in 'C', E. Bala Guruswami, 2nd Edition, TMH Publishing Company Limited.

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PHL114: Mathematics

4 Credits (3-1-0)

1. **Differential Calculus:** Intuitive idea of limit and continuity of a function, differentiation using first principle, Differentiation of the functions of the type x^n, $(ax+b)^n$, log x, e^x, a^x, x^x, trigonometric functions (excluding inverse trigonometric & hyperbolic functions), Derivative of sum and difference of two functions, Product rule and quotient rule of differentiation. Chain rule of differentiation.

2. **Integral Calculus:** Intuitive idea of integration as inverse of differentiation, Integration of sum and difference of two functions, Integration by substitution, Integration by parts (integration involving inverse trigonometric functions & Hyperbolic functions are excluded).

3. **Differential Equations:** Formation of differential equation, order and degree of differential equation, Solution of differential equation of first order and first degree.

4. **Statistical Methods:** Measures of central tendency. Measures of dispersion, Introduction of probability, random variable, probability distribution. Normal distribution. Testing of hypothesis, One tailed & two tailed tests. Level of significance. Z-test and t-test for single mean & equality of two means. Chi-square test for goodness of fit and independence of attributes. An introduction to analysis of variance.

5. **Correlation and Regression:** Bivariate data, scatter diagram, Karl Pearson coefficient of correlation, Regression lines, Properties of correlation coefficient & regression lines (Mathematical derivation in any case is excluded).

Books Recommended (Latest editions unless specified):

1. B.S.Grewal:Elementary Engg. Mathematics, Khanna Publishers, Delhi.

2. H.C.Sexena: Examples in statistics by Atma Ram & Sons, Delhi.

3. G.D. Hall, S.N. Chhibber, Hari Om Trivedi, Subodh Chandra: Frank Mathematics for B.Pharm.

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PBL-131: Punjabi (Compulsory)
ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

p`T-km Eq p`T psqk~

Credits: 2-0-0

(I) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT~ ilK kvl :

(a) B`el vlr isG
(E) p: prn isG
(e) p: mhn isG
(kivq`-s`r, ivS`–vsq, k`iv-kl`, kvl)

2. pj`bl Sbd bxqr : D`q/ml, vDqr (Egqr, ipCqr, ivalqpq Eq rp~qrl), sm`s |

(II) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kvl :

(a) Eimq` plqm
(E) f`. hrBjn isG
(e) iSv km`r bt`lvl
(kivq`-s`r, ivS`-vsq, k`iv-kl`, kvl)

2. pr` rcn` : kl`s ivc 10 iviSE~ (siBE`c`rk, D`rimk Eq r`jnlqk) q pr` rcn` d EiBE`s krv`ax |

(III) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kvl :

(a) f`. jsvq isG nkl
(E) f`. jgq`r
(e) f`. srjlq p`qr
(s) p`S
(kivq`-s`r, ivS`-vsq, k`iv-kl`, kvl)

2. mh`vr q EK`x (EK`x q mh`vr` kS ivc) 200 mh`virE~ Eq 100 EK`x~ n v`k~ ivc vrqx d EiBE`s krv`ax (kl`s ivc q Gr lel) |

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PBL-132: Mudhli Punjabi
ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Punjabi Compulsory)

2–0–0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ
   ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ
   ਬਹੁ–ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

2. ਪੰਜਾਬੀ ਵਾਕ–ਬਣਤਰ
   ਸਾਧਾਰਨ–ਵਾਕ : ਕਿਸਮਾਂ
   ਸੰਯੁਕਤ–ਵਾਕ : ਕਿਸਮਾਂ
   ਮਿਸ਼ਰਤ–ਵਾਕ : ਕਿਸਮਾਂ

3. ਪ੍ਰਕਾਰਜੀ ਪੰਜਾਬੀ
   ਚਿੱਠੀ ਪੱਤਰ
   ਪੈਰ੍ਹਾ ਰਚਨਾ
   ਸੰਖੇਪ ਰਚਨਾ
   ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਸੰਯੁਕਤ ਸ਼ਬਦ; ਸਮਾਸੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਲੋਕ ਸਭਾ); ਦੋਜਾਤੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਕਾਲਾ ਸਿਆਹ); ਦੋਹਰੇ ਸ਼ਬਦ/ਦੁਹਰੁਕਤੀ (ਜਿਵੇਂ ਧੂੜ ਧਾੜ/ਭਰ ਭਰ), ਮਿਸ਼ਰਤ ਸ਼ਬਦਾਂ ਦੀ ਬਣਤਰ/ਸਿਰਜਨਾ; ਅਗੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਉਪ ਭਾਸ਼ਾ), ਪਿਛੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਰੰਗਲਾ), ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ–2: ਪੜਨਾਵੀਂ ਰੂਪ, ਕਿਰਿਆ/ਸਹਾਇਕ ਕਿਰਿਆ ਦੇ ਰੂਪ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–2: ਮਾਰਕੀਟ/ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਿਤ।

2. ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ : ਕਰਤਾ ਕਰਮ ਕਿਰਿਆ; ਸਾਧਾਰਨ ਵਾਕ, ਬਿਆਨੀਆ, ਪ੍ਰਸ਼ਨਵਾਚਕ, ਆਗਿਆਵਾਚਕ, ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਵਾਕਾਂ ਦੀਆਂ ਕਿਸਮਾਂ; ਸੁਤੰਤਰ ਅਤੇ ਅਧੀਨ ਉਪਵਾਕ; ਸਮਾਨ (ਤੇ/ਅਤੇ) ਅਤੇ ਅਧੀਨ (ਜੋ/ਕਿ) ਯੋਜਕਾਂ ਦੀ ਵਰਤੋਂ; ਪੰਜਾਬੀ ਵਾਕਾਂ ਦੀ ਵਰਤੋਂ : ਵਿਭਿੰਨ ਸਮਾਜਕ/ਸਭਿਆਚਾਰਕ ਪ੍ਰਸਥਿਤੀਆਂ ਦੇ ਅੰਤਰਗਤ; ਘਰ ਵਿਚ, ਬਾਜ਼ਾਰ ਵਿਚ, ਮੇਲੇ ਵਿਚ, ਸ਼ੋਪਿੰਗ ਮਾਲ/ਸਿਨਮੇ ਵਿਚ, ਵਿਆਹ ਵਿਚ, ਧਾਰਮਿਕ ਸਥਾਨਾਂ ਵਿਚ, ਦੋਸਤਾਂ ਨਾਲ ਆਦਿ।

3. ਇਸ ਯੂਨਿਟ ਵਿਚ ਚਿੱਠੀ ਪੱਤਰ (ਨਿੱਜੀ/ਦਫ਼ਤਰੀ/ਵਪਾਰਕ), ਪੈਰਾ ਰਚਨਾਂ, ਸੰਖੇਪ ਰਚਨਾ ਅਤੇ ਅਖਾਣ ਮੁਹਾਵਰਿਆਂ ਦੀ ਵਰਤੋਂ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀ ਦੀ ਭਾਸ਼ਾਈ ਯੋਗਤਾ ਨੂੰ ਪਰਖਿਆ ਜਾਵੇਗਾ।

PHP116: Pharmaceutical Chemistry-VII: Organic Chemistry

2 Credits (0-0-2)

1. Organic preparations involving more than one step. Purification and spectroscopic analysis of the prepared organic compounds.
2. Qualitative test for alkaloids, carbohydrates, Proteins, amino acids and tennins.
3. Sepration, Purification and identification of compounds of binary organic mixture (liqud-liquid, liquid-solid and solid- solid) using chemical analysis IR and PMR Spectral data.

NOTE: ANY OTHER EXPERIMENTS(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PHP117: Pharmaceutical Chemistry VIII: Analytical Chemistry

1.5 Credits (0-0-1.5)

1. Standardization of analytical weights and celebration of volumetric apparatus.
2. **Acid Base Titration's:** Preparation and standardization of acids and bases; some exercises related to determination of acids and bases separately or in mixture form; some official assay procedures e. g. boric acid shall also be covered.
3. **Oxidation reduction Titration's:** Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine sodium thiosuphate etc., Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodated, potassium bromate, Iodine solution, titan us chloride, sodium 2, 6- dichlorophenol indophenols cerric ammonium sulfate be designed.
4. **Precipitation Titration's:** Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate; Titration according to Mohar's Volhard's and Fajan's methods.
5. **Gravimetric analysis:** Preparation of Gocch crucible for filtration and use of sintered glass crucibles Determination of water hydration; some exercises related to gravimetric analysis shall be covered.

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BACHELOR OF PHARMACY (SEMESTER-II)
(Under Credit Based Continuous Evaluation Grading System)

PHP118: Computer Applications-II

1.5 Credits (0-0-1.5)

1. Computer operating systems like MS-DOS, MS-Windows.
2. Word-processing like MS-Word.
3. Spreadsheet calculations using MS- Excel.
4. Graphic applications using MS-Power Point, MS-Excel.
5. Programming using 'C'.

Books Recommended:

1. Introduction to computer by P.K. Sinha, 2nd Edition, BPB Publication
2. Programming in 'C' by R.S. Salaria, 3rd Edition, Khanna Publishers
3. Windows based computer courses by courses by Gurvinder Singh & Rachpal Singh 4th Edition, Kalayani Publishers.
4. Programming in 'C'E. Bala Guruswami, Second Edition, TMH Publishing Company Limited.

PHP119: Pharmaceutics III: Engineering Drawing

2 Credits (0-0-2)

1. Importance of Engineering Drawing in Pharmaceutical industry.
2. Construction of scales.
3. Orthographic projections. Various techniques of sectioning i.e. offset, full, half, partial, removed and revolved.
4. Isometric projections and isometric views.
5. Layout of various sections in Pharmaceutical unit with special references to supply of water, steam, gases and electrical lines.
6. Flow sheets Basis and symbols employed in flow sheets.

Books Recommended (Latest editions unless specified):

1. Engineering Drawing and Graphics, IInd Ed., K. Venugopal, New Age International (P) Limited, Publishers, New Delhi.
2. Elemantary Engineering Drawing, N. D. Bhatt., 31st Ed, Charotar Publishing House, Anand- 388001, Gujrat.

BACHELOR OF PHARMACY (SEMESTER-III)
(Under Credit Based Continuous Evaluation Grading System)

PHL 120: Pharm. Chem. IX: Physical Chemistry

3 Credits (2-1-0)

1. **States of Matter:**

   Gaseous: Brief introduction to the behaviour of gases, ideal and real gases, equations of state, critical phenomena, critical constant and its determination.

   Liquids: Intensive and extensive properties, Additive and constitutive properties, molar volume, molar refraction, parachor, hydrophobicity, connectivity, importance in structure elucidation and biology.

   Solids: Amorphous and crystalline solids, types of crystals, physical properties of crystals, Bragg's equation. Swarm theory of liquid crystals.

2. **Solutions:**

   Non-Electrolyte Solutions: Ideal and Real solutions, colligative properties, mol. Wt. Determination, Donnan- Membrane Equilibrium and drug absorption, partition-coefficient and biological importance.

   Electrolyte Solutions: Arrhenius theory of electrolytic dissociation, Debye-Huckel theory and its use in protein purification, Ionic equilibrium in blood applications.

3. **Thermodynamics:**

   Energy and First Law of Thermodynamics,Second and Third Law of Thermodynamics. Helmholtz and Gibb's free energy, concept of spontaneity, chemical equilibrian, expressions for equilibrium constant, effect of volume, temperature and pressure.

4. **Chemical Kinetics:**

   Zero, first and second order reactions, theories of reaction Kinetics, Characteristics of catalyzsed reactions, homogeneous and heterogeneous catalysis, acid base catalysis, enzyme catalysis, theory of catalysis.

5. **Adsorption:**

   Physiosorption and Chemisorptions, adsorption isotherms, Freundlich and Langmuir adsorption isotherms, Gibbs adsorption isotherm, BET equation and its use in surface area determination.

6. **Photochemistry:**

   Basic principles of light absorption, Jablenski diagram, Quantum efficiency

Books Recommended (Latest editions unless specified):

1. S. H. Maron and C. F. Prutton, Principles of Physical Chemistry, Oxford and IEH Publishing Co.

2. A. Martin, Physical Pharmacy, (Fourth Edition, 1994). B. I. Waverly Pvt. Ltd., New Delhi

3. W.S Brey, Physical Chemistry and Biological Application, Academic Press, 1978.

4. B.R Puri. L.R Sharma, Principle of Physical Chemistry. Shoban Lal Nagin Chand & Co.1993

5. J. R. Barrante, Physical Chemistry of the Life Sciences, Prentice Hall (1977).

6. K. J. Laidler. Physical Chemistry with Biological Applications, Benjamin, 1980.

7. S. C. Wallwork, Physical Chemistry for students of Pharmacy and Biology, Longman. Third edition (1977).

BACHELOR OF PHARMACY (SEMESTER-III)
(Under Credit Based Continuous Evaluation Grading System)

PHL 121: Pharmaceutics IV: Engineering Operations

3 Credits (2-1-0)

1. **Materials of Pharmaceutical Plant Construction:** Metals, alloys and non-metals, corrosion and methods to reduce it.
2. **Fluid Flow:** Manometers concepts of boundary layer, basic equation of fluid flow, law of conservation in flow of fluids, valves, pumps, flow meters.
3. **Mixing, Dissolving Emulsifying:** Theory of mixing, .mixing equipment. Dissolving emulsifying equipment.
4. **Centrifugation:** Principles of centrifugation, industrial centrifuges, applications in Pharmacy.
5. **Filtration:** Theory of filtration, filter aids, filtering media, various filters, application in Pharmacy.
6. **Size Reduction:** Laws governing energy and power requirements. Types of Mills. Factors governing selection of mill type, applications in Pharmacy.
7. **Evaporation:** Basic concept of phase equilibria, Factors affecting rate of evaporation, Single effect and multiple effect evaporators, Factors governing selection of evaporation process and evaporators.
8. **Distillation:** Theory of distillation of mixtures, vapour liquid equilibrium relationship, volatility, azeotropic mixtures, phase diagrams, rectification, construction of coloums and plate concept. Simple fractional, vacuum, molecular and steam distillation. Production of water for injection.
9. **Heat Transfer:** Modes of heat transfer, heat transfer coefficient, OHTC, Convection concept of overall film coefficient, evaluation of Individual film coefficient radiation, heating media equipments. Steam as heating medium properties and uses of steam, Steam traps, pressure reducing value, steam heated heat exchanger, lagging and condensation, heating by electricity, numerical problems.
10. **Drying:** Theory of drying principles, equilibrium moisture content, rate of drying, factors affecting drying rate, drying of dilutes solutions and suspensions, types of dryers, special drying methods, freeze drying calculations for rotary dryers.

Books Recommended (Latest editions unless specified):

1. McCabe & Smith, Unit Operations of chemical Engineering. McGraw Hill Science (2000).
2. Bedger W L and Banchero J T. Introduction to Chemical Engg. McGraw Hill Co. (1955).

BACHELOR OF PHARMACY (SEMESTER-III)
(Under Credit Based Continuous Evaluation Grading System)

PHL 122: Pharmacology III: Human Anatomy & Physiology

3 Credits (2-1-0)

1.1 **Digestive System:** Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system.

1.2 **Respiratory System:** Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.

1.3 **Central Nervous System:** Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain, Cranial nerves and their functions.

1.4 **Autonomic Nervous System:** Physiology and functions of the autonomic nervous system. Neurohumoral transmission in the A.N.S.

1.5 **Urinary System:** Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance. Diseases of the urinary system.

1.6 **Reproductive System:** Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis and oogenesis. Pregnancy, its maintenance and parturition.

1.7 **Endocrine System:** Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and Ovary, their hormones and functions.

1.8 **Sense Organs:** Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

Books Recommended:

1. Tortora, G.J. and Derickson B.H., Principles of Anatomy and Physiology, John Wiley and Sons, 12th Edition (2009).
2. Guyton, A.C. and Hall, J.E., Textbook of Medical Physiology, W.B. Sanders Co., 12th Edition (2005).
3. Ganong, W.F., Review of Medical Physiology. Prentice Hall, 19th Edition (1999).
4. Chatterjee, C.C., Human Physiology, Medical Allied Agency, Calcutta, 11th Edition (1985).
5. Eroschenko, V.P., Di Fiore S H. Atlas of Histology with Functional Correlations. Lippincott Williams & Williams, 10th Edition (2004).
6. Di Fiore S.H., Atlas of Normal Histology, Lea & Febiger, Philadelphia, 6th Edition, 1988.
7. Ghai, C.L., A Textbook of Practical Physiology, Jay Pee Brothers, New Delhi, 4th Edition, 2008.

BACHELOR OF PHARMACY (SEMESTER-III)
(Under Credit Based Continuous Evaluation Grading System)

PHL123: Pharmacology IV: Pathology

3 Credits (2-1-0)

1. Cell Injury: Basic cell structure, etiology, pathogenesis and morphology of cell injury, reversible and irreversible cell injury, cell death – autolysis, necrosis, apoptosis and gangrene.
2. Cellular adaptations and Aging: Atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia; celluar basis of aging.
3. Inflammation and Healing: Chemical mediators, morphological changes, various events of acute and chronic inflammation, regeneration, repair and wound healing.
4. Diaorders of cardiovascular system: Hypertension, angina pectoris, congestive heart failure, anaemia, atherosclerosis.
5. Disorders of the respiratory system: Asthma, emphysema, atelectasis.
6. Disorders of gastrointestinal system: Peptic ulcers, ulcerative colitis.

BOOKS RECOMMENDED: (Latest editions unless specified):

1. Vinay Kumar, Ramzi S. Cotran and S.L. Robins, Basic Pathology, 6th Edition, Prism Books Pvt. Ltd., Banglore, India.
2. Harsh Mohan, Textbook of Pathology, 5th Edition, Jaypee Brothers Medical Publishers (P) Ltd.

BACHELOR OF PHARMACY (SEMESTER-III)
(Under Credit Based Continuous Evaluation Grading System)

PHL124: Pharmacognosy-III

3 Credits (2-1-0)

1. **Resins**: Study of Drugs Containing Resin and Resin Combination like Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger.
2. **Tannins:** Study of tannins and tannin containing drugs like Gambir, black catechu, galls and myrobalan.
3. **Volatile Oils:** General methods of obtaining volatile oils from plants. Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palamarosa Gaultheria, Sandal wood.
4. **Phytochemical Screening:** a) Preparation of extracts.
   b) Screening of alkaloids, saponins, cardenolides and bufradienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts.
5. **Fibres:** Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.
6. **Pharmaceutical aids:** Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.

Books Recommended and Suggested Reading:

1. Harborne, J.B., Phytochemical Methods. Chapman & Hall, International Edition, London, 3rd Edition (1988).
2. Tyler, V.C., Brady, L.R. and Robers, J.E., Pharmacognosy, Lea & Febiger, Philadelphia. 9th Edition (1988).
3. Guenther, E., The Essenial Oils –4D Van Nostrand Co., N.Y. (2008).
4. Miller, L.P., Phytochemistry 1-3 Van Nostrand Reinhold Co. (1973).
5. Swain, T., Comparative Phytochemistry Academic Press, London. (1966).
6. Trease, G.E. and Evans, W.C. Pharmacognosy. Bailliere Tindall, Eastbourne, U.K. 15th Edition (2002).
7. Wallis, T.E., Textbook of Pharmacognosy, J & A Churchill Ltd., London, 5th Edition (1967).

BACHELOR OF PHARMACY (SEMESTER-III)
(Under Credit Based Continuous Evaluation Grading System)

ESL220: Environmental Studies (Compulsory)

Credit 3-0-0

1. **The multidisciplinary Nature of Environmental Studies:** Definition, scope & its importance, Need for public awareness.

2. **Natural Resources**: Natural Resources and associated problems.

   a) **Forest Resources**: Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

   b) **Water Resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

   c) **Mineral Resources**: Use and exploitation, environmental effects of extracting and using mineral Resources, case studies.

   d) **Food Resources**: World food problems, change caused by agriculture and overgrazing, effects or modern agriculture, fertilizer-pesticide problem, salinity, case studies.

   e) **Energy Resources**: Growing of energy needs, renewable and non-renewable energy Resources, use of alternate energy sources, case studies.

   f) **Land Resourses**: Land as a resource, land degradation, soil erosion and desertification.

   g) Role of an individual in conservation of natural Resources, Equitable use of Resources for sustainable lifestyles.

3. **Ecosystem:**

   Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

   Introduction, Types, Characteristic Features, Structure and Function of the Following Ecosystems:

   a. Forest ecosystem

   b. Grassland ecosystem

   c. Desert ecosystem

   d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its Conservation:

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts

Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution:

Definition, Causes, Effects and Control Measures of:

a) Air Pollution

b) Water Pollution

c) Soil Pollution

d) Marine Pollution

e) Noise Pollution

f) Thermal Pollution

g) Nuclear Hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

6. Social Issues and Environment:

* From unsustainable to sustainable development
* Urban problems related to energy
* Water conservation, rain water harvesting, watershed management
* Resettlement and rehabilitation of people; its problems and concerns. Case studies
* Environmental ethics: Issues and possible solutions.
* Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents and holocause. Case studies.

* Wasteland reclamation
* Consumerism and waste products
* Environmental Protection Act
* Air (prevention and Control of Pollution) Act
* Water (prevention and Control of Pollution) Act
* Wildlife Protection Act
* Forest Conservation Act
* Issues involved in enforcement o£. environmental legislation
* Public awareness

7. Human Population and the Environment

* Population growth, variation among nations
* Population explosion-Family welfare programme
* Environment and human health
* Human rights
* Value education
* HIV / AIDS
* Women and child welfare
* Role of information technology in environment :and human health
* Case studies
* **Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs
* **Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance

8. Field Work: Visit to a local area to document environmental assets–river / forest / grassland / hill / mountain. Visit to a local polluted site–Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems–pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.
9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.
10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.

20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar.

PHP 126: Pharm. Chem. X: Physical Chemistry

1.5 Credits (0-0-1.5)

SUGGESTED EXPERIMENTS

1. To determine the molecular mass of naphthalene by Rast's method.
2. Determination of molecular mass by steam Distillation.
3. Determination of Ionization constant of Acetic acid in water by cryoscopy or study the composition of the complex formed between HgI_2 and I by cryoscopy.
4. To determine the specific reaction rate of the acid catalysed hydrolysis of ethyl acetate.
5. To determine the specific reaction rate of the hydrolysis of ethyl acetate by sodium hydroxide.
6. To determine the rate constant of the acid hydrolysis of acetate by dilatomatry.
7. To determine the partition cofficient of Iodine between CC14 and water.
8. To study the molecular state of benzoic acid in benzene by partition method.
9. To study the phase-diagram of a two component system having eutectic temperature (diphenylamine-napthalene).
10. To draw the mutual solubility curve of phenol water system.
11. To measure the surface tension of solutions of any alcohol in water at different concentrations and calculate the surface excess of these solutions.
12. To study the adsorption of acetic acid on activated charooal.
13. To determine the heat of neutralization of HCI and NaoH.
14. To determine the heat of combustion of naphthalene at constant pressure and temperature.
15. Determination of critical micalle concentration of soap.
16. Determination of Atomic parachors of C, H and O.

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BACHELOR OF PHARMACY (SEMESTER-III)
(Under Credit Based Continuous Evaluation Grading System)

PHP 127: Pharmaceutics V: Engineering Operations

1.5 Credits (0-0-1.5)

1. (a) Determination of absolute humidity, relative humidity, dew-point saturated- volume and humid heat using psychromotic chart.
   (b) Determination of dew point using ice & water and to compare it with that obtained using psychrometric chart.
2. To compare the efficacies of simple and differential manometers.
3. To perform Raynold's experiment and to calculate Roynold number for laminar, critical and turbulent flows.
4. Determination of overall efficiency of steam distillation unit (Aniline/water mixture).
5. Determination of overall heat transfer coefficient (HTC) of a distillation unit.
6. To determine rate of flow using water.
7. (a) Determination of rate of flow by venturimeter/orificemeter.
   (b) Determination of coefficient of venturimeter/orifice meter.
8. Determination of flow rate using pitot-tube.
9. To determine hardness of water.
10. Study of effect of insulating material on loss of heat.
11. Study of effect of colours on radiation.
12. To study the effect of thickness of cake on the rate of filtration.
13. To study the effect of viscosity on rate of sedimentation.
14. To determine equilibrium-moisture-content (EMC) of various substances like (a) Kaolin (b) Talc and (c) Strach.
15. Verification of Darcy's law.
16. Study of efficiency of number of balls on size reduction in ball mill.
17. Preparation of pyrogen free water for injection and its quality evaluation.

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

PHP 128: Pharmacology V: Human Anatomy & Physiology

1.5 Credit (0-0-1.5)

1. Microscopic studies of different tissues.
2. Simple experiments involved in the analysis of normal and abnormal urine: Collection of specimen, appearance, determination of PH of urine by pH meter. Quantitative determination of sugars, proteins, urea, lipid profile, uric acid and creatinine.
3. Physiological experiments on nerve-muscle preparations.
4. Determination of vital capacity, experiments of spirometry.

Books Suggested:

1. Tortora, G.J. and Derrickson B H. Principles of Anatomy and Physiology. John Wiley and Sons. 12th Edition (2009).
2. Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. W.B. Sanders Co. 12th Edition (2005).
3. Ganong, W.F. Review of Medical Physiology. Prentice Hall. 19th Edition (1999).
4. Chatterjee, C.C. Human Physiology, Medical Allied Agency, Calcutta. 11th Edition (1985).
5. Eroschenko, V.P, Di Fiore S H. Difore's Atlas of Histology with Functional Correlations. Lippincott Williams & Williams, 10th Edition (2004).
6. Di Fiore, S.H. Atlas of Normal Histology. Lea & Febiger, Philadelphia, 6th Edition,1988.
7. Ghai, C.L. A Textbook of Practical Physiology Jay Pee Brothers, New Delhi, 4th Edition (2008).

PHP 130: Pharmacognosy-IV

1.5 Credits (0-0-1.5)

1. Identification of crude drugs mentioned in theory.
2. Study of fibres and pharmaceutical aids.
3. Microsopic studies of seven-selected crude drugs and their powders mentioned under the category of volatile oils in theory and their chemical test.
4. General chemical tests for alkaloids, glycosides, steroids, flavonoids and tannins.

Books Recommended and Suggested Reading

1. Tyler, V.E. Jr. and Schwarting, A.E. Experimental Pharmacognosy. Burgess Pub. Co, Hinneapois, Minnesotta, 3rd Edition (1968).
2. Brain, K.R. and Turner, T.D. The Practical Evaluation of Phytopharmaceuticals. Wright-Scientechnica, Bristol (1975).

BACHELOR OF PHARMACY (SEMESTER-IV)
(Under Credit Based Continuous Evaluation Grading System)

PHL 131: Pharm. Chem. XI: Pharmaceutical Analysis

3 Credits (2-1-0)

1. **Non-aqueous Titrations:** Theoretical consideration, acid base equilibria in non-equeous media, titration of acids and bases, indicators, Applications.
2. **Complexometric Titrations:** Concept of complexation and chelation, Warner's coordination number and electronic structure of complex ions, stability constants, titration curves, masking and demasking agents, types of complexometric titration, metal ion indicators, factors influencing the stability of complexes, EDTA-METAL ion Complexes, Determination of hardness of water.
3. **Solvent Extraction:** Liquid solid extraction, liquid-lequid extraction, separation of mixtures by extraction, distribution law, successive extraction, the craige method of multiple extraction, contineuous counter-current extraction, effect of various factors on extraction.
4. **Chromatography:** Introduction, types of chromatography, Liquid- Solid adsorption chromatography, Liquid-Liquid partition chromatography, paper chromatography, Ion exchange chromatography, Thin layer chromatography. Gas chromatography, (introduction, basic GLC apparatus, Carrier gas, sample introduction, columns, solid support, temperature effects), Applications.
5. **Electrochemistry:** The electric cell, electrode potential, half-cell and its types, sign convention. Nernst equation, the salt bridge, electrochemical- series standard potential, standard hydrogen electrode, measuring relative voltage of half cells, calculations of standard potential, reference electrodes and indicator electrodes.

(a) Potentiometry: Theoretical considerations, ion-selective electrodes, measurement of potential, Location of the end point, analytical applications, direct measurement of metal concentration, differential curve, determination of Ksp, pH measurements, pH meter, relation of pH to potential and applications.

(b) Conductometric Methods: Introduction measurement of conductance and conducto metric titration.

(c) Colorimetric Titration's: Principle, controlled potential colorimetry, Cell design, instrumentation, advantages and limitations, electrode selection and applications.

(d) Polarography: Theory, dropping mercury electrode air current potential relationship. Polarization, choice of electrodes, effect of oxygen, instrumentation and applications.

7. Phase Solubility Analysis: Theory, experimental procedure and applications.

Books Recommended (Latest editions unless specified)

1. J. Bassett, R. C. Denney, G. H. Jeffery, J. Mendham, Vogel's Textbook of Quantitative Inorganic Analysis, Including Elementary Instrumental Analysis. The English Language Book Society and Long Man (1978).

2. K.A. Conner, A Textbook of Pharmaceutical Analysis, Willey Interscience Publication (1982).

3. H. H. Willard. L. L. Merritt Jr and J. A. Dean, Instrumental Methods of Analysis, Van Nostrand Reinhold, New York, USA (1974).

Suggested Readings (Latest editions).

1. Analytical Chemistry: An Introduction. D. A. Skoog and D. M. West. Thomas Learning. 5th Edition (1988).

2. Principles of Instrumental Analysis. D. A. Skoog and J. J. Leary, Sounders College Publishers, 4th Edition, 1997.

BACHELOR OF PHARMACY (SEMESTER-IV)
(Under Credit Based Continuous Evaluation Grading System)

PHL 132: Pharm. Chem. XII: Biochemistry

3 Credits (2-1-0)

Section A (Structure and Function of Macromolecules)

1. Biochemical organization of cell and transport processes across cell membrane.
2 **Amino acids and Proteins**: Common structural features of amino acids with special reference to stereoisomerism, zwitter ions, polarity and non-polarity, titration curve, isoelectric pH; primary, secondary tertiary and quaternary structure of proteins. Introduction to different biological function of protein, separation and sequencing of amino acids.
3. **Enzymes and Co-Enzymes**: Classification of enzymes, enzyme kinetics and mechanism of action, enzyme inhibition. allosteric enzyme, isozymes, vitamins and metals as co-enzyme and their significance.
4. **Lipids**: Storage and structural lipids; structural and functional importance of triacylglycerol, phospholipids, sphingolipids, sterols, isoprenoid units.
5. **Carbohydrates**: Monosaccharides and disaccharides; epimers, anomers, pyranoses, furanoses, hemiacetal and hemiketal linkage, glucoside bond, polysaccharides and proteoglycans, glycoproteins, glycolipids.
6. **Nucleotides and Nucleic Acid**: Nucleotides and nucleosides, oligo and poly nucleotides, structure of DNA, mRNA, tRNA, denaturation, hybridization, function of nucleotides.

Section B (Metabolism)

1. **Carbohydrate Metabolism**: Conversion of monosaccharides to glucose-1-phosphate, glycolysis, fermentation and their regulation, gluconogenesis, glycogen synthesis and glycogenolysis, pentose phosphate pathway.
2. **TCA Cycle**: Production of acetate and importance of pyruvate dehydrogenase complex, reaction of TCA cycle, energy conservation in the cycle and regulation of TCA cycle.
3. **Oxidative Phosphorylation**: Mitochondrial electron transport chain, ATP synthesis, its importance and regulation.
4. **Lipid Metabolism**: Digestion , mobilization and transport of fatty acids, β-oxidation , its energetics and regulation, formation of ketone bodies and their importance, biosynthesis of saturated and unsaturated fatty acids and their regulation.

Section C (Protein and Nucleic Acid Biochemistry)

1. **Protein and Nucleotide Metabolism**: Dietary fate of proteins, trans-amination reaction and pyridoxal phosphate, ammonia formation, nitrogen excretion and urea cycle, concept of “Krebs bicycle”, catabolism of amino acids, biosynthesis of amino acids, biosynthesis and degradation of nucleotides.
2. Introduction to the genetic organization of mammalian genome, DNA replication and repair, mutation.
3. Transcription and post transcriptional processing, ribozymes, central dogma and reverse transcriptase. Post translational modification and targeting of proteins.
4. Polymerase chain reaction, genetic engineering.

Books Recommended:

1. A.L. Lehninger, D.L. Nelson and M.M. Cox., Principles of Biochemistry, 2nd Edition, CBS Publishers & Distributors, New Delhi, India 1993.
2. Lubert Stryer, Biochemistry, W.H. Freeman & Company, New York, U.S.A., 1988.
3. E.E. Cohn, P.K. Stumpf, G. Brwening. L.H. Doi, Outlines of Biochemistry, John Wiley & Sons, Inc, New York, U.S.A., 1987.
4. R.K. Murray, D.K. Granner. P.A. Mayes, V.W. Rodwell, Harpers Biochemistry, Appleton & Lange, Connecticut, U.S.A., 1996.

PHL 133: Pharmaceutics VI: Cosmeticology and Formulation Development

3 Credits (2-1-0)

1. **Raw Materials Used for Cosmetic Preparations:** Surfactants, oil components, waxes, silicone oils, cream bases, o/w emulsifiers, w/o emulsifiers, humectants, aerosol propellants, perfumes, colors.

2. **Liquids:** Industrial production of suspensions, syrups and emulsions, batch to batch uniformity, concept of HLB, its ranges, uses and importance.

3. **Skin Care Products:** Introduction, anatomy and physiology of skin, Percutaneous absorption and factors affecting it, formulation aspects of skin cleansing creams, cleansing lotions, cold creams, foundation creams, moisturizing creams, skin tonics, sunscreen products, acne products, creams and lotions, production and packaging of ointments and contraceptive products.

4. **Hair Care Products:** Introduction, hair structure, formulation aspects of shampoos, conditioners, styling aids, setting lotions, hair fixers, hair creams, bleaches, hair colorants , hair removers and anti-dandruff preparations. Formulation, production and packaging of shampoos, shaving creams, shaving sticks and after shave lotions.

5. **Beautification Articles:** Introduction, formulation, production and packaging of lipsticks, eye liner, nail lacquers, nail polish remover, lip colour, face make up, eye make up.

6. **Dental Products:** Anatomy and physiology of teeth, formulation aspects of dentifrices and oral rinses.

7. **Personal Hygiene Products:** Formulation aspects of toilet soaps, shaving soaps, antiperspirants and deodorants. tooth powder, tooth paste and perfumes-rose, jasmine and lilac.

8. **Evaluation of various cosmetic preparations.**

9. **Quality control of various cosmetic preparations.**

10. **Packaging of cosmetics and toiletries.**

Books Recommended (Latest editions unless specified)

1. Lachman et. AlZ, Theory and practice of Industrial Pharmacy 2nd Ed. Lea & Febiger, Philadelphia, USA. 1976.
2. J. B. Wilkinson & R. J. Moore, Harry's Cosmeticology, Chemical publishing House, New York. 8th Edition (2000).
3. S. J. Carter, Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers and Distributors, Delhi-32.
4. A.R. Gennaro (ed), Remington's Pharmaceutical Sciences, 20th edition, Mack Publishing Company, Pennsylvania, U.S.A., 2000.
5. Perfumes, cosmetics and soaps, W. A. Poucher, Chapman & Hall, Landon, 10th edition, 2000.
6. Harry's Cosmeticology, J. B Wilkinson, R.J Moore, Longman Scientific & Technical, England, 8th Edition, 2000.
7. D.F. Williams and W.H. Schmitt, Chemistry and Technology of Cosmetics and Toiletries Industry, 1st edition, Blackie Academic and Professional, Glasgow, U.K.,1992.
8. W.A.Poucher, Perfumes, Cosmetics and Soaps vol 1,2 and 3, 9 th edition, Chapman and Hall, London, U.K., 1991.
9. R.M. Baird and S.F. Bloomfield , Microbial Quality Assurance in Cosmetics, Toiletries and Nonsterile Pharmaceuticals, 2nd edition , Francis and Taylor, Bristol, U.S.A., 1996.
10. M.S. Balsam and E. Sagarin, Cosmetics Science and Technology, Second Edition, Vol 1 and 2, Wiley-Interscience, New York, 1992.
11. J.H. Briston, Packaging of Cosmetics and Toiletries, 1st Edition, Newnes, Butterworths and Company, London, 1974.

BACHELOR OF PHARMACY (SEMESTER-IV)
(Under Credit Based Continuous Evaluation Grading System)

PHP 134: Pharmacology VII

3 Credits (2-1-0)

1. **General Pharmacology**:
   - 1.1 Definition, scope of Pharmacology.
   - 1.2 Routes of drug administration.
   - 1.3 Pharmacokinetics: Absorption, metabolism, distribution and excretion of drugs.
   - 1.4 Pharmacodynamics : mechanisms of drug action , receptors, theories of drug receptor interaction , agonist, partial agonist, antagonist, synergism, various types of antagonism, brief description of cellular signaling systems..

2. **Pharmacology of Drugs Acting on Autonomic Nervous System**:

2.1 Cholinergic system: Cholinergic transmission, cholinoceptors, parasympathomimetic agents, anticholinesterases and anticholinergic drugs.

2.2 Adrenergic system and drugs: Adrenergic transmission, biosynthesis storage, release, reuptake and metabolism of endogenous catecholamines, adrenergic receptors, adrenergic drugs, α & β adrenoceptors blockers, adrenergic neuron blockers.

2.3 Drugs acting on autonomic ganglia and neuromuscular blocking agents.

3. **Autacoids and Related Drugs**:
   - 3.1 Histamine, 5- hydroxytryptamine and their antagonist.
   - 3.2 Bradykinin and Angiotensin
   - 3.3 Eicosanoids and Non-steroidal anti-inflammatory agents.

4. **Local Anesthetics**

5. **Drugs Acting On Central Nervous System:**
   - 5.1 General anesthetics: Theories of anesthesia, stages of anesthesia, inhalation anesthetics, intravenous anesthetics, pre-anesthetic medication.
   - 5.2 Sedative-hypnotics: Barbiturates, benzodiozepines , and non- barbiturate hypnotics
   - 5.3 Pharmacology of alcohol.
   - 5.5 Antiepiliptic drugs.
   - 5.6 Drugs used in mental illness: antipsychotic agents, antianxiety drugs, antidepressants, antimaniac drugs, hallucinogens
   - 5.7 Opioid analgesics and antagonists.
   - 5.3 Drugs used in the treatment of neurodegenerative disorders: Antiparkinsonian drugs, drugs for Alzheimer's disease.

BOOKS RECOMMENDED: (Latest editions unless specified):

1. .J.G.Hardman and L.E.Limbird (Eds.), Goodman and Gilman's The Pharmacological Basis of Therapeutics, 11th Edition, Mc Graw Hill, NewYork, U.S.A.
2. C.R. Craig and R.E. Stitzel, Modern Pharmacology, 6th Edition, Little Brown and Company, New York, U.S.A.
3. K.D.Tripathi, Essentials of Medical Pharmacology, 6th Edition, Jaypee Brothers New Delhi, India.

PHL135: Pharmacognosy-V

3 Credits (2-1-0)

1. 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 containing glycosides:
    a. **Saponins:** Liquorice, ginseng, dioscorea, sarsaparilla, and senega.
    b. **Cardiocative sterols:** Digitalis, squill, strophanthus and thevetia.
    c. **Anthraquinone cathartics:** Aloe, senna, rhubarb and cascara.
    d. **Others:** Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia.
2. Studies of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacological, categories and common uses and marketed formulations of following indigenous drugs:
   Amla, Kantkari, Stavari, Gilo (Guruch), Bhilawa, Kalijiri, Bach, Rasna, Punarnava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi , Adusa, Arjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gyumnema, Shilajit, Nagarmotha, kalmegh and Neem.
3. The holistic concept of drug administration in traditional systems of medicine.
   Introduction of ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas.

Books Recommended and Suggested Reading:

1. Trease, G.E. and Evans, W.C. Pharmacognosy, Bailliere Tindall, Eastbourne, U.K. 15th Edition, 2002.
2. Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy, Lea & Febiger, Philadelphia. 9th Edition, 1988.
3. Wallis, T.E. Textbook of Pharmacognosy, J & A Churchill Ltd., London. 5th Edition, 1967.

BACHELOR OF PHARMACY (SEMESTER-IV)
(Under Credit Based Continuous Evaluation Grading System)

PHP 136: Pharm. Chem. XIII: Pharmaceutical Analysis

1.5 Credits (0-0-1.5)

SUGGESTED EXPERIMENTS:

1. Non-aqueous Titration: Preparations and standardization of perchloric acid and sodium/ potassium/Lithium methozides solution; Estimations of some Pharmacopoical products.
2. Complexometric Titrations: Preparation and standardization of EDTA solution, Some exercises related to Pharm.acopoical assays by complexometric titrations.
3. Miscellaneous Determinations: Exercises involving diazotisation, Kjeldah, karl-Fisher, Oxygen flask combustion and gasometry methods. Determination of alcohol content in liquid I A C galenicals, EPC procedures shall be covered.
4. Experiments involving seperation of drugs from exipients.
5. Chromatographic analysis of some Pharmaceutical products.
6. Exercises based on acid base a titration in equeous and nonequeous media, oxidation reduction titrations, precipitation titrations and complex formation titration using potentiometric technique. Determinations of acid base dissociation constants and plotting of titration curves using pH meter.
7. Exercises involving polarimetry.
8. Exercises involving conductiometric and polarographic techniques.
9. Exercises involving instrumental and other analytical techniques.

Books Recommended (Latest editions unless specified)

1. L.G. Chatten A Textbook of Pharmaceutical chemistry, Vol. I and II, Marcel Dekkar, New York, 1969.
2. A. H. Bockett and J. D. Stenlake practical Pharmaceutical Chemistry, Vol I and II, The Athlone press of the university of London 1976.
3. H. H. Willard, L. L. Merriet, Jr, and J. A. Dean, Instrumental Methods of analysis, Van Nostrand Roinhold, New York, 1974.

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

PHP 137: Pharmaceutics VIII: Cosmeticology and Formulation Development

1.5 Credits (0-0-1.5)

1. Formulation, preparation, packaging and presentation of following classes of dosage forms. Medicated syrups, dry syrups and topical ointments.
2. Formulation & preparation of emulsions and suspensions by homogeniser and colloid mill, evaluation of these products.
3. Preparation and quality control of cold creams, vanishing creams, moisturizing creams, cleansing lotions, skin. Tonics, shampoos, hair colorants, depilatories, shaving creams, tooth powder, tooth paste and after shave lotion.Experiments to illustrate comparative study of suspending agents, emulsifying agents and preservatives, use of HLB.

NOTE: ANY OTHER EXPERIMENTS(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

PHP 138: Pharm. Chem. XIV: Biochemistry

1.5 Credits (0-0-1.5)

1. Quantitative and qualitative estimation of reducing sugars, bile salts, cholesterol, chlorides, phosphates, urea, creatinine in biological fluids.
2. Enzyme estimations (Alkaline Phosphatase, SGOT, SGPT, LDH, myeloperoxidase, CPK, GPX) in plasma.
3. Estimation of vitamins (thymine, riboflavin), MDA in biological fluids.
4. Study of physiochemical properties of biomolecules such as proteins and carbohydrates.
5. Separation of amino acids by two dimensional paper chromatography and gel electrophoresis.
6. Separation of lipids by thin layer chromatography.
7. Quantitative estimation of amino acids and proteins.
8. Isolation and determination of RNA and DNA.
9. Effect of temperature on the activity of alpha-amylase.

BOOKS RECOMMENDED:

1. P.B. Hawk, B.L. Oser and W.H. Summerson, Practical Physiological Chemistry, McGraw Hill Book Company, New York 13th Edition, 1954.
2. L. J. Dancil and A.L. Neal, Laboratory Experiments in Biochemistry, Academic Press, New York.
3. J.M. Clark, R L Switzer, L F Garrity. Experimental Biochemistry, W.H. Freeman and Company, San Fransisco, 3rd Edition, 1999.
4. E. Baldwin and D.J. Bell, Cole's Practical Physiological Chemistry, Cambridge, W. Herrer and Sons Ltd., (1955).
5. J. Jayaraman, Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi. (1981).
6. D.T. Plumer, An Intoduction to Practical Biochemistry. Tata McGraw Hill, New Delhi. (1988).

PHP 139: Pharmacology VIII

1.5 Credits (0-0-1.5)

1. Various routes of drug administration.
2. Study of drugs acting on the central nervous system: Analgesics, anxiolytics, locomotor activity, antidepressants, anti-inflammatory agents etc.
3. Study of drugs acting on the autonomic nervous system: Demonstration of drugs acting on ANS using softwares.

Animal studies will be supplemented with simulated experiments with softwares wherever available.

Books Recommended: (Latest editions unless specified):

1. M.N. Ghosh, Fundamentals of Experimental Pharmacology, 2nd Edition, Scientific Books Agency, Calcutta, India, 1984.
2. U.K.Sheth, N.K. Dadkar and U.G. Kamath, Selected Topics in Experimental Pharmacology, Kothari Book Depot, Bombay, India, 1972.
3. Edinburgh University Pharmacology Staff (Ed.), Pharmacological Experiments on Isolated Preparations; Livingstone, London, U.K, 1968.

PHP 140: Pharmacognosy-VI

1.5 Credits (0-0-1.5)

1. Identification of crude drugs listed in theory.
2. Diagnostic macroscopic and Microscopic study of some important glycoside containing crude drugs as outlined above. Study of powdered drugs.
3. Standardization of some traditional drug formulations.

Books Recommended and Suggested Readings

1. Tyler, V.E. Jr. and Schwarting, A.E. Experimental Pharmacognosy. Burgess Pub. Co, Hinneapois, Hinnesotta, 3rd Edition, 1968.
2. Kokate, C.K. Practical Pharmacognosy. Vallabh Parkashan, Delhi, 2005.
3. Wallis, T.E. Analytical Microscopy. J & A Churchill Ltd., London, 1957.

PHL141: HETEROCYCLES, CARBOHYDRATES, PROTEINS & NUCLEIC ACIDS
3 Credits (2-1-0)

1. **Chemistry of Heterocyclic Compounds**: Nomenclature of heterocyclic compounds, five and six membered heterocycles, aromatic charactreristic of heterocyclic compounds. Structure, synthesis and reactions of pyrrole, furan and thiophene , pyridine and piperidine. Condensed five and six membered heterocyclics. Synthesis and reactions of indole quinoline and isoquinoline (Fischer Indole Synthesis, Skraup Synthesis and Bischler Nepieralski Synthesis). Heterocyclic ring systems containing up to two hetero atoms. Chemistry of pyrazole, imidazole, oxazole, thiazole. Purines and Pyrimidines, preparation and reactions of adenine, guanine, cytosine, uracil, thymine, Nucleotides, General methods for the synthesis of oligonucleotides.

2. **Carbohydrates:**Occurrence, classification, constitution and reactions of glucose and fructose, Osazone formation, mutarotation, Cyclic structures, determination of ring size. Configuration and conformation of monosaccharides, epimerization, Chain lengthening and shortening in aldoses, interconversions of aldoses and ketoses. Chemistry of ascorbic acid. Disaccharides and polysaccharides- Maltose, lactose, sucrose, cellulose, starch and gums.

3. **Amino acids Peptides Proteins:** Classification, source, essential and non essential amino acids. Synthesis, physical properties, zwitterion structure isoelectric point, chemical reactions and configuration of amino acids. Peptides and polypeptides, Geometry of peptide linkage, peptide synthesis.Structure determination of polypeptides and group analysis. Classification and general characteristics of proteins- primary, secondary, tertiary and quatenary structure of proteins, Helical and sheet structures.

Books Recommended (Latest Editions unless specified):

1. L. Finar, Organic chemistry, Vol. I and II, ELBS, Longman.
2. R. T. Morrison and R. N. Boyd, Organic Chemistry, Allyn and Bacon Inc. Boston.
3. R. N. Acheon, An Introduction to the chemistry of Hoterecyclic Compounds, Interscience Publishers, New York.
4. L. Stryer, Biochemistry, W. H. Freeman and Company, San Francisco.

BACHELOR OF PHARMACY (SEMESTER-V)
(Under Credit Based Continuous Evaluation Grading System)

PHL142: BIOLOGICAL PHARMACY

3 Credits (2-1-0)

1. **Disinfection:** Factors influencing disinfection, dynamics of disinfection, disinfectants, antiseptics and their evaluation.
2. **Sterilization:** Methods of sterilization i.e. physical, chemical , heat, radiation, gaseous and filtration methods, evaluation of efficiency of sterilization methods, equipments employed on large scale sterilization, examples of the materials sterilized by different methods, sterility indicators.
3. **Sterility Testing** : Sterility testing of products according to I.P., B.P. and U.S.P. sterility testing of parenteral products(solid, liquids), ophthalmic and other sterile products according to I.P., B.P. and U.S.P. , sterility testing of sterile surgical devices, dressings, implants, haemostats, surgical ligatures and sutures, pyrogen testing (Rabbit and LAL test).
4. **Aseptic Technique:** Sources of contamination and methods of prevention, designing of aseptic area, laminar flow equipments, their service and maintenance.
5. **Microbiological Standardization:** Microbiological methods for standardization of antibiotics, vitamins and amino acids.
6. **Immunological Preparations:** General method of preparation of bacterial vaccines, viral vaccines, rickettsial vaccines, antitoxins, serum immune blood additives and interferon. Methods of preparation, standardization and storage of BCG vaccine, diphtheria toxoid, small pox vaccine, polio myelitis vaccine, tetanus antitoxin and diagnostic biologicals.
7. **Blood and Glandular Products :** Preparation of extracts and isolation of pure substances for the preparation of dosage from pituitary, adrenal, thyroid, ovary, pancreas, stomach and liver, official blood products and plasma expanders.
8. **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, streptomycins, tetracyclines, alcohol, citric acid and vitamin B_{12} (cyanocobalamin).

Books Recommended:

1. W.B. Hugo and A.D. Russell, Pharmaceutical Microbiology, 5th Edition, Blackwell Scientific Publications, Oxford U.K., 1977.
2. Gilbert S. Banker and Christopher T. Rhodes, Modern Pharmaceutics, 2nd Edition, Marcel Dekker Inc., New York, U.S.A., 1990.
3. Gennaro A.R. (Ed.), Remington's Pharmaceutical Sciences, 18th Edition, Mack Publishing Company, Pennsylvania, U.S.A., 1990.
4. G. Reed (Ed.), Prescott and Dunn's Industrial Microbiology 4th Edition, CBS Publishers and Distributors, Delhi, India, 1982.

BACHELOR OF PHARMACY (SEMESTER-V)
(Under Credit Based Continuous Evaluation Grading System)

PHL143: PHYSICAL PHARMACY

3 Credits (2-1-0)

1. **Solubility and Related Phenomenon:** General considerations, solubility expressions; determination of solubility, solute-solvent interactions, solubility of gases in liquids, liquids in liquids and solids in liquids, Presentation of solubility data, solubility parameters, solubility curves, solubility product effect of co-solvents, pH and other factors.
2. **Interfacial phenomenon:** Surface tension, its origin and dimensions, surface free energy, pressure inside a droplet, vapour pressure of curved surfaces, Concept of surface excess, Gibbs equation. Contact angle measurement of surface and interfacial tension, spreading coefficient, surface films, Surface active agents; chemical classification, HLB, solubilsation and CMC, co-solubilization, emulsification wetting, imbibition, detergency, Adsorption at solid surface interface. Electrical properties of interfaces, (Diffused double layer, zeta potential), interfacial properties of particles in suspension, Particle interaction in liquids. Flocculation Kinetics.
3. **Colloids and Macromolecular System:** Dispersed systems methods of preparation of colloidal dispersions, size and shape of colloidal particles. Pharmaceutical applications. Types of colloidal systems. Optical Kinetics and electrical properties. Stability of colloidal systems. Sensitization of protective colloidal action.
4. **Rheology:** Scope and concepts. Mechanical models to represent concepts. Newtonian systems and Viscosity. Non-Newtonian systems and flow expressions. Thixotropy: Determination of viscosity and other rheological parameters. Pharmaceutical application.
5. **Micromeritcs and Powder Rheology:** Fundamental and derived properties of collection of particles; particles size distribution and its determination. Specific surface area. Particle number porosity, density, Angle of repose, Flow properties, Compaction and compression of powders.
6. **Kinetics and Drugs Stability:** General considerations and concepts, Complex reactions. Influence of temperature, light, solvent, catalytic species and other factors. Thermodynamic considerations and mechanisms in general, solid-solid degradations solid dosage from degradations, mechanisms that effect tablet stability, calculation of shelf life and assigning of expiry date, addition of overages in case of photo sensitive drugs like vitamins.
7. **Complexation:** Metal complexes, organic molecular complexes, inclusion complexes and their analysis.

Books Recommended (Latest editions unless specified):

1. Alfred Martin et. al., Physical Pharmacy, 4th Edition, 1994, B. I. Waberly Pvt. Ltd., New Delhi.
2. H. S. Beans, A. H. Beckett and J. E. Careless, Advances in Pharmaceutical Sciences, Vol. 1 to 4. Academic press, London.
3. Remington's Pharmaceutical Sciences, Mack Publishing Co, Eastern Pennsylvania, USA.

PHL144: PHARMACOGNOSY

3 Credits (2-1-0)

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, and specific chemical tests of following drugs containing alkaloids :

1.1 **Pyridine-piperidine**: Tobacco, areca and lobelia.
1.2 **Tropane**: Belladonna, hyoscyamus, datura, duboisia, coca and withania.
1.3 **Quinoline and isoquinoline**: cinchona, ipecac, opium.
1.4 **Indole**: Ergot, rauwolfia, catharanthus, nux-vomica and physostigma.
1.5 **Imidazole**: Pilocarpus
1.6 **Steroidal**: Veratrum and kurchi
1.7 **Alkaloidal amine**: Ephedra and colchicum
1.8 **Glycoalkaloid**: Solanum.
1.9 **Purines**: Coffee, tea and cola.

2. Role of medicinal and aromatic plants in national economy.
3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.
4. General biosynthetic pathways of natural products like alkaloids, glycosides, terpenoids, lignans, quassinoids, carotenoids and flavonoids.
5. Plant bitters and sweeteners.
6. Introduction, classification and brief study of different chromatographic methods and their applications in evaluation of herbal drugs.

Books Recommended:

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Kokate, C.K., Purohit, A.P. and Gokhale, S.B Pharmacognosy, Nirali Prakashan, Pune.
3. Handa, S.S and Kapoor, V.K. Textbook of Pharmacognosy, Vallabh Prashan, New Delhi.
4. Medicinal Plants of India. ICMR, New Delhi.
5. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
6. Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy. Lea & Febiger, Philadelphia.

PHP-145: HETEROCYCLES, CARBOHYDRATES, PROTEINS & NUCLEIC ACIDS

1.5 Credits (0-0-1.5)

1. Application of chromatographic techniques for analytical and preparative chemistry.

2. Isolation of National products and their spectrosapic characterization.

3. Multistep synthesis of organic medicinal compounds and hlotorocycles including preparation of raw material by commercial routes.

Note: Any other experiments(s) may be included in support of the theoretical aspects of the course.

PHP146: BIOLOGICAL PHARMACY

1.5 Credits (0-0-1.5)

1. Preparation and sterilization of aerobic and anaerobic media.
2. Aerobic and anaerobic cultivation of bacteria.
3. Gram's staining, acid fast staining and hanging drop preparation.
4. Separation of mixed cultures and maintenance of pure cultures.
5. Microbial viable count in Pharmaceutical Formulations.
6. Particle count in water for injection.
7. Thermal death time studies.
8. Morphological characteristics of moulds and Yeasts
9. Turbidimetric assay of at least one drug using microbial culture.
10. Bio-Chemistry reactions:
    i. Starch Hydrolysis test
    ii. Gelatin liquefaction test
    iii. Haemolysis of blood
11. Phenol coefficient test for the evaluation of disinfectants.
12. Biological assay of tetracycline and cyanocobalamin.
13. Test for limit of alkalinity of glass.
14. Test for sterility. (Rabbit method and LAL method)
15. Test for Pyrogens.
16. Preparation of injections of water, dextrose, normal saline and oily phenol.

Note: Any other experiments (s) may be included in support of the theoretical aspects of the course.

BACHELOR OF PHARMACY (SEMESTER-V)
(Under Credit Based Continuous Evaluation Grading System)

PHP147: PHYSICAL PHARMACY

1.5 Credits (0-0-1.5)

1. Experiments demonstrating the measure of angle of repose of loose powders (graphical methods and foot scale method). The factors affecting the flow of powders. (Use of lubricant with granules and to watch the change in angle and respose).
2. Viscosity determination of Newtonion and non-newtonion liquids by one point and multipoint viscometers. (Falling sphere method/ostwald's method).
3. Determination of particle size by optical method.
4. Determination of particle size by shifting methods and to study efficiency of screening operating system (granules).
5. Determination of particle size by sedimentation methods using Andreason pipette (sodium carbonate, Barium sulphate Barium chloride acacia etc.)
6. Study of the flow rates of loose powder through the tubes as a function of length of tube, diameter of orifice and pressure head (Different diametered tubes to be used).
7. Determination of H.L.B. value of surfactant by Saponification methods (Glyceryl monostearate).
8. Determination of H. L. B. value by modified Griffin Acacia Emulsion methods (Glycoryl monostearate).
9. Determination of C. M. C (critical micelle concentration) of surfactant by surface tension and / or other methods (Sodium lauryl sulphate).
10. Designing conduction and reporting of acclerated testing in studying chemical stabilization against hydrolytic/themolytic decomposition of drugs. (Aspirin tablets, paracetamol tablets, Multivitamin tablets).
11. Experiment demonstrating the usefulness of solubilizing agents in forming a clear liquid phase of two immiscible liquids. Ternary phase diagram, observation of effect of temperature (peppermint oil, propylene glycol, water).
12. Determination of spreading co-efficient of organic liquid or water as sublayer liquid.
13. Preparation of occlusion compounds and their studies.
14. Solubility of drug with respect to activity coefficient.
15. Adsorption of drug on adsorbing material efficacy and feasibility.

Note: Any other experiments (s) may be included in support of the theoretical aspects of the course.

PHP148: PHARMACOGNOSY

1.5 Credits (0-0-1.5)

1. Identification of crude drugs listed above.
2. Diagnostic macroscopic and microscopic study of characters of eight selected drugs given in theory in entire and powdered form.
3. Chemical evaluation of powdered drugs and enzymes.
4. Chromatographic studies of some herbal constituents.

Books Recommended:

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Kokate, C.K., Purohit, A.P. and Gokhale, S.B Pharmacognosy, Nirali Prakashan, Pune.
3. Handa, S.S and Kapoor, V.K. Textbook of Pharmacognosy, Vallabh Prashan, New Delhi.
4. Medicinal Plants of India. ICMR, New Delhi.
5. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
6. Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy. Lea & Febiger, Philadelphia.

BACHELOR OF PHARMACY (SEMESTER-VI)
(Under Credit Based Continuous Evaluation Grading System)

PHL 149: MEDICINAL CHEMISTRY-I

3 Credits (2-1-0)

1. **Principles of Medicinal Chemistry:** Drug absorption, distribution, metabolism and elimination. Drug receptor interaction, physico-chemical and steric aspects.

2. **Drug Metabolism:** Activation of oxygen and electron transport system. Role of cytochrome P-450 monoxygenases. Drug metabolising reactions: phase-I (Oxidative, reductive & hydrolytic) and phase-II (conjugative) reactions. Drug activation and consequences for human health. Factors effecting drug metabolism. Models mimicking drug metabolising enzymes.

3. **Pharmaceutical Chemistry:** (Source/synthesis, structure, stereochemistry, physico-chemical properties, structure activity relationships, mode of action and applications of the following classes of drugs:

(i) Steroids: Nomenclature and Stereochemistry, Steroidal receptors. Steroidal hormones (Androgens, Estrogens Progestogens, Glucocorticoids. Mineralocorticoids**).** Anabolic steroids, Oral contraceptives. Cardiotonic glycosides. Commercial production of steroids (Biosynthesis of cholesterol, Progesterone, testosterone, synthesis of progesterone, estradiol, stilbesterol, norethisterone, testosterone, hydrocortisone, cortisone.)

(ii) Analgesics and Non steroidal anti-inflammatory agents: Morphine and related compounds, Non-steroidal antiinflammatory analgesics. Antipyretics. Drugs for treatment of rheumatic arthiritis and gout. COX- 2 inhibitors (Indomethacin, Sulindac; ibuprofen, Naproxen, Piroxicam, Diclofenac, Nemisulide).

(iii) Antispasmodic, Antiulcer and antiallergenics: Histamine and anti-histaminic agents. Antiasthmetics Antitussive. Antiparkisonism drugs. Bradykinin & 5- hydroxy-tryptamine and their antagonists (Apomorphine, Mepyramine Diphenhydramine, Chlorpheniramine, Promethazine, Propantheline Bromide, Benzhexol)

(iv) CNS active agents: CNS depressants: General anaesthetics, Sedatives and hypnotics. Central relaxants with skeletal muscle relaxing properties. Tranquillizers. Anticonvulsants. Stimulants: Analeptics, Purines, Psychomotor stimulants, Halucinogens (Psychodelics, psychotomimetics) (Diethyl ether, Ethyl Chloride, cylopropane, Phenytoin, troxidone, Theophlline, chlorpromazine, Amitryptyline, Diazepam, Barbitone, Phenobarbitone, Cyclobarbitone, Thiopentone).

Books Recommended (Latest editions unless specified):

1. Wilson & Gisvold's Text Book of organic Medicinal and Pharmaceutical chemistry, 10th Edition. J. B. Lippincott Co, Philadelphia, USA.
2. W.C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA
3. H. Singh and V.K.Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi (Latest Edition).
4. M.E.Wolff, Ed. Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons, New York (Latest Edition).
5. J. E. F. Reynolds, Martindale, The Extra Pharmacopoeia. The Pharmaceutical Press, London, U. K.
6. B. G. Raben and H. A. Wittcoff, Pharmaceuticals Chemicals in Perspective, John Wiley & Sons, New York, 1989.

PHL 150: PHARMACEUTICAL TECHNOLOGY- I

3 Credits (2- 1 – 0)

1. **Tablet technology:**

   Tablet Dosage Form: Advantages and disadvantages of tablet dosage form, various forms of tablet such as coated and compressed layer tablets, effervescent, sublingual, buccal and chewable tablets, medicated lozenges, sustained release tablets.

   Tablet Formulation : Dry and wet granulation, properties of compressed tablets, systematic approach to tablet production design, components and additives of tablets, production of tablets including study of various processes, methods of manufacture of tablets. Problems in tablet manufacture.

   Compression and Compaction: Properties of tablets influenced by compression.

   Tablet Coating: Sugar coating including equipment, film and compression coating, methods of evaluating film coating, particle coating techniques.

   Evaluation of Tablets: Tablet thickness, colour, weight variation, friability, disintegration, hardness, dissolution and content uniformity.

   Pharmaceutical Tablet Compression Tooling: Terminology, tablet design, specification and information required, use and care of tooling, problem solving.
2. **Emulsions:** General considerations, theories of emulsification, formulation of emulsions, evaluation of emulsions, stability and shelf life of emulsions, official products.
3. **Suspensions:** Particle-particle interactions, crystal structure factors, rheological considerations, wetting agents, insoluble phase preparation, formulation, evaluation stability, official suspensions, gels and magmas.
4. **Capsules:** Hard and soft gelatin capsules, method of manufacturing, material used, processing and quality control, pharmaceutical application.
5. **Microencapsulation:** Microencapsulation including study of core and coat material, equipment, processing and evaluation.
6. **Suppositories:** Dose characteristics, therapeutic uses, physiological and physiochemical factors affecting drug absorption from rectum, types of suppository bases, formulation problems, manufacture, testing and packaging of suppositories.

Books Recommended (Latest editions unless specified):

1. H.A. Liebermann and L. Lachman, Pharmaceutical Dosage Forms, Tablets Vol. I, II, III Marrcel Dekker Inc., New York, U.S.A., 1980.
2. L.Lachman, 'The Theory and Practice of Industrial Pharmacy, 3rd Edition, Lea and Febiger, Philadelphia, U.S.A., 1987.
3. A.R.Gennaro (Ed.) Remington: Pharmaceutical Sciences, 18th Edition, Mack Publishing Company, Pennsylvania, U.S.A., 1990.
4. M.E. Aulton, Pharmaceutics -The Sciences of Dosage Form Design, 1st Edition, English Language Book Society, London, U.K., 2013.
5. G.S. Banker and C.T. Rhodes, Modern Pharmaceutics, Vol. 40, 2nd Ed., Marcel Dekker Inc., New York, U.S.A., 1990.
6. H.C. Ansel and N.C. Popovich, Pharmaceutical Dosage and Drug Delivery System, 5th Edition, Lea and Febiger, Pennsylvania, U.S.A.,2010.
7. Sanjay Kumar Jain , Vandana Soni Bentley's Textbook of Pharmaceutics. Elsevier India 2012.
8. Jain N.K. Pharmaceutical Product Development. CBS Publisher & Distributors P Ltd. 2011.
9. Linda Felton Remington: Essentials of Pharmaceutics. Pharmaceutical Press; 1 edition. 2013

BACHELOR OF PHARMACY (SEMESTER-VI)
(Under Credit Based Continuous Evaluation Grading System)

PHL 151: HOSPITAL PHARMACY

3 Credits (0-0-3)

1. **Introduction:** Organizational structure, classification and types of hospitals, Functions, planning, location and layout of hospital pharmacy, Flow chart of departmental activities (inpatient and outpatient), and relationship of pharmacy with other services in the hospital.

2. **Hospital Pharmacy Management:** Organization of pharmacy services, pharmacy and therapeutic committee. Man power planning in hospital pharmacy, Preparation of procedural manual, hospital formulary and budget. Purchase of drugs from distributors and Inventory control.

3. **Preparation of Formulation:** Central sterile supply room, manufacture of sterile preparations (small volume parenterals, large volume parenterals, total parenteral nutrition, i.v. admixtures) and non sterile preparations (liquid oral solution, external bulk concentrates) labeling and packaging.
4. **Handling and Storage:** Surgical instruments, ligatures and sutures, radiopharmaceuticals, medicinal gases, narcotic drugs, emergency medicines.

5. **Dispensing and Drug Distribution System:** Dispensing to ambulatory patients, unit dose dispensing, prepackaging of drugs and their labeling, patient councilling, charging the patient for hospital supplies and drugs, Dispensing to non ambulatory patients, floor stock system, Patient discharge including their drug supply and counseling.
6. **Clinical Pharmacy and Drug Information Service:** Role of hospital pharmacy in drug administration, safe use of medications in the hospital, drugs and poison information services, prevention of drug-drug interaction, drug dependence and drug abuse, role of pharmacist in education and research.

Books Recommended (Latest editions unless specified):

1. W.E. Hassan, Hospital Pharmacy, 5 th edition, K.M. Varghese Company, Bombay, India
2. M.C.Allwood and J.T. Fell. Text Book of Hospital Pharmacy, Black Well Scientific Publications, London , U.K.,
3. A.R. Gennaro (ed), Remington: The Science and Practice of Pharmacy 19th Edition, Mack Publishing Company, Pennsylvania, U.S.A., 1995., 1996

PHL 152: PHARMACOLOGY II

3 Credits (2-1-0)

1. **Drugs Acting on Cardiovascular System:** Cardiac glycosides and drug for congestive cardiac failure, coronary insufficiency and antianginal, antihypertensive drugs, antiarrhythmic drugs.
2. **Drugs acting on Haemopoietic System**: Anti anaemic agents, drugs for coagulation disorders, fibrinolytic agents, antiplatelet drugs, drugs used in bleeding disorders, agents used in hyperlipidemia.
3. **Drugs Acting on Kidney:** Diuretics, antidiuretics.
4. **Drugs Acting on Gastrointestinal Tract:** Drugs for treatment of peptic ulcer, emetics, antiemetics and prokinetic agents, purgatives and anti diarrhoeal agents.
5. **Hormones and Related Drugs:** Introduction to endocrine pharmacology, pituitary hormones, oxytocic and tocolytic agents, thyroid hormones and anti thyroid agents, hormones of pancreas and antihyperglycemic agents, adrenal corticosteroids and corticosteroid antagonists, gonadal hormones and their inhibitors, oral contraceptives, drugs regulating calcium homeostasis.
6. **Drugs acting on Respiratory System:** Bronchitis, Asthma, Cough.

Books Suggested (Latest editions unless specified):

1. K.D.Tripathi, Essentials of Medical Pharmacology, 6th edition, Jaypee Brothers, New Delhi, India.
2. P.K.Das, S.K.Bhattacharya and P.Sen, Pharmacology B.I.Churchill Livingstone Pvt. Ltd., New Delhi, India,
3. C.R.Craig and R.E. Stitzel, Modern Pharmacology, 6th Edition, Little Brown and Company, New York, U.S.A.
4. J.G.Hardman and L.E.Limbird (eds), Goodman and Gilman's The Pharmacological Basis of Therapeutics, 11th edition, Mc Graw Hill, New-York, U.S.A.
5. B.G.Katzung. Basic and Clinical Pharmacology, 10th edition, Prentice Hall, International Inc., New Jersey, U.S.A.

PHL 153: PHARMACOGNOSY (CHEMISTRY OF NATURAL PRODUCTS)

3 Credits (2-1-0)

1. Chemical and spectral approaches to identify simple molecules of natural origin.
2. Concept of stereoisomerism taking examples of natural products.
3. Chemistry and pharmacological activity of following medicinally important class of drugs:
   - **3.1 Terpenoids**: Mono-, di-, sesqui- and triterpenoids.
   - **3.2 Carotenoids**: Carotenes, vitamin A and xanthophylls
   - **3.3 Glycosides: D**igitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.
   - **3.4 Alkaloids :** Atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergot andbn vinca alkaloids.
   - **3.5 Antibiotics**: Penicillin, streptomycin and tetracycline.
   - **3.6 Miscellaneous**: Lignans and quassinoids, flavonoids.
4. **Peptidomimetics:** Introduction, Natural peptidomimetics, Mimicking of protein motifs, Design of peptidomimetic rigid scaffolds.

Books Recommended (Latest editions unless specified):

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, A Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Beckett, A.H. and Stenlake, J.B. Practical Pharmaceutical Chemistry, Fourth Edition Part Two, CBS Publishers and Distributors, New Delhi.
3. Chatwal, G.R. and Anand, S.K. Instrumental Methods of Chemical Analysis, Himalaya Publishing House, New Delhi.
4. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
5. Jackson, B.P. and Snowdon, D.W. Atlas of Microscopy of Medicinal Plants Culinerbs and Spices, CBS Publishers & Distributors (P) Ltd., New Delhi.

BACHELOR OF PHARMACY (SEMESTER-VI)
(Under Credit Based Continuous Evaluation Grading System)

PHP 154: MEDICINAL CHEMISTRY

1.5 Credits (0-0-1.5)

1. Synthesis of selected drugs involving two or more steps.
2. Special analysis of synthesized and other drugs.
3. Establishing the Pharmacopoeial standards of the synthesized drugs.

Note: Any other experiment(s) may be included in support of the theoretical aspects of the course.

PHP 155: PHARMACOLOGY II

1.5 Credits (0-0-1.5)

1. Methods to anaesthetize laboratory animals, examination of rat vaginal smears.s
2. Pharmacological techniques to study cardiovascular drugs.
3. Experimental methods to study the effect of diuretics, antidiuretics, hypoglycaemic agents, anti-inflammatory agents and drugs used in peptic ulcer.
4. Dose response relationship, calculation of EC 50, dose ratios and affinity constants using isolated rat fundus, isolated rat uterus, isolated rat colon and isolated rat anococcygeus muscle.

Books Recommended (Latest editions unless specified):

1. M. N. Ghosh, Fundamentals of Experimental Pharmacology, 2nd edition, Scientific Book Agency, Calcutta, India.
2. Edinburgh University. Pharmacology Staff (ed), Pharmacological Experiments on Intact Preparation, Lovingstone, London, U.K.
3. U. K. Seth, N. K. Dadkar and U. C. Kamath, Selected Topics in Experimental Pharmacology, Kothari Book Depot, Bombay , India.

PHP 156: PHARMACOGNOSY

1.5 Credits (0-0-1.5)

1. Laboratory experiments on isolation, separation, and purification of various groups of chemical constituents of pharmaceutical significance.
2. Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents.

Books Recommended:

1. Trease, G. E. and Evans, W.C. Pharmacognosy, Published by Elsevier, A Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. Beckett, A.H. and Stenlake, J.B. Practical Pharmaceutical Chemistry, Fourth Edition Part Two, CBS Publishers and Distributors, New Delhi.
3. Chatwal, G.R. and Anand, S.K. Instrumental Methods of Chemical Analysis, Himalaya Publishing House, New Delhi.
4. Wallis, T.E. Textbook of Pharmacognosy, Fifth Edition, CBS Publishers and Distributors, New Delhi.
5. Jackson, B.P. and Snowdon, D.W. Atlas of Microscopy of Medicinal Plants Culinerbs and Spices, CBS Publishers & Distributors (P) Ltd., New Delhi.

BACHELOR OF PHARMACY (SEMESTER-VI)
(Under Credit Based Continuous Evaluation Grading System)

PHP 157: Pharmaceutical Technology I

1.5 Credits (0-0-1.5)

1. Preparation and evaluation of tablets by dry and wet quanulation methods.
2. Quality control tests of tablets
3. Quality control tests hard and soft gelatin capsules
4. Preparation of tablets and study of the influence of formulation factors (binding agent, disntegrants, lubricants and glidants) on the dissolution rate of tablets.
5. Preparation and pan coating of granules, and tablets, Evaluation of granules, coated granules and tablets prepared from uncoated granules and coated granules.
6. Preparation of sustained release tablets and capsules of drugs and their in-vitro evaluation using dissolution rate testing apparatus.
7. Filling, sealing and evaluation of hard gelatin capsules and comparison with marketed products.
8. Industrial training/ Industrial tour

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHL157: MEDICINAL CHEMISTRY-II

3 Credits (2-1-0)

1. Introduction to drug design and development: History and objectives of drug designing. Economic aspects of drug designing. Procedures followed in drug designing. Drug discovery without a lead-de Novodrug designing. Lead based methods. Approaches to lead discovery. Dissection of a drug molecule into biofunctional moieties. Identification of Pharmacophore. Structural modifications: homologation, chain branching and ring chain transformations. Bioisosterism. Modulation of phamacokinetics by molecular manipulations. QSAR

2. Pharmaceutical Chemistry (Source/ synthesis, Structure, stereochemistry, physicochemical properties, Structure activity relationships. Mode of action and Applications) of the following classes of drugs:

(a) Adrenergic Agents: Adrenergic neuro transmitters. Adrenrrgic receptors. Sympathomimetic agents. Adrenergic Blockers.

(b) Cholinergic Drugs and Related Agents: Cholinergic neuro transmitters. Cholinergic agonists. Cholinergic blocking agents. Parasympathetic postganglionic blocking agents. Solanaceous alkaloid and synthetic analogs. Synthetic amino alcohol esters. Ganglionic blocking agents. Neuromuscular blocking agents.

(c) Local Anaesthetics: Nervous tissue, Mechanism of action of local anaesthetics Products.

(d) Cardiovascular Drugs: Antianginal drugs and vasodilators. Antiarrhythmic agents. Antihypertinsive drugs. Antihyperlipidemic agents. Coagulants and anticoagulants. Selerosing agents, Synthetic hypoglycemic drugs. Thyroid hormones and antithyroid drugs. Cardiotonic agents.

(e) Diuretics: Water and osmotic agents. Acidifying salts. Mercurials phenoxyacetic acids. Purines and related heterocycles. Sulfonamides, Sulfamyl benzoic acid derivatives. Endocrine antagonists. Miscellaneous compounds.

(f) Anti-infective agents: Local anti-infective agents, phenols and their derivatives. Urinary tract anti-infectives and anticeptics. Antiscabious and antipedicular agents preservatives.

(g) Diagnostic agents: Radioopaque diagnostic agents. Agents for kidney functi on test. Agents for liver function tests. Miscellaneous diagnostic agents.

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

Books Recommended (Latest editions unless specified):

1. Wilson & Gisvold's Text Book of organic Medicinal and Pharmaceutical Chemistry, 10th Edition. J. B. Lippincott Co, Philadelphia, USA.
2. W.C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA
3. H. Singh and V. K. Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi (Latest Edition).
4. M.E.Wolff, Ed. Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons, New York (Latest edition).
5. J. E. F. Reynolds, Martindale, The Extra Pharm Acepoeia. The Pharmaceutical Press, London, U. K.
6. B. G. Raben and H. A. Wittcoff, Pharmaceuticals Chemicals in Perspective John Wiley & Sons, New York, 1989.
7. The Organic Chemistry of Drug Design and Drug Action by R.B. Silverman, 2nd Edition, Academic Press, 2004.
8. Drug Design- A Series of Monographs in Medicinal Chemistry ed. E. J. Ariens, Ist Edition, Vol. 1., Vol. II., Vol. V., Vol. VIII & Vol. IX.
9. Comprehensive Medicinal Chemistry, Pcrgamon Press, 1990, Vol. 4.

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHL158: Pharmaceutical Technology-II

3 Credits (2-1-0)

1 **Preformulation Studies:** Organoleptic properties, purity, particle size, shape, surface area, solubility and dissolution of drugs. Chemical reactions involving drug excipient interactions, solid state stability studies.

2 **Parenteral Technology:** Preformulation factors, water for injection, pyrogenicity, non aqueous vehicles, isotonicity and it's adjustment methods, emulsions and suspension formulations as parenteral and their formulation. Containers i.e. glass composition and it's suitability, test for alkalinity, plastics container Closures i.e. natural and synthetic rubber and quality control of closures. Pre-filling treatment i.e. washing of containers and closures, preparation of small volume and large volume parenterals. Quality control test for SVP and LVP.

3 **Pharmaceutical Aerosols:** Components, formulation, types of systems, manufacturing, operation of an aerosol package, quality control and testing, oral inhalation nasal and topical aerosols.

4 **Controlled Drug Delivery Systems:** Introduction, terminology and drug targeting. Physiochemical and biological factors influencing design and performance of sustained release products. Design and fabrication of oral controlled release drug delivery system. Introduction to liposomes, microspheres,. endocytosis of macromolecular drug carriers, implantable and transdermal therapeutic systems. Commonly used polymers in controlled drug delivery systems.

5 **Packaging Technology:** Types of containers, materials used for packaging and their interaction with drugs, closures, unit dose packaging and strip packaging materials. Packaging of solid, parenterals and ophthalmic dosage forms. Tamper proof packaging.

6 **Good Manufacturing Practices for Pharmaceuticals:** Status and applicability of regulation. Current good manufacturing practices in manufacturing, processing, packaging and holding of drugs. Production and process controls, ISO 9000 certification.

7 **Dissolution testing of solid dosage forms:** In vitro- In vivo correlation and BCS classification of drugs

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

Books Recommended (Latest editions unless specified):

1. L.A. Lachman, H.A. Liberman and J.L. Kanic, The Theory and Practice of Industrial Pharmacy, 3rd Edition, Lea and Febiger, Philadelphia, U.S.A., 1986.
2. Gilbert S. Banker and Christopher T. Rhodes, Modern Pharmaceutics, 2nd Edition, Marcel Dekker Inc., New York, U.S.A., 1990.
3. M.E. Aulton, Pharmaceutics: The Science of Dosage form Design, English Book Society, London, U.K., 1988.
4. S.H.Willing, M.M. Tuckerman and W.S. Hitchings, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, 2nd Edition, Marcel Dekker Inc., New York, U.S.A., 1984.
5. Yie W.Chien, Novel Drug Delivery Systems: Fundamentals, Developmental Concepts, Biomedical Assesments, Marcel Dekker Inc., New York, U.S.A., 1984.
6. J.R.Robinson and V.H.L.Lee, (ed) Controlled Drug Delivery: Fundamental and Applications, 2nd Edition, Marcel Dekker Inc., New York, U.S.A., 1987.
7. A.R.Gennaro (Ed.) Remington: The Science and Practice of Pharmacy, 19th Edition, Mack Publishing Company, Pennsylvania, U.S.A., 1995.
8. Sanjay Kumar Jain , Vandana Soni Bentley's Textbook of Pharmaceutics. Elsevier India 2012.
9. Jain N.K. Pharmaceutical Product Development. CBS Publisher & Distributors P Ltd. 2011.
10. Linda Felton Remington: Essentials of Pharmaceutics. Pharmaceutical Press; 1 edition. 2013

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHL159: Pharmaceutical Management

3 Credits (2-1-0)

1. **Concept of Management:** Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, Innovation, Creativity, Delegation of Authority / Responsibility, Record Keeping).
2. **Personnel Management:** Definition, importance and objectives: Qualities and functions of personnel manager human resource planning: - Meaning and need, job analysis, job description and job specification. Recruitment and selection process: sources of manpower, recruitment policies, selection procedures. Promotion, demotion, transfer and separation. Employee training.
3. **Materials management:** Materials handling, equipment, inventory management, economic ordering quantity (EOQ), ABC analysis, value analysis, classification and codification of stores, obsolete, surplus and scrap management, lead time, inventory carrying costs, safety stock.
4. **Pharmaceutical Marketing:** Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.
5. **Salesmanship:** Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation, compensation to the pharmacist.
6. **Production Management :** A brief exposure of the different aspects of Production Management – Visible and Invisible inputs, Methodology of Activities Performance Evaluation Technique Process –Flow, Process Know-how, Maintenance Management.
7. **Management of hospital pharmacy**

   a) Introduction to health care systems in India and abroad, health services and hospital Pharmacy, recommendations of various committees and commissions.

   b) Pharmacist's role in administration, dispensing/ manufacturing, quality control, Pharmacy therapeutic committee Hospital formulary and provisioning of drugs in hospitals. Principles of stores management, establishment of central and sub stores in hospitals, centralized and decentralized stores, Precautions of storage of drugs, receipts and issue, OTC products.

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

Recommended Books (Latest editions unless specified):

1. Bhavesh S. Nayak, Biren N. Shah, Vineet C. Jain. A Textbook of Pharmaceutical Industrial Management. Elsevier India Pvt. Ltd., (2010).
2. R.M. Mehta, Pharmaceutical Industrial Management. Vallabh Publications.
3. G. Vidya Sagar.Pharmaceutical Industrial Management. Pharma Book Syndicate (2009).
4. Principals and Methods of Pharmacy Management, H.A. Smith and Lea and Febriger Philadelphia, Tenth Edition (2001).
5. Principles of Management, H. Koontz, C. O. Donnell and H. Weihrich, McGraw Book(P) Ltd. Singapore, Tenth Edition .
6. Marketing: A Managerial Introduction, J. C. Gandhi, Tata McGraw Hill Publishing Co., New Delhi.

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHL160: Pharmacology

3 Credits (2-1-0)

1. Introduction to the antimicrobial therapy
2. Chemotherapeutic Agents Part- I
   2.1. Beta- lactam and other cell- wall & membrane- active antibiotics
   2.2. Tetracyclins, macrolides, chloramphenicol & streptogramins
   2.3. Aminoglycosides & spectinomycin
   2.4. Sulfonamides, trimethoprim & quinolones
3. Chemotherapeutic Agents Part- II
   3.1. Antimycobacterial agents
   3.2. Antifungal agents
   3.3. Antiprotozoal agents
   3.4. Antiviral agents
4. Cancer chemotherapy
5. Immunopharmacology
6. Neurodegenerative disorders: Pathophysiology and drug therapy of Alzheimer's disease, Multiple sclerosis, Huntington's chorea.
7. Drug therapy of inflammatory disorders: Disease modifying antirheumatic agents (DMARDS), Gout and Inflammatory Bowel disease

Recommended Books (Latest editions unless specified):

1. J.G. Hardman and L.E. Limbird (Eds), Goodman and Gilman's The Pharmacological Basis of Therapeutics, 11th Edition, McGraw Hill, New-York, U.S.A.
2. B.G. Katzung, Basic and Clinical Pharmacology, 10th ed (or The Latest Ed. Available), McGraw Hill.
3. J.E.F. Reynolds, Martindale, The Extra Pharmacopoeia. The Pharmaceutical Press, London, U. K.
4. T.M. Speight (Ed.), Avery's Drug Treatment: Principles and Practice of Clinical Pharmacology and Therapautics, 3rd Edition, ADIS Press, Aucland, 1987.

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHL161: Pharmaceutical Biotechnology

3 Credits (2-1-0)

1. Introduction to pharmaceutical Biotechnology: concepts, basic techniques of biotechnology (such as ELISA, Western blot, Southern blot and Northern blot) and their application in pharmacy, biotechnology industry, products, application of bioreactors for large scale production of useful pharmaceutical products and markets.

2. Genetic recombination: Transformation, conjugation, transduction, protoplast fusion, gene cloning and their applications, Development of hybridoma for monoclonal antibodies, study of drugs produced by biotechnology such as Activase, Humulin, streptokinase, Hepatitis B etc.

3. Microbial transformation: Introduction, types of reactions mediated by microorganism design of biotransformation processes, selection of organism, biotransformation process and its improvements with special reference to steroids.

4. Immunology & Immunological preparation: Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen antibody reaction and their applications, hypersensitivity, active and passive immunization, vaccines, their preparation, standardization and dosages.

5. Enzyme immobilization: Techniques of immobilization of enzymes and cells, factors affecting enzyme kinetics. Applications in pharmaceutical industry, therapeutics and clinical assays.

6. Plant tissue culture: Introduction, types of cultures, nutritional requirements, application of plant tissue culture for the production of secondary metabolites. Study of callus culture, cell suspension culture, single cell culture, totipotency and Role of plant growth regulators for the production of secondary metabolites. Production and appliction of synthetic seeds.

7. Design of drug delivery system for biotechnological products.

Recommended Books (Latest editions unless specified):

1. Vyas and Dixit Pharmaceutical Biotechnology, 1st CBS Publisher, New Delhi, 1991
2. P. K. Gupta, Elements of Biotechnology, Rastogi Publication, 10th Edition, 2004
3. Daan J. A. Crommelin, Robert D. Sindelar. Pharmaceutical Biotechnology: Fundamentals and Applications, 3rd Edition (2007)
4. K. Sambamurthy, Ashutosh Kar, Pharmaceutical Biotechnology, 2nd Edition, New AGE International (LP) Limited, 2007.
5. Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne Kuby Immunology: W H Freeman & Co, 4th Edition (2000)

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHP 162: Pharmaceutical Technology II

1.5 Credits (0-0-1.5)

EXPERIMENTS:

1 Experiments based on preparation, characterization and quality control test for tablet, capsules, suspension, emulsion and parenteral dosage forms.

2 Experiments based on preformulation studies of drugs.

3 Experiments based on dissolution testing of immediate release and controlled release dosage forms.

4 Experiments based quality control test for packaging materials.

5 Preparation, characterization and quality control test for tablet, capsules, suspension, emulsion and parenteral dosage forms.

6 Industrial Tour

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHP 163: Pharmacology

1.5 Credits (0-0-1.5)

1 Study of toxicity with antimicrobials: Gentamycin induced nephropathy, isoniazid induced peripheral neuropathy etc.
2 Study of drugs useful for inflammatory conditions.
3 Study of drugs with memory enhancing action.
4 Application of statistical analysis using t- test etc.

Animal studies will be supplemented with simulated experiments with software's wherever available.

Books Recommended: **(Latest editions unless specified):**

1 M.N. Ghosh, Fundamentals of Experimental Pharmacology, 2nd Edition, Scientific Books Agency, Calcutta, India, 1984.
2 U.K.Sheth, N.K. Dadkar and U.G. Kamath, Selected Topics in Experimental Pharmacology, Kothari Book Depot, Bombay, India, 1972.
3 Edinburgh University Pharmacology Staff (Ed.), Pharmacological Experiments on Isolated Preparations; Livingstone, London, U.K., 1968.

BACHELOR OF PHARMACY (SEMESTER-VII)
(Under Credit Based Continuous Evaluation Grading System)

PHP 164: Pharmaceutical Biotechnology

1.5 Credits (0-0-1.5)

EXPERIMENTS:

1. Preparation of Nutrient Media
2. Preparation of plant cell culture media
3. Aseptic Technique and the Transfer of Microorganisms
4. Culture Techniques
    a. Liquid Media Inoculation
    b. Solid Media Inoculation like Streak plate, Pour plate, Stab culture, Swab culture.
5. To isolate the micro-organism from sample of water.
6. Isolation of DNA and its purity estimation
7. Estimation of DNA by Diphenylamine Method
8. To prepare hydrated synthetic seeds in-vitro
9. Isolation of RNA and its purity estimation
10. Enzyme immobilization by Ca-alginate method.
11. To isolate protoplast by mechanical method
12. Separation of green plant pigments by column chromatography
13. Spectrophotometric assay of enzymes
14. Estimation of
    a. Serum Glutamate Oxaloacetate Transaminase (SGOT) Test
    b. Serum Glutamate Pyruvate Transaminase (SGPT) Test
    c. Protein with standard curve by Ninhydrine method
15. Effect of Substrate Concentration on Enzyme Kinetics
16. Effect of temperature on enzyme kinetics

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

Books Recommended (Latest editions unless specified):

1. Seidman L.A., Kraus M.E., Brandner D, Mowery J. Laboratory Manual for Biotechnology and Laboratory Science: The Basics. Benjamin Cummings; 1 edition 2010.

2. Carson S., Miller H, Witherow D. S., Molecular Biology Techniques, Third Edition: A Classroom Laboratory Manual. Academic Press; 3 edition, 2011.

3. Dutta S., Dutta A., Experimental Biotechnology (Practical Manual Series). New India Publishing Agency 2011.

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHL164: MEDICINAL CHEMISTRY-III

3 CREDITS (2-1-0)

1. **Pharmaceutical Chemistry (Source/ synthesis, Structure, stereochemistry, physicochemical properties, Structure activity relationships. Mode of action and Applications) of the following classes of drugs:**
   a. **Sulfonamides Sulfones and folate reductase inhibitors with antibacterial action**: Sulfonamides and folate reductase inhibitors, Sulfonamides for burn therapy sulfonamidies for intestinal infections.
   b. **Antibiotics:** β-Lactum antibiotics. The aminoglycosides. The tetracyclines. Macrolide antibiotics. Polyene antibiotics. The lincomycins. Polypeptide antibiotics. Fluroquinolones. Chloramphenicol and other unclassified antibiotics. Antitubercular Agents, Antileprosy agents (Dapsone).
   c. **Antimalarials:** Cinchona alkaloids 7-chloro-4- aminoquinolines, 8-Aminoquinolones. 9- Aminoacridines. Mefloquine. Diaminopyridines. Biguanides. Sulfones and other miscellaneous antimalarials.
   d. **Antifungal agents:** Fatty acids and their derivatives, salicylic acid derivatives. Salicylanilids, Tolnaflate p-chloro-Methoxylenol. Acrisorcyin, Azoles, Chlorphenesin, Dithranal.
   e. **Antiviral Agents:** Adamantane derivertives (Amantadine Rimantadine).Idoxuridine, Trifluoruridine, Vidarabine, ibravarine, Acycloguanosine, Inospiplex, Methisazone, Zidovudine. Acycolovir, Ganciclovir, Foscarnet, Human interferon.
   f. **Antineoplastic Agents:** Alkylating agents, Antimetabolites , Antitumor antibiotics Antitumour alkaloids . Hormones (Steroids, Tamoxifan, mitotane, Dormantanolone propionate Testalactone Magestrol acetate Miscellaneous compounds (Hydroxy urea, cisplatin, Pipobroman).

g. Anthelmintical: Tetrachlorocthylene. Piperazine, Gentian Violet pyrinium pamoate. Thiabendazole, Mebendazole, Bephenium hydroxynaphthoate Diclophene Niclosamide. Levemisole hydrochloride. Tetramisole Niridazole. Biothional Antimony potassium tartarat stibiophen. Sodium stibiocaptate. Antiamoebic and antiprotozoal drugs.

Books Recommended (Latest editions unless specified):

1. Wilson & Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, 10th Edition. J. B. Lippincott Co, Philadelphia, USA.
2. W.C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA
3. H. Singh and V.K. Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi (Latest Edition).
4. M.E.Wolff, Ed. Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons, New York (Latest Edition).
5. J. E. F. Reynolds, Martindale, The Extra Pharm Acepoeia. The Pharmaceutical Press, London, U. K.
6. B. G. Raben and H. A. Wittcoff, Pharmaceuticals Chemicals in Perspective John Wiley & Sons, New York, 1989.
7. The Organic Chemistry of Drug Design and Drug Action by R.B. Silverman, 2nd Edition, Academic Press, 2004.
8. Drug Design- A Series of Monographs in Medicinal Chemistry ed. E. J. Ariens, Ist Edition, Vol. 1., Vol. II., Vol. V., Vol. VIII & Vol. IX.
9. Comprehensive Medicinal Chemistry, Pcrgamon Press, 1990, Vol. 4.

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHL170: PHARM. CHEM. XV: PHARMACEUTICAL ANALYSIS

3 Credits (2-1-0)

1. **Ultraviolet and Visible Spectroscopy:** Nature of electromagnetic radiation, the absorption of energy by atoms and molecules, the emission of radient energy by atoms and molecules; Electronic excitation, Fundamental laws of photometry, deviation from Beers law, representation of spectral data, selection of wavelength and bond width chromophores photometric error, instrumentation(radiation sources, monochromators and detectors), single and double beam instruments. Woodward Fieser rules and their applications, turbidimetry, naphlometry, polarimetry.
2. **Infrared Spectrocopy:** Theory characteristics absorbance bands of organic functional groups, interpretation of infrared absorption spectra frequency range, sample handling, infrared instrumentation (light sources, monochromators, detectors, FTIR), applications. Introduction to Raman spectroscopy and its difference with Infrared.
3. **Fluorimetric Analysis:** Theory quantitative description, factors affecting fluorescence intensity, relationship of fluorescence to molecular structure instrumentation, (Cells, light source, wavelength selection, detectors), correction of spectra and applications. Brief introduction to phosphorescence, flame emission and atomic absorption spectroscopy.
4. **Nuclear Magnetic Resonance Spectroscopy:** An Introduction to the theory of NMR, magnetic properties of the hydrogen nucleus, relaxation time chemical shift, spin-spin coupling, instrumentation, quantitative analysis of drugs, analytical limitations of NMR in Pharmaceutical analysis. Exchangeable protons. A brief introduction to fourier transform NMR and ^{13}C NMR.
5. **Mass Spectroscopy:** Instrumentation (Ionization sources, electron impact ionization, Field ionization, chemical ionization and fast atom bombardment, sources). Analyzers single & double focusing, time of flight and quadrupole, mass spectra determination of molecular formulae, recognition of the molecular ion peak, fragmentation, mass spectra of some simple compounds.

Books Recommended (Latest editions):

1. Principles of Instrumental Analysis by D. A. Skoog and J. J Leary, Saunders Publishing Co.
2. H. H. Willard. L. L. Merritt, Jr, and J. A. Dean,. Instrumental Methods of Analysis, Van Nostrand Reinhold, New York.
3. J. W. Robinson, Undergraduate Instrumental Analysis, Marcel Dekker, Inc, New York, 1970.
4. A. H. Beckett and J. B. Stenlake, Practical Pharmaceutical chemistry, Vol. I and II, The Athene Press of the University of London.
5. L. G. Chatten, A Textbook of Pharmaceutical Chemistry, Vol. I and II, Marcel Dekker, New York.

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHL166: Pharmacology (Clinical Pharmacology and Toxicology)

Credits (2-1-0)

1. **Basics Concept:** Definition scope and development of clinical pharmacy and clinical pharmacology.
2. **Drug Discovery and Development:** Concept of pharmacogenology, preclinical evaluation, safety and clinical evaluation, post marketing surveillance and drug regulatory affairs.
3. **Basic and General Principles of Drug Therapy:**
   - 3.1 **Monitoring of Drug Therapy:** Therapeutic, pharmacokinetic and pharmacodynamic monitoring of drug therapy
   - 3.2 **Adverse Reactions to Drugs:** Incidence, classification and surveillance methods of adverse reactions to drugs.
   - 3.3 **Pharmacogenetics:** Pharmacokinetic and pharmacodynamic aspects of pharmacogenetics.
   - 3.4 **Drug Interactions:** Incidence, pharmacokinetics and pharmacodynamic drug interactions.
   - 3.5 **Patient Compliance:** Factors which affect compliance. Methods of measuring and improving drug compliance.
   - 3.6 **Pharmacology of Placebos:** Mode of action, uses and abuses, adverse effects and factors which influence the response of placebos.Drug therapy in special populations: Drug therapy in children, elderly (geriatric pharmacology) and pregnant and lactating mothers.
4. **Drug Information:** Sources of drug information and counseling of patients.
5. **Prescription Writing:** The principles of prescription writing and practical prescribing.
6. **Clinical Toxicology:** Principles and management of different types of poisoning and toxicity reactions.

Recommended Books (Latest editions unless specified):

1. D.G. Grahame-Smith and J.K. Aronson, The Oxford Text Book of Clinical Pharmacology and Drug Therapy. Oxford University Press, Oxford, U.K.
2. T.M. Speight (Ed.), Avery's Drug Treatment: Principles and Practics of Clinical Pharmacology and Therapautics, 3rd edition, ADIS press, Aucland
3. J.T. Dipiro, R.L. Telbert, P.E. Hayer, G.C. Yee and L.M. Posey (Eds), Pharmacotherapy : A Pathophysiologic Approch, 5th Edition, Elsevier Science Publishing Co. Inc., New York, U.S.A.

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHL167: Pharmacognosy

Credits (2-1-0)

1. Recent developments in natural products with two examples each from anticancer, antimicrobial, antihepatotoxic, antiviral, antioxidants, antiprotozoals and CNS active plants.
2. Chemical standardization of plant drug material: Through marker analysis and fingerprint profiling.
3. Introduction to plant growth regulators and their physiological role.
4. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.
5. Plant derived insecticide.
6. Marine pharmacognosy, novel medicinal agents from marine sources.
7. Natural allergens and photosensitizing agents and fungal toxins.
8. Herbs and health foods and neutraceuticals and introduction to registration aspects of herbal products for marketing. Agencies controlling regulatory aspects for herbal products at national and international level. (WHO, EMEA etc).
9. Herbal cosmetics.

Books Recommended (Latest editions unless specified):

1. Atal, C.K. and Kapur, B.M. Cultivation & Utilization of Medicinal Plants, R.R. Jammu.
2. Kalia, A.N. Textbook of Industrial Pharmacognosy, CBS Publishers & Distributors, New Delhi.
3. Ansari, S.H. Essentials of Pharmacognosy. Third Edition 2009, Birla Publication Pvt. Ltd., Delhi.
4. Remington. The Science and Practice of Pharmacy, Vol. I & II, Mack Publishing Company, Pennsylvania.
5. Wagner, H. and Bladt, S. Plant Drug Analysis–A Thin Layer Chromatography Atlas, Second Edition, Springer India Pvt. Ltd., New Delhi.

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHL168: Pharmaceutical Jurisprudance

3 Credits (2-1-0)

1 Definition and scope of Forensic Pharmacy, Pharmacist's role in drug treatment, drug usage and pharmacist as a member of health care team.

2 Pharmaceutical legislation in India: Historical development of Pharmaceutical education in India and its present status, Professional ethics in Pharmacy practice, legal and ethical responsibilities of Pharmacists.

3 Study of drugs and Cosmetics Act 1940 and Rules made there under; with special reference to application for import of drugs, licensing formalities for whole sale, retail sale, manufacturing test license for drugs and cosmetics, DPCO, Special emphasis on schedules C, C1, G, H, M, P, U, W, X and Y. Emphasis on labeling of various classes of drugs, recent amendments in Drugs and Cosmetics Act.

4 Pharmacy Act 1948.

5 Medicinal and Toilet Preparations (excise duties) Act and rules made there under.

6 Drugs and Magic Remedies (objectionable Advertisements) Act.

7 The Shops Act of Punjab State.

8 The Medical Termination of Pregnancy Act.

9 Intellectual Property Rights (IPR): introduction, types and Procedure of filling patent (National & International).

10 Forensic Toxicology

Books Recommended (Latest editions unless specified):

1. Drugs and Cosemetics Act, 1940 and All Amendments, Govt of India.
2. B. M. Mithal, Text Book of Forensic Pharmacy, National Book Centre,
3. Dr. Sundari Mohan Avenue, Calcutta, 700014.
4. Relevant Acts & Rules Published by the Government of India.
5. Bansal P. IPR Handbook for Pharma Students and Researchers, Pharma Book Syndicate, Hyderabad, 2008

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHL169: Pharmacokinetics & Biopharmaceutics

3 Credits (2-1-0)

1. Introduction to Pharmacokinetics and Biopharmaceutics, Various terms used, Absorption, distribution, metabolism and excretion of drugs. Biological half life, Apparent volume of distribution
2. Fluid compartments, Circulatory system and protein binding.
3. Compartment models
   3.1 One Compartment Open Model: Pharmacokinetics of single dose administration as applied to intravenous (rapid) and oral administration, Intravenous transfusion, Multiple intravenous and oral administration.

   3.2 Two Compartment Open Model: Pharmacokinetics of single and multiple dose administration, Intravenous transfusion.

4. Curve fitting- area under blood level curves
5. Urinary excretion studies, Sigma minus plot

6. Pharmacokinetic basis of sustained release formulations
7. Clinical Pharmacokinetics
   7.1 Hepatic elimination of drugs, Drug metabolism and its kinetics using one compartment and two compartment models. Liver extraction ratio and its relationship with absolute availability, Relationship between blood flow, Intrinsic clearance and hepatic clearance.
   7.2 Dosing of drugs in infants, elderly and obese patients.
   7.3 Dosage regimen adjustment in patients with and without renal failure. Dosage adjustments in uremic patients

8. Bioavailability and Bioequivalence: Definitions, Terminology, Clinical significance and factors affecting biological performance of drugs. Methods of determination of bioavailability using blood level and urinary excretion data, Parameters used to evaluate bioequivalence.
9. Non linear Pharmacokinetics: Concepts, Reasons for non-linear behavior and methods to ascertain non-linear kinetics.

Books Recommended (Latest editions unless specified):

1) M. Gibaldi and D. Perrier (Eds), Pharmacokinetics, 2nd Edition, Marcel Dekker Inc., New York, U.S.A.
2) L.Shargel and A.B.C.Yu. (Eds) Applied Biopharmaceutics and Pharmacokinetics, 5th Edition, Prentice Hall International, London, U.K.
3) R, E.Notari (Ed) Biopharmaceutics and Clinical Pharmacokinetics: an Introduction, 4th Edition, Marcel Dekker Inc., New York, USA, 2005 (Indian Reprint).

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHP170: Pharmacology

1.5 Credits (0-0-1.5)

1 **Prescription Evaluation:** Exercises on clinical problems related to topic covered in theory.
2 Pharmacoepidemological studies using data collected from university Health Centre.
3 Calculation of LD50 Values and therapeutic index (startistical approach).
4 Experimental methods related to Biochemical Pharmacology using simulated samples and clinical samples collected from university Health Centre.
5 **Bioassays Designs:** Quantal and graded bioassays, matching and bracketing bioassays, 4 point bioassays.

Animal studies will be supplemented with simulated experiments with softwares wherever available.

Books Recommended (Latest editions unless specified):

1 M.N. Ghosh, Fundamentals of Experimental Pharmacology, 2nd Edition, Scientific Books Agency, Calcutta, India.
2 U.K.Sheth, N.K. Dadkar and U.G. Kamath, Selected Topics in Experimental Pharmacology, Kothari Book Depot, Bombay, India.
3 Edinburgh University Pharmacology Staff (Ed.), Pharmacological Experiments on Isolated Preparations; Livingstone, London, U.K.

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHP171: Pharmacokinetics & Biopharmaceutics

1.5 Credits (0-0-1.5)

1. Establishment of a standard curve of a drug substance.
2. Influence of vehicle on drug availability from topical dosage forms in vitro.
3. Comparative in vitro release rate studies of marketed formulations.
4. Determination of bioavailability of marketed formulations by plasma concentration method.
5. Determination of bioavailability of marketed formulations by urinary excretion method.
6. Bioequivalence studies on marketed solid oral products.
7. Correlation between urinary and salivary excretion kinetics.
8. Determination of bioavailability by AUC, Counting square and Gravimetric methods.
9. Determination of acid neutralizing capacity of different brands of antacids.
10. Verification of Noyes Whitney Equation.
11. Protein binding studies using egg albumin as protein moiety.

BACHELOR OF PHARMACY (SEMESTER-VIII)
(Under Credit Based Continuous Evaluation Grading System)

PHP 172: Pharmacognosy

1.5 Credits (0-0-1.5)

Pharmacognosy Practical

1. Isolation of some selected phytoconstituents studied in theory.
2. Extraction of volatile oils and their chromatographic profiles.
3. Some experiments in plant tissue culture.

Books Recommended (Latest editions unless specified):

1. Atal, C.K. and Kapur, B.M. Cultivation & Utilization of Medicinal Plants, R.R. Jammu.
2. Kalia, A.N., Textbook of Industrial Pharmacognosy, CBS Publishers & Distributors, New Delhi.
3. Ansari, S.H., Essentials of Pharmacognosy, Third Edition, 2009, Birla Publication Pvt. Ltd., Delhi.
4. Remington, The Science and Practice of Pharmacy, Vol. I & II, Mack Publishing Company, Pennsylvania.
5. Wagner, H. and Bladt, S. Plant Drug Analysis–A Thin Layer Chromatography Atlas, Second Edition, Springer India Pvt. Ltd., New Delhi.