FACULTY OF APPLIED SCIENCES

SYLLABUS

for

BACHELOR OF PHARMACY
(Semester: I-VI)

(Under Credit Based Continuous Evaluation Grading System)

(Part – IV Only)
(Old System)

Examinations: 2012-13

GURU NANAK DEV UNIVERSITY
AMRITSAR

BACHELOR OF PHARMACY

(CBCEGS)

FIRST SEMESTER:

S.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-103	Punjabi Compulsory **OR** Basic Punjab (Mudhli Punjabi)	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.	PHL-107	Pharm Chemsitry–IV: Inorganic Chemsitry	0	0	1.5	1.5
9.	PHL-108	Pharmaceutics–II: Introduction to Pharmacy	0	0	1.5	1.5
10.	PHL-109	Pharmacology–II: Human Anatomy and Physiology	0	0	1.5	1.5
11.	PHL-110	Pharmacognosy–II	0	0	1.5	1.5
					Total Credits:	**22.5**

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

SECOND SEMESTER:

Sr. No.	Course Code	Subject	Lecture (L)	Tutorial (T)	Practical (P)	Credits
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	PBL115	Punjabi Compulsory **OR** Basic Punjab (Mudhli Punjabi)	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.

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.

FORTH 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.

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

BACHELOR OF PHARMACY

(CBCEGS)

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

***Interdisciplinary Course(s)**

						06
					Total Credits	**25.5**

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

BACHELOR OF PHARMACY
(ANNUAL SYSTEM)

Scheme of Examination
Fourth Year

Sr.	Code PSY	Theory Course		Hrs/ Week	E.A.	I.A.	Total No. Marks
1.	401	Pharm. Chem.- XIX :	Medicinal Chemistry–II	2	80	20	100
2.	402	Pharm.Chem. – XX :	Medicinal Chemistry–III	2	80	20	100
3.	403	Pharm.Chem.- XXI	Drug Design & Drug Development	2	80	20	100
4.	404	Pharmaceutics- XVI :	Pharmaceutical Management	2	80	20	100
5.	405	Pharmaceutics-XVII :	Pharmaceutical Technology	2	80	20	100
6.	406	Pharmaceutics-XVIII	Pharmacokinetics & Biopharmaceutics	2	80	20	100
7.	407	Pharmaceutics-XIX	Pharmaceutical Jurisprudance	2	80	20	100
8.	408	Pharmacology – VIII	Clinical Pharmacology & Toxicology	2	80	20	100
9.	409	Pharmaceutical Biotechnology		2	80	20	100
10.	410	Pharmacognosy - VI		2	80	20	100

Practical Courses							
11.	411	Pharm.Chem.-XXII:	Medicinal Chemistry	3	80	20	100
12.	412	Pharmaceutics-XX :	Pharmaceutical Technology	3	80	20	100
13.	413	Pharmaceutics – XXI :	Pharmacokinetics & Biopharmaceutics	3	80	20	100
14.	414	Pharmacology-IX :	Clinical Pharmacology	3	80	20	100
15.	415	Pharm. Biotechnology		3	80	20	100
16.	416	Pharmaceutics XXII :	Industrial Training	One Month		-	50

BACHELOR OF PHARMACY

(ANNUAL SYSTEM)

SCHEME FOR EXTERNAL EXAMINATION

Sr. No.	Code PSY	Course		Duration Hrs	Max Mark
1.	101	Pharm. Chem.–I:	Inorganic Chemistry	3	80
2.	102	Pharm. Chem.–II:	Analytical Chemistry	3	80
3.	103	Pharm. Chem.–III:	Organic Chemistry-I	3	80
4.	104	Pharmaceutics–I:	Introduction to Pharmacy	3	80
5.	105	Pharmaceutics–II:	Mathematics	3	80
6.	106.	Pharmacol–I:	(Human Anatomy & Physiology)	3	80
7.	107	Pharmacognosy-I:		3	80
8.	108	Pharmaceutics–III:	Computer Applications-I	3	80
9.	109	Punjabi/Punjab History & Culture		3	100
10.	110	Pharm. Chem.–IV:	Inorganic Chemistry	4	80
11.	111	Pharm. Chem.–V:	Analytical Chemistry	4	80
12.	112	Pharm. Chem.– VI:	Organic Chemistry	4	80
13.	113	Pharmaceutics–I V:	Introduction to Pharmacy	4	80
14.	114	Pharmacol–II:	(Human Anatomy & Physiology)	4	80
15.	115	Pharmacognosy–II:		4	80
16.	116	Pharmaceutics–IV:	Computer Applications–I	4	80
17.	201	Pharm.-Chem.–VII:	Physical Chemistry	3	80
18.	202	Pharm. Chem.–VIII:	Pharmaceutical Analysis-I	3	80
19.	203.	Pharm. Chem.–IX:	Organic Chemistry – II	3	80
20.	204	Pharmaceutics–VI:	Pharmaceutical Microbiology	3	80
21.	205	Pharmaceutics–VII:	Pharmaceutical Engineering Operations	3	80
22.	206	Pharmacology–III:		3	80
23.	207	Pharmacology–IV:	Pathology	3	80
24	208	Environmental Studies		3	80
25.	209	Pharm. Chem.–X:	Physical Chemistry	4	80
26.	210	Pharm. Chem.–XI:	Pharmaceutical Analysis-I	4	80
27	211	Pharm.Chem.–XII:	Organic Chemistry	4	80

28.	212	Pharmaceutics–VIII:	Pharmaceutical Microbiology	4	80
29.	213	Pharmaceutics–IX:	Engineering Operations	4	80
30.	214	Pharmaceutics–X:	Engineering Drawing	4	80
31.	215	Pharmacology–V:		4	80
32.	216	Pharmaceutics–XI:	Computer Applications - II	4	80
33.	301	Pharm. Chem.–XIII:	Pharmaceutical Analysis – II	3	80
34	302	Pharm. Chem.–XIV:	Medicinal Chemistry-I	3	80
35.	303	Pharm.Chem.–X:	Heterocycles Carbyhydrates, Protoinse & Nucleic Acids	3	80
36.	304	Pharm.Chem–XVI:	Biochemistry	3	80
37	305	Pharmaceutics–XII:	Physical Pharmacy	3	80
38.	306	Pharmaceutics–XIII:	Formulation Techniques and Cosmeticology	3	80
39.	307	Pharmacology–VI:		3	80
40.	308	Pharmacognosy–III:	Natural Products	3	80
41.	309	Pharm.Chem.–XVII:	Heterocycles, Carbohydrates, Proteins & Nucleic Acids	6	80
42	310	Pharm.Chem.–XVIII:	Biochemistry	6	80
43.	311	Pharmaceutics–XIV:	Physical Pharmacy	6	80
44.	312	Pharmaceutics–XV:	Formulation Techniques and Cosmeticology	6	80
45.	313	Pharmacology–VII:		6	80
46.	314	Pharmacognosy–IV:	Natural Product	6	80
47.	315	Pharmacognosy–V:	Plants Collection Tour	One week	50
48.	401	Pharm. Chem.–XIX:	Medicinal Chemistry – II	3	80
49.	402	Pharm.Chem.–XX:	Medicinal Chemistry-III	3	80
50.	403	Pharm.Chem.–XXI	Drug Design & Drug Development	3	80
51.	404	Pharmaceutics–XVI:	Pharmaceutical Management	3	80
52.	405	Pharmaceutics–XVII:	Pharmaceutical Technology	3	80
53.	406	Pharmaceutics–XVIII:	Pharmacokinetics & Biopharmaceutics	3	80

54.	407	Pharmaceutics–XIX:	Pharmaceutical Jurisprudance	3	80
55.	408	Pharmacology–VIII:	Clinical Pharmacology & Toxicology	3	80
56.	409	Pharmaceutical Biotechnology		3	80
57.	410	Pharmacognosy–VI:		3	80
58.	411	Pharm.Chem.–XXII:	Medicinal Chemistry	6	80
59.	412	Pharmaceutics–XX:	Pharmaceutical Technology	6	80
60.	413	Pharmaceutics–XXI:	Pharmacokinetics & Biopharmaceutics	6	80
61.	414	Pharmacology–IX:	Clinical Pharmacology & Toxicology	6	80
62.	415	Pharm. Biotechnology		6	80
63.	416	Pharmaceutics–XXII:	Industrial Training	One Month	50

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. Aliphatic Nucleophilic Substitution : SN^1, SN^2, SN^i and neighbouring group mechanisms. Substitution at allylic, trigonal and vinylic carbon atoms. Effect of substrate structure, attacking nucleophile, and leaving group on reactivity. Hydrolysis of esters.

4. Elimination Reactions : E1, E2, E1-CB, E2-CB mechanisms, Saytzeff and Hoffman rules. Pyrolytic eliminations, Cleavage of quaternary ammonium hydroxides.

5. Addition to Carbon/Carbon and Carbon/Hetero Multiple Bonds : Electrophilic, nucleophilic and free radicals addition to carbon-carbon and Carbon/Hetero multiple bonds, orientation and stereochemistry.

6. Alkanes: Nomenclature, Physical properties, Industrial source and Preparation. Halogenation, combustion and pyrolitic reactions.

7. Cycloalkanes: Nomenclature, Physical properties, Industrial source and Preparation. Bayer's Strain theory, Conformations of cyclohoxanes and its monosubstituted derivatives.

8. Alkenes, Dienes and Alkynes: Nomenclature, physical properties, industrial source preparation and addition reactions. Polymerization of dienes. Acidity of alkynes.

9. Alcohols: Alkyl Halides and Ethers: Nomenclature, General methods of preparation, physical properties, chemical reactions and applications.

10. Aldehydes and Ketones : Structure, nomenclature, physical properties, industrial source, preparation and reactions. Acid/base promoted halogenation of ketones. 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.

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.

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:

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:

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)

(Under Credit Based Continuous Evaluation Grading System)

PBL103: pj`bl l`zml – I

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) ivc| 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 : **a|cl E|fl v`ll g|rg`bl**

(kh`xl-s`r, ivS`-vsq, kh`xl-kl`, kh`xlk`r)

2. grmKl ErQgr`Pl dl jgq, (p|ql; 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) ivc| hT ilK kh`xlk`r

(a) sqK isG Dlr : **s~Jl kD**

(E) klvq isG ivrk : **a|j`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) ivc| hT ilK kh`xlk`r

(a) pm pk`S : **m`V` bd`**

(E) glz`r isG sD : **kl|Cx|**

(e) mhn Bf`rl : **G|tx`**

(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 ivc| 15 pirE~ d EiBE`s krv`ax)

PBL–103: 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
   ਸੂਰ 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, ਸੂਰ ਵਾਹਕ (ਓ, ਅ, ਏ), ਲਗਾਂ ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ।

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ; ਸੂਰਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ (ਲਘੂ–ਦੀਰਘ ਸੂਰ); ਸੂਰ 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 ਸੂਰ (ਜਿਵੇਂ ਆ); ਸੂਰ ਅਤੇ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਆਰ); ਵਿਅੰਜਨ ਅਤੇ ਸੂਰ (ਜਿਵੇਂ ਪਾ); ਵਿਅੰਜਨ ਸੂਰ 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।

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:

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.

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 THE ORETICAL ASPECTS OF THE COURSE.

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 THE ORETICAL 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 THE ORETICAL 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.

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.

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.

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.

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.

PBL115: ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)

2 Credits (2-0-0)

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

(1) lK (jlvnl-prk, sm`jk q clq iviSE~ aq)

(2) pr` pV k asd hT~ idq pSn~ d a qr

(a) mh`vr (E) EK`x (e) ivSr`m icn

(3) E`qm En`qm (kivq` B`g) sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr, 2007.

Ek-vlf Eq prliKE` lel hd`ieq~ :

(1) lK (iqn~ ivcl iek)

(2) pr` pV k asd hT~ idq pSn~ d a qr :

(a) mh`vr (E) EK`x (e) ivSr`m icn

(3) E`qm En`qm (kivq` B`g)

(a) psg sihq ivE`iKE` (d ivcl iek)

(E) iks iek kivq` d` ivS` vsq/kldrl B`v/s`r (d ivcl iek) |

PBL–115: ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In the lieu of Compulsory Punjabi)

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

ਬਣਤਰ : ਸੰਯੁਕਤ ਸ਼ਬਦ; ਸਮਾਸੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਲੋਕ ਸਭਾ); ਦੋਜਾਤੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਕਾਲਾ ਸਿਆਹ); ਦੋਹਰੇ ਸ਼ਬਦ/ਦੁਹਰਰੁਕਤੀ (ਜਿਵੇਂ ਧੂੜ੍ਹ ਧਾੜ੍ਹ/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, ਸ਼ੌਪਿੰਗ 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.

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.

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.

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).

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. Mc Graw Hill Science (2000).
2. Bedger W L and Banchero J T. Introduction to Chemical Engg. McGraw Hill Co. (1955).

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.

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:

1. Vinay Kumar, Ramzi S. Cotran and S.L. Robins, Basic Pathology, 6th Edition, Prism Books Pvt. Ltd., Banglore, India, 1997.
2. Harsh Mohan, Textbook of Pathology, 5th Edition, Jaypee Brothers Medical Publishers (P) Ltd., 2008.

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).

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 recourses**: 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.

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).

PHL 131: Pharm. Chem. XI: Pharmaceutical Analysis

3 Credits (2-1-0)

Non-aqueous Titrations: Theoretical consideration, acid base equilibria in non-equeous media, titration of acids and bases, indicators, Applications.

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.

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.

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.

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.

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, -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 RECOMENDED

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.

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, & 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:

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, 2005.
2. C.R. Craig and R.E. Stitzel, Modern Pharmacology, 6th Edition, Little Brown and Company, New York, U.S.A., 2006.
3. K.D.Tripathi, Essentials of Medical Pharmacology, 6th Edition, Jaypee Brothers New Delhi, India. 2008.

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.

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. Mc Graw 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:

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. A**mino 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.

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.

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 PHARMCY

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.

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.

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:

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, I st edition, English Language Book Society, London, U.K., 1988.
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.,1990.

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:

1. W.E. Hassan, Hospital Pharmacy, 5 th edition, K.M. Varghese Company, Bombay, India 1986.
2. M.C.Allwood and J.T. Fell. Text Book of Hospital Pharmacy, Black Well Scientific Publications, London , U.K., 1980.
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:

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, 1995.
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.

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.

PHP 154: PHARM. CHEM. XIV: 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:

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.

PSY-401 PHARM. CHEM.-XIX: MEDICINAL CHEMISTRY-II

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week : 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

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

1. **Adrenergic Agents:** Adrenergic neuro transmitters. Adrenrrgic receptors. Sympathomimetic agents. Adrenergic Blockers. (5)
2. **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. (8)
3. **Local Anaesthetics:** Nervous tissue, Mechanism of action of local anaesthetics Products. (5)
4. **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. (12)
5. **Diuretics:** Water and osmotic agents. Acidifying salts. Mercurials phenoxyacetic acids. Purines and related heterocycles. Sulfonamides, Sulfamyl benzoic acid derivatives. Endocrine antagonists. Miscellaneous compounds. (16)
6. **Anti – infective agents:** Local anti-infective agents, phenols and their derivatives. Urinary tract anti-infectives and anticeptics. Antiscabious and antipedicular agents preservatives. (6)
7. **Diangostic agents:** Radioopaque diagnostic agents. Agents for kidney functi on test. Agents for liver function tests. Miscellaneous diagnostic agents. (7)
8. **Miscellaneous organic Pharmaceuticals:** Antirhumentic gold compounds. Alcohol detternt agents. Psoralens. Sunscrens, uricosuric agents. Antiemetic agents. Depigmenting agents. Chelating agents. Miscellaneous gastrointestinal agents. (7)

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, Pharmaceutical Chemicals in Perspective, John Wiley & Sons, New York, 1989.

PSY-402 PHARM. CHEM.-XX: MEDICINAL CHEMISTRY-III

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

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

1. **Sulfonamides Sulfones and folate reductase inhibitors with antibacterial action:** Sulfonamides and folate reductase inhibitors, Well absorbed, short and intermediate acting sulfonamides. Well-absorbed, and long acting sulfonamides. Sulfonamides for ophthalmic infections. Sulfonamides for burn therapy sulfonamidies for intestinal infections. Therapy ulcorative colitis and of reduction of bowel flora. Folate reductase inhibitors. (6)

2. **Antibiotics: -Lactum antibiotics.** The aminoglycosides. The tetracyclines. Macrolide antibiotics. Polyene antibiotics. The lincomycins. Polypeptide antibiotics. Fluroquinolones. Chloramphenicol and other unclassified antibiotics. Antitubercular agents(P-Amino-salicylic acid and its salts, lsonaizid, Ethoinamide, pyrazinanide, Prothionamide. Antitubercular antibiotics, Cycloserine). Antileprosy agents (Dapsone Sodium sulfoxone, Acetosulfone, Clofazimine. (12)

3. A**ntimalarials:** Cinchona alkaloids 7-chloro-4- aminoquinolines, 8-Aminoquinolones. 9-Aminoacridines. Mefloquine. Diaminopyridines. Biguanides. Sulfones and other miscellaneous antimalarials. (6)

4. **Antifungal agents:** Fatty acids and their derivatives, salicylic acid derivatives. Salicylanilids, Tolnaflate p-chloro-Methoxylenol. Acrisorcyin, Fluconazole Itratanazole. Haloprogin, Clotrimazole Econazole, Miconaxole. Ketoconazole (Nystatin, Ampbootericin- B). Chlorphenesin, Dithranal. (6)

5. **Antiviral Agents: Screening methodology**; Adamantane derivertives (Amantadine Rimantadine).Idoxuridine,Trifluoruridine,Vidarabine, ibravarine,Acycloguanosine, Inospiplex, Methisazone, Zidovudine. Acycolovir, Ganciclovir, Foscarnet, Human interferon. (6)

6. **Antineoplastic Agents**: Alkylating agents (Nitrogen mustards , Aziridines, Sulfonic acid esters, Nitrosoureas Expoxides. Trizines, phosphemides, Mitomycin).

   Antimetabolites (Methotroxate). Antimetabolites involved in the synthesis of nucleic acids (Mercaptopurine, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Azathioprine). Antitumor antibiotics Dactinomycin Daunorubicin, Aalarinomycin, Mithramycin, Bleomycin). Antitumer alkaloids (vincristine vinblastine). Hormones(Steroids, Tamoxifan, mitotane, Dormantanolone propinate Testalactone Magestrol acetate Miscellaneous compounds (Hydroxy urea, cisplatin, Pipobroman (12)

7. **Anthelmintical:** Tetrachlorocthylene. Piperazine, Gentian Violet pyrinium pamoate. Thiabendazole, Mebendazole, Bephenium hydroxynaphthoate Diclophene Niclosamide. Levemisole hydrochloride. Tetramisole Niridazole. Biothional Antimony potassium tartarat stibiophen. Sodium stibiocaptate. (6)
8. **Antiamoebic and antiprotozoal drugs**. Emetine hydrochloride.8- hydroxyquinoline, Iodochlorohydroxyquinol. Metronidazole Diloxanide furoate. Hydroxystilbamidine isothionate. Pentamidine isothionate. Nifurtimax. Suramin sodium. Carbarsone. Cyclbiarsol, Melarsoprol sodium biogluconate, Dimercaprol. Diothylcarbamazine citrate.Centarsone, Acetarsoene Bismuth sodium thioglycollate, Stibiophen, Furazolidone. (6)

Books Recommended:

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.

PSY-403 PHARM. CHEM.-XXI: DRUG DESIGN & DRUG DEVELOPMENT

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

1. **Introduction:** History and objectives of drug designing. Economic aspects of drug designing. Procedures followed in drug designing. Drug discovery without a lead-de Novo- drug designing. Lead based methods. Approaches to lead discovery. (3)
2. **Drug Development:** 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. (8)
3. **Quantitative Structure Activity Relationships:** Historical , Hansch paradigm, Apparent lack of structure activity relationships. Apparent structure activity relationships. Physiochemical parameters: Partition coefficient, Van der Waals volume, Molar refractivity (MR), Parachor, Molecular weight and density. Extra thermodynamic parameters: Electronic parameters. Hammett equation. Steric parameters, Taft equation. Linear multiple regression. Free and Wilson method (de Novo substituent constants). Topliss operational scheme. Cluster analysis and Pattern recognition. (8)
4. **Electronic aspects of drug design:** Molecular orbital methods Molecular orbital calculations and chemical reactivity. Perturbation theories of drug action. Pullman's dipositive bond theory. Role of charge- transfer processes in drug action. Conformational aspects. Molecular orbital approach to quantitative drug design with specific examples. (8)
5. **Drug receptor Interaction:** Receptor theories and forces involved in drug-receptor interaction. Stereochemical and conformational aspects of drug receptor interaction. Agonists and antagonists. Ion channel blockers. Examples of rational design of a receptor antagonist. Receptor binding as a tool in development of biologically active steroids. (8)
6. **Design of Enzyme inhibitors:** Mechanism of enzymatic catalysis: Theories of transition state analogs as enzyme inhibitors. Kinetics of irreversible enzyme inhibitors with examples.

a) **Design of Inhibitors of the following enzymes:** Chymotrypsin Subtilisin, Elastase Papain, Cholinesterase, Deaminases, Charboxypeptidase, Glutamine synthetase, Triosephosphate isomerase. Aldolase, Enolase, Decarboxylase. Lysozyme and other glycosyl transferring enzymes, Ribonuclease, Creatine Kinase, Adenylate Kinase, Aspartate transcarboxylase.

b) **Natural Products and Synthetic Drugs as enzyme inhibitors:** Penicillins, Cephalosporin, Leupeptins, Nojrimycin, Pentostatin, Vigabatrin, Floxuridine, 5-Fluoruracil derivatives used as antitumor agents, Allopurinol, Captopril, Lovastatin and Sulfonamides. (8)

7. **Prodrug Approach:** Basic concept. Common pro-moietics. Reversal of prodrugs chemical & enzymatic. Applications of prodrug approach to alter taste and odour, reduction of pain at injection site, reduction of gastrointestinal irritability, alteration of drug stability, increasing chemical stability, prevention of presystemic metabolism, prolongation of drug action, site specific drug delivery, reduction in toxicity, and allernation of drug metabolism. (5)

8. **Peptidomimetics**: Introduction, Natural peptidomimetics, Mimicking of protein motifs, Design of peptidomimetic rigid scaffolds. (6)

9. **Computer in Drug Design:** Computer requirements: Hardware, software. Data and information retrieval techniques. Graphical description of chemical structure. Molecular interactions and interactive graphics. Modeling in Medicinal chemistry- uses and limitations. Logico-structural approach, general principles, activity features selection within a series of compounds, activity prediction, Selection of topological and Topographical activity features. (6)

Books Recommended :

1. The Organic chemistry of Drug Design and Drug Action by R. B. Silverman, 2nd edition, Academic Press, 2004
2. 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
3. Comprehensive Medicinal Chemistry, Pcrgamon press, 1990, Vol. 4.

PSY-404 PHARMACEUTICS- XVI: PHAMACEUTICAL MANAGEMENT

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

1. **General Management:** Concept, functions and principles: Techniques of management**:** , Management by crisis, management by departmentation. Span of management, delegation of authority and power, centralization and decentralization, line and staff conflicts; Motivation: Need for recognizing motivating factors, hierarchy of human needs, theories X and Y; Communication: purpose, importance, process, barriers and breakdown in communication, making communication effective. (10)
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: Need, importance, principles of training, training methods. Performance appraisal: Meaning, objectives, approaches and methods. (10)
3. **Principles of Material Management:** Scope, Problems, cost of item, vender development, vendor audit (suppliers & quotations), Ordering procedures. Procurement of raw material and packaging material as per warehouse system, issue of materials to production department and documentation system thereof. Central Excise Act: Chapters 28, 29, 30, records thereof CENVAT, record keeping and total documentation of central excise, Dispatch of goods from Pharmaceutical manufacturing unit. (10)
4. **Marketing and Production Management:** Meaning, function and problems; functions of marketing executives. Product life cycle, product line policies and strategies. Concept and components of marketing information system. Pricing of Pharmaceutical formulations. DPCO considerations. Production planning & control, plant location and layout. (10)
5. **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. (4)

b) Pharmacist's role in administration, dispensing/ manufacturing, quality control, Pharmacy therapeutic committee Hospital formulary and provisioning of drugs in hospitals. (4)

c) 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. (6)

d) Procedures for purchase of materials for hospital Pharmacy units, application of modern management techniques like ABC, VED, analysis for inventory control, lead time, item, cost, inventory carrying cost, procurement cost, safety stock reorders level and EOQ analysis. (6)

Recommended Books:

1. Essentials of Human Resource Management, Shaun Tyson & Alfred York, Jordan Hill, Oxford, Fourth edition (2000).
2. Materials Management, P. Gopalkrishna, Prentice Hall. India (P) Ltd, New Delhi, Eleventh edition (1991).
3. Marketing Management, Philips Kotler, Prentice Hall. India (P) Ltd, New Delhi Seventh Edition (1991).
4. Marketing Management, G.S. Moonga and Shalini Anand, Deep & Deep Publications Pvt. Ltd, New Delhi (2003).
5. Principles of Management, H. Koontz, C. O. Donnell and H. Weihrich, McGraw Book(P) Ltd. Singapore, Tenth Edition (1993).
6. Marketing: A Managerial Introduction, J. C. Gandhi, Tata McGraw Hill Publishing Co., New Delhi, 2001.
7. Production Planning and Inventory Control, S.L.Narsimhan and Peter Bellington, Prentice Hall India (P) Ltd., New Delhi, 2003.
8. Principals and Methods of Pharmacy Management, H.A. Smith and Lea and Febriger Philadelphia, Tenth Edition (2001).

PSY-405 PHARMACEUTICS- XVII: PHAMACEUTICAL TECHNOLOGY

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

1. **(i) Tablet Formulations:** Systematic approach to tablet product design. Components and additives methods of manufacture, problems in manufacture. Properties of tablets influenced by compression. Measurement of transmission and distribution of forces in a compressed tablet, effect of pressure on relative volume. Lubrication, adhesion and cohesion of particles, factors affecting strength of tablets.

   (ii) Various Forms of Tablets: Coated and compressed tablets, effervescent, sublingual, buccal and chewable, lozenges and sustained release tablets etc.

   (iii) Evaluation of Tablets: Tablets thickness, colour, weight variation, friability, disintergration, hardness, dissolution rate and content uniformity etc.

   (iv) Tablet Coating: Sugar coating, film coating, compression coating and enteric coating. Methods of evaluation of coated tablets. Particle coating techniques.

   (v) Tablet Tooling: Terminology, tablet design specification and information required, use and care of tooling problem solving. (12)

2. **Aerosols:** Classification of aerosols systems, propellents, containers, valves aerosols packaging and applications. (9)

3. **Microencapsulation:** Microencapsulation including study of core and coat materials, equipment and processing. (9)

4. **Appliances:** Medical and surgical plastic appliances, nature of polymer, classification, uses and evalution. (3)

5. **Pharmaceutical Packaging:** Packaging components types specifications and methods of evaluation stability aspects of packing. Various packaging equipments. (10)

6. **Pharmaceutical Pilot Plant Scale Up:** Factors to be considered during development. Pilot plant design problems due to change of origin of additives. (7)

7. **Modern Drug Delivery Systems:** Formulation of oral and parenteral prolonged act on dosage forms, their evaluation. Targeted drug delivery system. Transdermal drug delivery systems, occuerts, osmotic, Osmotic pumps and implants. (10)

Books Recommended :

1. L. Lachman et. al, Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Hind Rajasthan Building, Dodar, Bombay- 400014.
2. J. R. Robinson & Vincent Pel-Lee. Controlled drug delivery, Marcel Dekker, New York, 1987.
3. M. H. Rubinstein Pharmaceutical Technology, (Tablatting Technology), Volume-1, Ellis Horwood Limited, John Wiley & Sons, 1987.
4. Bentely's Text Book of Pharmaceutics, ELBS.
5. Remington's Pharmaceutical Sciences, Mack Publishing Company, Pennsylvania, USA.

PSY-406 PHARMACEUTICS- XVIII: PHARMACOKINETICS AND BIOPHARMACEUTICS

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs. /week: 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

1. **Introduction:** Pharmacokinetics and Biopharmaceutics including history and their role in related disciplines.

2. **Pharmacokinetics:** Absorption, distribution, metabolism and excretion of drugs, Fluid compartments, Circulatory system and protein binding.

(i) Compartment Models:

a) One Compartment open model, Pharmacokinetics of single dose administration, as applied to intravenous and oral administration, intravenous transfusion, multiple intravenous and oral administration, Pharmacokinetic basis of sustained release formulations.

b) Two Compartment open model, Pharmacokinetics of single and multiple dose administration as applied to intravenous and oral administration, intravenous transfusion

(ii) Curve fittings, area under blood level curves and its significance.

(iii) Urinary excretion, sigma minus plot and its significance.

(iv) Dosage regimen adjustment in patients with and without renal failure.

3. Bio-pharmaceutics: Definitions, physico-chemical factors altering biological performance of drugs, Bio-pharmaceutical data of gastrointestinal tract, Bioavailability, methods of determination of bioavailability, using blood level and urinary excretion data. Parameters used to evaluate bioequivalence.

4. Non-Linear Pharmacokinetics: Concepts, Reasons for non-linear behavior and methods to ascertain non-linear kinetics.

5. Radioimmunoassay.

Books Recommended:

1. W. A. Ritschel, Handbook of Basic Pharmacokinetics, Drug Intelligence Publications, Hamilton III, 1977.
2. J. G. Wagner, Fundamentals of Clinical Pharmacokinetics. Drug Intelligence Publications, Hamilton, 1975.
3. Remington's Pharmaceutical Sciences, Chapter Bioavailability and Bioavailability Testing, Mack Publishing Co, Eastern, Pennsylvania, USA.
4. Rowland, Malcolm and Tozer, Thomas Ng, Clinical Pharmacokinetics, Lea & Febiger, Philadelphia, 1980.
5. R.E. Notari, Biopharmaceutics & Clinical Pharmacokinetics, Fourth Edition. Marcel Dekker, Inc. New York. Basel.

PSY-407 PHARMACEUTICS- XIX: PHARMACEUTICAL JURISPRUDENCE

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

1. Code of Professional ethics.
2. 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, C_1, G, H, M, P, U, W, X and Y. Emphasis on labeling of various classes of drugs, recent amendments in Drugs and Cosmetics Act.
3. Pharmacy Act 1948.
4. Dangerous Drugs Act 1930 and rules made there under.
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. International Documentation: New drug application. Relevant information for marketing the Pharmaceutical products in other countries, IPR studies, Procedure of filling patent (National & International).
10. Forensic foxicology.

Books Recommended :

1. Drugs and Cosemetics Act, 1940 and all amendments, Govt of India.
2. B. M. Mithal, Text Book of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta 700014.
3. Relevant Acts & Rules published by the Government of India.
4. Drug laws by P. L. Malik.

PSY-408 PHARMACOLOGY-VIII : CLINICAL PHARMACOLOGY AND TOXICOLOGY

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

NOTE: Examiner to set eight questions and candidates are required to attempt any five.

1. Definition scope and development of clinical pharmacy and clinical pharmacology. (1)
2. Drug discovery and development: Concept of pharmacogenology, preclinical evaluation, safety and clinical evaluation, post marketing surveillance and drug regulatory affairs. (2)
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.

   (20)
4. Clinical pharmacokinetics and dosage monitoring, bioavailability, bioequivalence, first pass metabolism, half life, apparent volume of distribution, clearance, loading dose, maintenance dose, linear and non-linear kinetics with reference to clinical applications. Individualization of dosage. (4)
5. Drug therapy in children (pediatric pharmacology), elderly (geriatric pharmacology) and pregnant and lactating mothers. (3)
6. Drug information and counseling of patients. (2)
7. The principles of prescription writing and practical prescribing. (1)
8. Pathophysiology and Pharmacotherapy:

8.1 Pathophysiology and drug therapy of hypertension, congestive cardiac failure, angina pectoris, cardiac arrhythmias, atherosclerosis and thromboembolism.

8.2 Pathophysiology and drug therapy of epilepsy, parkinsonism, migraine, schizophrenia, depression, anxiety and insomnia.

8.3 Pathophysiology and drug therapy of bronchial asthma, peptic ulceration, diabetes mellitus, anaemias, arthritis , gout, malaria and amoebiasis.

(25)

9. Clinical toxicology: Principles and management of different types of poisoning and and toxicity reactions.

(2)

RECOMMENDED BOOKS:

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., 1984.
2. T.M.Speight (ed), Avery's Drug Treatment : Principles and Practics of Clinical Pharmacology and Therapautics, 3rd edition, ADIS press, Aucland, 1987.
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. 2002.
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., 2005.
5. Roger Walker and Clive Edwards, Clinical Pharmacy and Therapeutics.3rd Edition, Churchill Livingstone, 2003.

PSY-409 PHARMACEUTICAL BIOTECHNOLOGY

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

Note: i) Examiner to set eight questions and candidates are required to attempt any five.
ii) The students can use non-programmable Scientific Calculators.

1. **Introduction to pharmaceutical Biotechnology:** concepts, basic techniques of biotechnology and their application in pharmacy, biotechnology industry, products, application of bioreactors for large scale production of useful pharmaceutical products and markets. (10)

2. **Drug Delivery Aspects of Biotechnological Products:** Introduction, Stability of peptides and proteins, Non conventional Routes of Administration. (3)

3. **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, Humatrope, Hepatitis B etc. (6)

4. **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. (6)

5. **Micropropagation:** Organigenesis and somatic embryogenesis, clonal propagation of elite germplasm of pharmaceutical importance, technical problems in micropropagation such as vitrification, explant exudation etc., effect of microenvironment on micropropogation. (6)

6. **Tissue culture:** Production and appliction of synthetic seeds, non classical techniques in the production of secondary metabolites, production of endogeneous compounds, anti-microbial agents, anti-tumor compounds, flavouring compounds, secondary metabolite with fungal elicitors, immobilization of cell system for the production of plant metabolities & production of edible vaccines from genetically engineered. (18)

7. **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. (6)

8. **Regulating and patenting biotechnology, intellectual property rights.** (5)

Books Recommended:

1. Biotechnology and Pharmacy, John M, Pazzute, Michael E. Johnson, and Hanri R. Manasse, Jr.
2. An Introduction to plant Tissue culture by M. K. Razdan, 1994, Oxford & IEH.
3. Plant cell tissue and organ culture fundamental methods by O. L. Gambarg and G. C. Phillips, 1996, Narosa Publishing House.
4. Secondary metabolism in plnat cell cultures by phillip Marris, Alan H. Scragg, Angle Staff and Michael W. Fowlar 1986, Cambridge University Press.
5. Biotechnology in Agriculture and Forestry Vol. IV, Medicinal and arematic plants I by V. P. S. Bajaj 1988, Springer Verlag.
6. Biotechnological applications of plant cultures by peter D. Shargoel and That T. Ngo, 1994. CRC Press Inc.

PSY-410 PHARMACOGNOSY- VI

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./week: 2

NOTE: Examiner to set eight questions and candidates are required to attempt any five.

1. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. 07
2 Biosynthetic pathways of secondary metabolites 05
3 Natural allergens and allergenic extracts 04
4 Photosensitizing agents 04
5. classification, isolation and chemistry of Quassinoids and Lignans 06
6 Study of tannins and tannin containing drugs like Hamamelis, Pale and Black catechu, Ashoka Bark and Nut gall 03
7 Biological sources, preparation, identification, tests and uses of the following enzymes: Diastase, pepaine, pepsin trypsin and pancreatin 03
8 Novel medicinal agents from marine sorces 05
9 Herbs as health food 04
10 Herbs and herbal products as cosmetics 04
11 Plant bitters and sweeteners 02
12 Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs 13

Books Recommended

1. Reinetrt, J & Bajaj, Y.P.S. Applied & Fundamental Aspects of Plant Cell, Tissue & Organ Culture. Berlin.

2. Scheuer, P.J. Marine Natural Products. Academic Press, London.

3. Swain, T. Chemical Plant Taxonomy Academic press, London.

4. J. E. Finar Organic chemistry, Vol. I and II, The English Language Book society, London

5. Atal, C.K. & Kapur, B.M.Cultivation and Utilization of Medicinal Plants. R.R.L, Jammu.

6. Barz, W., Reinhard, E. & Zerk, M.H. Plant Tissue Culture & its Biotechnological Application. Springer, Berlin.

7. Chadha, K.L. & Gupta, R. Advances in Horticulture Vol. II-Medicinal and Aromatic Plants. Malhotra Publishing House, N.Delhi.

8. Export Potential of selected Medicinal Plants; prepared by Basic Chemicals, Pharmaceuticals & Cosmetic Export promotion Council, Mumbai & other Reports.

9. Faulkner, D.J. & Fenical, W.H. Marine Natural Products Chemistry (NATO Conference Series 4) Plenum Press N.Y.

PRACTICAL
PSY-411 PHARM. CHEM. – XXII: MEDICINAL CHEMISTRY

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./ week: 3

Note：The student can use non-programmable calculator.

4. Synthesis of selected drugs involving two or more steps.
5. Special analysis of synthesized and other drugs.
6. 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.

PRACTICAL
PSY-412 PHARMACEUTICS-XX: PHARMACEUTICAL TECHNOLOGY

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./ week: 3

Note：The student can use non-programmable calculator.

EXPERIMENTS:

1. Preparation and evaluation of tablets by dry and wet quanulation methods.
2. Preparation of tablets and study of the influence of formulation factors (binding agent, disntegrants, lubricants and glidants) on the dissolution rate of tablets.
3. Preparation and pan coating of granules, and tablets, Evaluation of granules, coated granules and tablets prepared from uncoated granules and coated granules.
4. Microencapsulation and evaluation of microcapsules prepared by phase separation conservation method and multiorifice centrifugal microencapsulator.
5. Coating of drug particles by fluidization and their evaluation (wurster process).
6. Preparation of an aerosol system by using different combinations of propellants and their evaluation.
7. Strip Packaging of tablets and capsules and quality control tests, there of evaluation of packging materials strip packs & blister packs).

i) Thickness of Aluminium foil lamination.

ii) Water permeability and quality of printing.

iii) Leakage test.

8. Preparation of sustained release tablets and capsules of drugs and their *in-vitro* evaluation using dissolution rate testing apparatus.
9. Filling, sealing and evaluation of hard gelatin capsules and comparison with marketed products.

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

PRACTICAL
PSY-413 PHARMACEUTICS-XXI: PHARMACOKINETICS AND BIOPHARMACEUTICS

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./ week: 3

Note：The student can use non-programmable calculator.

EXPERIMENTS

1. Intestinal transport of drugs including plotting of standard curve (salicylic acid, riboflavin).
2. Protein binding of drugs through diffusion cell.
3. Determination of dissolution rate constant using Noyes- Whitney equation.
4. Determination of effect of P^H on dissolution rate constant.
5. Determination of urinary excretion of sulfonamides / any other drug.
6. Determination of partition coefficient of hydrophilic and hydrophobic drugs in water/ octanol system
7. In-viro evaluation of sustained release versus traditional dosage forms (capsules and tablets).
8. In-situ absorption studies of paracetamol.
9. Study of release rate of drug through various ointment bases using agarplates/ dialysis membrane.
10. Study of effect of various additives on rate of release of drugs using dialysis method.
11. To study acid neutralizing capacity and rapidity of action of antacid tablets.
12. Determination of bioavailability of sulfonamides / any other drug.

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

PRACTICAL
PSY-414 PHARMACOLOGY-IX: CLINICAL PHARMACOLOGY

Time: 3 Hours **Max. Marks: 100**
University Examination: 80
Sessional: 20
Hrs./ week: 3

EXPERIMENTS

1. Calculation of LD50 Values and therapeutic index (startistical approach).
2. Prescription evaluation: Exercises on clinical problems related to topic covered in theory.
3. Experimental methods related to biochemical, clinical Pharmacology.

Books Recommended

1. S. K. Kulkarni, Hand Book of Experimental Pharmacology Vallakh Prakashan, Delhi – 110034.
2. M. N. Ghosh, Fundamentals of Experimental Pharmacology Scientic Book Agency of Calcutta, Second Edition (1984).

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

PRACTICAL
PSY- 415: PHARMACEUTICAL BIOTECHNOLOGY

Max. Marks: 100
University Examination: 80
Sessional: 20
Hrs. /week: 3

EXPERIMENTS:

1. Laboratory design, aseptic techniques.

2. Media preparation and preparation of solution of plant growth regulators.

3. Culture organ explants and micropropagation by axillary bud proliferation.

4. Initiation and maintenance of callus cultures.

5. Initiation and maintenance of plant cell suspension cultures.

6. Production of secondary metabolites, their extraction and quantification.

7. Nurse culture technique.

8. Hardening of tissue raised plants.

9. Cell viability study.

10. Synthesis of artificial seeds.

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

PRACTICAL
PSY-416 PHARMACEUTICS-XXII: INDUSTRIAL TRAINING
(One Month)

Total Marks: 50

1. The students will undergo one months training in a pharmaceutical industry in the period immediately after third year examinations during summer vacation.

2. Students shall be required to submit a report on the training and a certificate from the company certifying the same. The report shall be evaluated by a panel of examiners consisting of the Head and two senior teachers and shall be awarded out of 50 marks.