



SYALLABUS OF

B. PHARM.

(REGULAR) 4 YEAR PROGRAM

GYAN VIHAR SCHOOL OF PHARMACY

EDITION 2013-14

GYAN VIHAR SCHOOL OF PHARMACY

B-PHARMACY – 4 YEAR PROGRAM

Need objectives and main features of curriculum

The professional pharmacy curriculum is designed to produce pharmacists who have the abilities and skills which are necessary to achieve outcomes related to:

- Providing pharmaceutical care to patients
- Developing and managing medication distribution and control systems
- Managing the pharmacy
- Promoting public health
- Providing drug information and education

In order to provide students with the opportunity to develop a strong foundation on which to build these skills, the curriculum emphasizes major areas of instructions in, Pharmaceutics, Medicinal Chemistry, Pharmacology, and Pharmacognosy.

Role of curriculum in national development

Pharmacists today are responsible for ensuring the rational, safe and cost-effective use of drugs. Pharmacist duties include: participating in the drug use decision-making process, establishing therapeutic goals for each patient, selecting the appropriate drug dosage form, selecting the drug product source of supply, determining the dose and dosage schedule, preparing the drug product for patient use, providing the drug product and drug information to the patient, monitoring the patient to maximize compliance, monitoring the patient to detect adverse drug reactions and drug interactions, and monitoring the patient's progress to improve therapeutic outcomes.

(1) As a member of the health team in a health facility

- Not only dispenses medications but also is the authority on issues related to drug treatment for patients;
- Contributes to the delivery of effective, qualitative and equitable health services;
- Contributes to the development and management of human resources for health.

(2) As a Professional operating a Pharmacies

- Sells/dispenses medicines whose availability and affordability is one of the key dimensions of quality health services; Provides access to health care and renders some public health services (e.g. health education, screening).
- Employs labour and contributes to reduction of unemployment Global trends reflected in the curriculum.

Global Trends reflecting in the curriculum

The profession of pharmacy has embraced a practice philosophy called pharmaceutical care. Specifically, pharmaceutical care is defined as commitment of the pharmacist to design, implement and monitor patient drug therapy for the purpose of achieving optimal therapeutic

outcomes with the ultimate goal of improving the patient's quality of life. Present Course has developed an emphasis of pharmaceutical care within its curriculum and strives to prepare pharmacy students for their future practices in delivering this global trend. The curriculum develops skills in pharmaceutical care and emphasizes critical thinking, communication skills, awareness of ethical and social responsibilities, and lifelong self-learning ability.

Possibility,motivational & scope for self learning

Pharmaceutical science helps identify preferred of optimal methods to deliver or dose a drug and reliably ensure therapeutic benefit with minimal side effects at the physiological site of action or disease. The field requires high level scientific input from scientists trained across several disciplines, including medicine, pharmacology, medicinal chemistry, analytical chemistry, process chemistry, and pharmaceuticals.

Placement opportunities

Employment of pharmacists is expected to grow faster than average through 2014. There has been an increased demand for pharmaceutical services by the public as the population ages and as more potent, costly and high risk drugs enter the marketplace.

GYAN VIHAR SCHOOL OF PHARMACY
Teaching and Examination Scheme for Bachelor's of Pharmacy 4 Year Program
Edition 2013

I Year

I Semester

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
A. Theory									
1	PH 101	Pharmaceutical Analysis-I	3	3	-	-	3	30	70
2	PH 103	Pharmaceutical Biology	3	3	-	-	3	30	70
3	CA 149	Computer Science & Applications	4	4	-	-	3	30	70
4	PH 105	Pharmaceutical Chemistry-I (Inorganic Pharmaceutical Chemistry)	3	3	-	-	3	30	70
5	PH 107	Pharmaceutics – I (Dispensing & Community Pharmacy)	3	3	-	-	3	30	70
6	ES101	Environmental Studies	2	2	-	-	3	30	70
B. Practical									
7	PH 151	Practical - Pharmaceutical Analysis-I	2	-	-	3	3	60	40
8	PH 153	Practical - Pharmaceutical Biology	2	-	-	3	3	60	40
9	CA 199	Practical - Computer Science & Applications	2	-	-	3	3	60	40
10	PH 155	Practical - Pharmaceutical Chemistry-I (Inorganic Pharmaceutical Chemistry)	2	-	-	3	3	60	40
11	PH 157	Practical - Pharmaceutics – I (Dispensing & Community Pharmacy)	2	-	-	3	3	60	40
C. Discipline & Co Curricular Activities									
12	DE 101	Discipline & Co Curricular Activities	2	-	-	-	-	100	
Total			30	18		15			
Total Teaching Load				33					

I Year

II Semester

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
A. Theory									
1	PH 102	Pharmaceutics-II (Physical Pharmacy)	3	3	-	-	3	30	70
2	PH 104	Mathematics & Biostatistics	4	4	-	-	3	30	70
3	PH 106	Pharmaceutical Chemistry-II (Physical Chemistry)	3	3	-	-	3	30	70
4	PH 108	Pharmaceutical Chemistry-III (Organic Chemistry-I)	3	3	-	-	3	30	70
5	PH 110	Human Anatomy and Physiology - I	3	3	-	-	3	30	70
6	HS 132	Communication Skills	3	3	-	-	3	30	70
B. Practical									
7	PH 152	Practical - Pharmaceutics-II (Physical Pharmacy)	2	-	-	3	3	60	40
8	PH 154	Practical - Pharmaceutical Chemistry-II (Physical Chemistry)	2	-	-	3	3	60	40
9	PH 156	Practical - Pharmaceutical Chemistry-III (Organic Chemistry-I)	2	-	-	3	3	60	40
10	PH 158	Practical - Human Anatomy and Physiology – I	2	-	-	3	3	60	40
C. Discipline & Co Curricular Activities									
11	DE 102	Discipline & Co Curricular Activities	2	-	-	-	-	100	
Total			29	19		12	--		
Total Teaching Load				31					

L = Lecture
S = Seminar

T = Tutorial
P = Practical

CE = Continuous Evaluation
ESE = End Semester Examination

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II Year

III Semester

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	PH 201	Pharmaceutics-III (Unit operations-I including Engg. Drawing)	3	3	-	-	3	30	70
2	PH 203	Pharmaceutical Chemistry –IV (Organic Chemistry-II)	3	3	-	-	3	30	70
3	PH 205	Pharmacognosy-I	3	3	-	-	3	30	70
4	PH 207	Pharmaceutical Analysis-II	3	3	-	-	3	30	70
5	PH 209	Pharmacy Practice	3	3	-	-	3	30	70
		B. Practical							
6	PH 251	Practical - Pharmaceutics-III (Unit operations-I including Engg. Drawing)	2	-	-	3	3	60	40
7	PH 253	Practical - Pharmaceutical Chemistry –IV (Organic Chemistry-II)	2	-	-	3	3	60	40
8	PH 255	Practical - Pharmacognosy-I	2	-	-	3	3	60	40
9	PH 257	Practical – Pharmaceutical Analysis-II	2	-	-	3	3	60	40
		C. Discipline & Co Curricular Activities							
10	DE 201	Discipline & Co Curricular Activities	2	-	-	-		100	
		Total	25	15		12			
		Total Teaching Load		27					

II Year

IV Semester

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	PH 202	Pharmaceutics-IV (Unit Operations-II)	3	3	-	-	3	30	70
2	PH 204	Pharmaceutical Microbiology	3	3	-	-	3	30	70
3	PH 206	Pharmacognosy-II	3	3	-	-	3	30	70
4	PH 208	Pathophysiology of Common Diseases.	4	4	-	-	3	30	70
5	PH 210	Human Anatomy, Physiology and Health Education II	3	3	-	-	3	30	70
		B. Practical							
6	PH 252	Practical - Pharmaceutics-IV (Unit Operations-II)	2	-	-	3	3	60	40
7	PH 254	Practical - Pharmaceutical Microbiology	2	-	-	3	3	60	40
8	PH 256	Pharmacognosy-II	2	-	-	3	3	60	40
9	PH 258	Practical - Human Anatomy, Physiology and Health Education II	2	-	-	3	3	60	40
		C. Discipline & Co Curricular Activities							
10	DE 202	Discipline & Co Curricular Activities	2	-	-	-		100	
		Total	25	17		12			
		Total Teaching Load		29					

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III Year			V Semester						
S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
A. Theory									
1	PH 301	Pharmaceutical Chemistry-V (Biochemistry)	3	3	-	-	3	30	70
2	PH 303	Pharmaceutics-V (Pharmaceutical Technology-I)	3	3	-	-	3	30	70
3	PH 305	Pharmacology-I	3	3	-	-	3	30	70
4	PH 307	Pharmacognosy-III	3	3	-	-	3	30	70
5	PH 309	Pharmaceutics-VI (Hospital Pharmacy)	3	3	-	-	3	30	70
B. Practical									
6	PH 351	Practical - Pharmaceutical Chemistry-V (Biochemistry)	2	-	-	3	3	60	40
7	PH 353	Practical - Pharmaceutics-V (Pharmaceutical Technology-I)	2	-	-	3	3	60	40
8	PH 355	Practical - Pharmacology-I	2	-	-	3	3	60	40
9	PH 357	Practical - Pharmacognosy-III	2	-	-	3	3	60	40
10	PH 359	Practical - Pharmaceutics-VI (Hospital Pharmacy)	2	-	-	3	3	60	40
C. Discipline & Co Curricular Activities									
11	DE 301	Discipline & Co Curricular Activities	2	-	-	-		100	
Total			27	15	-	15			
Total Teaching Load				30					

III Year			VI Semester						
S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
A. Theory									
1	PH 302	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	3	3	-	-	3	30	70
2	PH 304	Pharmaceutical Jurisprudence & Ethics.	4	4	-	-	3	30	70
3	PH 306	Pharmaceutics-VII (Biopharmaceutics & Pharmacokinetics)	3	3	-	-	3	30	70
4	PH 308	Pharmacology-II	3	3	-	-	3	30	70
5	PH 310	Pharmacognosy-IV (Chemistry of Natural Products).	3	3	-	-	3	30	70
6	HS 332	Soft Skills-I	3	3	-	-	3	30	70
B. Practical									
7	PH 352	Practical - Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	2	-	-	3	3	60	40
8	PH 354	Practical - Pharmaceutics-VII (Biopharmaceutics & Pharmacokinetics)	2	-	-	3	3	60	40
9	PH 356	Practical - Pharmacology-II	2	-	-	3	3	60	40
10	PH 358	Practical - Pharmacognosy-IV (Chemistry of Natural Products).	2	-	-	3	3	60	40
C. Discipline & Co Curricular Activities									
11	DE 302	Discipline & Co Curricular Activities	2	-	-	-		100	
Total			29	19		12			
Total Teaching Load				31					

Note: * Professional training to be carried out for 400 Hrs during summer after the completion of III Year (VI Semester).

L = Lecture
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IV Year

VII Semester

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	PH 401	Pharmaceutical Biotechnology	3	3	-	-	3	30	70
2	PH 403	Pharmaceutics-VIII (Pharmaceutical Technology-II)	3	3	-	-	3	30	70
3	PH 407	Pharmacology-III	3	3	-	-	3	30	70
4	PH 409	Pharmaceutical Chemistry-VII (Medicinal Chemistry- II)	3	3	-	-	3	30	70
5	PH 405	Pharmaceutical Industrial Management	3	3	-	-	3	30	70
		B. Practical							
6	PH 451	Practical - Pharmaceutical Biotechnology	2	-	-	3	3	60	40
7	PH 453	Practical - Pharmaceutics-VIII (Pharmaceutical Technology-II)	2	-	-	3	3	60	40
8	PH 455	Practical - Pharmacology-III	2	-	-	3	3	60	40
9	PH 457	Practical - Pharmaceutical Chemistry-VII (Medicinal Chemistry- II)	2	-	-	3	3	60	40
		C. Discipline & Co Curricular Activities							
10	DE 401	Discipline & Co Curricular Activities	2	-	-	-		100	
		Total	25	15	-	12			
		Total Teaching Load		27					

IV Year

VIII Semester

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CE	ESE
		A. Theory							
1	PH 402	Pharmaceutics-IX (Dosage form design)	3	3	-	-	3	30	70
2	PH 404	Pharmaceutical Analysis-III	3	3	-	-	3	30	70
3	PH 406	Pharmaceutical Chemistry-VIII (Medicinal Chemistry -III)	3	3	-	-	3	30	70
4	PH 408	Pharmacognosy-V	3	3	-	-	3	30	70
5	PH 410	Pharmacology-IV (Clinical Pharmacy & Drug interactions)	3	3	-	-	3	30	70
6	HS 432	Soft Skills-II	3	3	-	-	3	30	70
		B. Practical							
7	PH 452	Practical - Pharmaceutics-IX (Dosage form design)	2	-	-	3	3	60	40
8	PH 454	Practical - Pharmaceutical Analysis-III	2	-	-	3	3	60	40
9	PH 456	Practical - Pharmaceutical Chemistry-VIII (Medicinal Chemistry -III)	2	-	-	3	3	60	40
10	PH 458	Practical - Pharmacognosy-V	2	-	-	3	3	60	40
11	PH 460	Project related to elective, Dissertation on Practical work.	2	-	-	3	3	60	40
		Total	28	18	-	15			
		Total Teaching Load		33					

L = Lecture
S = Seminar

T = Tutorial
P = Practical

CE = Continuous Evaluation
ESE = End Semester Examination

GYAN VIHAR SCHOOL OF PHARMACY

LIST OF COURSES FOR B. PHARMA PROGRAM

Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
			L	T/S	P		CE	ESE
PH 101	Pharmaceutical Analysis-I	3	3	-	-	3	30	70
PH 102	Pharmaceutics-II (Physical Pharmacy)	3	3	-	-	3	30	70
PH 103	Pharmaceutical Biology	3	3	-	-	3	30	70
PH 104	Mathematics & Biostatistics	4	4	-	-	3	30	70
PH 105	Pharmaceutical Chemistry-I (Inorganic Pharmaceutical Chemistry)	3	3	-	-	3	30	70
PH 106	Pharmaceutical Chemistry-II (Physical Chemistry)	3	3	-	-	3	30	70
PH 107	Pharmaceutics – I (Dispensing & Community Pharmacy)	3	3	-	-	3	30	70
PH 108	Pharmaceutical Chemistry-III (Organic Chemistry-I)	3	3	-	-	3	30	70
PH 110	Human Anatomy and Physiology - I	3	3	-	-	3	30	70
PH 151	Practical - Pharmaceutical Analysis-I	2	-	-	3	3	60	40
PH 152	Practical - Pharmaceutics-II (Physical Pharmacy)	2	-	-	3	3	60	40
PH 153	Practical - Pharmaceutical Biology	2	-	-	3	3	60	40
PH 154	Practical - Pharmaceutical Chemistry-II (Physical Chemistry)	2	-	-	3	3	60	40
PH 155	Practical - Pharmaceutical Chemistry-I (Inorganic Pharmaceutical Chemistry)	2	-	-	3	3	60	40
PH 156	Practical - Pharmaceutical Chemistry-III (Organic Chemistry-I)	2	-	-	3	3	60	40
PH 157	Practical - Pharmaceutics – I (Dispensing & Community Pharmacy)	2	-	-	3	3	60	40
PH 158	Practical - Human Anatomy and Physiology – I	2	-	-	3	3	60	40
PH 201	Pharmaceutics-III (Unit operations-I including Engg. Drawing)	3	3	-	-	3	30	70
PH 202	Pharmaceutics-IV (Unit Operations-II)	3	3	-	-	3	30	70
PH 203	Pharmaceutical Chemistry –IV (Organic Chemistry-II)	3	3	-	-	3	30	70
PH 204	Pharmaceutical Microbiology	3	3	-	-	3	30	70
PH 205	Pharmacognosy-I	3	3	-	-	3	30	70
PH 206	Pharmacognosy-II	3	3	-	-	3	30	70
PH 207	Pharmaceutical Analysis-II	3	3	-	-	3	30	70
PH 208	Pathophysiology of Common Diseases.	4	4	-	-	3	30	70
PH 209	Pharmacy Practice	3	3	-	-	3	30	70
PH 210	Human Anatomy, Physiology and HealthEducation II	3	3	-	-	3	30	70
PH 251	Practical - Pharmaceutics-III (Unit operations-I including Engg. Drawing)	2	-	-	3	3	60	40
PH 252	Practical - Pharmaceutics-IV (Unit Operations-II)	2	-	-	3	3	60	40
PH 253	Practical - Pharmaceutical Chemistry –IV (Organic Chemistry-II)	2	-	-	3	3	60	40
PH 254	Practical - Pharmaceutical Microbiology	2	-	-	3	3	60	40
PH 255	Practical - Pharmacognosy-I	2	-	-	3	3	60	40
PH 256	Practical - Pharmacognosy-II	2	-	-	3	3	60	40
PH 257	Practical – Pharmaceutical Analysis-II	2	-	-	3	3	60	40
PH 258	Practical - Human Anatomy, Physiology and HealthEducation II	2	-	-	3	3	60	40
PH 301	Pharmaceutical Chemistry-V (Biochemistry)	3	3	-	-	3	30	70
PH 302	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	3	3	-	-	3	30	70
PH 303	Pharmaceutics-V (Pharmaceutical Technology-I)	3	3	-	-	3	30	70
PH 304	Pharmaceutical Jurisprudence & Ethics.	4	4	-	-	3	30	70
PH 305	Pharmacology-I	3	3	-	-	3	30	70
PH 306	Pharmaceutics-VII (Biopharmaceutics & Pharmacokinetics)	3	3	-	-	3	30	70
PH 307	Pharmacognosy-III	3	3	-	-	3	30	70
PH 308	Pharmacology-II	3	3	-	-	3	30	70
PH 309	Pharmaceutics-VI (Hospital Pharmacy)	3	3	-	-	3	30	70

PH 310	Pharmacognosy-IV (Chemistry of Natural Products).	3	3	-	-	3	30	70
PH 351	Practical - Pharmaceutical Chemistry-V (Biochemistry)	2	-	-	3	3	60	40
PH 352	Practical - Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	2	-	-	3	3	60	40
PH 353	Practical - Pharmaceutics-V (Pharmaceutical Technology -I)	2	-	-	3	3	60	40
PH 354	Practical - Pharmaceutics-VII (Biopharmaceutics & Pharmacokinetics)	2	-	-	3	3	60	40
PH 355	Practical - Pharmacology-I	2	-	-	3	3	60	40
PH 356	Practical - Pharmacology-II	2	-	-	3	3	60	40
PH 357	Practical - Pharmacognosy-III	2	-	-	3	3	60	40
PH 358	Practical - Pharmacognosy-IV (Chemistry of Natural Products).	2	-	-	3	3	60	40
PH 359	Practical - Pharmaceutics-VI (Hospital Pharmacy)	2	-	-	3	3	60	40
PH 401	Pharmaceutical Biotechnology	3	3	-	-	3	30	70
PH 402	Pharmaceutics-IX (Dosage form design)	3	3	-	-	3	30	70
PH 403	Pharmaceutics-VIII (Pharmaceutical Technology-II)	3	3	-	-	3	30	70
PH 404	Pharmaceutical Analysis-III	3	3	-	-	3	30	70
PH 405	Pharmaceutical Industrial Management	3	3	-	-	3	30	70
PH 406	Pharmaceutical Chemistry-VIII (Medicinal Chemistry -III	3	3	-	-	3	30	70
PH 407	Pharmacology-III	3	3	-	-	3	30	70
PH 408	Pharmacognosy-V	3	3	-	-	3	30	70
PH 409	Pharmaceutical Chemistry-VII (Medicinal Chemistry- II)	3	3	-	-	3	30	70
PH 410	Pharmacology-IV (Clinical Pharmacy & Drug interactions)	3	3	-	-	3	30	70
PH 451	Practical - Pharmaceutical Biotechnology	2	-	-	3	3	60	40
PH 452	Practical - Pharmaceutics-IX (Dosage form design)	2	-	-	3	3	60	40
PH 453	Practical - Pharmaceutics-VIII (Pharmaceutical Technology-II)	2	-	-	3	3	60	40
PH 454	Practical - Pharmaceutical Analysis-III	2	-	-	3	3	60	40
PH 455	Practical - Pharmacology-III	2	-	-	3	3	60	40
PH 456	Practical - Pharmaceutical Chemistry-VIII (Medicinal Chemistry -III)	2	-	-	3	3	60	40
PH 457	Practical - Pharmaceutical Chemistry-VII (Medicinal Chemistry- II)	2	-	-	3	3	60	40
PH 458	Practical - Pharmacognosy-V	2	-	-	3	3	60	40
PH 460	Project related to elective, Dissertation on Practical work.	2	-	-	3	3	100	-
CA 149	Computer Science & Applications	2	4	-	-	3	30	70
CA 199	Practical - Computer Science & Applications	2	-	-	3	3	60	40
ES101	Environmental Studies	2	2	-	-	3	30	70
HS 132	Communication Skills	3	-	-	-	3	60	40
HS 332	Soft Skills-I	3	3	-	-	3	30	70
HS 432	Soft Skills-II	3	3	-	-	3	30	70
DE 101	Discipline & Co Curricular Activities	2	-	-	-	-	-	-
DE 102	Discipline & Co Curricular Activities	2	-	-	-	-	-	-
DE 201	Discipline & Co Curricular Activities	2	-	-	-	-	-	-
DE 202	Discipline & Co Curricular Activities	2	-	-	-	-	-	-
DE 301	Discipline & Co Curricular Activities	2	-	-	-	-	-	-
DE 302	Discipline & Co Curricular Activities	2	-	-	-	-	-	-
DE 401	Discipline & Co Curricular Activities	2	-	-	-	-	-	-
DE 402	Discipline & Co Curricular Activities	2	-	-	-	-	-	-

PH 101 PHARMACEUTICAL ANALYSIS-I**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significant figures, Rules for retaining significant digits, types of errors, Mean, Standard deviation, Statistical Treatment of small data sets, Selection of sample, Precision and accuracy. Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.	8
II	Acid Base Titrations: Acid base concepts, Role of solvent, Relative strengths of acids and bases, Ionization, Law of mass action, Common-ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hasselbach equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyprotic system, Polyamine and amino acid systems, Amino acid titration, applications in assay of H ₃ PO ₄ , NaOH, CaCO ₃ etc.	8
III	Oxidation Reduction Titrations: Concepts of Oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of Redox titrations, Redox indicators, Cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate; titanous chloride and Sodium 2, 6-dichlorophenol indophenol.	8
IV	Precipitation Titrations: Precipitation reactions, Solubility products, Effects of acids, temperature and solvent upon the solubility of a precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators, Gay-Lussac method; Mohr's method, Volhard's method and Fajan's method.	8
V	Gravimetric Analysis: Precipitation techniques, Solubility products; the colloidal state, Supersaturation coprecipitation, Post-precipitation, Digestional washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.	8
Total		40

Reference:

- Beckett, A.H., and Stanlake, J.B. Practical Pharmaceutical Chemistry, Athlone Press, London.
- Jeffery, G.H., Bessett, J., Mendham J. and Denney, R.C., Vogel's Textbook of Quantitative Inorganic Analysis including Elementary Instrumental Analysis 4th ed. the ELBS and Longman London, 1978.
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- Connors, K.A. Textbook of Pharmaceutical Analysis. 3rd Edition. John Wiley & Sons, New York.
- Kalhoff, I.M. and Stenger, V.A. Volumetric Analysis Vol.II Titration Methods. Interscience Publishers Inc., New York.
- Varma, R.M. Analytical Chemistry, Theory & Practice. 3rd edition CBS Publishers & Distributors, New Delhi.

PH 102 PHARMACEUTICS-II (PHYSICAL PHARMACY)**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	1. Matter and Properties of Matter : State of matter, change in the state of matter, latent heats and vapor pressure, sublimation-critical point, Eutectic mixtures, gases, aerosols -inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism. 2. Micromeritics and Powder Rheology: Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods of determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.	8
II	1. Surface and Interfacial Phenomena: Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid- gas and solid-liquid interfaces, complex films, electrical properties of interface. 2. Viscosity and Rheology: Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers.	8
III	1. Dispersion Systems: Colloidal Dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability.	8
IV	1. Complexation: Classification of complexes, methods of preparation and analysis, applications. 2. Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.	8
V	1. Kinetics and Drug Stability: General considerations & concepts, half-life determination, Influence of temperature, light, solvent, catalytic species and other factors, Accelerated stability study, expiration dating.	8
Total		40

Reference:

- Martin, A., Cammarata, A., and Swarbrick, J. Physical Pharmacy. K.M. Varghese & Co., Mumbai.
 Shotton, E. and Ridgaway, K. Physical Pharmaceutics. Oxford University Press, London.
 Subramanyam, C.V.S. Textbook of Physical Pharmaceutics. Vallabh Prakashan, New Delhi.
 Connors, K.A., Amidon, G.L. and Stella, V.J. Chemical Stability of Pharmaceuticals. John Wiley and Sons, New York.
 Gennaro, A.R. Ed. Remington's Pharmaceutical Sciences. 19th ed. Mack Publishing Co., Eastern Pennsylvania, 3000
 Martin, A., Bustamante, P., Chun, A.H.C. Physical Pharmacy. 4th Edition. B.I. Waverley (P) Ltd.,

Unit	Course Contents	Hours
I	Scope and significance of biology in pharmaceutical sciences. Modern concept of Biology i.e. Molecular, physiological and biochemical aspects. Classification of plants with special reference to the following families, their diagnostic characteristic with emphasis on plants of medicinal and economic importance. <ol style="list-style-type: none"> i. Papaveraceae ii. Ranunculaceae iii. Cruciferaeae iv. Leguminoseae v. Rutaceae vi. Umbelliferae vii. Rubiaceae viii. Apocynaceae ix. Solanaceae x. Labiatae xi. Liliaceae xii. Zingiberaceae 	8
II	General structure, physiology, life history and medico-economic importance of <ol style="list-style-type: none"> a. Bacteria b. Penicillium c. Claviceps d. Yeast e. Mushroom f. Lycopodium General structure and life history of parasites and Amoeba, Entamoeba, Trypanosoma, Plasmodium, Schistosoma, Taenia, Ascaris.	9
III	General morphology of shoot, flower, fruit and their importance & classification. Structure of Typical plant cells and their non living cell inclusions, organization of cells into different plant tissues.	8
IV	Anatomical study of normal monocot and Dicot Root, stem and leaf including secondary growth of dicot stem and root.	7
V	Macro and micro plant nutrients, photosynthesis and its mechanism. General structure and life history of insects including their relation to man and medicinal crops, of cockroach, Mosquito, Housefly, silkworm and Mites.	8
Total		40

Reference:

1. Y.D.Tyagi-Text Book of Botany.
2. A.C. Dutta-Text Book of Botany.
3. Khetrapal & Kotpal-Invertebrates.
4. H.S.Youngken-Pharmaceutical Botany, Pub.The Balkistan company Toronto.
5. K.Easou-Anatomy of seed plants,John Willey and sons.

PH 104 MATHEMATICS & BIostatISTICS

C (L, T, P) = 4 (4, 0, 0)

Unit	Course Contents	Hours
I	Sets, relations and functions equation of straight line. Calculus of finite differences Finite different , difference table finite difference operator and their properties.	08
II	Linear equation and matrices solutions of linear programming programinig problems by graphical method and simplex method.	08
III	Differential calcuts limits continuity and differentiability differentiation. Basic fundamental theorems on differentiation differentiation of trigonometric and hyperbolic function (including inverse trigonometric and hyperbolic function) logarithmic differentiation partial differentiation.	08
IV	Integral Calculus: Integration as inverse process of differentiation. Integration by substation integration by parts. Integration of algebraic functions.	08
V	Bio – Statistics : Tables and graphs 'Life tables only, Linear correlation coefficient Pearson's assumptions and causality, Regression of Y on X and X on Y, standard error estimate. Correlation coefficient .Linear and curvilinear correlation. Sampling Non – Probability and probability samples . Sampling distribution confidence intervals computing 99% and 95 % fiducially limits form tables of areas and ordinates of normal curve. Probability rules, binomial experiments 'Z' score computing "t" tests and analysis of variance. All calculation should be illustrated with examples from true laboratory pharmacological experimental models.	08
Total		40

PH 105 PHARMACEUTICAL CHEMISTRY-I (INORGANIC PHARMACEUTICAL CHEMISTRY)**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	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. Acids and Bases : Buffers, Water. Gastrointestinal Agents : Acidifying agents, Antacids, Protectives and Adsorbents, Cathartics. Major Intra- and Extra-cellular Electrolytes : Physiological ions. Electrolytes used for replacement therapy.	8
II	Essential and Trace Elements : Transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements. Cationic and anionic components of inorganic drugs useful for systemic effects. Topical Agents : Protectives, Astringents and Anti-infectives.	8
III	Gases and Vapours : Oxygen, Anesthetics and Respiratory stimulants. Dental Products : Dentifrices, Anti-caries agents. Complexing and chelating agents used in therapy.	8
IV	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.	8
V	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.	8
Total		40

Reference:

1. Block, J.H., Roche, E, Soine, T.O. and Wilson, C.O. Inorganic Medicinal and Pharmaceutical Chemistry Lea and Febiger, Philadelphia, PA.
2. Discher, L.A. Modern Inorganic Pharmaceutical Chemistry.
3. Suchla, G. Vogel's Textbook of Micro and Semimicro Qualitative Inorganic Analysis. Orient
4. Longman, Hyderabad .
5. Qadry, J.S. and Qadry, S.Z. Textbook of Inorganic Pharmaceutical and Medicinal Chemistry.

PH 106 PHARMACEUTICAL CHEMISTRY-II (PHYSICAL CHEMISTRY)**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Behaviour of Gases : Kinetic theory of gases, deviation from ideal behaviours and explanation. The Liquid State : Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents).	8
II	Solutions : Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory. Adsorption : Freundlich and Gibbs adsorption, isotherms, Langmuir theory of adsorption.	8
III	Thermodynamics : First, second and third laws, Zeroth law, absolute temperature scale, thermo chemical equations, phase equilibria and phase rule.	8
IV	Chemical Kinetics : Zero, first and second order reactions, complex reactions, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis.	8
V	Photochemistry : Consequences of light absorption, Jablenski diagram, Lambert-Beer Law, Quantum efficiency. Quantum Mechanics : Postulates of quantum mechanics, operators in quantum mechanics, the Schrodinger wave equation.	8
Total		40

Reference:

1. Laidler, K.J. Physical Chemistry with Biological Applications. Benjamin. 1970
2. Shoemaker, D.P. and Garland, C.W. Experiments in Physical Chemistry. McGraw Hill Book Co. New York.
3. Puri, B.R., Sharma, L.R. and Pathania, M.S. Principles of Physical Chemistry. Shoban Lal Nagin Chand & Co. 1993
4. Brey, W.S. Physical Chemistry and Biological Applications. Academic Press, 1978.
5. Kitckner, J.A. Ed. Findley's Physical Chemistry. Green & Co., London
6. Wallwork, S.C. Physical Chemistry for Students of Pharmacy and Biology. Longman
7. Pali, S.R. and Prabartak, S.K.D.E. Practical Physical Chemistry. Halton Ltd., Calcutta
8. Williams, V.R. and Williams, H.S. Basic Physical Chemistry for the Life Sciences. W.H. Freeman
9. Barrante, J.R. Physical Chemistry of the Life Sciences. Printell

Unit	Course Contents	Hours
I	Definition and Scope	05 Hr.
II	Prescription: Handling of prescription, source of errors in prescription, General dispensing procedures including labeling of dispensing products.	8
III	Pharmaceutical calculations: Posology, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, alligation, alcohol dilution, proof spirit, isotonic solutions, displacement value, etc.	9
IV	Principles involved and procedures adopted in dispensing of: Typical prescriptions like mixtures, solutions, emulsions, creams, ointments, powders, capsules, pastes, jellies, suppositories, ophthalmic, pastilles, lozenges, pills, lotions, liniments, inhalations, paints, sprays, tablet triturates etc.	10
V	Incompatibilities: Physical and chemical incompatibilities, inorganic incompatibilities including incompatibilities of metals and their salts, non-metals, acids, alkalis, organic incompatibilities. Purine bases, alkaloids, pyrazolone derivatives, amino acids, quaternary ammonium compounds, carbohydrates, glycosides, anesthetics, dyes, surface active agents, correction of incompatibilities. Therapeutic incompatibilities.	10
Total		37

Reference:

1. Carter, S.J. Cooper and Gunn's Dispensing for Pharmaceutical Students CBS Publishers, Delhi.
2. Stoklosa, M.J. Pharmaceutical Calculations. Lea & Febiger, Philadelphia.
3. Zafar & Zafar Health Education & Community Pharmacy.
4. Burnade Drug Store & Administration
5. British National Formulary.
6. Hoover, J.E. Dispensing of Medication Mack Publishing Co., Easton, PA
7. Martindale's Extra Pharmacopoeia.
8. Martin, E.W. Dispensing of Medication Mack Publishing Co., Easton, PA.
9. National Formulary of India.
10. Remington's The Science & Practice of Pharmacy. Mack Publishing Co., Easton, P.A.

Unit	Course Contents	Hours
I	Structure and Properties: Atomic structure, Atomic orbitals, Molecular orbital theory, wave equation, Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases.	8
II	Stereochemistry: Isomerism & nomenclature and associated physicochemical properties, optical activity, stereoisomerisms, specification of configuration, reactions involving stereoisomerisms, chirality, chiral reagent, conformations. Structure, Nomenclature and Properties with special Emphasis on reaction Mechanism of following	8
III	Alkanes, Alkenes, Alkynes, Cycloalkanes, Dienes, Benzene, Polynuclear aromatic compounds, Arenes.	8
IV	Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones.	8
V	Carboxylic acids, Functional derivatives of carboxylic acids, Reactive intermediates- carbocations, carbanions, carbenes, nitrene and nitrenium ions.	8
Total		40

Reference:

1. Mann, F.C. and Saunders, B.C. Practical Organic Chemistry. ELBS/ Longman. London
2. Morrison, T.R. and Boyd, R.N. Organic Chemistry. Prentice Hall of India, New Delhi
3. Roberts, J.D. and Caserio, M.C. Basic Principles of Organic Chemistry. W.A. Benjamin, Inc., New York.
4. Vogel, A.I. A Textbook of Practical Organic Chemistry. ELBS/ Longman, London
5. Eliel, E.L. Stereochemistry of Organic Compounds McGraw Hill Book Co., Inc., New York.
6. Finar, I.L. Organic Chemistry Vols. I & II ELBS/Longman, London
7. Furniss, N.S., Hannaford, A.J., Smith, P.W.G. and Tatehell, A.R. Vogel's Textbook of Practical Organic Chemistry., ELBS/Longman, London
8. Sykes, P.A. A Guidebook to Mechanism in Organic Chemistry. Orient Longman, New Delhi.

PH 110 HUMAN ANATOMIES AND PHYSIOLOGY – I**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Scope of anatomy and physiology and basic medical terminology used in these Courses. 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.	8
II	Anatomy and Physiology with emphasis to various system. Osseous System: Structure, composition and functions of skeleton, Classification of joints, types of movements of joints, Disorders of joints. Skeletal Muscles: Gross anatomy; physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.	8
III	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.	8
IV	Lymph and Lymphatic System: Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.	8
V	Cardiovascular System: Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Basic understanding of Cardiac cycle, heart sounds and understanding of Cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorder like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.	8
Total		40

Reference

1. Tortora, G.J. and Grabowski, S.R. Principles of Anatomy and Physiology. Collins College Publishers, Luciano, New York.
2. Eroschenko, V.P. Difore's Atlas of Histology with functional correlations. Lippincott Williams & Williams.
3. Ghai, C.L. A Textbook of Practical Physiology Jay Pee Brothers, New Delhi.
4. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology. W.B. Sanders Co.
5. Chaurasia, B.D. Human Anatomy, Regional and Parts I, II & III. CBS Publishers & Distributors, New Delhi.
6. Difore, S.H. Atlas of Normal Histology. Lea & Febiger, Philadelphia
7. Chatterjee, C.C. Human Physiology, Medical Allied Agency, Calcutta
8. Subhash, S. Human Physiology, Medical Allied Agency, Calcutta
9. Keele, C.A., Neil, E. and Joels, N. Samson Wright's Applied Physiology. Oxford University Press
10. McNaught, A.B. and Callander, R. Illustrated Physiology. Churchill Livingstone.
11. Parmar, N.S. Health Educations and Community Pharmacy, CBS Publishers & Distributors, New Delhi
12. Ranade, V.G. Textbook of Practical Physiology. Pune Vidyarthi Griha Parkas Han, Pune
13. Vander, A.J., Sherman, J.H. and Lucians, D.S. Human Physiology. Tata McGraw Hill Publishing Co., New Delhi
14. Ganong, W.F. Review of Medical Physiology. Prentice. Hall Guyton, A.C., Hall, J.E. Textbook

PH 151 PRACTICAL PHARMACEUTICAL ANALYSIS-I**C (L, T, P) = 2 (0, 0, 3)**

1. The students should be introduced to the main analytical tools through demonstrations. They should have a clear understanding of a typical analytical balance, the requirements of a good balance, weights, care and use of balance, methods of weighing and errors in weighing. The students should also be acquainted with the general apparatus required in various analytical procedures.
2. Standardization of analytical weights and calibration of volumetric apparatus.
3. **Acid base Titrations** : Preparation and standardization of acids and bases; some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.
4. **Oxidation Reduction Titrations** : Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2, 6- dichlorophenol indophenol, and ceric ammonium sulphate.
5. **Precipitation Titrations** : Preparation and standardization of titrants like silver nitrate and, ammonium thiocyanate,
6. Titrations according to Mohr's, Volhard's and Fajan's methods.
7. **Gravimetric Analysis** : Preparation of gooch crucible for filtration and use of sintered glass crucible, Determination of water of hydration,
8. Some exercises related to gravimetric analysis should be covered.

PH 152 PRACTICAL - PHARMACEUTICS-II (PHYSICAL PHARMACY)**C(L, T, P) = 2 (0, 0, 3)**

1. Determination of particle size, particle size distribution and surface area using various methods of Particle size analysis.
2. Determination of derived properties of powders like densities, porosities, compressibility, angle of repose etc.
3. Determination of surface/interfacial tension, spreading coefficient HLB value, and critical micellar concentration of surfactants.
4. Study of rheological properties of various types of systems using different Viscometers.
5. Preparation of various types of suspensions and determination of their sedimentation parameters.
6. Preparation and stability studies of emulsions.
7. Studies on different types of complexes and determination of their stability constants.
8. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals
9. Preparation of pharmaceutical buffers and determination of buffer capacity.
10. X Experiments involving tonicity adjustments.

PH 153 PRACTICAL - PHARMACEUTICAL BIOLOGY**C (L, T, P) = 2 (0, 0, 3)**

1. Care and use of microscope.
2. Non-living cell inclusions and their micro chemical tests.
3. Preparation, microscopic examination and description of transverse section of stem, root and leaf of
4. monocot and dicot plants (Normal structures)
5. Morphological characteristics of the plant families mentioned in theory.
6. Preparation of herbarium sheets.
7. Morphology of flowers and fruits.
8. structure of human parasites and insects mentioned in theory with the help of specimens and
9. microscopic slides.

PH 154 PRACTICAL -PHARMACEUTICAL CHEMISTRY-II (PHYSICAL CHEMISTRY) C(L, T, P)= 2(0, 0, 3)

1. To determine molar mass by Rast method and cryoscopic method.
2. To determine refractive index of given liquids and find out the contribution of carbon, hydrogen and oxygen in molar refraction of a compound.
3. To determine molar mass of volatile liquids by Victor-Meyer method.
4. To determine the specific rotation of sucrose at various concentrations and determine the intrinsic rotation.
5. To determine the heat of solution, heat of hydration and heat of neutralization.
6. To determine the cell constant, verify Ostwald dilution law and perform conductometric titration.
7. To determine rate constant of simple reaction.

PH 155 PRACTICAL - PHARMACEUTICAL CHEMISTRY-I (INORGANIC PHARMACEUTICAL CHEMISTRY)**C (L, T, P) = 2 (0, 0, 3)**

The background and systematic qualitative analysis of inorganic mixtures of up to four radicals. Six Mixtures to be analyzed, preferably by semi-micro methods. All identification tests for pharmacopoeal inorganic pharmaceuticals and qualitative tests for cations & anion should be covered .

PH 156 PRACTICAL - PHARMACEUTICAL CHEMISTRY-III (ORGANIC CHEMISTRY-I) C (L, T, P) = 2 (0, 0, 3)

1. The student should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, p-bromoacetanilide, anthraquinone from anthracene, reduction of nitrobenzene, etc.)
2. Identification of organic compounds and their derivatisation.
3. Introduction to the use of stereo models.

PH 157 PRACTICAL - PHARMACEUTICS – I (DISPENSING & COMMUNITY PHARMACY) C (L, T, P) = 2 (0, 0, 3)**Dispensing of prescription falling under the categories:**

Mixtures, solutions, emulsions, creams, ointments, powders, suppositories, ophthalmic, capsules, paste, jellies, Pastilles, lozenges, pills, tablet triturates, lotions, liniments, inhalations, paints, etc. Identification of various types of incompatibilities in prescription, correction thereof and dispensing of such prescriptions. Dispensing procedures involving pharmaceuticals calculations, pricing of prescriptions and dosage calculations for pediatric and geriatric patients. Dispensing of prescriptions involving adjustment of tonicity. Categorization and storage of Pharmaceutical products based on legal requirements of labeling and storage. Project report on Visit to the nearby Community for Counseling on the rational use of drugs and aspects of healthcare.

PH 158 PRACTICAL - HUMAN ANATOMY AND PHYSIOLOGY – I**C (L, T, P) = 2 (0, 0, 3)**

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 leucocyte count, D.L.C. and E.S.R.
5. Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram-PQRST waves and their significance.

PH 201 PHARMACEUTICS-III (UNIT OPERATIONS-I INCLUDING ENGG. DRAWING) C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Unit Operations: Introduction, basic laws. Fluid Flow : Types of flow, Reynold's number, Viscosity, Concept Of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure. Material Handling Systems: a. Liquid handling- Different types of pumps. b. Gas handling- various types of fans, blowers and compressors. c. Solid handling- Bins, Bunkers, Conveyers, Air transport.	8
II	Filtration and Centrifugation: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, and centrifugal sedimenters.	8
III	Crystallization: Characteristics of crystals like-purity, size, shape, geometry, habit, forms size and factors affecting them. Solubility curves and calculation of yields. Supersaturation theory and its limitations, Nucleation mechanisms, Crystal growth. Study of various types of Crystallizers, tanks, Caking of crystals and its prevention. Numerical problems on yields.	8
IV	Dehumidification and Humidity Control: Basic concepts and definition, wet bulb and adiabatic saturation temperatures, Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations. Refrigeration and Air Conditioning : Principles and applications of refrigeration and air conditioning.	8
V	Material of Construction : General study of composition, corrosion, resistance, Properties and applications of the materials of construction with special reference to stainless steel and glass. Factors affecting the choice. Industrial hazards and Safety Precautions: Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, Accident records etc.	8
Total		40

Reference:

1. Badger, W.L. and Banchero, J.T. Introduction to Chemical Engineering. McGraw Hill International Book Co., London.
2. Brown, C.G. Unit Operations (Indian Ed.) CBS Publishers & Distributors.
3. McCabe, W.L. and Smith, J.C. and Harriott, P. Unit Operations of Chemical Engineering. 5th Edition McGraw Hill, International Book Co., London.
4. Bhatt N.D. and Panchal, V.M. Machine Drawing Charocar Publishing House, Opp. Amul Dairy, Anand, 387001 (India).
5. Perry, R.H. & Green, D.W. Chemical Engineers Handbook. McGraw Hill, International Editors Ltd.

PH 202 PHARMACEUTICS-IV (UNIT OPERATIONS-II)

C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Stoichiometry : Unit processes material and energy balances, molecular units, mole fraction, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae, dimensionless groups, different types of graphic representation, mathematical problems. Heat Transfer : Source of heat, heat transfer, steam and electricity as heating media, determination of requirement of amount of steam/electrical energy, steam pressure, Boiler capacity, Mathematical problems on heat transfer.	8
II	Evaporation : Basic concept of phase equilibria, factor affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, Mathematical problems on evaporation. Distillation : Raoult's law, phase diagrams, volatility; simple steam and flash distillations, principles of rectification, Calculation of number of theoretical plates, Azeotropic and extractive distillation. Mathematical problems on distillation.	8
III	Drying: Moisture content and mechanism of drying, rate of drying and time of drying calculations; classification and types of freeze drying dryers behaviour of solids during drying, MC, EMC, CMC and LOD dryers used in pharmaceutical industries and special drying methods. Mathematical problems on drying.	8
IV	Size Reduction and Size Separation: Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of mills including ball mill, hammer mill, fluid energy mill etc.	8
V	Mixing: Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments Fundamentals of Automated Process control system and Computer aided manufacturing (CAM). Reactors and fundamentals of reactors design for chemical reaction.	8
Total		40

Reference:

1. Brown, C.G. Unit Operations (Indian Ed.) C.B.S. Publishers & Distributors.
2. McCabe, W.L. and Smith, J.C. Unit Operations of Chemical Engineering. McGraw Hill International Book Co., London.
3. Badger, W.L. and Banchero, J.T. Introduction to Chemical Engineering. McGraw Hill International Book Co., London.
4. Perry, R.H. & Green, D.W. Chemical Engineers Handbook. McGraw Hill International Edition.
5. Subramanyam, C.V.S. Setty, J.T. Suresh, S. and Devi, U.K.
6. Pharmaceutical Engineering. (Principal and Practises), Vallabh Prakash.

Unit	Course Contents	Hours
I	Nucleophilic aromatic substitutions; □-unsaturated carbonyl compounds; Conservation of orbital symmetry and rules. Electrocyclic, Cycloaddition and sigmatropic reactions; Neighbouring group effects	8
II	Catalysis by transition metal complexes, Stereoselective and stereospecific reactions; New organic reagents used in drug synthesis	8
III	Heterocyclic Compounds: Chemistry, preparations and properties of some important heterocyclics containing 3,4,5,6, & 7 atoms with one or two heteroatoms like O, N, S.	8
IV	Chemistry of Lipids, Carbohydrates.	8
V	Chemistry of Proteins and Nucleic acids.	8
	Total	40

Reference:

1. Acheson, R.N. An Introduction to the Chemistry of Heterocyclic Compounds. Interscience Publishers, N.Y.
2. Finar, I.L. Organic Chemistry. Vol. I & II ELBS/Longman, London.
3. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. and A.R. Tatehell. Vogel's Textbook of Practical Organic Chemistry.
4. Addison Wesley Longman.
5. Morrison, R.T. and Boyd, R.N. Organic Chemistry. Prentice Hall of India, N.Delhi.
6. Roberts, J.D. and Caserio, M.C. Basic Principles of Organic Chemistry. W.A. Benjamin, Inc., N.Y.
7. Sykes, P. A Guide book to Mechanism in Organic Chemistry. Orient Longman, N.Delhi.
8. Paquette, L.A. Advanced Heterocyclic Chemistry.

PH 204 PHARMACEUTICAL MICROBIOLOGY

C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Introduction to scope of microbiology. Structure of Bacterial Cell. Classification of microbes and their taxonomy. Actinomycetes, Bacteria, Rickettsiae, spirochetes and viruses. Identification of microbes: Stains and types of staining techniques, electron microscopy. Nutrition, cultivation, Isolation of bacteria, Actinomycetes, fungi, virus, etc. Microbial genetics and variation.	8
II	Control of Microbes by physical and chemical methods: Disinfectants: Dynamics of disinfection, factors affecting the process of disinfection, Evaluation of liquid disinfectants & methods of measuring growth inhibition (MIC). Types of chemical agents employed for disinfection, antiseptics and preservation with their full description & use.	8
III	Principles and Practice of sterilization methods : Introduction, sensitivity of micro-organisms, typical survival curves for bacterial spores exposed to moist heat or gamma radiations, expression of resistance in terms of D value and Z value & sterility assurance. Sterilization methods (Heat, Gaseous, Radiations & Filtration using different filter devices) with emphasis on sterilization of items used in hospital, thermolabile drugs and injectables. Monitoring of sterilization processes. Laminar aseptic hoods and aseptic processing.	8
IV	Sterility Testing: Methods and media used with emphasis of the specific details of the sterility testing of parenterals and ophthalmics containing antimicrobial agents and other non injectable preparations such as catgut etc. Microbial assays of antibiotics, vitamins and amino acids.	8
V	Immunology : Historical aspects, non specific defence mechanism (Skin and mucous membrane, phagocytosis, the complement system, inflammation, host damage following failure of primary defences, exotoxins and endotoxins), specific defence mechanism, antigens and antigenic structure of microbial cell, antibody structure and immunoglobulin classes, humoral and cell mediated immunity, immunity (natural and acquired), antibody response following immunization, immunological tolerance.	8
	Total	40

Reference:

1. Carter, S.J. Cooper and Gunn's Dispensing for the Pharmaceutical Students. CBS Publishers, Delhi.
2. Hugo and Russel. Pharmaceutical Microbiology. Balckwell Scientific Publication, Oxford.
3. Prescott, L.M., Harley, G.P. and Klein, D.A. Microbiology 3rd Edition V.C. Brown Publishers, Oxford.
4. Avis, K.E., Lachman, I and Lieberman, H.A. Pharmaceutical Dosage Forms: Parenteral Medications. Vol. I and II Marcal Dekker Inc., N.Y.
5. Bergey's manual of Determinative Bacteriology.
6. Brock, T.D and Madigen, M.T. Biology of Micro-organisms. Prentice-Hall, New Jersey (USA)
7. Davis, Dulbetco and Eisen . Microbiology.
8. Lewin Benjaamin Gene V Microbiology.
9. Pepler. Microbial Technology Vol. I & II .
10. Pharmacoepa of India. Controllor of Publications, GOI, Delhi.
11. Prescott and Dunn. Industrial Microbiology McGraw Hill Book Co. Inc.
12. Salle, A.J. Fundamental Principles of Bacteriology.
13. Stainer, R.Y. Adelberg, E.A and Ingraham J.L. General Microbiology 4th Edition. Macmillan Press, London.
14. Sykes, G. Disinfection and Sterilization.
15. Turco, S. and King, R.E. Sterile Dosage Forms. Lea & Febiger, Philadelphia.

Unit	Course Contents	Hours
I	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.	8
II	Tannins: Study of tannins and tannin containing drugs like Gambir, black catechu, gall and myrobalan.	6
III	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.	8
IV	Phytochemical Screening: a) Preparation of extracts. b) Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoantho cyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts.	9
V	Fibres: Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos. Pharmaceutical aids: Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.	9
Total		40

Reference

- Harborne, J.B. Phytochemical Methods. Chapman & Hall, International Edition, London.
- Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy . Lea & Febiger, Philadelphia.
- Tyler, V.E. Jr. and Schwarting, A.E. Experimental Pharmacognosy. Burgess Pub. Co, Hinneapois , Minnesota
- Brain, K.R. and Turner, T.D. The Practical Evaluation of Phytopharmaceuticals. Wright-Scientechica, Bristol.
- Guenther, E. The Essenial Oils –4D Van Nostrand Co., N.Y.
- Miller, L.P. Phytochemistry 1-3 Van Nostrand Reinhold Co.
- Swain, T. Comparative Phytochemistry Academ Press, London.
- Trease, G.E. and Evans, W.C. Pharmacognosy. Bailliere Tindall, Eastbourne, U.K.
- Wallis, T.E. Textbook of Pharmacognosy. J & A Churchill Ltd., London.

PH 206 PHARMACOGNOSY – II

C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides: Saponins : Liquorice, ginseng, dioscorea, sarsaparilla, and senega. Cardioactive sterols: Digitalis, squill, strophanthus and thevetia.	8
II	Anthraquinone cathartics: Aloe, senna, rhubarb and cascara. Others: Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia.	8
III	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 and Shankhapushpi	8
IV	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: Brahmi , Adusa, Arjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gyumnema, Shilajit, Nagarmotha, kalmegh and Neem.	8
V	The holistic concept of drug administration in traditional systems of medicine. Introduction of ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas.	8
Total		40

Reference:

- Trease, G.E. and Evans, W.C. Pharmacognosy. Bailliere Tindall, Eastbourne, U.K.
- Handa, S.S. and Kapoor, V.K. Atextbook of Pharmacognosy. Vallabh Prakashan, Delhi.
- Kokate, C.K, Purohit, A.P. and Gokhale, S.N. Pharmacognosy (Degree). Nirali prakashan, Pune.
- Medicinal Plants of India. ICMR, New Delhi.
- Tyler, V.C., Brady, L.R. and Robers, J.E. Pharmacognosy. Lea & Febiger, Philadelphia.
- Tyler, V.E. Jr. and Schwarting, A.E. Experimental Pharmacognosy. Burgess Pub. Co, Hinneapois , Hinnesotta
- Wallis, T.E. Textbook of Pharmacognosy. J & A Churchill Ltd., London.
- Chopra, R.N., Nayar, S.L. and Chopra, I.C. Glossary of Indian Medicinal Plants. CSIR, New Delhi.
- Kokate, C.K. Practical Pharmacognosy. Vallabh Parkashan, Delhi.
- Wallis, T.E. Analytical Microscopy. J & A Churchill Ltd., London.

Unit	Course Contents	Hours
I	Non-aqueous Titrations & Complex metric Titrations:- Non-aqueous Titrations:- Theoretical consideration, scope and limitations, Acid base equilibria in non-aqueous media, titration of weak bases, titration of weak acids, indicators Pharmaceutical products should be selected for illustrating application in drug analysis and quality control. Complex metric Titrations:- Concept of complexation and chelations, Werner's coordination number, electronic structure of some complex ions, stability constants, titration curves, masking and demasking agents, types of complexometric titrations, metal ion indicators and application in drug analysis.	8
II	Miscellaneous methods of Analysis :- Basic principles, instrument and application of A) Diazotisation titration B) Kjeldahl method of nitrogen estimation C) Determination of water by Karl-Fisher titration D) Oxygen flask combustion E) Gasometry	8
III	Chromatography:- Fundamentals of the following techniques will be discussed with relevant examples of pharmaceutical and/or natural products TLC, HPTLC, HPLC, GLC, paper chromatography and column chromatography. Extraction procedures:- Liquid-solid extraction, Liquid-Liquid extraction, separation of mixtures by extraction, distribution law, successive extraction separation of drugs from excipients.	8
IV	Electrochemistry:- The electric cell, electrode potential, half cells, sign convention, Nerst equation, the salt bridge, activity series, standard potential, standard hydrogen electrode, reference electrode indicator electrode, measuring the relative voltage of half-cells and calculation of std potential Potentiometry:- Theoretical consideration, ion-selective electrodes, measurement of potential location of the end-point, instrumentation, analytical application . pH meter, definition of pH, relationship between pH and potential, equipment and applications	8
V	Conductometry :- Ohm's law, specific resistance, specific conductance, conductivity cell, ionic conductivity, change of conductivity during titration, change in volume during conductometric titration, method and instrumentation. Coulometric Titration :- Principles and application controlled potential coulometry, cell design, instrumentation, method, electrode selection and advantages and limitations. Polarography :- Theory, mass transport processes, current potential relationship, polarization choice of electrode, effect of oxygen, instrumentation and calculation of concentration. Amperometric titration and its application	8
	Total	40

Reference:

1. Beckett, A.H. & Stenlake, J.B. Practical Pharmaceutical Chemistry. Athlone Press, London.
2. Chatten, L.G. (Editor) Pharmaceutical Chemistry Vol. I & II. Marcel Dekker, Inc., N.Y.
3. Connors, K.A . A Textbook of Pharmaceutical Analysis Johan Wiley & Sons, N.Y.
4. Kolthoff, I.M. and Stenger, V.A. Volumetric Analysis Vol.II Titration Methods. Interscience Pub., N.Y.
5. Knevel, A.M. and Digangi, F.E. Jenkin's Quantitative Pharmaceutical Chemistry.

PH 208 PATHOPHYSIOLOGY OF COMMON DISEASES

C (L, T, P) = 4 (4, 0, 0)

Unit	Course Contents	Hours
I	Basic Principles of Cell Injury and Adaptation: Causes of Cellular injury, pathogenesis, morphology of cell injury. Intercellular alterations in lipids, proteins and carbohydrates, Cellular adaptation, atrophy, hypertrophy.	8
II	Basic Mechanisms involved in the process of inflammation and repair: Alterations in vascular permeability and blood flow, migration of WBCs, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.	8
III	Pathophysiology of Common Diseases: Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania, Alzheimer disease.	8
IV	Hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, diabetes, peptic ulcer, asthma, ulcerative colitis, various types of Hepatitis, liver cirrhosis.	8
V	Acute and chronic renal failure, tuberculosis, urinary tract infections, sexually transmitted diseases, AIDS, anemia, Iatrogenic diseases, and common types of neoplasm. Wherever applicable the molecular basis should be discussed.	8
	Total	40

Reference:

1. Cotran, R.S., Kumar, V., Collins, T. Robbins Pathological Basis of Disease. W.B. Saunders Co.
2. Remington's The Science and Practice of Pharmacy. Mack Publishing Co. Easton, PA 19th edition. Vol. I, p.655 (1995)
3. Wilson, J.D. et al, eds. Harrison's Principles of Internal Medicine. Mc Graw-Hill, N.Y.
4. Dipiro, J.T. et al. Pharmacotherapy. A Pathological Approach. Appleton & Lange, Stamford, Connecticut.
5. Gilman, A.G., Goodman, L.S., Rall, T.W. and Murad, F. eds. The Pharmacological Basis of
6. Therapeutics. Mc Millan, N.Y.

Unit	Course Contents	Hours
I	Introduction - Trade, Industry and commerce, functions and subdivision of commerce. Forms of business organization. Drug house management: Selection of location of drug store, layout and legal requirements, chain store. Material management: Importance and objectives of purchasing selection of suppliers credit information tenders contracts and price determination and legal requirements thereto. Storage: General principles codification handling of drug store and other hospital suppliers Inventory Control: Objective and importance modern techniques like ABC VED analysis the lead time inventory carrying cost safety stock minimum and maximum stock levels economic order quality scrap and surplus disposal	8
II	Sales promotion: Salesmanship qualities of salesman literature detailing advertising and window display Recruitment selection orientation training evaluation and compensation of the Pharmacist. Channels of distribution buying selling transportation storage wholesale retails departmental store multiple shop mail order business with special reference to Indian marketing environment.	8
III	Banking and finance service and functions of bank finance planning and sources of finance. Costing accounting: Cost ascertainment various elements of cost sheet preparation statement of cost.	8
IV	Accounting: Introduction to the accounting concepts and conventions double entry book keeping different kinds of account recording of transactions – journal cash book ledger trial balance profit and loss account balance sheet computation of various ratios and analysis of financial statements.	8
V	Budgeting: Meaning importance and types of budgets Elementary knowledge of preparing sales cash production and flexible budgets.	8
Total		40

Reference:

1. Introduction to Accountancy:Gerwal,T.S.
2. Cost Accounting-S.P.Jain & N.L.Narang.
3. Auditing:-T.R.Verma.
4. Management Accounting:S.N.Maheshwari
5. R.G.Saxena,Principles and practice of auditing.
6. I.M.Pandey:financial management, Vikas Publishers.
7. Khan & Jain,Management Accounting,Tata Mc Graw hill.

PH 210 HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION – II C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	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. Respiratory System: Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.	8
II	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. Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S. 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.	8
III	Reproductive System: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis. Pregnancy its maintenance and parturition. Endocrine System: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and Ovary, their hormones and functions. Sense Organs : Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).	8
IV	Health Call Concepts of health and disease: Disease causing agents and prevention of disease. Classification of food requirements: Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water. Demography and family planning: Medical termination of pregnancy.	8
V	Communicable diseases: Brief outline, their causative agents, modes of transmission and prevention (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and AIDS). First Aid: Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.	8
Total		40

Reference:

1. Ganong, W.F. Review of Medical Physiology. Prentice-Hall.
2. Guyton , A.C., Hall, J.E. Textbook of Medical Physiology . W.B. Saunders Co
3. Parmar, N.S. Health Education and Community Pharmacy, CBS Publishers & Distributors , New Delhi.
4. Tortora, G.J. and Anagnodokos, N.P. Principles of Anatomy and Physiology. Harpar & Row Publishers, New York.
5. Chaurasia, B.D. Human Anatomy, Regional and Parts I, II & III. CBS Publishers & Distributors, New Delhi.
6. DiFore. S.H. Atlas of Normal Histology. Lea & Febiger Philadelphia.
7. Chatterjee, C.C. Human Physiology, Medical Allied Agency, Calcutta.
8. Keele, C.A. Neil, E. and Joels, N. Samson Wright's Applied Physiology. Oxford University Press.
9. McNaught, A.B. and Callander, R. Illustrated Physiology. Churchill Livingstone.
10. Ranade. V.G. Textbook of Practical Physiology. Pune Vidyarthi Griha Prakashan, Pune.
11. Subhash, S.Human Physiology. CBS Publishers & Distributors, New Delhi.
12. Vander. A.J., Sherman, J.H. and Lucians, D.S. Human Physiology. Hill TataMcGraw.Publishing Co., New Delhi.
13. Bothara, K.G., Khandelwal, K.R., Paranjape, M.H. Textbook of Health Education and Community Pharmacy, Nirali Prakashan, Pune.

PH 251 PRACTICAL - PHARMACEUTICS-III (UNIT OPERATIONS-I INCLUDING ENGG. DRAWING)**C (L, T, P) = 2 (0, 0, 3)**

1. Measurement of flow of fluids and their pressure, determination of Reynold's number and calculation of Frictional losses.
2. Evaluation of filter media, determination of rate of filtration and Study of factors affecting filtration.
3. Experiments to demonstrate applications of centrifugation.
4. Thermometers and Psychrometric charts.
5. Determination of humidity-use of Dry Bulb and Wet Bulb.
6. Elementary Knowledge of Engineering Drawing-Concept of orthographic and isometric views of elevation and third angle projection.
7. Notation and abbreviation used in Engineering drawing.
8. Basic Engineering Drawing Practice- Bolts, nuts, rivetted fronts, screws, worm screws as per specification.
9. Drawing of simple pharmaceutical machinery parts.

PH 252 PRACTICAL - PHARMACEUTICS-IV (UNIT OPERATIONS-II) -**C (L, T, P) = 2 (0, 0, 3)**

1. Determination of overall heat transfer coefficient.
2. Determination of rate of evaporation.
3. Experiments based of steam, extractive and azeotropic distillations.
4. Determination of rate of drying, free moisture content and bound moisture content.
5. Experiments of illustrate the influence of various parameters on the rate of drying.
6. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of size Reduction.
7. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.

PH 253 PRACTICAL - PHARMACEUTICAL CHEMISTRY –IV (ORGANIC CHEMISTRY- II)**C (L, T, P) = 2 (0, 0, 3)**

At least five exercises in synthesis involving various heterocyclic ring systems. An exercise involving stereoselective synthesis of a compound. Resolution of racemic DL-alanine or any other example. Workshop on molecular modelling of primary, secondary and tertiary structures of proteins, molecular modelling on double helical structure of nucleic acid showing hydrogen bonding. Determination of physico-chemical constants for oils and fats; preparation of organic compounds.

PH 254 PRACTICAL - PHARMACEUTICAL MICROBIOLOGY**C (L, T, P) = 2 (0, 0, 3)**

Experiments devised to prepare various types of culture media, sub-culturing of common aerobic and anaerobic bacteria, fungus and yeast, various staining methods, various methods of isolation and identification of microbes, sterilization techniques and validation of sterilization techniques, evaluation of antiseptics and disinfectants, testing and sterility of pharmaceutical products as per I.P. requirements, microbial assays of antibiotics, vitamins etc.

PH 255 PRACTICAL - PHARMACOGNOSY-I**C (L, T, P) = 2 (0, 0, 3)**

1. Identification of crude drugs mentioned in theory .
2. Study of fibres and pharmaceutical aids.
3. Microscopic 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.

PH 256 PRACTICAL - PHARMACOGNOSY – II**C (L, T, P) = 2 (0, 0, 3)**

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.

PH 257 PRACTICAL - PHARMACEUTICAL ANALYSIS-II**C (L, T, P) = 2 (0, 0, 3)**

1. Non aqueous Titrations: Preparation and standardization of perchloric acid and sodium/ potassium/ lithium methoxides solutions; Estimations of some pharmacopoeial products.
2. Complexometric Titrations: Preparations and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.
3. Miscellaneous Determinations: Exercises involving diazotisation, Kjeldahl, Karl-Fischer, Oxygen flask combustion and gasometry methods. Determination of alcohol content in liquid galenicals, procedure (BPC) shall be covered.
4. Experiments involving separation of drugs from excipients.
5. Chromatographic analysis of some pharmaceutical products.
6. Exercises based on acid base titration in aqueous and non-aqueous media, oxidation-reduction titrations using potentiometric technique, Determination of acid-base disassociation constants and plotting of titration curves using pH meter.
7. Exercises involving polarimetry.
8. Exercises involving conductometric and polarographic techniques.

PH 258 PRACTICAL - HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION – II**C (L, T, P) = 2 (0, 0, 3)**

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.

PH 301 PHARMACEUTICAL CHEMISTRY-V (BIOCHEMISTRY)**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Biochemical organization of the cell and transport process across cell membrane. The concept of free energy, bioenergetics, production of ATP and its biological significance.	8
II	Enzymes: Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis. Co-enzymes: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.	8
III	Carbohydrate Metabolism: Conversion of polysaccharide to glucose-1- phosphate, Glycolysis and fermentation and their regulation, gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia, role of sugar nucleotides in biosynthesis, and Pentosephosphate pathway. The Citric Acid Cycle: Significance, reactions and energetic of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle.	9
IV	Lipids Metabolism: Oxidation of fatty acids, α -oxidation & energetic, β -oxidation, β -oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids, and sphingolipids. Biological Oxidation: Enzymes and co-enzymes involved in oxidation reduction & its control, respiratory chain, its role in energy capture and its control, Inhibitors of respiratory chain and oxidative phosphorylation, Mechanism of oxidative phosphorylation. Nitrogen & Sulphur Cycle: Ammonia assimilation, Incorporation of sulphur in organic compounds, Release of sulphur from organic compounds.	10
V	Metabolism of Ammonia and Nitrogen Containing Monomers: Nitrogen balance , Biosynthesis of amino acids, Catabolism of amino acids, Conversion of amino acids to specialized products, Assimilation of ammonia, Urea cycle, metabolic disorders of urea cycle, Metabolism of sulphur containing amino acids, Porphyrin biosynthesis, formation of bile pigments, hyperbilirubinemia, Purine biosynthesis, Purine nucleotide interconversion, Pyrimidine biosynthesis and Formation of deoxyribonucleotides. Biosynthesis of Nucleic Acids: Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and RNA. Genetic Code and Protein Synthesis: Genetic code, Components of protein synthesis, and Inhibition of protein synthesis. Brief account of genetic engineering and polymerase chain reactions. Regulation of gene expression.	10
	Total	40

Reference:

1. Conn, E.E. and Stump, P.K. Outlines of Biochemistry. John Wiley & Sons, New York.
2. Jayaraman, J. Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi
3. Lehninger, A.L. Biochemistry, Worth Publisher, Inc.
4. Plumer, D.T. An Introduction to Practical Biochemistry. Tata McGraw Hill, New Delhi.
5. Harper's Biochemistry, Lange Publishing Group.
6. Harrow, B and Mazur, A. Textbook of Biochemistry. W.B. Saunders Co., Philadelphia.
7. Lehninger, A.L. Principles of Biochemistry. CBS Publishers.
8. Martin, D.W., Mayos, P.A. and Redwell, V.M. Harper's Biochemistry. Lange Medical Publications.
9. Mussay, R.K., Granner, D.K., Mayos, P.A. and Redwell, V.M. Harper's Biochemistry. Prentice-Hall International.
10. Ramarao Textbook of Biochemistry UBSPD.
11. Stryer, L. Biochemistry. W.H. Freeman & Co., San Fransisco.

PH 302 PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-I) C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Basic Principles of Medicinal Chemistry: Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action, Drug-receptor interaction including transduction mechanisms.	8
II	Quantitative Structure – Activity Relationships (QSAR), Brief account of various descriptors, (Lipophilic, Electronics, Steric, Topological) Hansch and Free-Wilson approaches, Fundamentals of computer-aided Drug Design (CADD) and Molecular modeling. Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including physicochemical properties of the following classes of drugs	8
III	Drugs acting at Synaptic and neuro-effector junction sites: i. Cholinergics and Anticholinesterases ii. Adrenergic drugs iii. Antispasmodic and anti ulcer drugs iv. Neuromuscular blocking agents.	8
IV	Autocoids i. Antihistamines ii. Eicosanoids iii. Non-opioid analgesics, anti-inflammatory (non-steroidal) agents.	8
V	Drugs affecting uterine motility: Oxytocics (including oxytocin, ergot alkaloids and prostaglandins) Biochemical approaches in drug designing wherever applicable should be discussed.	8
	Total	40

Reference:

1. Foye, W.C. Principles of Medicinal Chemistry Lea & Febiger, Philadelphia.
2. Wilson & Giswold Text book of Organic Medicinal & Pharmaceutical Chemistry. J. Lippincott Co., Philadelphia.
3. Hansh, C. Comprehensive Medicinal Chemistry Vol. IV Quantitative Drug Design. Pergamon Press, Oxford.
4. Jurs, P.C. Computer Software Application in Chemistry. John Wiley & Sons, New York.
5. Martin, Y.C. Quantitative Drug Design- A critical Introduction (Medicinal Research Monograph. Vol.8) Marcel Dekker, Inc. New York.
6. Pops and Perruns. Computer Aided Drug Design. Academic Press, New York.
7. Singh, H. and Kapoor, V.K. Medicinal and Pharmaceutical Chemistry. Vallabh Prakashan, Delhi.

PH 303 PHARMACEUTICS-V (PHARMACEUTICAL TECHNOLOGY-I) C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Liquid Dosages Forms: Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.	8
II	Semisolid Dosage Forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging. Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation. Extraction and Galenical Products: Principle and method of extraction. Preparation of infusion, tinctures, dry and soft liquid extracts.	8
III	Blood Products and Plasma Substitutes: Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin foam, plasma substitutes, ideal requirements, PVP, dextran etc. for control of blood pressure as per I.P.	8
IV	Pharmaceutical Aerosols: Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. Ophthalmic Preparations: Requirements, formulation, methods of preparation, containers, evaluation.	8
V	Cosmetology and Cosmetic Preparations: Fundamentals of cosmetic science, structure and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair, dentifrice and manicure preparations like nail polish, Lipsticks, eye lashes, baby care products etc.	8
	Total	40

Reference:

1. Aulton, M.E. Pharmaceutics- The Science of Dosage Form Design. ELBS/Churchill Livingstone.
2. Lachman, L., Lieberman, H.A., and Kanig, J.L. The Theory & Practice of Industrial Pharmacy. Lea & Febiger, Philadelphia.
3. Sagarin & Balsam, M.S. Cosmetic Science & Technology. Vol. 1-3 2nd ed. John Wiley.
4. Poucher's Cosmetology.
5. Ansel, H.C. Introduction to Pharmaceutical Dosage Forms. V.M. Verghese & Co., Mumbai.
6. Banker, G.S. and Rhode, C.T. Modern Pharmaceutics. Marcel Dekker.
7. Carter, S.J. Cooper & Gunn's Tutorial Pharmacy. CBS Publishers, Delhi.
8. Jellinek, J.S. Formulation and Function of Cosmetics. John Wiley & Sons.
9. Kac Chensney, J.C. Packaging of Cosmetics and Toiletries. Newness Butter Worth, London.
10. Pharmaceutical Dosage Forms and Drug Delivery Systems. Lea and Febiger, Philadelphia.
11. Rawlins, E.A. Bentley's Textbook of Pharmaceutics. ELBS.
12. Thomssen, S.G. Modern Cosmetics Universal Publishing Corp., Mumbai.

PH 304 PHARMACEUTICAL JURISPRUDENCE & ETHICS**C (L, T, P) = 4 (4, 0, 0)**

Unit	Course Contents	Hours
I	Introduction - Pharmaceutical Legislations- A brief review. Drugs & Pharmaceutical Industry- A brief review. Pharmaceutical Education- A brief review. AICTE Act 1987.	8
II	An elaborate (practical oriented) study of the following - Code of Pharmaceutical Ethics Pharmacy Act 1948. Drugs and Cosmetics Act 1940 and Rules 1945. Medicinal & Toilet Preparations (Excise Duties) Act 1955. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules. Drugs Price Control Order.	8
III	A brief study of the following with special reference to the main provisions. - Poisons Act 1919 Drugs and Magic Remedies (Objectionable Advertisements) Act 1954. Medical Termination of Pregnancy Act 1970 & Rules 1975.	8
IV	Prevention of Cruelty to Animals Act 1960. States Shops & Establishments Act & Rules. Insecticides Act 1968. Factories Act 1948.	8
V	Minimum Wages Act 1948. Patents Act 1970. A brief study of the Various Prescription/Non-prescription Products, Medical / Surgical accessories, Diagnostic aids, appliances available in the market. Note: The teaching of all the above Acts should cover the latest amendments.	8
Total		40

Reference:

- Jain, N.K. A Textbook of Forensic Pharmacy. Vallabh Prakashan, New Delhi.
- Mithal, B.M. A Textbook of Forensic Pharmacy. National Book Depot, Kolkatta.
- Bharti, H.K. Drugs & Pharmacy Laws in India, Sadhna Mandir, Indore. A C T S (with their latest Amendments)
- AICTE Act 1987
- Drug and Cosmetics Act, 1940 and Rules 1945
- Drugs and Magic Remedies (Objectionable Advertisements) Act 1954
- Drugs Price Control Order (DPCO)
- Factories Act 1948
- Insecticides Act 1968
- Medicinal & Toilet Preparations (Excise Duties) Act 1955
- Medical Termination of Pregnancy Act (MTPA) 1970 & Rules 1975
- Minimum Wages Act 1948
- Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- Pharmacy Act 1948.
- Poisons Act 1919
- Prevention of Cruelty of Animals Act 1960
- Patents Act 1970
- States Shops & Establishments Act & Rules.

PH 305 PHARMACOLOGY- I**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	General Pharmacology: Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying Drug action, tolerance and dependence, Pharmacogenetics. Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, ADME drug interactions, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.	8
II	Pharmacology of Peripheral Nervous System: Neurohumoral transmission (autonomic and Somatic) Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic Receptor and neuron blocking agents, Ganglionic, stimulants and blocking agents. Neuromuscular blocking Agents. Local anesthetic Agents.	8
III	Pharmacology of Central Nervous System: Neurohumoral transmission in the C.N.S. General Anesthetics. Alcohols and disulfiram. Sedatives, hypnotics, Anti-anxiety agents and Centrally acting muscle relaxants.	8
IV	Psychopharmacological agents (anti psychotics) antidepressants, anti maniacs and hallucinogens) Anti-epileptics drugs. Anti-Parkinsonian Drugs. Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs.	8
V	Narcotic analgesics and antagonists. C.N.S. stimulants Drug Addiction and Drug Abuse.	8
Total		40

Reference:

- Craig, C.R. and Stitzel, R.R. Modern Pharmacology. Little Brown & Co.
- Ghosh, M.N. Fundamentals of Experimental Pharmacology . Scientific Book Agency, Kolkatta.
- Tripathi Pharmacological Experiments in Intact & Isolated Preparations.
- Barar, F.S.K. Textbook of Pharmacology. Interprint, New Delhi.
- Crossland, J. and Thomson, J.H. Essentials of Pharmacology. Harper & Row Publishers, New York.
- Goodman and Gilman's The Pharmacological Basis of Therapeutics. Editors J.G. Hardman et al. Pergamon Press.
- Kulkarni, S.K. Handbook of Experimental Pharmacology. Vallabh Prakashan, Delhi.
- Mycek, M.J., Gertner, S.B. and Perper, M.M. Pharmacology. Lipponcott's Illustrated Reviews.
- Paul, L. Principles of Pharmacology. Chapman & Hall.
- Rang, M.P., Dale M.M. and Ritter, J.M. Pharmacology. Churchill Livingstone.
- Theoharides, T.C. Pharmacology. Little Brown & Co.
- Lewi's Pharmacology
- Laurence & Bennett Clinical Pharmacology Churchill Livingstone.
- Harrisons Principles of Internal Medicine.

PH 306 PHARMACEUTICS-VII (BIOPHARMACEUTICS & PHARMACOKINETICS) C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.	6
II	Biopharmaceutics : Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis) Factors influencing absorption- Physicochemical, physiological and pharmaceutical. Drug distribution in the body, plasma protein binding.	9
III	Pharmacokinetics: Significance of plasma drug concentration measurement Compartment and model-Definition and Scope. Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant using Wagner – Nelson and Loo- Reigelman method. Volume of distribution and distribution coefficient. Compartment kinetics- one compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route. Curve fitting (method of Residuals), regression procedures. Clearance concept, Mechanism of renal clearance, clearance ratio, Determination of renal clearance. Extraction ratio, hepatic clearance, biliary excretion, Extrahepatic circulation.	8
IV	Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten Equation, detection of non-linearity (Saturation mechanism). Non-Compartmental concept of mean residence time (MRT) Clinical Pharmacokinetics: Definition and scope, Dosage adjustment in patients with and without renal failure.	9
V	Bioavailability and Bioequivalence: Measures of bioavailability, Cmax, tmax and area under the curve (AUC). Design of single dose bioequivalence study and relevant statistics. Review of regulatory requirements for conduct of bioequivalent studies.	8
Total		40

Reference:

- Notari, R.E. Biopharmaceutics & Pharmacokinetics- An Introduction. Marcel Dekker.
- Rowland, M. and Tozer, T.N. Clinical Pharmacokinetics. Lea & Febiger, N.Y.
- Gibaldi, M. & Perrier, D. Pharmacokinetics. Marcel Dekker Inc. N.Y.
- Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. Lea & Febiger, Philadelphia.
- Pecile, A & Rescigno, A. Pharmacokinetics. Plenum Press, N.Y.
- Remington's The Science & Practice of Pharmacy. Mack Publishing Co., Easton, Pennsylvania.
- Ritschel, W.A. Handbook of Basic Pharmacokinetics. Drug Intelligence Publications, Hamilton.
- Shargel, L. and Yu, A. Applied Biopharmaceutics and Pharmacokinetics. Appleton & large, Norwalk.
- Wagner, J.G. Fundamentals of Clinical Pharmacokinetics. Drug Intelligence Publications, Hamilton.
- Wagner, J.G. Pharmacokinetics for Pharmaceutical Scientists. Technomic Publishing, A.G. Basel, Switzerland.
- Winter, M.E. Basic Clinical Pharmacokinetics. Applied Therapeutics, Inc., San Francisco.
- Welling, P.G. & Tse. Francis L.S. Pharmacokinetics, Marcel Dekker, NY.
- Madan, P.L. Biopharmaceutics & Pharmacokinetics.
- Venkateswarm, V. Fundamentals of Biopharmaceutics and Pharmacokinetics, Paras Publishing.
- Brahmankar and Jaiswal, Biopharmaceutics and Pharmacokinetics; A treatise, Vallabh Prakashan

PH 307 PHARMACOGNOSY-III**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, and specific chemical tests of following alkaloid containing drugs: a) Pyridine - piperidine: Tobacco, areca and lobelia. b) Tropane: Belladonna, hyoscyamus, datura, duboisia, coca and withania. c) Quinoline and isoquinoline: cinchona, ipecac, opium.	8
II	d) Indole: Ergot, rauwolfia, catharanthus, nux-vomica and physostigma. e) Imidazole: Pilocarpus f) Steroidal: Veratrum and kurchi	8
III	Alkaloidal amine: Ephedra and colchicum h) Glycoalkaloid: Solanum. i) Purines: Coffee, tea and cola. Role of medicinal and aromatic plants in national economy.	8
IV	Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin. General biosynthetic pathways of natural products like alkaloids, glycosides, terpenoids, lignans, quassinoids, carotenoids and flavonoids.	8
V	Plant bitters and sweeteners. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.	8
Total		40

Reference:

- Handa, S.S. and Kapoor, V.K. A Textbook of Pharmacognosy. Vallabh Prakashan, Delhi.
- Kokate, C.K. Practical Pharmacognosy. Vallabh Prakashan, New Delhi.
- Trease, G.E. and Evans, W.C. Pharmacognosy Bailliere Tindall, Eastbourne, U.K.
- Atal, C.K. and Kapur, B.M. Cultivation and Utilization of Medicinal Plants. RRL, Jammu.
- Chadha, K.L. and Gupta, R. Advances in Horticulture Vol. II Medicinal and Aromatic Plants. Malhotra Publishing House, New Delhi.
- Henry, T.A. The Plant Alkaloids. Mc Graw Hill, New York.
- Kokate, C.K., Purohit, A.P. and Gokhale, S.B. Pharmacognosy (Degree), Nirali Prakashan, Pune.
- Manske, R.H.F. The Alkaloids. Academic Press, New York.

PH 308 PHARMACOLOGY – II
C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Pharmacology of Cardiovascular System : a) Digitalis and cardiac glycosides. b) Antihypertensive drugs. c) Antianginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists. d) Antiarrhythmic drugs e) Antihyperlipidemic drugs f) Drugs used in the therapy of shock.	8
II	Drugs Acting on the Hemopoietic System : a) Hematinics b) Anticoagulants, Vitamin K and hemostatic agents. c) Fibrinolytic and anti-platelet drugs. d) Blood and plasma volume expanders.	9
III	Drugs acting on urinary system: a) Fluid and electrolyte balance b) Diuretics	07
IV	Autocoids : a) Histamine, 5- HT and their antagonists. b) Prostaglandins, thromboxanes and leukotrienes. c) Pentagastrin , Cholecystokinin, Angiotensin, Bradykinin and Substance P.	8
V	Drugs Acting on the Respiratory System: a) Anti-asthmatic drugs including bronchodilators. b) Anti-tussives and expectorants. c) Respiratory stimulants.	8
Total		40

Reference:

- Ghosh, M.N. Fundamentals of Experimental Pharmacology. Scientific Book Agency, Kolkatta.
- Goodman and Gilman's The Pharmacological Basis of Therapeutics. Editors J.G. Hardman et al. Pergamon Press.
- Sheth, U.K.
- Tripathi K.D., Textbook of Pharmacology Jay Pee Brothers.
- Barar, F.S.K. Textbook of Pharmacology. Interprint, New Delhi.
- Crossland, J. and Thomson, J.H. Essentials of Pharmacology. Harper & Row Publishers, New York.
- Craig, C.R. and Stitzel, R.R. Modern Pharmacology. Little Brown & Co.
- Kulkarni, S.K. Handbook of Experimental Pharmacology. Vallabh Prakashan, Delhi.
- Mycek, M.J., Gertner, S.B. and Perper, M.M. Pharmacology. Lippincott's Illustrated Reviews.

PH 309 PHARMACEUTICS-VI (HOSPITAL PHARMACY)
C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Organization & Structure: Organization of a hospital and hospital Pharmacy, Responsibilities of hospital pharmacist, Pharmacy and therapeutic committee, Budget preparation and Implementation. Hospital Formulary: Contents, preparation and revision of hospital formulary.	8
II	Drug Store Management and Inventory Control: (a) Organization of drug store, Types of materials stocked, storage conditions. (b) Purchase and Inventory Control-principles, purchase procedures, Purchase order, Procurement and stocking.	8
III	Drug distribution System in Hospitals: (a) Outpatient dispensing, methods adopted. (b) Dispensing of drugs to in-patients. Types of drug distribution systems. Charging policy, labeling. (c) Dispensing of drugs to ambulatory patients. (d) Dispensing of controlled drugs.	8
IV	Central Sterile Supply Unit and their Management: Types of materials for sterilization, Packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials. Manufacture of Sterile and Non-sterile Products: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula Card, production control, Manufacturing records.	8
V	Drug Information Services: Sources of Information on drugs, disease, treatment schedules, procurement of information, computerized services (e.g., MEDLINE), Retrieval of information, Medication error. Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc. Nuclear Pharmacy: Introduction to Radio pharmaceuticals, radio-active half life, Units of radio-activity Production of radio-pharmaceuticals, Permissible radiation dose level, Radiation hazards and their prevention, specifications for radio-active laboratory.	8
Total		40

Reference:

- Owunwonne Handbook of Radio pharmaceuticals. Narosa Publishing House, New Delhi.
- Hassan, William E. Hospital Pharmacy. Lea & Febiger, Philadelphia.
- Remington's The Science & Practice of Pharmacy Mack Publishing Co. Easton, PA
- Turco, S. and King, R.E. Sterile Dosage Forms. Lea & Febiger, Philadelphia.
- Allwodd, M.C. and Fell, J.T. Textbook of Hospital Pharmacy Blackwell Scientific Publications, Oxford.
- Chittion, H.M. and Witcofski, R.L. Nuclear Pharmacy. Lea & Febiger, Philadelphia.
- Dittert, L.W. Sprowl's American Pharmacy. J& B Lippincott Co., Philadelphia.

Unit	Course Contents	Hours
I	Chemical and spectral approaches to simple molecules of natural origin. Concept of stereoisomerism taking examples of natural products.	8
II	Chemistry and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes, and triterpenoids. Carotenoids: β - carotenoids, β - carotenes, vitamin A, Xanthophylls of medicinal importance.	8
III	Glycosides: Chemistry, pharmacological activity of digitoxin, digoxin, hecogenin, sennosides, diogenin and sarasapogenin.	8
IV	Alkaloids : Chemistry, and pharmacological activity of atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids.	8
V	Chemistry and pharmacological activity of medicinally important lignans and quassinoids, flavonoids. Chemistry and therapeutic activity of penicillin, streptomycin and tetracycline.	8
	Total	40

Reference:

1. Finar, I.L. Organic Chemistry Vol.II ELBS/Longman, London
2. Harborne J.B. Phytochemical Methods. Chapman & Hall, International Edition, London.
3. Manitto, P. The Biosynthesis of Natural Products. Ellis Horwood, Chichester.
4. De Mayo P. The Chemistry of Natural Products 2-3, Interscience, New York.
5. Faulkner, D.J. and Fenical, W.H. Marine Natural Products Chemistry (NATO Conference Series 4) Plenum Press, New York.
6. Pridham, J.B. Terpenoids in Plants. Academic Press, N.Y.
7. Pridham, J.B. and Swain, T. Biosynthetic Pathways in Higher Plants. Academic Press, New York.
8. Rabinson, T. The Biochemistry of Alkaloids. Springer Verlag, New York.
9. Scheuer, P.J. Marine Natural Products. Academic Press, New York.
10. Sinnott, E.W., Dunn, L.C., and Dobzhansky, T. Principles of Genetics. Tata Mcgraw Hill Publishing Co, New Delhi.
11. Welsch, J.R. Fundamentals of Plant Genetics and Breeding, Wiley, New York.

PH 351 PRACTICAL - PHARMACEUTICAL CHEMISTRY-V (BIOCHEMISTRY) C (L, T, P) = 2 (0, 0, 3)

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by two dimensional paper chromatography and gel electrophoresis.
4. Separation of lipids by TLC.
5. Separation of serum proteins by electrophoresis on cellulose acetate.
6. Quantitative estimation of amino acids.
7. Quantitative estimation of proteins.
8. Determination of glucose by means of the enzyme glucose oxidase.
9. Enzymatic hydrolysis of glycogen by alpha- and beta- amylases.
10. Isolation and determination of RNA and DNA.
11. Effect of temperature on the activity of alpha-amylase.
12. Estimation of SGOT, SGPT, Alkaline phosphatase and Bilirubin in the serum.

PH 352 PRACTICAL - PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY- I)**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Exercises based on QSAR:
- ❖ Synthesis of selected drugs from the course content.
- ❖ Spectral analysis of the drugs synthesized.
- ❖ Establishing the pharmacopoeial standards of the drugs synthesized.
- ❖ Determination of partition coefficient, dissociation constant and molar
- ❖ Activity of compounds of QSAR analysis

PH 353 PRACTICAL - PHARMACEUTICS-V (PHARMACEUTICAL TECHNOLOGY-I) C (L, T, P) = 2 (0, 0, 3)

1. Preparation, evaluation and packaging of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, aerosols, eye drops, eye ointments etc.
2. Preparation of pharmacopoeial extracts and galenical products utilizing various methods of Extraction.
3. Collection, processing, storage and fractionation of blood.
4. Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.

PH 354 PRACTICAL - PHARMACEUTICS-VII (BIOPHARMACEUTICS & PHARMACOKINETICS)**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Experiments designed for the estimation of various pharmacokinetic parameters with given data.
- ❖ Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters.
- ❖ In vitro evaluation of different dosage forms for drug release.
- ❖ Absorption studies – in vitro and in situ.
- ❖ Statistical treatment of pharmaceutical data.

PH 355 PRACTICAL - PHARMACOLOGY- I**C (L, T, P) = 2 (0, 0, 3)**

1. Introduction of Experimental Pharmacology: Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental Pharmacology. Common laboratory animals and anesthetics used in animal studies.
2. Software demonstration of Commonly used instruments in experimental pharmacology. Some common and standard techniques. Bleeding and intravenous injection, intragastric administration. Procedures for rendering animals unconscious- stunning of rodents, pithing of frogs, chemical euthanasia.
3. Software demonstration of Experiments of intact preparations: Study of different routes of administration of drugs in mice/rats.
4. Software demonstration of to study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice.
5. Software demonstration of Experiments on Central Nervous system: Recording of spontaneous motor activity, stereotypy, analgesia, anticonvulsant activity, anti-inflammatory activity, and muscle relaxant activity of drugs using simple experiments.
6. Software demonstration of Effects of autonomic drugs on rabbit's eye.
7. Software demonstration of Effect of various agonists and antagonists and their characterization using Isolated preparations like frog's rectus abdominis muscle and isolated ileum preparations of rat, guinea pig and rabbit.

PH 356 PRACTICAL - PHARMACOLOGY – II**C (L, T, P) = 2 (0, 0, 3)****❖ Experiments on Isolated Preparations:**

1. Software demonstration of To record the concentration response curve (CRC) of acetylcholine using rectus abdominis muscle preparation of frog.
2. Software demonstration of To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using rectus abdominis muscle preparation of frog.
3. Software demonstration of To record the CRC of 5-HT on rat fundus preparation.
4. Software demonstration of To record the CRC of histamine on guinea pig ileum preparation.
5. Software demonstration of To record the CRC of noradrenaline on rat anococcygeus muscle preparation.
6. Software demonstration of To record the CRC of oxytocin using rat uterus preparation.

❖ Pharmacology of Cardiovascular System:

1. Software demonstration of To study the inotropic and chronotropic effects of drugs on isolated frog heart.
2. Software demonstration of To study the effects of drugs on normal and hypodynamic frog heart.
3. Software demonstration of Blood Pressure of anaesthetized Dog/Cat/Rat: To demonstrate the effects of various drugs on the B.P. and Respiration including the Vasomotor Reversal of Dale and nicotinic action of acetylcholine.

PH 357 PRACTICAL - PHARMACOGNOSY-III**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Identification of crude drugs listed above.
- ❖ Diagnostic macroscopic and microscopic study of characters of eight- selected drugs given in theory in entire and powdered form.
- ❖ Chemical Evaluation of powdered drugs, and enzymes.
- ❖ Chromatographic studies of some herbal constituents.

PH 358 PRACTICAL - PHARMACOGNOSY-IV (CHEMISTRY OF NATURAL PRODUCTS)**C (L, T, P) = 2 (0, 0, 3)**

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

PH 359 PRACTICAL - PHARMACEUTICS-VI (HOSPITAL PHARMACY)**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Experiments based on Sterilization of various types of materials used in Hospitals.
- ❖ Practical designed on the use of computers in Drug Information Center, prescription filling, documentation of information on drug interaction.
- ❖ Preparation and quality control of i.v. fluids and i.v. admixtures Experiments to illustrate handling of radio pharmaceutical products, measurement of radioactivity.
- ❖ Case studies of prescriptions regarding drug interactions, drug dosage corrections, suggesting antidotes for poisoning cases, managing ADR, etc.

PH 401 PHARMACEUTICAL BIOTECHNOLOGY**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Immunology and Immunological Preparations: Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen antibody reactions and their applications. Hypersensitivity, Active and Passive immunization; Vaccines- their preparation, standardization and storage.	8
II	Genetic Recombination: Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, umulin, Streptokinase Humatrope, Hepatitis B vaccine etc.	8
III	Antibiotics: Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillins, streptomycins, tetracyclines and vitamin B12	8
IV	Microbial Transformation: Introduction, types of reactions mediated by microorganisms, design of biotransformation processes, selection of organisms, biotransformation process and its improvements with special reference to steroids.	8
V	Enzyme immobilization: Techniques of immobilization of enzymes, factors affecting enzyme kinetics. Study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases etc. immobilization of bacteria and plant cells.	8
Total		40

Reference:

1. Carter, S.J. Cooper and Gunns Tutorial Pharmacy CBS Publishers, Delhi
2. Hygo, W.B. and Russel A.D. pharmaceutical microbiology 6th Ed Blackwell Scientific Publisher, Oxford.
3. Prescott, L.M. Harley, J.P. Klein, D.A. Microbiology 2nd edition, WmC. Brown publication, Oxford, England.
4. Kielslich, K. "Biotechnology" Volume 6a Verlag Cheme, Switzerland.
5. Pepler "Microbial Technology" Vol. II & I.
6. Prescott & Dunn "Industrial Microbiology" Mc Graw Hill.
7. Standbury, p.F., Whitaker, A. "Principles of Fermentation Technology" Pergamon Press, Oxford.
8. Ward, O.P. "Fermentation Technology, Principles, Processes & products" Open University press, Milton Keynes, U.K.

PH 402 PHARMACEUTICS-IX (DOSAGE FORM DESIGN)**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Preformulation studies : a) Study of physical properties of drugs like physical form, particle size, shape, density, wetting, dielectric constant. Solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability. b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products. c) Study of pro-drugs in solving problems related to stability, bioavailability and elegance of formulation.	8
II	Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions.	8
III	Stabilization and stability testing protocol for various pharmaceutical products.	8
IV	Performance evaluation methods : (http://www.fda.gov/cder/guidance/index.htm) a) In vitro dissolution studies for solid oral dosage forms, Federal perspectives on Immediate Release (IR) and Extended Release (ER) products. b) Brief Concepts of Biopharmaceutics Classification Scheme (BCS), in-vitro in-vitro correlation and bio-waiver. c) Important federal considerations for bio-availability and bio-equivalence studies for oral products; Statistical considerations including Crossover ANOVA.	8
V	GMP and quality assurance, Quality audit. Design, development, production and evaluation of controlled released formulations.	8
Total		40

Reference:

1. Ansel, H.C. Introduction to Pharmaceutical Dosage Forms. K.M. Verghese & Co. Mumbai.
2. Aulton, M.E. Pharmaceutics : The Science of Dosage Form Design ELBS.
3. Avis, K.E., Lachman, L & Liberman, H.A., Pharmaceutical Dosage forms : Paraenteral medications Vols. 1 & 2
4. Marcel Dekker, N.Y.
5. Juliano, R.L. Drug Delivery Systems Oxford University Press, Oxford.
6. Pharmaceutical Dosage Forms & Drug Delivery systems Lea & Febiger, Philadelphia.
7. Lieberman, H.A. Lachman, L & Schwartz, J.B. Pharmaceutical Dosage Forms. Tablets Vols. 1-3, Marcel Dekker.
8. Robinson, J.R. & Lea Vincet Controlled Drug Delivery: Fundamentals & Applications, Marcel Dekker.
9. Lachman, L., Lieberman, H.A. & Kanig, J.L, The Theory & and Practice of Industrial Pharmacy. Lea and Febiger,

PH 403 PHARMACEUTICS-VIII (PHARMACEUTICAL TECHNOLOGY-II)**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Capsules: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms. Microencapsulation: Types of microcapsules, importance on microencapsulation in pharmacy, microencapsulation by phase separation, coacervation, multi orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.	8
II	Tablets: a) Formulation of different types of tablets, granulation technology or large scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipment employed, evaluation of tablets. b) Coating of Tablets:- Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process evaluation of coated tablets. c) Stability kinetics and quality assurance.	8
III	Parenteral Products: a) Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment. b) Formulation details, containers and closures and selection. c) Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products. d) Aseptic Techniques:- source of contamination and methods of prevention, design of aseptic area, laminar flow bench services and maintenance. e) Sterility testing of Pharmaceuticals.	8
IV	Surgical products:- Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc. bandages, adhesive tape, protective cellulosic hemostatics, official dressings, absorbable and non absorbable sutures, ligatures and catguts. Medical prosthetics and organ replacement materials.	8
V	Packaging of Pharmaceutical Products: Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing. Controlled release (CR) delivery systems: Advantages and Disadvantages, Classification and types of oral, transdermal and parenteral CR drug delivery agents.	8
Total		40

Reference:

1. Lachman, L. Lieberman, H.A. Kanig, J.L. The Theory & Practice of industrial Pharmacy. Lea & Febiger, Philadelphia.
2. Turco, S & King, R.E. Sterile Dosage Forms. Lea & Febiger, Philadelphia
3. Remington's the science and practice of Pharmacy mack Publishing Co. Easton, PA.
4. Lieberman, H.A. Lachman, L. Sachwitz, J.B. Pharmaceutical Dosage Forms: Tablets Vols 1-3 Marcel Dekker, N.Y.
5. Lieberman, H.A. Rieger, M.M. & Banker, G.S. Pharmaceutical Dosage Forms: Disperse Systems. Vol 1-2 Marcel Dekker, N.Y.
6. Ridgway, K. Hard Capsules The Pharmaceutical Press, London
7. Ansel, H.C. Introduction to Pharmaceutical Dosage Forms KM Verghese.

PH 404 PHARMACEUTICAL ANALYSIS-III**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	GLP, ISO 9000, TQM, Quality Review and Quality Documentation. Regulatory control, regulatory drug analysis, interpretation of analytical data. Validation, quality audit: quality of equipment, validation of equipment, validation of analytical procedures.	8
II	The theoretical aspects, basic instrumentation, elements of interpretation of spectra, and applications of the following analytical techniques should be discussed Ultraviolet and Visible spectrophotometer. Fluorimetry. Infrared Spectrophotometer	8
III	Nuclear Magnetic resonance spectroscopy including ¹³ C NMR. Mass Spectrometry	8
IV	Flame Photometry Emission Spectroscopy Atomic Absorption Spectroscopy.	8
V	X-ray Diffraction. Radio immunoassay.	8
Total		40

Reference:

1. Connors, K.A.A Textbook of Pharmaceutical Analysis. Wiley Interscines.
2. Joffery Vogel's Textbook of Quantitative Chemical Analysis.
3. Silverstein, R.M. and Webster, F.X. Spectrometric identification of organic compounds 6th Ed. John Wiley,

PH 405 PHARMACEUTICAL INDUSTRIAL MANAGEMENT**C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Concept of Management: Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (personnel, Materials, Production, Financial, Marketing, Time/space, margin/ Morale), Principles of Management (Co-ordination, Communication, Motivation, Decision Making, leadership, innovation, creativity, delegation of Authority/ Responsibility, Record keeping). Identification of key points to give maximum thrust for development and perfection.	8
II	Accountancy: Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes of hundies, documentary bills. Economics: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.	8
III	Pharmaceutical Marketing: Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business. Salesmanship: Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing. Recruitment, training, evaluation, compensation to the pharmacist.	8
IV	Market Research: a) Measuring & Forecasting Market Demands- Major concept in demand measurement, estimating current demand, Geodemographic analysis, estimating industry sales, market share & future demand. b) Market Segmentation & Market Targeting. Material Management: A brief exposure of basic principles of materials management- major areas, scope, purchase, stores, inventory control and evaluation of materials management.	8
V	Production Management: A brief exposure of the different aspects of Production Management- Visible and Invisible inputs, methodology of activities, performance evaluation techniques, process flow, process know how, maintenance management.	8
Total		40

Reference:

1. Mohan Singhal and Jai Dev Drug Store and Business Management S.V Kar & Co, Jalandhar 1995
2. Sukhdev Singh and Paramjit Singh Drug Store and Business Management
3. S.Dinesh & Co. Circular Road Jalandhar 1995.
4. Koontz & O'Donnel Principles of Management Tata Mc Graw Hill, Delhi
5. K.K Dewett Economics 1997.
6. T.S. Grewal Introduction to Accounting 1996.
7. Remingtons The Science & Practice of Pharmacy, Mack Publishing C.

PH 406 PHARMACEUTICAL CHEMISTRY-VIII (MEDICINAL CHEMISTRY -III) C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Drug metabolism and concepts of Prodrugs. Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs (Biochemical approaches in drug designing wherever applicable should be discussed). Ant metabolites (including sulfonamides)	8
II	Chemotherapeutic agents used in Protozoal, Parasitic and other infections.	8
III	Antineoplastics agents, Anti-viral including anti-HIV agents, Immunosuppressive and immunostimulants.	8
IV	Amino acids, peptide, nucleotides and related drugs. a. Thyroid and Anti thyroid drugs. b. Insulin and oral hypoglycaemic agents. c. Peptidomimetics and nucleotidomimetics.	8
V	Diagnostic agents, Pharmaceutical Aids.	8
Total		40

Reference:

1. Delgado, J.N. & Remers, W.A.R. Eds. Wilson & Gisvold's Textbook of Organic Medicinal & Pharmaceutical
2. Chemistr. J. Lippincott Co., Philadelphia.
3. Foye, W.C. Principles of Medicinal Chemistry Vol. IV Quantitative Drug Design. Pergamon Press, Oxford.
4. Wolff, M.E. Ed Burger's Medicinal Chemistry. John Wiley & Sons. N.Y.
5. Lader B.N., Mandel, H.G. & Way, E.L. Fundamentals of Drug Metabolism & Disposition. Williams & Welkins, Baltimore.
6. Hansh, C. Comprehensive Medicinal Chemistry Vol. IV Quantitative Drug Design. Pergamon Press, Oxford.
7. Nagrady, T. Medicinal Chemistry-A biochemical Approach Oxford University Press, Oxford.
8. Pops and Perruns. Computer Aided Drug Design. Academic Press, N.Y.

Unit	Course Contents	Hours
I	Drugs Acting on the Gastrointestinal Tract: a) Antacids, Anti Secretory and Anti- ulcer drugs. b) Laxatives and antidiarrhoeal drugs. c) Appetite Stimulants and Suppressants d) Emetics and anti- emetics. e) Miscellaneous- Carminatives, demulcents, protectives, adsorbents, Astrigents, digestants, enzymes and mucolytics.	8
II	Pharmacology of Endocrine System: a) Hypothalamic and pituitary hormones. b) Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D. c) Insulin, oral hypoglycaemic agents and Glucagon. d) ACTH and corticosteroids e) Androgens and anabolic steroids f) Estrogens, progesterone and oral contraceptives g) Drugs acting on the uterus.	9
III	Chemotherapy a) General Principles of Chemotherapy b) Sulfonamides and cotrimoxazole c) Antibiotics- penicillins, cephalosporins, chloramphenicol, erythromycin, Quinolones and miscellaneous antibiotics.	9
IV	Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases. e) Chemotherapy of malignancy and immunosuppressive agents.	8
V	Principles of Toxicology a) Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning. b) Heavy metals and heavy metal antagonists.	6
Total		40

Reference:

1. Craig, C.R. & Stitzel, R.R. Modern Pharmacology Little Brown & Co.
2. Goodman and Gilman's The Pharmacological basis of Therapeutics. Editors J.G. Hardman et al. Pergamon Press.
3. Barar, F.S. K. Textbook of Pharmacology. Interprint, N.Delhi.
4. Rang, M.P., Dale, M.M. & Ritter, J.M. Pharmacology. Churchill Livingstone.
5. Theoharides, T.C. Pharmacology. Little Brown & Co.

PH 408 PHARMACOGNOSY-V

C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	World-wide trade in medicinal plants and derived products with special reference to diosgenin (dioscorea) taxol (Taxus sps) digitalis, tropane alkaloid containing plants, papain, Cinchona, Ipeacac, Liquorice, Ginseng, Aloe, Valerian, Rauwolfia and plants containing laxatives.	8
II	A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Utilization and production of phytoconstituents such as quinine, calcium sennosides, podophyllotoxin, diosgenin, solasodine, and tropane alkaloids.	8
III	Utilization of aromatic plants and derived products with special reference to sandalwood oil, mentha oil, lemon grass oil, vetiver oil, geranium oil and eucalyptus oil. Marine pharmacognosy, novel medicinal agents from marine sources.	8
IV	Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Chemotaxonomy of medicinal plants.	8
V	Natural allergens and photosensitizing agents and fungal toxins. Herbs and health foods. Herbal cosmetics.	8
Total		40

Reference:

1. Reinert, 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. Atal, C.K. & Kapur, B.M. Cultivation and Utilization of Medicinal Plants. R.R.L, Jammu.
5. Barz, W., Reinhard, E. & Zerk, M.H. Plant Tissue Culture & its Biotechnological Application. Springer, Berlin.
6. Chadha, K.L. & Gupta, R. Advances in Horticulture Vol. II-Medicinal and Aromatic Plants. Malhotra Publishing
7. 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.
10. Gamborg, O.L & Wetter, L.R. Plant Tissue Culture Methods National Research Council of Canada, Saskatchewan.
11. Staba, E.J. Plant Tissue Culture as a source of Biomedicinals. CRC Press, Florida.
12. Street, H.E. Tissue Culture & Plant Science Academic Press, London.
13. The Wealth of India, Raw Materials (All Volumes) CSIR, New Delhi.
14. Whistler, R.L. Industrial Gums, Polysaccharides & their Derivatives Academic Press, N.Y.

PH 409 PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY- II) C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Steroids and related drugs: Steroidal nomenclature and stereochemistry, androgens and anabolic agents, estrogens and progestational agents, adrenocorticoids.	8
II	General Anesthetics, Local Anesthetics, Hypnotics and Sedatives.	8
III	Opioid analgesics, antitussives, anticonvulsants, antiparkinsonism drugs	8
IV	CNS stimulants, Psychopharmacological agents (neuroleptics, antidepressants, anxiolytics).	8
V	Diuretics, Cardiovascular drugs, anticoagulant and anti platelet drugs. Biochemical approaches in drug designing wherever applicable should be discussed.	8
Total		40

Reference:

1. Delgado, J.N. & Remers, W.A.R. Eds. Wilson & Gisvold's Textbook of Organic Medicinal & Pharmaceutical Chemistry.
2. J. Lippincott Co., Philadelphia
3. Foye, W.C. Principles of Medicinal Chemistry. Lea & Febiger, Phila.
4. Wolff, M.E. Ed. Burger's Medicinal Chemistry. John Wiley & Sons, N.Y.
5. Hansh, C. Comprehensive Medicinal Chemistry Vol.-IV Quantitative Drug Design, Pergamon Press, Oxford.
6. Nogrady, T. Medicinal Chemistry- A biochemical Approach Oxford University Press, Oxford
7. Pops & Perruns, Computer Aided Drug Design, Academic Press, N.Y.
8. Singh, H and Kapoor, V.K. Medicinal and Pharmaceutical Chemistry vallabh prakashan, Delhi.

PH 410 PHARMACOLOGY-IV (CLINICAL PHARMACY & DRUG INTERACTIONS) C (L, T, P) = 3 (3, 0, 0)

Unit	Course Contents	Hours
I	Introduction to Clinical Pharmacy Basic Concepts of Pharmacotherapy. Clinical Pharmacokinetics and individualization of Drug Therapy. Drug Delivery systems and their Biopharmaceutic and Therapeutic Considerations.	8
II	Drug use during Infancy and in the Elderly (Pediatrics and Geriatrics). Drug use during pregnancy. Drug induced Diseases. The Basics of Drug Interactions. General Principles of Clinical Toxicology. Interpretation of Clinical Laboratory Tests.	8
III	Important Disorders of Organ Systems and their Management : Cardiovascular Disorders-Hypertension, Congestive Heart Failure, Angina, Acute Myocardial Infarction, Cardiac arrhythmias. CNS Disorders : Epilepsy, Parkinsonism, Schizophrenia, Depression. Respiratory Disease-Asthma Gastrointestinal Disorders- Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis. Endocrine Disorders-Diabetes mellitus and Thyroid Disorders.	8
IV	Infectious Diseases-Tuberculosis, Urinary Tract Infection, Enteric Infections, Upper Respiratory Infections. Hematopoietic Disorders-Anemias. Joint and Connective Tissue Disorders-Rheumatic Diseases, Gout and Hyperuricemia. Neoplastic Diseases-Acute Leukemia, Hodgkin's disease.	8
V	Therapeutic Drug Monitoring. Concept of Essential Drugs and Rational Drug use.	8
Total		40

Reference:

1. Herfindel, E.T. & Hirshman, J.L. Clinical Pharmacy & Therapeutics Williams & Wilkins.
2. Remington's The Science and Practice of Pharmacy, Mach Publishing Co. Pennsylvania.
3. Applied Therapeutics : The Clinical use of Drugs. Applied Therapeutics Inc.
4. Dipiro, J.L. Pharmacotherapy; A Pathophysiological Approach. Elsevier.
5. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall.
6. Laurence, D.R. & Bennet, P.N. Clinical Pharmacology, Churchill Livingstone.
7. Rowland, M. and Tozer, T.N. Clinical Pharmacokinetics Lea and Febiger, N.Y.
8. Winter, M.E. Basic Clinical Pharmacokinetics, Applied Therapeutics Inc., San Francisco.

PH 451 PRACTICAL - PHARMACEUTICAL BIOTECHNOLOGY**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Based on theory syllabus

PH 452 PRACTICAL - PHARMACEUTICS-IX (DOSAGE FORM DESIGN)**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Preformulation studies including drug-excipient compatibility studies, effect of stabilizers, preservatives etc. in dosage form design.
- ❖ Experiments demonstrating improvement in bioavailability through prodrug concept.
- ❖ Stability evaluation of various dosage forms and their expiration dating.
- ❖ Dissolution testing and data evaluation for oral solid dosage forms.
- ❖ Evaluation of Bioequivalence of some marketed products.
- ❖ In vivo bioavailability evaluation from plasma drug concentration and urinary excretion curves.
- ❖ Design, development and evaluation of controlled release formulations

PH 453 PRACTICAL - Pharmaceutics-VIII (Pharmaceutical Technology-II)**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like powders, capsules, tablets, parenterals, micro-capsules, surgical dressing etc.
- ❖ Evaluation of materials used in pharmaceutical packaging

PH 454 PRACTICAL - PHARMACEUTICAL ANALYSIS-III**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Quantitative estimation of at least ten formulations containing single drug or more than one drug, using instrumental Techniques.
- ❖ Estimation of Na⁺, K⁺, Ca⁺⁺ ions using flame photometry.
- ❖ IR of samples with different functional groups (-COOH, -COOR, -CONHR; -NH₂-OH, etc)
- ❖ Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.

PH 455 PRACTICAL - PHARMACOLOGY- III**C (L, T, P) = 2 (0, 0, 3)**

- 1. Software demonstration of Experiments on Isolated Preparations:**
 - To calculate the pA₂ value of atropine using acetylcholine as an agonist on rat ileum preparation.
 - To calculate the pA₂ value of mepyramine or chlorpheniramine using histamine as agonist on guinea pig ileum.
- Software demonstration of To estimate the strength of the test sample of against/ drug (e.g. Acetylcholine, Histamine, 5HT, Oxytocin etc.) Using a suitable isolated muscle preparation employing matching bioassay, bracketing assay, three point assay and four point bioassay.
- Software demonstration of Pharmacology of the Gastrointestinal Tract:
- Software demonstration of To study the Anti- secretory and anti- ulcer activity using pylorus ligated rats.
- Software demonstration of Clinical pharmacology:
- Software demonstration of To determine the effect of certain clinically useful drugs on human volunteers like:
 - Antihistaminics
 - Anti-anxiety and sedative drugs
 - Analgesics
 - Beta blockers.

PH 456 PRACTICAL - PHARMACEUTICAL CHEMISTRY-VIII (MEDICINAL CHEMISTRY -III)**C (L, T, P) = 2 (0, 0, 3)**

- ❖ **Experiments designed on drug metabolism :**
 - Preparation of S₉ and microsomes from tissue homogenates and standardization of protein.
 - Effect of Phenobarbital pretreatment on microsomal cytochrome p-450, cytochrome b₅, and NADPH-Cytochrome C-reductase and comparison of microsomes from control.
 - Determination of microsomal aminopyrine demethylase and p-nitroanisole o-demethylase activities.
 - Determination of microsomal azo- and nitroreductase activities.
- ❖ 2 Synthesis of selected drugs.
- ❖ Establishing the pharmacopoeal standards and spectral studies.

PH 457 PRACTICAL - PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY- II)**C (L, T, P) = 2 (0, 0, 3)**

- ❖ Workshop on stereomodel use of some selected drugs.
- ❖ Synthesis of selected drugs from the course content involving two or more steps and their spectral analysis.
- ❖ Establishing the Pharmacopoeial standards of the drugs synthesized.

PH 458 PRACTICAL - PHARMACOGNOSY-V**C (L, T, P) = 2 (0, 0, 3)**

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

PH 460 PROJECT RELATED TO ELECTIVE, DISSERTATION ON PRACTICAL WORK C (L, T, P) = 2 (0, 0, 3)

Unit	Course Contents	Hours
I	Project related to elective, Dissertation on Practical Work	03 Hr. / Week

CA 149 COMPUTER SCIENCES & APPLICATION**C (L, T, P) = 4(4. 0 .0)**

Unit	Course Contents	Hours
I	Introduction to computers : Characteristics of computers, Historical perspectives of computers, computer generations, types of computers and uses, Software, Hardware, Basic architecture and functions of CPU and its parts, Important I/O devices like Keyboard, Mouse, Printers, Video Monitors. Number System : Decimal, Binary, Basic Binary arithmetic (Conversion to and from decimal numbers, Binary addition and subtraction).	8
II	Memory Storage : Memory Cells, Semiconductor and Magnetic core memory, ROM (its types), RAM, Cache and Virtual memory, Secondary storage devices and their organization (Hard disk, Floppy disk, CD, DVD). Operating Systems : Definitions, Need, Organization, Functions, Types of Operating Systems, DOS, Windows, Handling Drives, Directories and files, Commands (Internal & External), Icons, Clipboard, Folders, Major differences between DOS & Windows,.	8
III	Communication Networks : Hardware and software components, Seven layers of OSI architecture, Network Topologies (Ring, Star, Fully Connected and Bus), LAN and WAN, Bounded and unbounded communication media, Internet, World Wide Web and I.T., Browsers, Important terminology regarding Internet applications, Electronic Mail, Potential uses and abuses of Internet.	8
IV	Computer Programming : Programming languages, Classifications, Low level and high level languages, merits and pitfalls of languages, object oriented languages, Syntax and semantics, Basic steps involved in software development, Flow charts, Compilers and Interpreters. Simple programming using 'C' - Data types, Constants, Variables, Arithmetic and relational expressions, Symbolic constants, Input and output assignment statements, If-else, Switch statements, Loops (While, do-while and for), Transfer statements, Arrays, Problem solving using 'C' taking simple algorithms.	8
V	Computer Applications: Word processing : Techniques, File manipulation, Formatting, Printing setups Table handling, Mail merge, etc. using MSWord. Spreadsheet package : Worksheets, Formatting sheets, Calculations and graphing using formulae and functions, Import and export of data using MS-Excel. Graphics : Objectives and types of graphics , Presentation packages, Slides designing, Diagrams and graphs, Import and Export data using MS-Power Point. Data security against viruses : Definition of computer viruses, Detection, prevention and cure against viruses using antivirus software packages. Pharmaceutical applications : Basics of computer use in various pharmaceutical and clinical applications like drug information services, hospital and community pharmacy, drug design, pharmacokinetics and data analysis.	8
Total		40

Reference:

1. Fundamentals of Computers by Rajaraman, Prentice Hall of India
2. Let us 'C' by Kanetkar, BPB Publications.
3. Learn MS-Office 3000 by Stultz, BPB Publications.
4. Using Microsoft Windows 1998 by Ivens, Prentice Hall of India.
5. Learn DOS in a day by Stultz, BPB Publications.

CA 199 PRACTICAL - COMPUTER SCIENCES & APPLICATION**C (L, T, P) = 2 (0. 0 .3)**

- ❖ Simple exercises based upon the following need to be dealt :
- ❖ Computer operating systems like MS-DOS, MS-Windows.
- ❖ Word-processing like MS-Word.
- ❖ Spreadsheet calculations using MS- Excel.
- ❖ Graphic applications using MS-Power Point, MS-Excel.
- ❖ Programming using 'C'.

Unit	Course Contents	Hours
I	Unit – I - Man & Environment - Definition of environment & its various components, Ecosystem concepts. Dependence of Man on nature for its various needs. Human population growth & its impacts on environment. Environment & human health. Environmental concerns including climate change, Global warming, Acid Rain. Ozone layer Depletion etc. Environmental ethics, Traditional ways of utilizing various components of environment. Sustainable developments.	05
II	Unit – II Natural Resources - Forest resources, Mining, Dams & their effects on forester & tribal people. Water resource over utilization of water, floods, droughts and conflicts over water resources. Mineral Resources use of various minerals for Human welfare & environmental effects of mining Food resources World food problem. Impacts of changing Agriculture practices on Environment. Energy Resources Renewable and non renewable energy Resources & exploration of alternative energy sources. Land Resources land degradation, soil erosion, and desertification & soil contamination.	05
III	Unit – III Ecosystems - Structure & function, energy flow, food chains food webs, Ecological pyramids, Basics of forest grasslands, desert & aquatic ecosystem (Ponds, Streams, Lakes, Rivers, Oceans & Estuaries.)	05
IV	Unit – IV Biological Diversity - Genetic, species & ecosystem diversity, Values of Biodiversity, Global, National & Local Biodiversity, Hotspots of Biodiversity, threat to biodiversity, Endangered & endemic species of India. Conservation of biodiversity in situ & ex-situ.	05
V	Unit – V Environment Pollution. - Causes effects & control of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution & Nuclear Hazards, Solid wastes & their Management, Disaster Management Flood, Drought, Earthquake, Land slides etc.	05
Total		25

References

1. Agrawal K.C. 2001 Environment Biology, Niddi Publishers Ltd Bikaner.
2. Bharticha Erach 2003 The Biodiversity of India, Mapin Publishing Pvt. Ltd Ahmedabad – 380013.
3. Brunner RC, 1998 Hazardous Waste Incineration Mcgraw Hill Inc 480 pgs.
4. Clark RS, Marine Pollution Clarendon Press Oxofrd (TB)
5. Cunningham WP, Cooper TH, Gorhani E & Hepworth MT, 2001. Environment Encyclopedia.
6. De AK, Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Center for Sciences and Environment (R).
8. Gleick HP, 1993 Water in Crisis, Pacific Institute for Students in Development, Environment acd. Security, Stockholm Environmental Institute, Oxford University Press, 473 pgs.
9. Hawkins RE, Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay ®

HS 132**Communication Skills****C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Features of Indian English - Correction of sentences - Structures - Tenses - ambiguity - idiomatic distortions	08
	Grammar: Transformation of sentences; words used as different parts of speech; one word substitution; abbreviations, technical terms etc	
II	Informal conversation Vs Formal expression - Verbal and non-verbal communication, barriers to effective communication – kinesics	08
	Types of Communication - - Oral, aural, Writing and reading - Word-Power - Vocabulary- Jargon - rate of speech, pitch, tone - Clarity of voice	
III	Technical presentations - types of presentation –video conferencing-- participation in meetings - chairing sessions.	08
	Formal and informal interviews – ambiance and polemics - interviewing in different settings and for different purposes e.g., eliciting and giving information, recruiting, performance appraisal.	
IV	Written communication - differences between spoken and written communication - features of effective writing such "as clarity, brevity, appropriate tone clarity, balance etc.- GRE. TOEFL models	08
	Letter-writing - business letters – pro forma culture - format - style – effectiveness, promptness - Analysis of sample letters collected from industry - email, fax.	
V	Technical Report writing - Business and Technical Reports – Types of reports - progress reports, routine reports - Annual reports - format - Analysis of sample reports from industry	08
	Synopsis and thesis writing	
Total Hrs.		40

REFERENCE BOOKS:

1. Essentials of Business Communication, Rajendra Pal, J S Korlahahi : Sultan Chand & Sons, New Delhi.
2. Basic Communication Skills for Technology, Andrea J. Rutherford: Pearson Education Asia, Patparganj, New Delhi-92.
3. Advanced Communication Skills, V. Prasad, Atma Ram Publications, New Delhi.
4. Raymond V. Lesikav; John D. Petit Jr.; Business Communication; Teory & Application, All India Traveller Bookseller, New Delhi-51.
5. Business Communication, RK Madhukar, Vikas Publishing House Pvt Ltd
6. K.R. Lakshminarayana : English. for Technical Communication – vols. 1 and 2, SCITECH Publications (India) Pvt. Ltd., T. Nagar, Chennai-600 017.
7. Edmond H Weiss: Writing Remedies: Practical Exercises for Technical Writing, Universities Press, Hyderabad.
8. Cliffs Test Prep for GRE and TOEFL: Computer Based Test, IDG Books. India (P) Ltd. New Delhi-002.
9. GRE and TOEFL; Kaplan and Baron's English in Mind, Herbert Puchta and Jeff Stranks, Cambridge

HS 332**Soft Skills I****C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	The art of salesmanship, Salesmanship Training Persuasion and Negotiation Skills	08
II	Stress Management Training Employee Grievance Handling, Creating an open culture, Cross cultural training	08
III	Anchoring, Conducting Meetings, Scheduling and Minute Taking Public Relations Management	08
IV	Achievement Motivation Training Career Counseling	08
V	Interview Training	08
	Total	40

HS 432**Soft Skills II****C (L, T, P) = 3 (3, 0, 0)**

Unit	Course Contents	Hours
I	Training in Writing Job Applications and Resumes, Preparing Statement of Purpose.	08
II	Emotional Intelligence Training	08
III	Business Etiquettes Presentation Techniques	08
IV	Group Discussion Training	08
V	Introduction to business terms, Economic Times Reading	08
	Total	40