



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (1st Semester)

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	101	Pharmaceutical Chemistry-I (Inorganic Chemistry)
02.	101P	Pharmaceutical Chemistry-I (Practical)
03.	102	Pharmaceutical Analysis-I
04.	102P	Pharmaceutical Analysis-I (Practical)
05.	103	Pharmaceutics-I (Introduction to Dosage Form)
06.	103P	Pharmaceutics-I (Practical)
07.	104	Human anatomy & Physiology-I
08.	104P	Human anatomy & Physiology-I (Practical)
09.	105	Basic Electronics & Computer Application

HEAD

**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (2nd Semester)

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	201	Pharmaceutical Chemistry-II (Organic Chemistry)
02.	201P	Pharmaceutical Chemistry-II (Practical)
03.	202	Pharmaceutical Analysis-II
04.	202P	Pharmaceutical Analysis-II (Practical)
05.	203	Pharmaceutics-II (Physical Pharmacy-I)
06.	203P	Pharmaceutics-II (Practical)
07.	204	Human anatomy & Physiology-II
08.	204P	Human anatomy & Physiology-II (Practical)
09.	MABI	Mathematics & Biostatistics

HEAD

**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (3rd Semester)

Academic Year 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	301	Pharmaceutical Chemistry-III (Heterocyclic Compounds)
02.	302	Pharmaceutical Chemistry-III (Practical)
03.	303	Pharmaceutics-III (Physical Pharmacy-II)
04.	304	Pharmaceutics-III (Practical)
05.	305	Pharmacognosy-I
06.	306	Pharmacognosy-I (Practical)
07.	307	Pharmaceutics-V (Dispensing Pharmacy)
08.	308	Pharmaceutics-V (Practical)
09.	309	Pathophysiology of Common Diseases

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**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (4th Semester)

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	401	Pharmaceutical Chemistry-IV (Biochemistry)
02.	402	Pharmaceutical Chemistry-IV (Biochemistry) (Practical)
03.	403	Pharmaceutics-V (Unit Operations)
04.	404	Pharmaceutics-V (Unit Operations) (Practical)
05.	405	Pharmacognosy-II
06.	406	Pharmacognosy-II (Practical)
07.	407	Pharmacology-I
08.	408	Pharmacology-I (Practical)
09.	409	Hospital Pharmacy

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**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (5th Semester)

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	501	Pharmaceutical Chemistry-V (Medicinal Chemistry-I)
02.	502	Pharmaceutical Chemistry-V (Practical)
03.	503	Pharmaceutics-V (Pharmaceutical Technology-I)
04.	504	Pharmaceutics-V (Pharmaceutical Technology-I) (Practical)
05.	505	Pharmacognosy-III
06.	506	Pharmacognosy-III (Practical)
07.	507	Pharmacology-II
08.	508	Pharmacology-II (Practical)
09.	509	Pharmaceutical Microbiology
10.	510	Pharmaceutical Microbiology (Practical)

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**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (6th Semester)

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	601	Pharmaceutical Chemistry-VI (Medicinal Chemistry-II)
02.	602	Pharmaceutical Chemistry-VI (Practical)
03.	603	Pharmaceutics-VI (Pharmaceutical Technology-II)
04.	604	Pharmaceutics-VI (Pharmaceutical Technology-II) (Practical)
05.	605	Pharmacognosy-IV
06.	606	Pharmacognosy-IV (Practical)
07.	607	Pharmacology-III
08.	608	Pharmacology-III (Practical)
09.	609	Forensic pharmacy & Ethics
10.	611	Pharmaceutical Chemistry-VI (Medicinal Chemistry-II)
11.	601	Pharmaceutical Chemistry-VI (Practical)

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**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (7th Semester)

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	1907-701	Pharmaceutical Chemistry-VII (Medicinal Chemistry-III)
02.	1907-702	Pharmaceutics-VIII (Biopharmaceutics & Pharmacokinetics)
03.	1907-703	Pharmaceutical Biotechnology
04.	1907-704	Pharmacology-IV
05.	1907-705	Pharmaceutical Industrial Management
06.	1907-706A	Bioavailability & Therapeutic Drug Monitoring
07.	1907-706B	Drug Design

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**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pharmacy

Programme Name : B. Pharm. (8th Semester)

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	1908-801	Pharmaceutical Chemistry-VIII (Medicinal Chemistry-IV)
02.	1908-802	Pharmaceutical Analysis-III
03.	1908-803	Pharmaceutics-IX (Dosages Form Design)
04.	1908-804	Pharmacognosy-V (including Herbal Technology)
05.	1908-805	Pharmacology-V (Clinical Pharmacy)
06.	1908-806	Open Elective: Cosmetology/ Quality Assurance
07.	1908-807	Project (Library Assignment)

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**S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)**



Scheme and Syllabus

B. Pharm.

Course Code	Course	Hrs/week	Credit Points	Marks
1st Semester				
101	Pharmaceutical Chemistry-I (Inorganic Chemistry)	3	3	100
101P	Pharmaceutical Chemistry-I (Practical)	4	2	100
102	Pharmaceutical Analysis-I	3	3	100
102P	Pharmaceutical Analysis-I (Practical)	4	2	100
103	Pharmaceutics-I (Introduction to Dosage Form)	3	3	100
103P	Pharmaceutics-I (Practical)	4	2	100
104	Human anatomy & Physiology-I	3	3	100
104P	Human anatomy & Physiology-I (Practical)	4	2	100
105	Basic Electronics & Computer Application	3	3	100
105P	Basic Electronics & Computer Application	4	2	100
	Total	35	25	1000
2nd Semester				
201	Pharmaceutical Chemistry-II (Organic Chemistry)	3	3	100
201P	Pharmaceutical Chemistry-II (Practical)	4	2	100
202	Pharmaceutical Analysis-II	3	3	100
202P	Pharmaceutical Analysis-II (Practical)	4	2	100
203	Pharmaceutics-II (Physical Pharmacy-I)	3	3	100
203P	Pharmaceutics-II (Practical)	4	2	100
204	Human anatomy & Physiology-II	3	3	100
204P	Human anatomy & Physiology-II (Practical)	4	2	100
MABI	Mathematics & Biostatistics	3	3	100
	Total	31	23	900



Course Code	Course	Hrs/week	Credit Points	Marks
3rd Semester				
301	Pharmaceutical Chemistry-III (Heterocyclic Compounds)	3	3	100
302	Pharmaceutical Chemistry-III (Practical)	4	2	100
303	Pharmaceutics-III (Physical Pharmacy-II)	3	3	100
304	Pharmaceutics-III (Practical)	4	2	100
305	Pharmacognosy-I	3	3	100
306	Pharmacognosy-I (Practical)	4	2	100
307	Pharmaceutics-V (Dispensing Pharmacy)	3	3	100
308	Pharmaceutics-V (Practical)	4	2	100
309	Pathophysiology of Common Diseases	3	3	100
	Total	31	23	900
4th Semester				
401	Pharmaceutical Chemistry-IV (Biochemistry)	3	3	100
402	Pharmaceutical Chemistry-IV (Biochemistry) (Practical)	4	2	100
403	Pharmaceutics-V (Unit Operations)	3	3	100
404	Pharmaceutics-V (Unit Operations) (Practical)	4	2	100
405	Pharmacognosy-II	3	3	100
406	Pharmacognosy-II (Practical)	4	2	100
407	Pharmacology-I	3	3	100
408	Pharmacology-I (Practical)	4	2	100
409	Hospital Pharmacy	3	3	100
	Total	31	23	900



Course Code	Course	Hrs/week	Credit Points	Marks
5th Semester				
501	Pharmaceutical Chemistry-V (Medicinal Chemistry-I)	3	3	100
502	Pharmaceutical Chemistry-V (Practical)	4	2	100
503	Pharmaceutics-V (Pharmaceutical Technology-I)	3	3	100
504	Pharmaceutics-V (Pharmaceutical Technology-I) (Practical)	4	2	100
505	Pharmacognosy-III	3	3	100
506	Pharmacognosy-III (Practical)	4	2	100
507	Pharmacology-II	3	3	100
508	Pharmacology-II (Practical)	4	2	100
509	Pharmaceutical Microbiology	3	3	100
510	Pharmaceutical Microbiology (Practical)	4	2	100
	Total	35	25	1000
6th Semester				
601	Pharmaceutical Chemistry-VI (Medicinal Chemistry-II)	3	3	100
602	Pharmaceutical Chemistry-VI (Practical)	4	2	100
603	Pharmaceutics-VI (Pharmaceutical Technology-II)	3	3	100
604	Pharmaceutics-VI (Pharmaceutical Technology-II) (Practical)	4	2	100
605	Pharmacognosy-IV	3	3	100
606	Pharmacognosy-IV (Practical)	4	2	100
607	Pharmacology-III	3	3	100
608	Pharmacology-III (Practical)	4	2	100
609	Forensic pharmacy & Ethics	3	3	100
	Total	31	23	900



Course Code	Course	Theory (Hrs/week)	Practical (Hrs/week)	Credit Points (T+P)	Marks
7th Semester					
1907-701	Pharmaceutical Chemistry-VII (Medicinal Chemistry-III)	3	4	3+2	200
1907-702	Pharmaceutics-VIII (Biopharmaceutics & Pharmacokinetics)	3	4	3+2	200
1907-703	Pharmaceutical Biotechnology	3	4	3+2	200
1907-704	Pharmacology-IV	3	4	3+2	200
1907-705	Pharmaceutical Industrial Management	3	-	3	100
1907-706A	Open Elective: (Bioavailability and Therapeutic Drug Monitoring OR Drug Design)	3	-	3	100
	Total	18	16	26	1000
8th Semester					
1908-801	Pharmaceutical Chemistry-VIII (Medicinal Chemistry-IV)	3	4	3+2	200
1908-802	Pharmaceutical Analysis-III	3	4	3+2	200
1908-803	Pharmaceutics-IX (Dosages Form Design)	3	4	3+2	200
1908-804	Pharmacognosy-V (including Herbal Technology)	3	4	3+2	200
1908-805	Pharmacology-V (Clinical Pharmacy)	3	-	3	100
1908-806	Open Elective: Cosmetology/ Quality Assurance	3	-	3	100
1908-807	Project (Library Assignment)	-	4	2	100
	Total	18	20	28	1100



B. PHARM. (1st SEMESTER)

101 – Pharmaceutical Chemistry – I (Inorganic Chemistry)

BACHELOR OF PHARMACY

B.PHARM. FIRST SEMESTER

PHARMACEUTICAL CHEMISTRY - I

(INORGANIC PHARMACEUTICAL CHEMISTRY) (THEORY)

(3 hrs/week)

Unit	Content
1.	Impurities in pharmaceutical substances, importance of limit test, general principle and procedure for limit test for chloride, sulphate, iron, arsenic, lead, heavy metals, special procedure for limit tests.
	General methods of preparation, properties, tests for purity, storage condition, assay of inorganic compounds listed in IP belonging to the following classes:
2.	Acids and bases: Buffers, water
3.	Gastrointestinal agents: Acidifiers: HCl Antacids: Aluminium hydroxide gel, dried aluminium hydroxide gel, tablets, CaCO ₃ , sod. bicarbonatate, magnesium trisilicate, magnesium carbonate (light and heavy), magnesium hydroxide mixture. Protective and Adsorbents: Kaolin, talc, bismuth subcarbonate. Saline cathartics: Magnesium sulphate, sodium orthophosphate, sodium sulphate
4.	Gases & Vapours: Compounds of oxygen, nitrous oxide, carbon dioxide, hydrogen peroxide, oxygen therapy and anaesthetics gases.
5.	Topical agents and Dermatological preparations: Protectives: Talc, zinc oxide, zinc stearate, titanium dioxide, silicon polymers etc. Antimicrobials: Potassium permanganate, chlorinated lime. Astringent: Aluminium sulphate, alum, zinc sulphate
6.	Dental products: Dentifrices, anti-caries agents, desensitizing agents, calcium carbonate, sodium fluoride, stannous fluoride, zinc chloride.
7.	Major Intra and Extra-cellular electrolytes: Major physiological ions, electrolytes used for replacement therapy, acid-base balance and combination therapy.
8.	Essential Trace Elements, their compounds and applications: Iron salt as haematinics and mineral supplements trace elements like copper, cobalt, iron, zinc, magnese, chromium, iodine, sulphur. Haematinics: Ferrous sulphate, ferrous gluconate, ferrous fumarate, iron dextrin injection, iron and ammonium citrate.

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9.	Radiopharmaceuticals: Introduction, units of radioactivity, measurement of radioactivity, diagnostic and therapeutic applications, dosage hazards and precautions. Sodium chromate, iron citrate, gold injection, sodium iodide, sodium phosphate, strontium chloride, barium sulphate.
10.	Miscellaneous agents: Buffers and colorants, antioxidants, complexing and chelating agents. Sclerosing agents: Sodium morrhuate injection. Emetics: Copper sulphate, antimony potassium iodide. Expectorants: Ammonium chloride, potassium iodide. Poisons and antidotes: Sodium nitrite, sodium thiosulphate, charcoal (activated). Respiratory stimulants: Ammonium carbonate. Cationic and anionic components of inorganic drugs useful for systemic effects.

Books Recommended

1. J.H. Block, E.B. Roche, T.O. Soine, C.O. Wilson, Inorganic medicinal and pharmaceutical chemistry, Verghese Publications.
2. C.A. Dicher. Modern inorganic pharmaceutical chemistry.
3. Bentley and Drivers text book of pharmaceutical chemistry, 8th edition, Oxford university press, ELBS, London.
4. Remington's pharmaceutical sciences, Mack publishing company.
5. Indian Pharmacopoeia 2007, 5th edition, Ministry of Health and Family Welfare, Government of India, New Delhi,



102 – Pharmaceutical Analysis – I

BACHELOR OF PHARMACY
B.PHARM. FIRST SEMESTER
PHARMACEUTICAL ANALYSIS – I (THEORY)
(3 hrs/week)

Unit	Content
1.	Accuracy and precision, classification of errors and their minimization, rejection of doubtful values, significant figures and computation, mean deviation, standard deviation, sampling techniques, calibration of analytical equipments.
2.	Titrimetric analysis: Classification of reactions in titrimetric analysis, fundamentals of volumetric analysis, methods of expressing concentrations, standard solutions, primary and secondary standards (Theoretical considerations), physiochemical concepts required for analysis such as electrolytic dissociations, modern concepts of acids and bases, chemical equilibrium, pH & buffer actions, Hanerson-Hasselbach equation, solubility product, common-ion effect.
3.	Acid-Base titrations: Theory of acid-base titrations, neutralization curves, acid base indicators, theory of indicators, choice of indicators, mixed indicators, universal indicators, assay of sodium bicarbonate, sodium carbonate, boric acid, ammonium chloride.
4.	Redox titrations: Principles of oxidation reduction titrations, redox indicators & their use in pharmaceutical analysis, Iodometric and Iodimetric titrations, Titrations involving Potassium permanganate, potassium dichromate, potassium iodate, ceric ammonium sulphate, assay of ferrous sulphate, hydrogen peroxide solution, iodine solution, chlorinated lime, copper sulphate.
5.	Precipitation titrations: Introduction, precipitation reactions, factors affecting stability of precipitate, location of end point, assay of sodium chloride injection and ammonium chloride.
6.	Gravimetric analysis: Introduction, precipitation methods, conditions of precipitation, filtration and washing of the precipitate, drying and ignition of the precipitate, assay of sodium sulphate and magnesium sulphate.

Books Recommended

1. G.H. Jeffery, J. Bassett, J. Mandham, R.C. Denney, Vogels text book of quantitative chemical analysis, 5th edition, Addison Wesley Longman, Singapore.
2. P.C. Kambhoj, Pharmaceutical analysis, Theory and practicals, Volume-I, 1st edition, Vallabh Publications, New Delhi.
3. A.V. Kasture, K.R. Mahadik, S.G. Wadodkar, H.N. More, Text book of pharmaceutical analysis, Volume I and II, 17th edition, Nirali Prakashan, Pune.

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103 – Pharmaceutics – I (Introduction to Dosage Form)

BACHELOR OF PHARMACY

B.PHARM. FIRST SEMESTER

PHARMACEUTICS I (INTRODUCTION TO DOSAGE FORM) (THEORY)

(3 hrs/week)

Unit	Content
1.	History of pharmaceutical practice through ages. Pharmacy as carrier, Various systems of medicines. Significance of pharmacopoeias with special reference to Indian, British, United States, International and Extra pharmacopoeias.
2.	Rules of administration and classification of pharmaceutical dosage form.
3.	Definition general formulation, principles and procedures adopted for preparing official products of the following- Aromatic waters, Solutions, Syrups, mixtures, spirits, elixirs, Linctuses, Lotions, Liniments, Glycerites, Gargles, Mouth washes, Inhalations, Powders, Capsules, Tablet triturates, Ointments, Creams, Pastes, Suppositories, Ophthalmics, Emulsions, Suspensions, Milk and Magmas, Mucilages, Jellies, Infusion, Decoctions, Tinctures and Extracts.
4.	Pharmaceutical Calculation: Different systems of weights and measures, Dilution and concentration of solutions, Percentage solution, Calculation by allegation, Proof Spirit, Calculation of doses, Displacement values.
5.	Detailed methods employed in the preparation of plant extractives

Books Recommended

1. Indian Pharmacopoeia, Volume I and II, Ministry of Health and Family Welfare, Government of India, New Delhi, 1996.
2. British Pharmacopoeia, Volume I and II, Ministry of Health and Social Services for Northern Ireland, London, 1980.
3. United States Pharmacopoeia, United States Pharmacopoeial Convention, Twinbrook Parkway, Rockville, 1990.
4. Extra Pharmacopoeia, 13th edition, The Pharmacopoeial Press, London, 1993.
5. Gennaro AL., Remington, The Science and Practice of Pharmacy, Volume I and II, 20th edition, Philadelphia Lippincott Williams and Wilkins, 2000.
6. M.E. Aulton, Pharmaceutics, The Science of Dosage Form Design, 2nd edition, Edinburgh, Churchill Livingstone, 2002.
7. N.K. Jain, S.N. Sharma, A text book of professional pharmacy, 5th edition, CBS publisher and distributors, New Delhi, 2007.
8. J. Mitchell, Stoklosa, Howard C. Ansel, Pharmaceutical calculations, 10th edition, Williams and Wilkins, London, 1996.



104 – Human Anatomy & Physiology – I

BACHELOR OF PHARMACY
B.PHARM. FIRST SEMESTER
HUMAN ANATOMY AND PHYSIOLOGY -I (THEORY)
(3 hrs/week)

Unit	Content
1.	Scope of anatomy and physiology and basic terminology used in these subjects. Structure of cell, its components and their functions.
2.	Elementary Tissues of the Human Body: Epithelial, connective, muscular and nervous tissues, their sub-types and their characteristics
3.	Osseous System: Structure, composition and functions of skeleton, Classification of joints, types of movements of joints, Disorders of joints.
4.	Skeletal Muscles: Gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders
5.	Hemopoietic System: Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation
6.	Lymph and Lymphatic System: Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen
7.	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 disorders like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias

Books Recommended:

1. A.C. Guyton, J.E. Hall, Text book of Medical Physiology, WB Saunders Company.
2. C.C. Chatterjee, Human Physiology, Medical Allied Agency, Calcutta.
3. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
4. G.J. Tortora, S.R. Grabowski, Principles of Anatomy & Physiology, Harper & Collins Publisher, New Jersey.
5. Seeley, Stephens, Tate, Essentials of Anatomy & Physiology, McGraw Hill Company Inc.
6. C.A. Keele, E. Niel, N. Joels, Samson Wright's Applied Physiology, Oxford University Press.
7. W.D. Glarze, Mosbey's Medical Nursing and Allied Health, Mosby Publisher.

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105 – Basic Electronics & Computer Application

BACHELOR OF PHARMACY
B.PHARM. FIRST SEMESTER
BASIC ELECTRONICS AND COMPUTER APPLICATIONS (THEORY)
(3 hrs/week)

Unit	Content
1.	Introduction to computers: Basic components of computers, types of computers, characteristics and hardware aspects of computer.
2.	Operating systems: Definition, types of operating system, MS-DOS, UNIX, LINUX, Memories, RAM, ROM and secondary memory.
3.	Language of computer: Introduction to programming languages, character set-C token, keyword, flowchart and identifiers assigning values of variables, designing symbolic constants, arithmetic, relational, logical, assignment, bitwise, special increment and decrement operators, reading and writing character.
4.	Decision making and branching: Decision making with IF statement (simple IF statement, IF-ELSE statements, Nesting of IF-ELSE, the ELSE-IF ladder), switch statement.
5.	Decision making and looping: While statement, the Do statement, FOR statement, array, string handling function, user defined function.
6.	Computer packages: MS-Office-MS Word, MS Power Point, MS Excel, Tally advantages and use.
7.	Introduction to computer networks: Definition, LAN, WAN, advantages, internet, World Wide Web.
8.	Computer graphics: Definition, display devices, graphical input and output devices, multimedia definition and application.
9.	Computer applications in pharmaceutical and clinical studies.

Books Recommended

1. P.K. Sinha, Computer fundamentals, BPB publications.
2. V. Rajaraman, Computer fundamental, PHI publications.
3. A. Leon, M. Leon, Fundamental of information technology, Vikas publications.

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B. PHARM. (2nd SEMESTER)

201 – Pharmaceutical Chemistry – II (Organic Chemistry)

BACHELOR OF PHARMACY

B.PHARM. SECOND SEMESTER

PHARMACEUTICAL CHEMISTRY - II (ORGANIC CHEMISTRY) (THEORY)
(3 hrs/week)

The subject of organic chemistry will be treated in its modern perspective keeping for the sake of convenience, the usual classification of organic compounds

Unit	Content
1.	Structure and properties: Atomic structure, atomic orbitals, molecular orbital theory, wave equations, molecular orbitals, bonding and antibonding orbitals, covalent bond, hybrid orbitals, intramolecular and intermolecular forces, bond dissociation energy, polarity of the bond, polarity of the molecule, electronegativity, inductive effects, resonance, hyperconjugation, structure and physical properties.
2.	Stereochemistry: Optical activity and chirality, kinds of molecules displaying optical activity, absolute configuration, methods of determining configuration, molecules with more than one chiral center, stereospecific and stereoselective synthesis, racemic modification resolution cis-trans isomerism, conformational analysis and Bayer's strain theory.
3.	Structure, nomenclature, preparation and reaction mechanism of: Alkanes, alkenes, alkynes, cycloalkanes, dienes, benzene, polyaromatic compounds, arenas, alkylhalides, alcohols, ethers, amines, nitro compounds, phenols, aldehydes and ketones, carboxylic acids and functional derivatives of carboxylic acids.
4.	Reactive intermediates: Carbocations, carbanions, carbenes, nitrenes and nitronium ion, their generation and fate.
5.	α , β -Unsaturated compounds
6.	Conservation of orbital symmetry rules, electrocyclic, cycloaddition and sigmatropic reactions.
7.	Chemistry of polynuclear hydrocarbons and their derivatives- Naphthalene, anthracene and phenanthrene.

Books Recommended

1. O.P. Agarwal, Organic chemistry 'Reactions and reagents', Goel publishing house.
2. A Bahl, B.S. Bahl, A text book of organic chemistry, S. Chand & Company.
3. Morrison Boyd, Organic chemistry, 7th edition, Pearson publishers.
4. I.L. Finar, Organic chemistry, 5th and 6th edition, Volume I and II, Pearson publishers.



202 – Pharmaceutical Analysis – II

BACHELOR OF PHARMACY
B.PHARM. SECOND SEMESTER
PHARMACEUTICAL ANALYSIS – II (THEORY)
(3 hrs/week)

Unit	Content
1.	Complexometric titrations: Introduction, stability of complexes, factors influencing the stability, types of EDTA titrations, pM indicators, masking & demasking agents, assay of calcium carbonate, calcium gluconate, magnesium sulphate.
2.	Non-aqueous titrations: Solvents used in non-aqueous titrations, Titrations of acidic and basic substances in non-aqueous solvents.
3.	Refractometry: Introduction, refractive index, specific and molar refraction, Principle, instrumentation and applications of refractometry.
4.	Polarimetry: Introduction, specific rotation, measurement of optical rotation, Instrumentation and applications of polarimetry.
5.	Conductometry: Introductions, Conductometric titrations, Instrumentation and applications of conductometry.
6.	Potentiometry: Electrode potential, Reference electrode, Indicator electrode, Measurement of potential and pH, Potentiometric titrations, Instrumentation and applications of potentiometry.
7.	Chromatography: Fundamentals of Chromatography, Principles, instrumentation and applications of following chromatographic techniques: Paper chromatography, Thin layer chromatography, Ion-exchange chromatography, Gel filtration chromatography, Gas Liquid Chromatography and High Performance Liquid Chromatography

Books Recommended

1. G.H. Jeffery, J. Bassett, J. Mandham, R.C. Denney, Vogels text book of quantitative chemical analysis, 5th edition, Addison Wesley Longman, Singapore.
2. P.C. Kambhoj, Pharmaceutical analysis, Theory and practicals, Volume I, 1st edition, Vallabh Publications, New Delhi.
3. A.V. Kasture, K.R. Mahadik, S.G. Wadodkar, H.N. More, Text book of pharmaceutical analysis, Volume I and II, 17th edition, 2007, Nirali Prakashan, Pune.
4. R.D. Braun, Introduction to instrumental analysis, 2nd edition, 2012, Pharmamed Press, Hyderabad.



203 – Pharmaceutics – II (Physical Pharmacy - I)

BACHELOR OF PHARMACY

B.PHARM. SECOND SEMESTER

PHARMACEUTICS - II (PHYSICAL PHARMACY - I) (THEORY)

(3 hrs/week)

Unit	Content
1.	Solubility & Distribution Phenomenon: Solubility definition, expression dissolution rate, solvent-solute interactions, polar solvents-non polar solvents semi polar solvents, solubility of gases in liquids, effect of pressure temperature salting out, ideal and real solutions, miscibility, dielectric constant and solubility, Solubility of solids in liquids, ideal and non ideal solutions, solution and association in solution. Solubility of salts in water solubility of slightly soluble and weak electrolytes, influence of co-solvents, pH & partition coefficient on the solubility of drugs. Combined effect of pH and solvents distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition and drug action. Preservation action of weak acids in emulsion.
2.	Micromeritics: Particle size and size distribution, Methods for determining particle size, Particle shape and surface area, Derived properties of powder, Porosity, packing arrangement, Densities Bulkiness, Flow properties.
3.	Viscosity and Rheology: Newtonian system, law of flow, kinematic viscosity, effect of temperature, Non-Newtonian system, pseudo plastic, dilatants, plastic, thixotropy, thixotropy in formulation determination of viscosity and thixotropy, application of rheology in pharmacy.
4.	Inter molecular forces and states of matter: Binding forces between molecules, States of matter, Amorphous and crystalline states of solids. Polymorphism, Latent heat vapour pressure. Sublimation critical point, Phase equilibria and phase rule. Eutectic mixtures. Liquid crystals.

Books Recommended

1. Martin's physical pharmacy and pharmaceutical sciences, Physical, chemical and biopharmaceutics principles in the pharmaceutical sciences, Lipincott Williams and Wilkins
2. C.V.S. Subramaniam, Text book of physical pharmaceutics, Vallabh Prakashan, New Delhi.

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204 – Human Anatomy & Physiology – II

BACHELOR OF PHARMACY
B.PHARM. SECOND SEMESTER
HUMAN ANATOMY AND PHYSIOLOGY -II (THEORY)
(3 hrs/week)

Unit	Content
1.	Digestive System: Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system
2.	Respiratory System: Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity
3.	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
4.	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.
5.	Automatic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S
6.	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
7.	Endocrine System: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and Ovary, their hormones and functions
8.	Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin
9.	Concepts of health and disease: Disease causing agents and prevention of disease
10.	Classification of food requirements: Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water
11.	Demography and family planning: Medical termination of pregnancy
12.	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)

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MABI – Mathematics & Biostatistics

BACHELOR OF PHARMACY
B.PHARM. SECOND SEMESTER
MATHEMATICS & BIOSTATISTICS (THEORY)
(3 hrs/week)

Unit	Content
1.	Differential calculus: continuity and limit, differentiation, derivability and derivative, R.H. derivatives and L.H. derivatives, differentiation, general theorem of derivation.
2.	Integral calculus: integration as on inverse process of differentiation, definite integrals, integration by substitution, integration of algebraic function of E evolution of area in simple cases.
3.	Differential equations: formation of differential equations, order and degree solution of first order differential equations.
4.	Matrices: Definition of matrices, operation of matrices, addition, difference, multiplication, inverse of matrix, solution of linear simultaneous equations by matrix method, the characteristics equation of a matrix statement of cayley-Hamilton theorem (without Proof)- examples Pharmaceutical application of determinations and matrices, determinants of two and three order, Cramer's rule.
5.	(a) Scope of statistical methods in medicine and pharmacy; (b) Collection of data; (c) Classification of data; (d) Visual aids, diagrams, charts and graphs; (e) Measures of central tendency; (f) Dispersion; (g) Theory of sampling; (h) Statistical interference; (i) Correlation and regressions; (j) Probabilities

Books Recommended

1. Gorakh Prasad, Differential calculus, Pothishala Private Limited, Allahabad.
2. Gorakh Prasad, Integral calculus, Pothishala Private Limited, Allahabad.
3. H.S. Hall, S.R. Knight, Higher Algebra, Book place, New Delhi.
4. S.C. Gupta, V.K. Kapoor, Fundamental of mathematical statistics, S.Chand and Sons.



B. PHARM. (3rd SEMESTER)

301 – Pharmaceutical Chemistry – III (Heterocyclic Compounds)

The study of fundamentals of heterocyclics, nomenclature, methods of synthesis, medicinal importance and important chemical reactions of following:

1. Five membered heterocycles: Furan, thiophene, pyrrole, thiazole, oxazole, imidazole, triazole, pyrazole, isoxazole.
2. Six membered heterocycles: Pyridine, Pyrimidine, pyrazine, pyridazine.
3. Quinoline and isoquinolines.
4. Indoles
5. Benzo(b) thiophenes and benzo(b) furan, benzimidazole.

303 – Pharmaceutics – III (Physical Pharmacy – II)

1. **Colloids:** Introduction, types, properties, optical, kinetic and electrical. Pharmaceutical application, solubilization.
2. **Coarse dispersion:** Suspension, interfacial properties suspended particles. Settling in suspensions. Theory of sedimentation of Brownian moment. Sedimentation of flocculated particle. Settling of particles. Controlled flocculation. Flocculation in structured vehicle. Rheological consideration. Emulsion, theory of emulsion, physical stability of emulsions, preservation of emulsion, Rheological properties of emulsion, phase equilibrium and emulsion formulation, special emulsion systems.
3. **Surface and interfacial Phenomenon:** Surface and interfacial tension, surface free energy, measurement of surface and interfacial tension, surface active agents, HLB classification, detergency, electrical properties of interfaces.
4. **Polymer science:** Pharmaceutical application. Preparing polymer solution, phase separation; gel formation mechanical properties of polymeric films. Future trends in pharmaceutical and other biomedical uses of polymers.
5. **Radiopharmaceutical:** Radioactivity and radionuclide, production and storages of radiopharmaceuticals. Measurement of radiation, regulations, radiopharmaceuticals dosage forms.



305 – Pharmacognosy – I

1. Definition, history, scope and development of pharmacognosy.
2. Sources of drugs: Biological, marine, mineral and plant tissue culture as sources of drugs.
3. Classification of drugs: Alphabetical, morphological, taxonomical, chemical and pharmacological.
4. Morphological and Microscopical examination of crude drugs
 - a. Leaf, bark, wood, flower, fruit, seed, stem and root.
 - b. Cell differentiation and ergestic cell contents – the cell wall and plant tissue and tissue system
5. Introduction to Primary and secondary metabolites
6. Study of active constituents of plant: Definition, classification, Properties.
7. Principles related to commercial production of natural products
 - a. Method of cultivation
 - b. Factor influencing cultivation of medicinal plant
 - c. Collection of crude drugs
 - d. Processing and drying of crude drugs
 - e. Storage condition and preservation
 - f. Packaging and labeling
 - g. Plant growth regulators
 - h. Polyploidy, mutation and hybridization with reference to medicinal plants.
8. Quality control of crude drugs – Adulteration and evaluation.

307 – Pharmaceutics – V

Prescriptions: Various parts of prescriptions and their functions, handling of prescription, sources of errors, care required in dispensing procedures including labeling of dispensed products, Preliminary knowledge of important Latin terms used in prescriptions and their translation into English.

2. **Principal and procedures of dispensing prescription:** Principals involved and procedures adopted in dispensing of liquid preparations such as mixtures, solutions, lotions, suspension, emulsion, and liniments, semisolid preparation such as ointment, creams, pastes, jellies and suppositories, solid dosage form such as powder, capsule and effervescent powder, tablet triturates and lozenges, paints, spray, inhalations and poultice.
3. **Incompatibilities :** Definition, study of types of incompatibilities: physical, chemical and therapeutic incompatibilities, inorganic incompatibilities involving metals and their salts, non metal, acid and alkalis, organic incompatibilities involving specific organic salts, pure bases, alkaloids, pyrole derivatives, amino acid, quaternary ammonium compound, carbohydrates, glycosides, sulfonamides, local anesthetic, dyes, surface active agent and vitamins study of example of prescriptions containing incompatibilities and their correction and dispersing method.



309 – Pathophysiology of Common Diseases

1. **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.
2. **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.
3. **Pathophysiology of Common Diseases:** Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, Diabetes, peptic ulcer, asthma, ulcerative colitis, hepatic disorders, acute and chronic renal failure. Tuberculosis, urinary tract infections, sexually transmitted diseases, anemias and common types of neoplasms. Wherever applicable the molecular basis should be discussed.



B. PHARM. (4th SEMESTER)

401 – Pharmaceutical Chemistry – IV (Biochemistry)

1. Biochemical organization of the cell and transport processes across cell membrane.
2. **Bioenergetics:** concept of free energy, redox potential, **electron transport system**, high energy phosphates, oxidative phosphorylations.
3. **Enzymes and Co-enzymes:** classification, kinetics, **Michaelis menton equation**, determination of Km value. **Mechanism of enzymes** action, inhibitors and activators.
4. **Carbohydrate Metabolism:** Glycolysis, TCA cycle, HMP shunt, **Glycogenesis**, Glycogenolysis and uronic acid pathway. Regulation of blood sugar level, carbohydrate metabolic disorder.
5. **Nucleic acids proteins and Nitrogen metabolism :** Purines and pyrimidines biosynthesis and degradation, **structure of DNA its replication genetic code**, mutations, transcriptions and processing of mRNA, Translation, urea cycle, creatine and creatinine, nitrogen balance, **disease related with purines**, pyrimidines and urea metabolism.
6. **Nitrogen and sulphur cycle:** Nitrogen fixation, Ammonia assimilation, nitrification and nitrate assimilation. Sulphur activation, sulphate reduction, incorporation and release if sulphate.
7. **Lipids Metabolism:** Oxidation of fatty acids, **β -oxidation** & energetic, α -oxidation, w-oxidation, , Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, **Control of lipid metabolism**, Essential fatty acids and eicosanoids, phospholipid and sphingolipids.
8. **Biological oxidation:** Redox potential, **Enzymes and Co-enzymes** involved in oxidation reduction and its control. **The respiratory chain**, its role in energy capture and its control.



403 – Pharmaceutics – IV (Unit Operations)

- Fluid Flow:** Types of flow, Renoulds number, Bernoulli's theorem, total energy & total mechanical energy balance, energy losses in Fluid flow, measurement of flow rate, orifice, pitot tube, rotameter.
- Heat Transfer:** Different mechanisms of heat transfer, conduction, Fourier's law, convection, concept of film, overall heat transfer coefficient, heat transfer by radiation, Stefan-boltzman law.
- Corrosion and its prevention:** Introduction, types of corrosion, causes of corrosion, theories of corrosion, methods of prevention of corrosion.
- Size Reduction:** Definition, Objectives of size reduction, mechanism of size reduction. Factors affecting size reduction. Pharmaceutical application of size reduction. Selection of size reduction equipments, Classification of size reduction equipments, Size reduction equipments ball mill, hammer mill, fluid energy mill, and colloid mill.
- Size Separation:** size separation by settling- sedimentation, Standard for powders, sieves.
- Filtration:** Theories of filtration, Factors affecting filter selection. Kozneys equation, Filter media. Filter aids. Classification of filters -filter press, leaf filters, Rotary continuous filters, Meta filters, Membrane filters, industrial centrifugal filters.
- Drying:** Theory of drying, Moisture content and mechanism of drying. Rate of drying, Classification of dryers. Compartment, tunnel, rotary, cylindrical, vacuum, spray, freeze, and fluidized bed dryers.
- Evaporation:** Factors affecting evaporation. Types of evaporators- jacketed kettles, Tube evaporators, Forced circulation evaporators, film evaporators, Factors influencing heat transfer coefficient. Principle and operation of a single and multiple effect evaporators.
- Mixing:** Theory of mixing, solid-solid, solid-liquid, liquid - liquid mixers used in pharmaceutical industry.



405 – Pharmacognosy – II

Systemic Pharmacognostic Study:

1. **Carbohydrate and derived product:** Agar, Guar Gum, Acacia Honey, Isabgol, Pectin, Sterculia and Tragacanth.
2. **Lipids:** Beeswax, Castor oil, Cocoa Butter, Cod-liver oil, Linseed oil, Shark-liver oil and wool fat, Bran oil.
3. **Resins:** Study of Drugs containing Resins and Resin combination like colophonoy, Podophyllum, Cannabis, Capsicum, Balasum of Tolu, Balasum of Peru, Turmeric, Ginger.
4. **Tannins:** Black Catachu, Myrrobalan, Gall, pale catechu, Tannic acid.
5. **Volatile oil:** General methods of obtaining volatile oils from plants, study of volatile oil of Mentha, Coriander, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmrosa, Gaultheria, Sandal wood.
6. **Phytochemical screening**
 - a) **Preparation of extracts:** Introduction, basic principles, conventional methods of extraction i.e. maceration, percolation, infusion, decoction, continuous hot extraction
 - b) Preliminary screening of natural products
 - c) **Chemical test** for the detection of carbohydrates, tannin, alkaloids, glycoside, steroids, saponin, terpenes, and flavonoids
7. **Fibers.** Study of fibers used in pharmacy such as cotton, silk, wool, nylon, glasswool, polyester and asbestos.
8. **Pharmaceutical Aids:** talc, diatomite, kaoline, bentonite, gelatine and natural colors.

407 – Pharmacology – I

1. **General Pharmacology:** Introduction to Pharmacology, sources of drugs. Dosage forms and routes of administration, mechanism of action, factors modifying drug action, tolerance and dependence, pharmacogenetics. Absorption, Distribution, Metabolism and Excretion of drugs. Molecular mechanism of drug action, receptors, dose response relationship, types of drug action, drug interactions. Drug addiction and drug abuse. Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.
2. **Pharmacology of Peripheral Nervous System:** General considerations, Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic receptor and neuron blocking agents, Ganglionic stimulants and blocking agents. Neuromuscular blocking Agents. Local anesthetic Agents.
3. **Drugs acting on Urinary System: Diuretics.**
4. **Autacoids:** Histamine, 5-HT and their antagonists. Prostaglandins, Thromboxanes and Leukotrienes. Pentagastrin, Cholecystokinin, Angiotension, Bradykinin and Substance P.



409 – Hospital Pharmacy

- 1. Organization and structure:** Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist, Pharmacy and therapeutic committee, Budget preparation and implementation.
- 2. Hospital Formulary:** Contents, preparation and revision of hospital formulary.
- 3. Drugs Store Management and Inventory Control:**
 4. Organization of drug store, types of materials stocked, storage conditions.
 5. Purchase and Inventory control - principles, purchase procedures, purchase order, procurement and stocking.
 6. Central Sterile Supply Unit and their Management: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, supply of sterile materials.
 7. Drug Information Services: Sources of information on drugs, disease, treatment, schedules, procurement of information, computerized services (e.g., MEDLINE), retrieval of information, medication error.
 8. Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.
 9. Drug distribution Systems in Hospitals:
 - Out-patient dispensing, methods adopted.
 - Dispensing of drugs to in-patients. Types of drug distribution systems, charging policy, labeling.
 - Dispensing of drugs to ambulatory patients.
 - Dispensing of controlled drugs.
 10. Organisation and structure of retail and whole sale pharmacy.
 11. Introduction to community pharmacy, Role of community pharmacist in health care systems as per prescribed guidelines
 12. Polypharmacy and its implications



B. PHARM. (5th SEMESTER)

501 – Pharmaceutical Chemistry – V (Medicinal Chemistry-I)

1. Basic principle of Medicinal Chemistry, History and development of medicinal chemistry.
2. Physicochemical properties in relation to biological action: Ionization, drug distribution and pka values, hydrogen bonding, protein binding, chelation, isosterism, optical and geometrical isomerism, Types of receptors, drug receptor interaction including signal transduction mechanisms.
3. The following topics shall cover structure, nomenclature classification, synthesis, SAR and metabolism of drugs official in IP & B.P.
 - (i) Antihypertensive drugs
 - (ii) Antiarrhythmic drugs
 - (iii) Antianginal drugs
 - (iv) Diuretic drugs
 - (v) Hypoglycaemic drugs: Insulin and oral hypoglycaemic drugs.
 - (vi) Antihyperlipidemic drugs.
 - (vii) Vasodilators
 - (viii) Cardiotonic agents.

503 – Pharmaceutics – V (Pharmaceutical Technology - I)

1. **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, quality control, storage of capsule dosage forms.
2. **Tablets:** Formulation of different types of tablets, granulation technology on large-scale by various techniques, different types of tablets, equipments employed and evaluation of tablets.
Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablets.
3. **Semisolid Dosage Forms:** Definitions, mechanisms of drug penetration, factors influencing penetration.
(a) **Ointment:** Classification, bases, preparation method, factor, evaluation and packaging.
(b) **Cream:** Classification, preparation, evaluation and packaging.
4. **Suppositories:** Ideal requirements, bases, manufacturing procedure, evaluation and packaging.
5. **Pharmaceutical Aerosols:** Definition, propellants, general formulation, manufacturing, packaging, evaluation methods and pharmaceutical applications.
6. **Packaging of pharmaceuticals.** Types of containers, glass and plastic materials used, closures, packaging of tablets, capsules & parenteral dosage forms, test for containers and closures.



505 – Pharmacognosy – III

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

- (i) Saponins: Liquorice, ginseng, dioscorea, sarsaparilla and senega
- (ii) Cardioactive sterols: Digitalis, squill, strophanthus and thevetia.
- (iii) Anthraquinone cathartics: Aloe, senna, rhubarb and cascara
- (iv) Others: Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia.

2. Studies of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Amla, Kantkari, Satavari, Tylophora, Bhilawa, Kalijiri, Bach, Rasna, Punarnava, chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Arjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gumnema, Shilajit, Nagarmotha, Neem, Tulsi

3. Natural Allergen: Introduction, classification, cause, history, skin test, treatment, inhalant, ingestant, injectant, contactant, infectant, infestant, allergen, plants causing allergy.

4. Study of Natural Pesticide: Introduction, methods and control of pest with special reference to pyrethrum and neem.

5. Pharmaceutical Enzyme- Diastase, Pepsin, Trypsin, Papain and Pancreatin.

507 – Pharmacology – II

Pharmacology of Central Nervous System: General considerations, Alcohol and Disulfiram, General anesthetics. Sedatives, hypnotics, anti-anxiety agents and centrally acting muscle relaxants. Psychopharmacological agents anti psychotics, antidepressants, anti maniacs and hallucinogens. Anti-Epileptic drugs. Anti-Parkinsonian Drugs. C.N.S. stimulants.

2. Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs, Narcotic analgesics and antagonists.

3. **Pharmacology of Cardiovascular System:** General considerations, Digitals and cardiac glycosides, Antihypertensive drugs, Antianginal and Vasodilator drugs. Antiarrhythmic drugs.

4. **Drugs Acting on the Hemopoietic System:** Hematinics, Antihyperlipidemic drugs. Drugs used in the therapy of shock. Anticoagulants, Vitamin K and hemostatic agents.

5. **Drugs Acting on the Respiratory System:** Anti-asthmatic drugs including bronchodilators. Antitussives and expectorants. Respiratory stimulants.



510 – Pharmaceutical Microbiology – II

- Introduction and the scope of microbiology, Structure of bacterial cell, Classification of microbes and their taxonomy, Bacteria and Viruses.
2. Identification of Microbes, stains and types of staining techniques, Preparation and sterilization of media Nutrition, cultivation, isolation of bacteria and viruses, Microbial genetics and variation.
 3. Control of microbes by physical and chemical methods.
 - (a) Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
 - (b) Sterilization, different methods, validation of sterilization methods & equipments.
 4. Sterility testing of Pharmaceutical products as per Indian Pharmacopoeia, Microbial assays of Antibiotics & Vitamins, Immunity, primary and secondary, defensive mechanisms of body, microbial resistance, interferon.
 5. Aseptic techniques: Sources of contamination and methods of prevention, designing of aseptic area, laminar flow equipment, its services and maintenance.
 6. Microbial assay of antibiotics and vitamins.



B. PHARM. (6th SEMESTER)

601 – Pharmaceutical Chemistry-VI

1. **Drug metabolism:** General pathway of drug metabolism including different Types of reaction in phase-I and Phase-II with examples, factors affecting drug metabolism including stereo chemical aspects, significance of drug metabolism in medicinal chemistry.
2. The following topics shall cover structure, nomenclature classification, synthesis, SAR and metabolism of drugs official in I.P. & B.P.
 - (i) Cholinergic agent (Parasympathomimetics)
 - (ii) Cholinergic blocking agents (Parasympatholytics)
 - (iii) Adrenoceptor stimulants (Sympathomimetics)
 - (iv) Adrenoceptor blocking agents (Sympatholytics)
 - (v) Drugs affecting uterine motility
 - (vi) Local anaesthetic drugs
 - (vii) Anticoagulant and antiplatelet drugs.
 - (viii) Antihistaminics.

603 – Pharmaceutical Technology-II

1. **Micro-encapsulation:** Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-acervation, multi orifice, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique, coating pan and other techniques.
2. **Liquid Dosage Forms:** Introduction, additives used in formulations - Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors and flavours. Manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.
3. **Parenteral Products:** Preformulation factors, route of administration, water for injection, pyrogenicity, non aqueous vehicles, isotonicity, methods of adjustment, preparation and evaluation of parenterals.
4. **Surgical Products:** Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc., bandages, adhesive tape, protective cellulosic homeostasis, official dressing, absorbable and non absorbable sutures, ligature and catguts.
5. **Ophthalmic preparations:** Requirements, formulation, methods of preparation, containers and evaluation.



605 – Pharmacognosy-IV

1. Systematic study of source, cultivation, collection, processing, chemical constituents, substitutes, adulterants, uses, macroscopy, microscopy and special chemical test of the following alkaloid containing drugs:

- Pyridine-Piperidine: Areca, Lobelia and Tobacco.
- Tropane: Belladonna, Hyoscyamus, Datura and withania.
- Quinoline and Isoquinoline: Cinchona, Opium, Ipecac.
- Indole: Ergot, Rauwolfia, catharanthus, Nux vomica.
- Imidazole: Pilocarpus.
- Steroidal: Kurchi.
- Alkaloidal amines: Ephedra and Colchicum.
- Glycoalkaloids: Solanum.
- Purines: Coffee, Tea, Cola.

2. Chromatography: Introduction, classification, study TLC, Column, Paper and Electrophoresis chromatographic methods and their application in evaluation of herbal drugs.
3. Biogenetic investigations of basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.
4. Extraction, isolation and chemistry of Glycoside, Lignans, Quassinoids, Flavonoids, Alkaloids and Terpenoids.

607 – Pharmacology-III

1. Drugs Acting on the Gastrointestinal Tract: Antacids, Anti secretory and Anti-Ulcer drugs. Laxatives and Antidiarrhoeal drugs. Appetite Stimulants and Suppressants. Emetics and Anti-emetics. Miscellaneous - Carminatives, Demulcents, Protectives, Adsorbents, Astringents, Digestants, Enzymes and Mucolytics.
2. Pharmacology of Endocrine System: Hypothalamic and pituitary hormones. Thyroid hormones and Anti Thyroid drugs, Parathormone, Calcitonin and Vitamin D. Insulin, Oral Hypoglycemic agents & Glucagon. ACTH and Corticosteroids. Androgens and Anabolic steroids. Estrogens, Progesterone and Oral Contraceptives. Drugs acting on the uterus.
3. Chemotherapy: General Principles of Chemotherapy. Sulfonamides and Clotrimoxazole. Antibiotics- Penicillins, Cephalosporins, Chloramphenicol, Erythromycin and Miscellaneous Antibiotics. Quinolones. Chemotherapy of Tuberculosis, Leprosy, Fungal diseases, Viral diseases. Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy and Immunosuppressive Agents.
4. Gene expression, regulation and gene mapping.
5. Gene therapy: Clinical application of gene therapy, disease target for gene therapy, pharmacokinetic and pharmacodynamic consideration for gene therapy.



609 – Forensic Pharmacy & Ethics

1. Historical Background:
 - a) Drug legislation in India
 - b) Code of Ethics for Pharmacists
2. Pharmacy Act
3. Drug Laws (as amended up to date):
 - a) Drugs and cosmetic Act
 - b) Narcotic Drugs and Psychotropic substance Act, and Rules
 - c) Drugs and Magic Remedies (Objectionable Advertisements) Act
 - d) Medicinal and Toilet Preparations (Excise Duties) Act, Rules
4. Prevention of Cruelty to Animals Act including CPCSEA guidelines
5. Medical termination of pregnancy Act
6. The D. ; (price control) Order
7. AICTE Act
8. Patent Act
9. Factory Act
10. Poison Act

611 – Drug Regulatory Affairs

1. Requirement of Current Good Manufacturing Practices (CGMP).
2. Requirement of Good Laboratory Practices (GLP).
3. Brief review on USFDA guidelines (General drug approval process)
4. The WHO Guidelines – Relevance in international registration.
5. Overview of ISO 9000 Application to Drug and Medical Devices.
6. Documentation- Protocols, Forms and Maintenance of Records in Pharmaceutical Industries, New Drug Approval and Export Registration.
7. Processing and its application Intellectual property rights (Patents, Copy rights and Trademarks).
8. Sewage disposal and Pollution control.

Books and Reference Recommended:

1. Willing, Tuckerman and Hitching, Good Manufacturing Practice for Pharmaceuticals.
2. Bharatha, Drugs and Pharmacy Laws in India.
3. Banker G.S. and Rhodes C.T. Modern Pharmaceutics.
4. Indian Pharmacopoeia
5. British Pharmacopoeia.
6. United States Pharmacopoeia.



B. PHARM. (7th SEMESTER)

(1907-701) – Pharmaceutical Chemistry-VII

The following topics shall cover structure, nomenclature, classification, synthesis, SAR and metabolism of drugs official in IP & B.P

- (i) Sedatives & hypnotics (Including SAR in barbiturates)
- (ii) Anticonvulsants
- (iii) Neuroleptics (Including SAR in Phenothiazines)
- (iv) Antidepressants
- (v) Anxiolytics
- (vi) General anaesthetics
- (vii) Diagnostic agents
- (viii) Preparation, storage and care of Radiopharmaceuticals
- (ix) Vitamins and hormones
- (x) Analgesics: Morphine, codeine, Nalorphine Naloxone, meparidine hydrochloride, Methadone hydrochloride. (with SAR in Morphine)
- (xi) NSAIDS

(1907-702) – Pharmaceutics-VII

1. Introduction to biopharmaceutics and pharmacokinetics and their role in formulation development.
2. Biopharmaceutics:
 - i. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis)
 - ii. Factors influencing absorption- physicochemical, physiological and pharmaceutical.
 - iii. Drug distribution in the body, plasma protein binding.
3. Pharmacokinetics:
 - (a) Significance of plasma drug concentration measurement.
 - (b) Compartment model definition and scope.
 - (c) Volume of distribution and distribution coefficient.
 - (d) Compartment kinetics- one compartment and two compartment model. Determination of pharmacokinetics parameters from plasma and urine data after drug administration by intravascular and oral route, rate constant using Wagner- Nelson and Loo Reigelman method.
 - (e) Curve fitting (method of residuals), regression procedure.
 - (f) Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance.
 - (g) Extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.
4. Clinical Pharmacokinetics: Definition and scope, Dosage adjustment in patients with and without renal and hepatic failure, Pharmacokinetics drug interaction and their significance in combination therapy.
5. Bioavailability And Bioequivalence: Factors affecting bioavailability of drugs, protocol for bioavailability testing, statistical treatment of data.
6. Measure of bioavailability Cmax, Tmax and area under the curve (AUC).



(1907-703) – Pharmaceutical Biotechnology

1. **Introduction:** Brief review on history of biotechnology; traditional and modern biotechnology; biotechnology as an interdisciplinary area; terminologies used in biotechnology; global impact of biotechnology on healthcare.

2. **Recombinant DNA technology:** Chemical and Physical nature of DNA; General principles of DNA replication; tools and techniques of genetic engineering, site directed mutagenesis, polymerase chain reaction and analysis of DNA sequences, gene library; Advantages of producing biotechnological products by recombinant means, Plants and transgenic animals as potential sources of recombinant biotechnological products, Study of biotechnology drugs such as human insulin, Interferons, Human growth hormone, Hepatitis B vaccines, Erythropoietin etc.

3. **Gene Therapy:** brief concept; viral and non viral gene delivery systems; applications in treatment of single gene disorders such as Cystic fibrosis, ADA etc.

4. **Immunology and immunological preparation:** Introduction to immunology: antigen, antibodies, cells and organs of immune system; active and passive immunity; Antigen-antibody reactions and their applications; hypersensitivity; Immunological tolerance; Classification, preparations, standardization and storage of immunologicals: vaccines, antisera, toxoids etc. New generation vaccines such as sub-unit vaccines, DNA vaccines etc.

5. **Hybridoma technology:** Formation and selection of hybrid cells, principles and productions of monoclonal antibodies, commercial, production, characterization, quality control and storage of monoclonal antibodies. Advantages and applications of monoclonal antibodies

(1907-704) – Pharmacology-IV

1. **Principles of Toxicology:** Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning. Heavy metals and heavy metal antagonists. Definition of acute, sub acute and chronic toxicity. Genotoxicity and carcinogenicity, teratogenicity and mutagenicity studies. Applications of isolated organ techniques in toxicology. Techniques in membrane toxicology. Applications of pharmacokinetics in toxicology. Role of analytical toxicology in poisoning management, toxicovigilance and prevention of poisoning.

2. **OECD guidelines for toxicity studies of chemicals.**

3. **Free radicals pharmacology:** Generation of free radicals, role of free radicals in etiopathology of various diseases. Protective activity of certain important antioxidants.

4. **Drug interactions, their types and prevention of drug interaction.** Rationale for drug combination.

5. **Chronopharmacology:** Definition of rhythms and cycles. Biological clock and their significance leading to chronotherapy.



(1907-705) – Pharmaceutical Industrial Management

1. **Concept of management:** Administrative management (Planning Organizing, Staffing, Directing and Controlling), Entrepreneurship development and operative management, (Personnel, Materials, Production, Financial, Marketing). Principles of management (Co-ordination, communication, motivation, decision-making, leadership, innovation, creativity, delegation of authority, responsibility, record keeping).
2. **Pharmaceutical Marketing:** Function, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, department store, multiple shops and mail order business.
3. **Salesmanship:** Principles of sales promotion, advertising, ethics of sales merchandising, literature, detailing, recruitment, training, evaluation and compensation to the pharmacist.
4. **Human resource management (HRM):** Human resource planning, recruitment and interviewing, human skills evaluation through various instruments, job description, job evaluation, role clarity, career planning.
5. **Management of Industrial relations:** Industrial disputes, settlement of disputes through various routes as bargaining.
6. **Productivity and operation management:** Productivity concepts, problems, tools and techniques for improvement.
7. **Marketing concepts,** and analyzing marketing opportunities, marketing strategy, market segmentation, understanding the product and its market, product positioning, launching product, understanding the product manager role, market research, global marketing management.



(1907-706A) – Bioavailability & Therapeutic Drug Monitoring

1. Principles of Drug Dissolution Related to Bioavailability; Dissolution rate; Clearance; Idea of *in vitro* and *in vivo* correlation and its significance.
2. Explanation of terms: Bioavailability (Absolute and Relative), Bioequivalence, and clinical and therapeutic equivalence, pharmaceutical alternative; Purpose and methods of bioavailability studies using blood level and urinary excretion data; Specific requirements.
3. Definition of Pharmacokinetics and introduction to different pharmacokinetic parameters, such as rate constants for absorption and elimination, half-life, apparent volume of distribution, clearance, steady state plasma drug concentrations and factors affecting it; Calculation of Dosage regimen.
4. Therapeutic Drug Monitoring – Individualization of need based Dose regimen; Design of Dosage regimen; Pharmacokinetic evaluation of drug levels; Readjustment of dosage regimen, clinical examples.

Suggested books: Latest editions of-

01. "Modern Pharmaceutics", G.S.Banker and C.T.Rhodes, Marcel Dekker Inc., NY.
02. J.G.Wagner - Fundamentals of Clinical Pharmacokinetics, Drug Information Publications, Hamilton, PA, USA.

(1907-706B) – Drug Design

1. Principles of Drug Design (Theoretical Aspect), Traditional analog and medicinal approaches.
2. Quantitative Structure-activity relationship (QSAR) study.
 - (a) Objectives and Limitation of Quantitative Structure-activity relationship.
 - (b) QSAR Parameters
 - (c) QSAR Methods
 - (d) Substituent constants
 - (e) Linear relationship between Log P and Biological activity
 - (f) Non-Linear relationship between Log P and Biological activity
 - (g) Steric substituent constants
3. Introduction to Graph theory, Applications and Quantum mechanics, Computer in Drug Designing and Molecular Modeling.
4. Preliminary idea of Quantitative Structure Pharmacokinetic relationship (QSPR) in Drug Design.

Suggested books: Latest editions of-

01. C.Hanch, Comprehensive Medicinal Chemistry, Vol. IV, Quantitative Drug Design, Pergamon Press, Oxford, U.K.



B. PHARM. (8th SEMESTER)

(1908-801) – Pharmaceutical Chemistry-VIII

1. Drug Design: Principles of drug design including QSAR.
2. Structure Activity Relationship and drug design
3. Analog approach, mechanism based drug design
4. Brief introduction to computer aided drug design.
5. Discovery and development of new drugs: Random screening, Molecular manipulation, serendipity. Role of preclinical & clinical evaluation in drug development.
6. Prodrugs: Basic concepts and application of prodrug design.
7. The following topics shall cover structure, nomenclature, classification, synthesis, SAR and metabolism of drugs official in I.P. & B.P.
 - (i) Sulphonamides
 - (ii) Anti-tubercular drugs
 - (iii) Antimalarial drugs
 - (iv) Antiprotozoal drugs
 - (v) Antiviral drugs
 - (vi) Anticancer drugs
 - (vii) Antibiotics
 - (viii) Anthelmintic drugs

(1908-802) – Pharmaceutical Analysis-III

The students should be made well acquainted with the use of following techniques as applied to assay of drugs in quality assurance programme.

1. Ultraviolet and Visible Spectrophotometry: Electromagnetic Radiation (EMR), laws of photochemistry, Single and double beam instruments and applications.
2. Infrared Spectroscopy: Principle, Instrumentation, sample handling and applications.
3. Nuclear Magnetic Resonance Spectroscopy: Principle, chemical shift, coupling, Instrumentation & applications, brief Introduction to ¹³C-NMR.
4. Mass Spectroscopy- Principle, Fragmentation rules, Instrumentation and applications.
5. Polarography: Principle, Instrumentation & Applications.
6. Atomic Absorption and Emission Spectroscopy: Principle, relationship between atomic absorption and flame emission spectroscopy, Instrumentation, Interferences & applications.
7. Fluorimetry: Fluorescence and Phosphorescence, Instrumentation and applications.
8. Electron Spin Resonance Spectroscopy: Principle and applications of ESR.



(1908-803) – Pharmaceutics-VIII

1. Preformulation studies

(I) Study of physical properties of drugs like physical form, polymorphism, solubility, salt formation, dissolution and partitioning effects and their influence on formulation, stability and bioavailability of products.

(II) Study of chemical properties like hydrolytic degradation, oxidation, racemization, decarboxylation, polymerization and their influence on formulation and stability of products. Drug substance - excipient interaction study.

2. New Drug Delivery Systems

Importance, Formulation and Applications:

(I) Transdermal Drug Delivery Systems: Concept, Advantages and disadvantages, Approaches used in developing Transdermal drug delivery systems, *in vitro* evaluation of Transdermal drug delivery systems.

(II) Liposomes: Formulation, Preparation of liposomes-physical dispersion and solvent dispersion, Characterisation of Liposomes, Applications in Pharmacy.

(III) Ocular Drug Delivery Systems: Concept, Advantages and disadvantages, Mucoadhesives, design of Ocuserts (Pilo 40 and Pilo 20), Erodable inserts.

(IV) Nanoparticles: A brief introduction to Nanoparticle technology and Nanoparticles as drug carriers in controlled & targeted drug delivery systems.

3. Blood Products and Plasma Substitutes

Classification of blood products; 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 substitute, ideal requirements and large scale preparation of dextran.

4. Cosmetics

(I) Hair care products: Introduction, hair structure, shampoos, conditioners, setting lotion, hair creams, bleaches and hair dyes

(II) Skin care products : Introduction, anatomy and physiology of skin, formulation of skin cleaners, creams, lotions, moisturizers, sun screen products and acne products.

(III) Color cosmetics: Introduction, lip colors, nail polish, face make up and eye make up.

(IV) Dental products: Dentrifices, oral rinses, tooth powder and tooth paste.

(1908-804) – Pharmacognosy-V



(1908-805) – Pharmacology-V

1. **Introduction to Clinical Pharmacy:** Development and scope of clinical pharmacy in India, concept of health care team, role of clinical pharmacist as a member of health care team and his/her important functions.
2. **Basic Concepts of Pharmacotherapy:** Recording of medication history, self medication, nonprescription drug usage, improving patient compliance and providing patient counseling, Clinical Pharmacokinetics and Individualization of Drug Therapy. Drug use during Infancy and in the Elderly (Pediatrics & Geriatrics), Drug use during Pregnancy. Drug induced Diseases. The basics of Drug Interactions, General Principles of Clinical Toxicology, Interpretation of Clinical Laboratory Tests.
3. **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, Infectious Diseases - Tuberculosis, Urinary Tract Infection, Enteric Infections, Upper Respiratory Infections.
4. **Therapeutic Drug Monitoring.**
5. **Concept of Essential Drugs and Rational Drug use.**
6. **Drugs and poison information centers.**
7. **Communication skills, behavioral and interpersonal, with patients and other professional.**

(1908-806) – Project

(1908-807) – Quality Assurance