Department of Chemistry

Publications of faculty of department of chemistry
List of Research Papers Published in National/International Journals
Name of Department: - Chemistry

Faculty Name:- Dr. Anita Rani **Designation:- Assistant Professor**

S.No	Title of Research Papers	Journal Name	Vol. /Issue	ISS N No.	Year of Publication	SCI/SCOPUS/WOS/UGC Care
1	Zahoor Abbas, Manoj Kumar, Hardeep Singh Tuli, Essam M. Janahi, Shafiul Haque, Steve Harake, Kuldeep Dhama, Pallvi Aggarwal, Mehmet Varol, **Anita Rani** and Shashi Sharma. Synthesis, Structural Investigations, and In Vitro/In	molecules	27, 8874 27248874		2022	**SCOPUS**
2	Silico Bioactivities of Flavonoid Substituted Biguanide: A Novel Schiff Base and Its Diorganotin (IV) Complexes.					
3	Thakur M, Chandel M, Sharma A, Rani A, Sharma A, Kumar N. Indian Journal of Advances in Chemical Science.	Indian Journal of Advances in Chemical Science.	10(2):85-99	ISS N NO: 2320-0898 (p); 2320-0928 (e)	2022	Indian Journal of Advances in Chemical Science.
4	Kumari A, Kumar A, Thakur M, Pathania D, Rani A, Sharma A. Murraya Koenigii plant-derived biochar (BC) and lanthanum ferrite (BC/LaFeO3) nano-hybrid structure for efficient ciprofloxacin adsorption from waste water.	Chemistry Africa	6(6):3079-95		2023	Springer
5	Santal AR, Rani R, Kumar A, Sharma JK, Singh NP. Biodegradation and detoxification	Biocatalysis and Biotransform	2;42(1):41-55		2024	

	of textile dyes using a novel bacterium Bacillus sp. AS2 for sustainable environmental cleanup.	ation				

List of Book /Book Chapters Published at National/International Level

Name of Department: - Chemistry

1. **Faculty Name:-Dr. Anita Rani** **Designation:- Assistant Professor**

S.No	Title of Book	ISBN NO	Year	Publisher
1	Rani A, Kumari A, Thakur M, Mandhan K, Chandel M, Sharma A. Bionanocomposite synthesized from nanocellulose obtained from agricultural biomass as raw material.	ISBN13: 9780841297821eISBN: 9780841297814	2022	ACS publications
2	Rani A, Kumari A, Kumar M. Aspects of forest degradation and inventory approaches for forest management.		2023	Academic Press
3	Rani A, Kumar N, Kumar M. Environmentally friendly green approaches and applications of nanoparticles.	9781003323464	2023	CRC Press.
4	Kaur R, Rani A. Incidence and Determinants of Poverty among Rural Labour Households in Punjab.	ISBN:09749071 23220457	2023	Journal of Agricultural Development and Policy.
4	Rani A, Kumar M, editors. Plant Mediated Synthesis of Metal Nanoparticles.	ISBN 978-981-5256-35-2	2024	Bentham Science Publishers

List of Research Papers Presented in National/International Conference

Name of Department:-Chemistry

1. **Faculty Name:- Dr. Anita Rani** **Designation:- Assistant Professor**

S.No	Title of Research Papers	Conference Theme	Conference Date	National/International Conference
1	Rani A, Bhardwaj V. Simulation Based Comparative Study of Routing Protocols in Fanet. Kilby.		2023	ICCS

List of Research Papers Published in National/International Journals

Name of Department:-Chemistry

1. **Faculty Name:- Dr. Manita Thakur** **Designation:- Assistant Professor**

S.No.	Title of Research Papers	Journal Name	Vol. /Issue	ISSN No.	Year of Publication	Sci/Scopus/WOS/UGC care
1	Sharma A, Thakur M, Kumar A, Gautam M, Kumari S, Pathania D, Sharma A. Efficient photodegradation of fast sulphon black and crystal violet dyes from water systems using locust bean gum (LBG)-encapsulated zirconium-based nanoparticles and antibacterial activity.	Nanotechnology for Environmental Engineering.	8(4)	859-77	2023	Springer
2	Chandel M, Thakur M, Sharma A, Pathania D, Kumar A, Singh L. Chlorophyll sensitized (BiO) 2CO3/CdWO4/rGO nano-hybrid assembly for solar assisted photo-degradation of chlorzoxazone.	Chemosphere.	1;305	135472.	2022	Chemosphere.

3	Kumar A, Sharma K, Thakur M, Pathania D, Sharma A. Fabrication of high visible light active LaFeO3/Cl-g-C3N4/RGO heterojunction for solar assisted photo-degradation of aceclofenac.	Journal of Environmental Chemical Engineering	10(4)	108098.	2022	Journal of Environmental Chemical Engineering
4	Thakur M, Chandel M, Sharma A, Rani A, Sharma A, Kumar N. IIndian Journal of Advances in Chemical Science.	Indian Journal of Advances in Chemical Science.	10(2)	ISSN NO: 2320-0898 (p); 2320-0928 (e)	2022	Indian Journal of Advances in Chemical Science.
5	Thakur M, Sharma A, Kumar A, Gautam M, Kumari S. Bio-synthesis of lead oxide nanoparticles using Chinese mahogany plant extract (CMPE@ LO) for photocatalytic and antimicrobial activities..	BioNanoScience	13(4)		2023	Springer
6	Thakur M, Chandel M, Kumar A, Kumari S, Kumar P, Pathania D. The development of carbohydrate polymer- and protein-based biomaterials and their role in environmental health and hygiene.	International Journal of Biological Macromolecules.	1;242:124875.		2023	International Journal of Biological Macromolecules.
7	Thakur M, Chandel M, Rani A, Sharma A, Pathania D. Chemical methods for the treatment of biomedical hazardous waste. InWaste Management and Resource Recycling in the Developing World.	Waste Management and Resource Recycling in the Developing World.	(pp. 521-541).		2023	Elsevier.
8	Kumari A, Kumar A, Thakur M, Pathania D, Rani A, Sharma A. Murraya Koenigii plant-derived biochar (BC) and lanthanum ferrite (BC/LaFeO3) nano-hybrid structure for efficient ciprofloxacin adsorption from waste water.	Chemistry Africa	6(6):3079-95		2023	Springer

9	Thakur M, Sharma A, Kumar A, Gautam M, Kumari S. Bio-synthesis of lead oxide nanoparticles using Chinese mahogany plant extract (CMPE@ LO) for photocatalytic and antimicrobial activities.	BioNanoScience.	13(4):1896-910.		2023	Springer
10	Thakur M, Chandel M, Kumar A, Kumari S, Kumar P, Pathania D. The development of carbohydrate polymer- and protein-based biomaterials and their role in environmental health and hygiene: A review. .	International Journal of Biological Macromolecules	1;242:124875.		2023	Elsevier
11	Devi S, Kumari S, Sharma A, Dhiman M, Thakur M, Kumar A. Boosting the photocatalytic activity of g-C3N4 via loading bio-synthesized Ag0 nanoparticles and imidazole modification for the degradation and mineralization of fluconazole.	Environmental Science and Pollution Research	(10):15851-71		2024	Springer
12	Thakur M, Kumar A, Sharma A, Pathania D. Synthesis of Potato-Starch Based Bio-nanocomposite for the Removal of Trifluralin Under Visible Light Illumination. 2024 May;.	Chemistry Africa.	7(4):1981-93		2024	Springer

List of Book /Book Chapters Published at National/International Level

Name of Department: - Chemistry

2. Faculty Name:-Dr. Manita Thakur **Designation:- Assistant Professor**

1	Thakur M, Chandel M, Rani A, Sharma A. Introduction to biorenewable nanocomposite materials: methods of preparation, current developments, and future perspectives. InBiorenewable Nanocomposite Materials, Vol. 2: Desalination and Wastewater Remediation.	ISBN13: 9780841297807eISBN: 9780841297791	2022	ACS publications
2	Rani A, Kumari A, Thakur M, Mandhan K, Chandel M, Sharma A. Bionanocomposite synthesized from nanocellulose obtained from agricultural biomass as raw material.	ISBN13: 9780841297821eISBN: 9780841297814	2022	ACS publications
3	Rani A, Kumar M, editors. Plant Mediated Synthesis of Metal Nanoparticles.	ISBN 978-981-5256-35-2	2024	Bentham Science Publishers

List of Research Papers Presented in National/International Conference

Name of Department:- Chemistry

Faculty Name:- **Mr. Ajay Sharma** **Designation:-** **Assistant Professor**

S. No.	Title of Research Papers	Journal Name	Vol. /Issue	ISSN No.	Year of Publication	Sci/Scopus/WOS/UGC care
1	Thakur M, Chandel M, Sharma A, Rani A, Sharma A, Kumar N. Indian Journal of Advances in Chemical Science.	Indian Journal of Advances in Chemical Science.	10(2)	ISSN NO: 2320-0898 (p); 2320-0928 (e)	2022	UGC
2	Sharma A, Thakur M, Kumar A, Gautam M, Kumari S, Pathania D, Sharma A. Efficient photodegradation of fast sulphon black and crystal violet dyes from water systems using locust bean gum (LBG)-encapsulated zirconium-based nanoparticles and antibacterial activity.	Nanotechnology for Environmental Engineering.	8(4)	859-77	2023	Springer
3	Thakur M, Chandel M, Rani A, Sharma A, Pathania D. Chemical methods for the treatment of biomedical hazardous waste. InWaste Management and Resource Recycling in the Developing World.	Waste Management and Resource Recycling in the Developing World.	(pp. 521-541).		2023	Elsevier.

List of Book /Book Chapters Published at National/International Level

Name of Department: - Chemistry

3. Faculty Name:-Dr. Anita Rani **Designation:- Assistant Professor**

S.No	Title of Book	ISBN NO	Year	Publisher
1	Rani A, Kumari A, Thakur M, Mandhan K, Chandel M, Sharma A. Bionanocomposite synthesized from nanocellulose obtained from agricultural biomass as raw material. InBiorenewable Nanocomposite Materials, Vol. 1: Electrocatalysts and Energy Storage 2022 (pp. 47-74).	ISBN13: 9780841297821eISBN: 9780841297814	20 22	ACS publications

List of Research Papers Presented in National/International Journal

Name of Department:- Chemistry

Faculty Name:- **Dr. Deepika Sharma** **Designation:-** **Assistant Professor**

S. No.	Title of Research Papers	Journal Name	Vol. /Issue	ISSN No.	Year of Publication	Sci/Scopus/WOS/UGC care
1	Tea-waste-derived charcoal as an efficient adsorbent for the removal of rhodamine B.	Biomass Conversion and Biorefinery.	4:1-11	2190-6815	2023	Springer

Syllabus to be updated on website

SCHEME &SYLLABUS

OF

BACHELOR OF SCIENCE IN PPHARMACEUTICAL CHEMISTRY

SCHOOL OF BASIC & SCIENCES
I.E.C UNIVERSITY, BADDI, SOLAN
HIMACHAL PRADESH,
PIN-174103, INDIA

Program Structure B. Sc. Pharmaceutical Chemistry

B.Sc. Pharmaceutical Chemistry Three Years Programme Curricula												
First Semester			Periods			Internal				Ext		
S. No.	Sub Code	Subject	L	T	P	CA	MST	P	Total	Total	Sub Total	Credits
1.	BPCH-101	Introduction to Pharmaceutical Sciences	3	0	0	20	40	0	60	40	100	3
2.	BPCH-102	Pharmaceutical Chemistry-I	3	0	0	20	40	0	60	40	100	3
3.	BPCH-103	Physical Chemistry	3	0	0	20	40	0	60	40	100	3
4.	BPCH-104	Industrial Safety and Environmental Sciences	3	0	0	20	40	0	60	40	100	3
5.	BPCH-105	Project-I	0	0	20	0	0	50	50	50	100	10
6	BPCH-151-P	Pharmaceutical Chemistry-I Lab	0	0	4	0	0	30	30	20	50	2
Total			12	0	24	80	160	80	320	230	550	24

B.Sc. Pharmaceutical Chemistry Three Years Programme Curricula					
Second Semester	Periods	Internal	Ext		

S. No.	Sub Code	Subject	L	T	P	CA	MST	P	Total	Total	Sub Total	Credits
1.	BPCH-201	Physical Pharmaceutics-I	3	0	0	20	40	0	60	40	100	3
2.	BPCH-202	Chemistry of Natural Products	3	0	0	20	40	0	60	40	100	3
3.	BPCH-203	Pharmaceutical Microbiology	3	0	0	20	40	0	60	40	100	3
4.	BPCH-204	Pharmaceutical Analysis-I	3	0	0	20	40	0	60	40	100	3
5	BPCH-205	Project-II	0	0	20	0	0	50	50	50	100	10
6	BPCH-251 P	Physical Pharmaceutics-I Lab	0	0	4	0	0	30	30	20	50	2
Total			12	0	24	80	160	80	320	230	550	24

B.Sc. Pharmaceutical Chemistry Three Years Programme Curricula

Third Semester			Periods			Internal				Ext		
S. No.	Sub Code	Subject	L	T	P	CA	MST	P	Total	Total	Sub Total	Credits
1.	BPCH-301	Pharmaceutical Operation-I	3	0	0	20	40	0	60	40	100	3
2.	BPCH-302	Pharmaceutical Chemistry-II	3	0	0	20	40	0	60	40	100	3
3.	BPCH- 303	Physical Pharmaceutics-II	3	0	0	20	40	0	60	40	100	3
4.	BPCH-304	Pharmaceutical Regulatory Affairs	3	0	0	20	40	0	60	40	100	3
5.	BPCH-305	Project-III	0	0	20	0	0	50	50	50	100	10
6.	BPCH-351-P	Pharmaceutical Operation-I Lab-II	0	0	4	0	0	30	30	20	50	2
Total			12	0	24	80	160	80	320	230	550	24

B.Sc. Pharmaceutical Chemistry Three Years Programme Curricula												
Fourth Semester			Periods			Internal				Ext		
S. No.	Sub Code	Subject	L	T	P	CA	MST	P	Total	Total	Sub Total	Credits

1.	BPCH-401	Physiology and Pharmacology-I	3	0	0	20	40	0	60	40	100	3
2.	BPCH-402	Biochemistry	3	0	0	20	40	0	60	40	100	3
3.	BPCH-403	Pharmaceutical Process-I	3	0	0	20	40	0	60	40	100	3
4.	BPCH-404	Industrial Pharmacy & Packaging Technology	3	0	0	20	40	0	60	40	100	3
5.	BPCH-405	Project-IV	0	0	20	0	0	50	50	50	100	10
6	BPCH-451-P	Physiology and Pharmacology-I lab	0	0	4	0	0	30	30	20	50	2
Total			12	0	24	80	160	80	320	230	550	24

B.Sc. Pharmaceutical Chemistry Three Years Programme Curricula

Fifth Semester			Periods			Internal				Ext		
S. No.	Sub Code	Subject	L	T	P	CA	MST	P	Total	Total	Sub Total	Credits
1.	BPCH-501	Medicinal Chemistry-I	3	0	0	20	40	0	60	40	100	3
2.	BPCH-502	Pharmaceutical Analysis-II	3	0	0	20	40	0	60	40	100	3
3.	BPCH-503	Pharmaceutical Quality Assurance	3	0	0	20	40	0	60	40	100	3
4.	BPCH-504	Pharmaceutical Process-II	3	0	0	20	40	0	60	40	100	3
5.	BPCH-505	Project-V	0	0	20	0	0	50	50	50	100	10
6	BPCH-551-P	Medicinal Chemistry-I lab	0	0	4	0	0	30	30	20	50	2
7	BPCH-552-P	Pharmaceutical Analysis-II Lab	0	0	4	0	0	30	30	20	50	2
Total			12	0	28	80	160	110	350	250	600	26

B.Sc. Pharmaceutical Chemistry Three Years Programme Curricula

Sixth Semester			Periods			Internal				Ext		
S. No.	Sub Code	Subject	L	T	P	CA	MST	P	Total	Total	Sub Total	Credits
1.	BPCH-601	Dosage Form Design	3	0	0	20	40	0	60	40	100	3

2.	BPCH-602	Medicinal Chemistry-II	3	0	0	20	40	0	60	40	100	3
3.	BPCH-603	Pharmaceutical Operation-II	3	0	0	20	40	0	60	40	100	3
4.	BPCH-604	Pharmaceutical Operation Management	3	0	0	20	40	0	60	40	100	3
5.	BPCH-605 P	Project-VI	0	0	20	0	0	50	50	50	100	10
6	BPCH-651 P	Dosage Form Design Lab	0	0	4	0	0	30	30	20	50	2
7	BPCH-652 P	Medicinal Chemistry-II Lab	0	0	4	0	0	30	30	20	50	2
Total			16	0	28	80	160	110	350	250	600	26

Note: L= Lecture, T = tutorial, P = Practical, CA = Class assessment, MST = Mid sem test, Ext = External.

B.Sc. Pharmaceutical Chemistry 1st Year			
Semester-1st	**L**	**T**	**C**
	3	0	0
Course Code: BPCH-101	Course Title: Introduction to Pharmaceutical Sciences		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT- I

Orientation and historical background of pharmacy profession: Pharmacy as a career, Pharmacy Profession: History of Pharmacy in India, Pharmaceutical education in India and abroad. Official books: Introduction to official compendia with emphasis on Indian pharmacopeias, British Pharmacopeias and United State Pharmacopeias

UNIT II

Routes of Drug Administration: Need for dosage forms, therapeutic consideration in dosage form designing. Routes of drug administration and dosage forms for oral, rectal, parenteral, subcutaneous, ocular, optic and nasal route. Introduction to different dosage forms, their classification with examples:

UNIT- III

Definitions of solid dosages form like powders and granules, dentifrices, capsules and tablets, liquid orals like solutions, aromatic waters, syrups, spirits, elixirs, glycerine, lotions, liniments, gargles, mouth washes, douches, draught preparation, sterile products like injectables, implants, ophthalmic formulations and semi solid products, solutions for external use- suppositories.

UNIT- IV

Important terminologies in Pharmacy: Definitions and examples. Introduction to Quality Control: Significance of quantitative analysis in quality control, Different techniques of analysis.

Suggested Books

- Allen LV, Popovich NG, Ansel HC. Pharmaceutical Dosage Forms and Drug Delivery. Lippincott Williams and Wilkins.
- Carter SJ. Cooper and Goon's Tutorial Pharmacy. CBS Publishers and Distributors.
- Carter SJ. Dispensing for Pharmaceutical Students. CBS Publishers and Distributors.
- Rowe R, Sheskey P, Quinn ME. Handbook of Pharmaceutical Excipients. Pharmaceutical Press.

B.Sc. Pharmaceutical Chemistry 1st Year			
Semester-1st	**L**	**T**	**C**
	3	0	0
Course Code: BPCH-102	Course Title: Pharmaceutical Chemistry-I		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-1

Acid-base concept and Buffers: Arrhenius concept, Bronsted Lowry concept and Lewis concept. Buffer action, buffer capacity and pharmaceutical applications of buffers. Gastrointestinal agents: Acidifying agents, antacids, cathartics, emetics and antimicrobial agents. Major Intra and extra cellular electrolytes: Major physiological ions, electrolytes used in replacement therapy, physiological acids-base balance, electrolytes used in acid-base therapy, electrolyte combination therapy.

UNIT-II

Essential and trace ions: Copper, zinc, chromium, manganese, molybdenum, selenium, sulphur and iodine. Miscellaneous inorganic pharmaceutical agents: Inhalants; respiratory stimulants, expectorants, poison and antidote and pharmaceutical aids. Aromatic Compounds: Structure and resonance of benzene, aromatic character, mechanism of electrophilic aromatic substitution, orientation effects in electrophilic substitution, nucleophilic aromatic substitution.

UNIT-III

Preparation, properties and actions of: Phenols, carboxylic acids, amines, diazonium salts, aryl halides and ketones. Poly nuclear aromatic hydrocarbons: Naphthalene, phenanthrene and anthracene.

UNIT-IV

Heterocyclic compounds: Study of fundamentals of heterocyclics, nomenclature, methods of synthesis and important chemical reactions of the following: (a) Five-membered heterocycles: Furan, thiophene, pyrrole, thiazole, oxazole, imidazole, pyrazole, triazole and tetrazole; (b) Six-membered heterocycles: Pyridine, pyridazine, pyrimidine, pyrazine. Benz-fused heterocycles:

Quinoline, isoquinoline, indole.

Suggested Books

- Chaudhary NC, Gurbani NK. Pharmaceutical Chemistry 1. Vallabh Prakashan.
- Nadendla RR. Pharmaceutical Organic Chemistry (Part I). Vallabh Prakashan.
- Nadendla RR. Pharmaceutical Organic Chemistry (Part II). Vallabh Prakashan.

B.Sc. Pharmaceutical Chemistry 1st Year			
Semester-1st	**L**	**T**	**C**
	0	0	2
Course Code: BPCH-151P	Course Title: Pharmaceutical Chemistry-I Lab		
Max Marks: 30+20	Time: 3H		

1. Limit tests for impurities in Pharmacoepial compounds.
2. Quantitative/Qualitative analysis: Assay of the following compounds will be done: solution of ammonia, boric acid, sodium bicarbonate, sodium carbonate, ferrous sulphate, strong and weak iodine solutions, copper sulphate, chlorinated lime, sodium chloride, ammonium chloride, sodium sulphate, calcium gluconate, magnesium sulphate, arsenic trioxide, bismuth oxychloride, and bismuth subnitrate.

Reference text:

- Beckett AH, Stenlake JB. Practical Pharmaceutical Chemistry. The Athelone Press.
- Singh HK, Kapoor VK. Practical Pharmaceutical Chemistry. Vallabh Prakashan.

B.Sc. Pharmaceutical Chemistry 1st Year			
Semester-1st	**L**	**T**	**C**
	3	0	0
Course Code: BPCH-103	Course Title: Physical Chemistry		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage

of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-I

Thermodynamics: Preliminary and definitions of systems, surrounding, macroscopic properties and state variables, thermodynamic equilibria, extensive and intensive properties, first law of thermodynamics, internal energy and first law, enthalpy of system, heat capacity, correlation between Cp and Cv for an ideal gas. Work done on reversible isothermal expansion of an ideal gas. Adiabatic expansion of an ideal gas, work of expansion, internal energy change and enthalpy change. Comparison of isothermal and adiabatic changes. Limitations of first law and need of second law.

UNIT-II

Cyclic process, Carnot cycle, definition of second law of thermodynamics, spontaneous process. Concept of entropy, entropy change accompanying change of phase, entropy changes in reversible and irreversible processes. Absolute entropy, determination of absolute entropy with the help of third law of thermodynamics. Applications of thermodynamics. Solutions: Solutions of liquids in liquids, ideal and real solutions, colligative properties of dilute solution, lowering of vapor pressure of non-volatile solute, osmosis and osmotic pressure in terms of chemical potential, Vant-Hoff equation for osmotic pressure of dilute solutions, elevation of boiling point and depression in freezing point by a non-volatile solute, determination of molar mass from vapor pressure lowering, osmotic pressure, boiling point elevation and freezing point depression, Solute distributing in immiscible solvent, distribution coefficient, conditions for validity of distribution law and the thermodynamic derivation, biological applications.

UNIT-III

Electrochemistry: Electrode potential, Nernst equation, standard potential, standard hydrogen electrode, reference electrodes, indicator electrodes. Potentiometry: Theoretical consideration, ion-selective electrodes, measurement of potential, location of the end point, equipment, analytical applications, differential curves, determination of Ksp, pH measurements, dead-stop titrations; pH meter, pH definition, equipment, applications. Kinetics: Reaction Rate: Rate and rate constant, order and molecularity, zero, first and second order reactions, half life time, integration of rate expressions, methods of determining order of a reaction, effect of temperature on reaction rates, Arrhenius equation. Concept of steady state approximation, activation energy, energy barrier. Collision and activated complex theory of bimolecular reactions.

UNIT-IV

Catalysis: Characteristics of catalyzed reactions; definition of the terms, autocatalysis, negative catalysis, inhibitors, promoters, homogeneous and heterogeneous catalysis, acid base catalysis and its mechanism, enzyme catalysis, Michaelis Menten equation, turn over number, the Line Weaver-Burk method. Photochemistry: Introduction, consequences of light absorption, the Jablonski diagram, Lambert Beer law, Grothus Draper law, the Stark-Einstein law of Photochemical equivalence, Quantum efficiency of quantum yield, Photochemical reaction.

Suggested Books

- Laidler KJ. Physical Chemistry with Biological Applications. Benjamin.
- Puri BR, Sharma LR, Pathania MS. Principles of Physical Chemistry. Vishal Publishing.
- Bahl BS, Tuli GD, Bahl A. Essentials of Physical Chemistry. S. Chand Publishers.

B.Sc. Pharmaceutical Chemistry 1st Year			
Semester-1st	**L**	**T**	**C**
	3	0	0
Course Code: BPCH-104	Course Title: Industrial Safety and Environment Sciences		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-I

Personal Basics and Chemical Safety: PPE, Compatibility Matrices, MSDS, Waste Management, Storage Concerns, Safety measures in handling and storage of chemicals, Fire chemistry and its control, Safety color codes of chemicals. Hazard Classification: Hazard Classification chemical, physical, mechanical, ergonomics, biological and noise hazards, Hazards from utilities like air, water, steam.

UNIT-II

Process Safety: Process Regulation Via Controls, Runaway Reactions, Vents and Valves, Licencing, Plant Design/Layout, Energetic Concerns (Explosions), Spill Clean-Up, Accident Analysis, Utilities Management, Safety in plant design and layout, Safety provisions in the factory act 1948, Indian explosive act 1884, ESI act 1948. Risk Management: Overall risk analysis, Methods for determining consequences effects: Effect of fire, Effect of explosion and toxic effect, Emergency Planning, First aids.

UNIT-III

Environmental Pollution: Definition; Causes, effects and control measures of air, water, soil, marine, noise, thermal, and nuclear pollution; Solid waste management, Role of an individual in prevention of pollution, Disaster management. Social Issues and the Environment: From unsustainable to sustainable development, Urban problems and related to energy, Water conservation, Rain water harvesting, Watershed management, Resettlement and rehabilitation of people, Environmental ethics, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation, Consumerism and waste products, Acts (EPA, Water, Air, Wildlife and Forest conservation)

UNIT-IV

Environmental legislation. Human Population and the Environment: Population growth and explosion, Environment and human health, Human Rights, Value Education, HIV / AIDS, Family, Women and Child Welfare, Role of Information Technology in Environment and Human Health.

Suggested Books

- Blake RP. Industrial Safety. Prentice Hall.
- Lees FP. Loss Prevention in Process Industries: Hazard Identification, Assessment and Control. Butterworth Heinemann.
- Bharucha E. Textbook of Environmental Studies for Undergraduate Courses. Universities Press.

Semester II

B.Sc Pharmaceutical Chemistry 1st Year			
Semester-II	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-201	Course Title: **Physical Pharmaceutics-I**		
Max Marks: 60+40	Time: 3H		

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each. Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks

UNIT – I

Ideal Gases: Behaviour of ideal gases, Application of ideal gas law, Vapor pressure, Effect of temperature on vapor pressure, Properties of Miscible and Immiscible Liquids, Solutions.
Matter and Properties of Matter: State of matter, change in the state of matter, latent heats and vapour pressure, sublimation-critical point, Eutectic mixtures, gases, aerosols - inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids crystalline, amorphousandpolymorphism.

UNIT –II

MicromereticsandPowderRheology:Particlesizeand 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.

UNIT – III

Viscosity and Rheology: Newtonian systems, laws of flow, cinematic viscosity, effect of temperature on flow and viscosity. Determination of viscosity, capillary, falling ball, and rotational viscometers. Non-Newtonian systems, pseudoplastic and plastic systems. Thixotropy in formulations. Rheological properties of emulsions, and theory of emulsification.

UNIT – IV

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

Book (s) Recommended:

- Lachman L, Lieberman HA, Kanig JL. The Theory & Practice of Industrial Pharmacy. Varghese PublishingHouse.
- Sinko PJ. Martin's Physical pharmacy & Pharmaceutical sciences, B.I. Publications Pvt. Ltd.
- Subhramanyam CVS. Textbook of Physical Pharmaceutics, Vallabh Prakashan, New Delhi.
- Remington's The Science & Practice of Pharmacy Mack Publishing Co. Easton,PA.

	B.Sc Pharmaceutical Chemistry 1st Year			
Semester-II	**L**	**T**	**P**	**C**
	0	0	4	2
Course Code: BPCH-251 P		Course Title: **Physical Pharmaceutics-I Lab**		
Max Marks: 30+20		Time: 3H		

Determination of particle size, particle size distribution and surface area using various methods of Particle size analysis.
Determination of derived properties of powders like densities, porosities, compressibility, angle of repose.
Study of rheological properties of various types of systems using different Viscometers.
Preparation of various types of suspensions and determination of their sedimentation parameters.
Preparation and stability studies of emulsions.
Studies on different types of complexes and determination of their stability constants.
Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
Preparation of pharmaceutical buffers and determination of buffer capacity. Experiments involving tonicity adjustments.

Book (s) Recommended:

- Carter SJ. Cooper and Gunn's Tutorial Pharmacy. CBS Publishers &Distributors.
- Remington's The Science & Practice of Pharmacy Mack Publishing Co. Easton,PA.
- Gaud RS, Gupta GD. Practical Physical Pharmacy. CBS Publishers &Distributors.

Subhramanyam CVS. Textbook of Physical Pharmaceutics. VallabhPrakasha

B.Sc Pharmaceutical Chemistry 1st Year			
Semester-II	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-202	Course Title: **Chemistry of Natural Products**		
Max Marks: 60+40	Time: 3H		

THEORY

UNIT – I

Chemical and spectral approaches to characterize molecules of natural origin. Concept of stereoisomerism taking examples of natural products.

UNIT – II

Chemistry and pharmacological activity of following medicinally important terpenoids: Monoterpenes, sesquiterpenes, diterpenes and triterpenoids. Carotenoids: a- carotenoids, b-carotenes, vitamin A.

UNIT – III

Glycosides: Chemistry, pharmacological activity of digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin. Alkaloids: Chemistry, and pharmacological activity of atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids.

UNIT – IV

Chemistry and pharmacological activity of medicinally important lignans and quassinoids, flavonoids and xanthophylls. Chemistry and therapeutic activity of penicillin, streptomycin andtetracycline.

Book (s) Recommended:

- Trease GE, Evans WC. Pharmacognosy. Elsevier India Pvt. Ltd.
- Aggarwal OP. Organic Chemistry Natural Products - Vol. I. KrishanPublishers.
- Aggarwal OP. Organic Chemistry Natural Products - Vol. II. KrishanPublishers.

B.Sc Pharmaceutical Chemistry 1st Year			
Semester-II	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-203	Course Title: **Pharmaceutical Microbiology**		
Max Marks: 60+40	Time: 3H		

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each. Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks

UNIT-I

Introduction: Biochemical organization of the cell and transport process across cell membrane. Historical development and scope of pharmaceutical microbiology, Structure of Bacterial Cell. Identification of microbes: Stains and types of staining techniques, electron microscopy. Nutrition, cultivation and Isolation: Bacteria, Actinomycetes, Fungi and Virus.

UNIT-II

Microbial genetics and variation: Structure of gene, genetic code, transcription, translation, mutation and regulation of gene expression, bacterial enzymes. 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.

UNIT-III

Control of Microbes: Physical and chemical methods: (a) 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, antisepsis and preservation with their full description & use. (b) Principles and Practice of sterilization methods: Introduction, sensitivity of microorganisms, 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.

UNIT-IV

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. Sterility Testing: Methods and media used with emphasis of the specific details of the sterility testing of parenterals and ophthalmics and other non injectable preparations such as catgut etc. Immunity: Primary and secondary, defensive mechanisms of body, microbial resistance, interferon.

Book (s) Recommended:

- Hugo and Russel. Pharmaceutical Microbiology. BlackwellScientific.
- Prescott LM, Harley GP, Klein DA. Microbiology. V.C. BrownPublishers.

- Pelczar MJ, Chan ECS, Krieg NR. Microbiology. Tata McGrawHill.
- Ananthanarayan R, Panikar CKJ. Textbook of Microbiology. Orient Longmann.
- Gupte S. The short textbook of Medical Microbiology. JaypeeBrothers.

B.Sc Pharmaceutical Chemistry 1st Year			
Semester-II	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-204	Course Title: **Pharmaceutical Analysis-I**		
Max Marks: 60+40	Time: 3H		

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each. Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks

UNIT-I

Acid Base Titrations: Acid base concept, role of the solvent, Relative strengths of acids and bases; Law of mass action; common-ion effect, ionic product of water, pH, Hydrolysis of salts, Handerson – Hesselbach equation; Buffer and buffer capacity: Acid base indicators, Theory of indicators, Choice of indicators; Neutralization curves (Strong acid and strong base, strong acid weak base, weak acid strong base and weak acid weak base) Polyprotic system, dissociation calculations for polyprotic acids, fractions and equilibrium concentrations of dissociating species at a given pH, salts of polyprotic acids, (Amphoteric salts and unprotonated salts), Buffer calculations for polyprotic acids, titrations of polyprotic acid, amino acid system and its titrations. Application in assay of H_3B0_3, HCl, H_3P0_4, NaOH and Na_2B0_3.

UNIT-II

Oxidation-Reduction Titrations: Concepts of oxidation and reduction, redox reactions, equivalent weights of oxidizing and reducing agents, electrochemical cells, reduction potential, standard reduction potential, Nernst equation, cell representations, measurement of electrode potential and its application in determining the equilibrium constant of a reaction, concept of formal potential, oxidation reduction curves, redox indicators, potassium permanganate titrations, iodimetry and iodimetry, ceric sulphate titrations, potassium iodate titrations, sodium 2, 6- dichlorophenol - indophenol titrations, pharmaceutical applications.

Precipitation Titrations: Precipitation reactions, solubility product, effects of common ion, acids, temperature and solvent upon the solubility of a precipitate, conditional solubility product, fractional precipitation, argentiometric titrations, ammonium or potassium thiocyanate titrations, mercuric nitrate titrations, indicators, Gay- Lussac method, Mohr's method, Volhard's method, Fajan's method, Pharmaceutical applications.

UNIT-III

Gravimetric Analysis: Precipitation techniques, the colloidal state, gravimetric factor, super saturation, co precipitation and its types, Post precipitation, digestion, washing of the precipitate, filtration, filter papers and crucibles, ignition, thermo gravimetric curves of copper sulphate, specific examples like barium as barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants. Phase Solubility Analysis: Theory, experimental procedures, applications in Pharmaceutical analysis.

UNIT-IV

Chromatography: Various principles of chromatography including adsorption, partition, ion exchange, size exclusion, gel and other methods. Gas chromatography: Introduction; Principles of gas chromatography, basic GLC apparatus, carrier gases; sample introduction, column, column efficiency, solid support, liquid phases, branches of gas chromatography; Detectors, temperature effect; HPLC: Introduction and methods for qualitative and quantitative analysis usingHPLC.

Book (s) Recommended

- Mendham J, Denney RS, Barnes JD, Thomas MJK. Vogel's Textbook of Quantitative chemical analysis. Addison Wesley LongmanLtd.
- Chatwal GR, Anand SK. Instrumental Methods of Chemical Analysis. Himalaya PublishingHouse.
- Kamboj PC. Pharmaceutical Analysis Volume I, II & III, VallabhPrakashan.
- **Pharmaceutical Operation**Ravi Shankar. Textbook of Pharmaceutical Analysis. RXPublisher.
- Kasture AV, Mahadik KR. Pharmaceutical Analysis, Vol-I & II. NiraliPrakashan.

B.Sc Pharmaceutical Chemistry 2nd Year			
Semester-III	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-301	Course Title: **-1**		
Max Marks: 60+40	Time: 3H		

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each. Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

Unit-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: Liquid handling- Different types of pumps. Gas handling- Various types of fans, blowers and compressors. Efficiency test of Air compressor. Solid handling- Bins, Bunkers, Conveyers, Air transport.

Unit-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. 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, principles of humidity and humidity control.

Unit-III

Refrigeration and Air Conditioning: Principles and applications of refrigeration and air conditioning HVAC system, Type of Air filters, AHU, Ventilation units, dry & wet scrubbers, dust extraction system, Filtration concepts, clean room classification as per ISO14644. 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.

Unit-IV

Temperatures and Its Measurements- Concept of Heat, Temperature and its Measurements, Liquid Thermometers and Mercury Thermometers, Bimetallic Thermometers, Platinum Resistance Thermometers, Thermoelectric Thermometers, Pyrometers, Factors for Selection of Thermometers for Particular Use, Temperature Range and Comparison of Various Thermometers. Vacuum Science and Technology- Introduction to Vacuum Technology, Physical Parameters at Low Pressure, Classification of Vacuum Ranges, General Idea of Vacuum Pump and System, Classification of Vacuum Pumps, Exhaust Pumps and their

Characteristics, Measurements of Low Pressure.

Book (s) Recommended:

- Badger WL, Banchero JT. Introduction to Chemical Engineering. McGraw Hill,London.
- McCabe WL, Smith JC, Harriolt P. Unit Operations of Chemical Engineering. McGraw Hill,London.
- Badger WL, Banchero JT. Introduction to Chemical Engineering. McGraw Hill InternationalBook.
- Subrahmanyam CVS. Pharmaceutical Engineering: Principles and Practices. Vallabh Prakashan, NewDelhi.
- Hadkar UB. Practical Physical Pharmacy & Physical Pharmaceutics. NiraliPrakashan.

	B.Sc Pharmaceutical Chemistry 2nd Year			
Semester-III	**L**	**T**	**P**	**C**
	0	0	4	2
Course Code: BPCH-351-P		Course Title: **Pharmaceutical Operation-I lab**		
Max Marks: 30+20		Time: 3H		

Measurement of flow of fluids and their pressure, determination of Reynold's number and calculation of Frictional losses.

Evaluation of filter media, determination of rate of filtration and Study of factors affecting filtration.

Experiments to demonstrate applications of centrifugation.

Thermometers and Psychometric charts.

Determination of humidity-use of Dry Bulb and Wet Bulb.

Workshop practice of basic maintenance &mechanics.

Book (s) Recommended:

- Prager G. Practical Pharmaceutical Engineering. John Wiley &Sons.
- Hadkar UB. Practical Physical Pharmacy & Physical Pharmaceutics. NiraliPrakashan.
- Gaud RS, Gupta GD. Practical Physical Pharmacy. CBS Publishers & Distributors, New Delhi.
- Kasture PV, Paradkar AR, Parakh SR, Gokhale SB. Practical Pharmaceutics- II. Nirali Prakashan.

B.Sc Pharmaceutical Chemistry 2nd Year

Semester-III	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-302	Course Title: **Pharmaceutical Chemistry-II**		
Max Marks: 60+40	Time: 3H		

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each. Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks

Unit-I

Structure and Properties: Organic chemistry, structural theory, chemical bond, quantum mechanics, atomic orbitals, electronic configuration, molecular orbitals, bond lengths, bond angles, bond energy, polarity of bonds, polarity of molecules, dipole moment, structure and physical properties including melting point, boiling point and solubility, acidity and basicity, isomerism.

Unit-II

Aldehydes and Ketones: Nomenclature of aldehydes and ketones (carbonyl compounds), preparation of aldehydes and ketones. Reactions of aldehyde and ketones: Oxidation, reduction, addition of Grignard reagents, Cannizaro reaction.

Alcohol, Ethers and Role of the Solvent: Nomenclature, methods of preparation, physical properties and chemical reactions. Role of Solvent: Secondary bonding, solubility of non-ionic and ionic solutes, protic and aprotic solvents, ion pairs, role of solvent in substitution reactions, phase-transfer catalysis.

Alkanes: Nomenclature of straight and branched chain alkanes and alkyl groups, classification of carbon atoms of alkanes, isomerism, sources, methods of preparation, physical properties and chemical reactions. Mechanism of free radical halogenation of alkanes, orientation, reactivity and selectivity, chlorofluorocarbons and ozone layer.

Unit-III

Stereochemistry of Organic Compounds: Stereoisomers, enantiomers, diastereoisomers, optical activity, chiral centre, racemic modification, meso-structures, configuration, reactions involving stereoisomers, stereoselective and stereospecific reactions. Geometric isomers, conformational isomers, configurational isomers, conformational analysis of ethane and n-butane, conformations of cyclohexanes, axial and equatorial bonds, Newman projections, Fischer and Wedge formula. Relative and absolute configuration, sequence rules, D &L, R & S and E & Z system of nomenclature.

Unit-IV

Proteins and Nucleic Acid: Structure of amino acids, amino acids as dipolar ions, isoelectric point, configuration of natural amino acids, preparation and reactions of amino acids, peptides, geometry of peptide linkage, determination of structure of peptides, terminal residue analysis, partial hydrolysis, synthesis of peptides, classification, functionand denaturation of proteins, structure of proteins, peptide chain, side chains, electrophoresis, conjugated proteins, coenzymes, secondary structure of proteins.

Book (s) Recommended:

- Morrison RT, Boyd RN. Organic Chemistry. Prentice-Hall of India, Pvt. Limited, New Delhi.
- Solomens G, Fryhle C, Johnson R. Organic Chemistry. Wiley(Singapore).
- Smith MB, March J. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure.Wiley.

B.Sc Pharmaceutical Chemistry 2nd Year			
Semester-III	**L**	**T**	**C**
	4	0	4
Course Code: BPCH- 303	Course Title: **Physical Pharmaceutics-II**		
Max Marks: 60+40	Time: 3H		

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each. Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

Unit-I

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.

Unit-II

Dispersion Systems: Colloidal Dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy.

Unit-III

Suspensions: 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.

Unit-IV

Emulsions-types, theories, physical stability. Solubility of drugs: (a) Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, quantitative approach to the factors influencing solubility of drugs, Dissolution & drug release, diffusion principles in biological systems. (b) Solubility of gas in liquids. (c) Solubility of liquids in liquids, (Binary solutions, ideal solutions). (d) Distribution law, its limitations andapplications.

Book (s) Recommended:

- Sinko PJ. Martin's Physical pharmacy & Pharmaceutical sciences, B.I. Publications Pvt. Ltd.
- Subhramanyam CVS. Textbook of Physical Pharmaceutics, Vallabh Prakashan, New Delhi.
- Troy DB, Beringer P. Remington's The Science & Practice of Pharmacy. Mack Publishing Co. Easton,PA.

B.Sc Pharmaceutical Chemistry 2nd Year			
Semester-III	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-304	Course Title: **Pharmaceutical Regulatory Affairs**		
Max Marks: 60+40	Time: 3H		

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each. Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

Unit-I

An overview of Drugs and Cosmetics Act 1940 and rules there under, The Patents and Designs Act 1970, Trademarks. Drug Regulatory Agencies-Historical perspectives, organization structure activities & responsibilities: India (CDSCO), US (FDA), EU (EMEA), Japan (PMDA), UK (MHRA), Australia (TGA) & WHO.

Unit-II

Preparation of documents for New Drug Application (NDA) as per requirements of FDA and EUDRA guidelines. GMP requirements as per CFR 210-211 and ICH Q8, Q9 qnd Q10. Master Files, Out of specification. Stability studies as per ICH, EUDRA, FDA, and Analytical Methodology.

Unit-III

Patent discussion with emphases on: Patentable subject matter, Non-patentable subject matter, Criteria for getting a patent, Types of patent and its usefulness. Filing procedure for patents, patent co-operation treaty. Trade related aspects of IPR.

Unit-IV

Harmonization of regulatory requirements: Study of ICH common technical documents. Harmonization of Pharmacopoeial standards. Regulatory considerations of Pre-clinical and clinical evaluations withspecial reference to legislation and guidelines of good clinical practice in US, European community and Japan. Study of Environment Act, Factory Act, Industry Act, Consumer Protection Act, Narcotic Psychotropic Substance Act and Copy

Right Act. CFR: Quality Management Systems, GLP, GCP. SUPAC guideline

Book (s) Recommended:

- The Pharmaceutical Regulatory Process, Current edition. – Ira R. Berry, Robert P.Martin
- Medical Product Regulatory Affairs: Pharmaceutical, Diagnostics, Medical Devices – John J. Tobin and GaryWalsh
- FDA Regulatory Affairs: A Guide for Prescription Drugs, Medical Devices and Biologics, Current edition – Douglas J. Pisano and David S.Mantus
- Good Drug Regulatory Practices: A Regulatory Affairs Quality Manual (Good Drug Development Series) – Helene I.Dumitriu.

B.Sc. (PharmaceuticalChemistry) 2nd Year			
Semester-**IV**	**L**	**T**	**C**
	4	0	4
Course Code: **BPCH-401**	Course Title: **PhysiologyandPharmacology-I**		
Max Marks: **60+40**	Time: **3H**		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.
Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-1.

Gastrointestinal (GIT) system and associated endocrines: those of liver, pancreas andgall-bladder variousgastrointestinal secretion and their role in the absorption and digestion of food. Disorder ofdigestivesystem.
RespiratorySystem:Anatomyofrespiratoryorgans,functionsofrespiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.

UNIT-2.

Central Nervous System: Functions of different parts of brain and spinal cord. Neurohumoraltransmission in the central nervous system, reflex action, electroencephalogram, specializedfunctionsofthebrain,Cranialnervesandtheirfunctions.
AutonomicNervousSystem: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoraltransmission in the A.N.S.
Urinary System: Various parts, structures and functions of thekidney and urinary tract.Physiology of urine formation and acid-basebalance. Diseases ofthe urinary system.

UNIT-3.

Reproductive System: Male and female reproductive systems and theirhormones,physiologyofmenstruation,coitusandfertilization.Sexdifferentiation,spermatogenesis & oogenesis. Pregnancy its maintenance and parturition.
Endocrine System:Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testesand Ovary, their hormones andfunctions.
Sense Organs:Basicanatomy and physiology oftheeye (vision),ear

(hearing),tastebuds,nose(smell)andskin(superficialreceptors).

UNIT-4.

Classificationoffoodrequirements:Balanceddiet,nutritionaldeficiencydisorders,their treatment and prevention, specifications for drinking water.

Communicable diseases: Briefoutline, 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).

Book(s)Recommended:

- TortoraGJ,GrabowskiSR.PrinciplesofAnatomyandPhysiology.CollinsCollegePublishers, Luciano,New York.
- GanongWF.ReviewofMedicalPhysiology.Prentice-Hall.
- ParmarNS.HealthEducationandCommunityPharmacy.CBSPublishers&Distributors,NewDelhi.
- GuytonAC,Hall JE.TextbookofMedicalPhysiology.W.B.SandersCo.

B.Sc. (PharmaceuticalChemistry) 2nd Year			
Semester-IV	**L**	**T**	**C**
	0	0	2
Course Code: **BPCH-451P**	Course Title: **PhysiologyandPharmacology-ILab**		
Max Marks: **30+20**	Time: **3H**		

1. Microscopic studiesofdifferenttissues.
2. Simple experimentsinvolved inthe analysisofnormal and abnormal urine.
3. Collection of specimens, appearance, determination of pH ofurine by pH meter.
4. Quantitative determination of Sugars, proteins, urea, lipid profile, uricacid & creatinine. Physiological experiments on nerve-muscle preparations. Determination ofvital capacity, experiments of spirometry.
5. Estimation of SGOT, SGPT, Alkaline phosphotaseandBilirubin in theserum.

Book(s)Recommended:

- TortoraGJ,GrabowskiSR.PrinciplesofAnatomyandPhysiology.CollinsCollegePublishers, Luciano,New York.
- GanongWF.Reviewof MedicalPhysiology.Prentice-Hall.
- ParmarNS.HealthEducationandCommunityPharmacy,CBSPublishers& Distributors,NewDelhi.
- GhaiCL.A TextbookofPracticalPhysiology.JayPeeBrothers,NewDelhi.
- GuytonAC,Hall JE.TextbookofMedicalPhysiology.W.B.SandersCo.

B.Sc. (PharmaceuticalChemistry) 2nd Year			
Semester-IV	**L**	**T**	**C**
	4	0	4
Course Code: **BPCH-402**	Course Title: **Biochemistry**		
Max Marks: **60+40**	Time: **3H**		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.
Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-1.

Carbohydrate Metabolism: Conversion of polysaccharide to glucose-1-phosphate, Glycolysisand fermentation and their regulation, gluconeogenesis and glycogenolysis, Metabolism ofgalactose and galactosemia, role of sugar nucleotides in biosynthesis, and Pentose phosphatepathway.
TheCitricAcidCycle:Significance,reactionsandenergeticofthecycle,Amphibolic role of the cycle, and Glyoxalicacid cycle.

UNIT-2.

LipidsMetabolism:Oxidationoffatty acids, 1-oxidation & energetic, 1-oxidation, 1-oxidation, Biosynthesis of ketone bodiesand their utilization, Biosynthesis of saturated and unsaturated fatty acids, Control of lipidmetabolism,Essentialfattyacids&eicosanoids(prostaglandins,thromboxanesandleukotrienes), phospholipids,andsphingolipids.
BiologicalOxidation:Enzymesandco-enzymes involved in oxidation reduction & its control, respiratory chain its role in energycaptureanditscontrol,Inhibitorsofrespiratorychainandoxidativephosphorylation,Mechanism of oxidative phosphorylation.

UNIT-3.

Metabolism of Ammonia and Nitrogen ContainingMonomers:Nitrogenbalance,Biosynthesisofaminoacids,Catabolismofaminoacids, Conversion of amino acids to specialized products, Assimilation of ammonia, Urea cycle,metabolic disorders of urea cycle, Metabolism of sulphur containing amino acids, Porphyrinbiosynthesis, formation of bile pigments,hyperbilirubinemia, Purine biosynthesis, Purinenucleotide interconversion, Pyrimidine biosynthesis and Formation of deoxyribonucleotides.

UNIT-4.

Biosynthesis of Nucleic Acids: Brief introduction of genetic organization of the mammaliangenome, alteration and rearrangements of genetic material, Biosynthesis of DNA and RNA.
Enzymes:Nomenclature,enzymekineticsanditsmechanismofaction,mechanismofinhibition,enzymes and iso-enzymes in clinicaldiagnosis.

Book(s)Recommended:

- ConnEE,Stump PK.OutlinesofBiochemistry.JohnWiley&Sons, New York.
- NelsonDL,Cox MM.LehningerPrinciplesofBiochemistry.Macmillan.
- SatyanarayanaU,ChakrapaniU.Biochemistry.Elsevier.

- RamaRaoAS.ATextbookofBiochemistry. UBSPublishers.
- JainJL,JainS,JainN.FundamentalsofBiochemistry. S.ChandPublishers.

B.Sc. (PharmaceuticalChemistry) 2nd Year			
Semester-IV	**L**	**T**	**C**
	4	0	4
Course Code: **BPCH-403**	Course Title: **PharmaceuticalProcess-I**		
Max Marks: **60+40**	Time: **3H**		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.
Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-1.

LiquidDosagesForms:Introduction,typesofadditivesusedinformulations,Vehicles,stabilizers,preservatives,suspendingagents,emulsifyingagents,solubilizers,colors,flavours andothers,manufacturingpackagingandevaluationofclearliquids,suspensionsandemulsionsofficialinpharmacopoeia.

UNIT-2.

SemisolidDosageForms:Definitions,types,mechanisms of drug penetration, factors influencing penetration, semisolid bases and theirselection. General formulation of semisolids, clear gels manufacturing procedure, evaluationandpackaging.
Suppositories:Classification,Idealrequirements,bases,manufacturingprocedure,packagingandevaluation.
PharmaceuticalAerosols:Definition,propellants,generalformulation,manufacturing andpackaging methods,pharmaceuticalapplications.
Ophthalmic Preparations:Requirements,formulation,methodsofpreparation,containers,evaluation.
Cosmeticology and Cosmetic Preparations: Fundamentals of cosmetic science.

UNIT-3.

NovelDrugDeliverySystemsandControlledrelease(CR)deliverysystems:Principle,AdvantagesandDisadvantages,Classificationandtypesoforaldrugdeliverysystem,transdermalandparenteralCRdrugdelivery agentsincludingMucoadhesive,Gastroretentive, MAB based delivery systems, Nanoparticle and nanotechnology, vesicularsystemsincludingliposomes,nanosomesetc.

UNIT-4.

BioavailabilityofdosageformsandBioequivalence: Evaluation methods: In vitro dissolution studies for solid oral dosage forms,Federal perspectives on Immediate Release (IR) and Extended Release (ER) products. BriefConcepts of Biopharmaceutics Classification Scheme (BCS), in-vitro in-vitro correlation andbio-waiver. Important federal considerations for bio-availability and bio-equivalence studiesfororal products; Statisticalconsiderations includingCrossover ANOVA.

Book(s)Recommended:

- LachmanL, LiebermanHA,KanigJL.TheTheory&PracticeofIndustrialPharmacy.
- AultonME.Pharmaceutics-TheScienceofDosageFormDesign,ChurchillLivingstone,NewYork.
- Ansel'spharmaceuticalDosageForms&DrugDeliverySystems.

- LiebermanHA,Lachman L,SachwartzJB.” PharmaceuticalDosage Forms:Tablets”.

B.Sc. (PharmaceuticalChemistry) 2nd Year			
Semester-IV	**L**	**T**	**C**
	4	0	4
Course Code: **BPCH-404**	Course Title: **IndustrialPharmacy&PackagingTechnology**		
Max Marks: **60+40**	Time: **3H**		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.
Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-1.

Building and facilities design: Introduction, Principal Area, layout design for sterile & nonsterilefacility.
Equipment:Introduction,Design,size,locationandConstructionofEquipment, Cleaning and Maintenance of Equipment, Automatic, Mechanical and ElectronicEquipments.

UNIT-2.

Manufacturingoperationsandcontrol:Introduction,SanitationofManufacturing Premises, Mix-ups and Cross Contamination, Processing of Intermediates andBulkproduct,PackagingOperations,I.P.Q.C.,ReleaseofFinishedProduct,ProcessDeviations,Charge-
inofComponents,TimeLimitationsonProduction,DrugproductInspection,ExpirationDating,CalculationofYields,ProductionRecordReview.

UNIT-3.

Pharmaceuticalpackaging:Status,Scopeinpharmaceuticalindustry,Classificationof packaging material,Primary andsecondary packaging,Functionsof packaging.Samplingandqualitycontrolofpackagingmaterials.DesirablefeaturesandadetailedstudyofdifferenttypesofPharmaceuticalContainersandclosures(Glass,PlasticsandRubber),including their merits and demerits.

UNIT-4.

Packaging machinery: including strip packaging, form,fill and seal machines, liquid and solid filling machines, capping machines. Product–Packagecompatibility:Stabilityofproduct,packageselectionanddevelopmentcriteria.Tamperevident packaging systems: Various types and their mechanism.
Flexible packaging: Types offilms, Co-extruded films, foils, coating and laminates, shrink and stretch films. Corrugatedand solid fibreboards and boxes:Types of corrugation methods and types of box design andQualitycontrol.

Book(s)Recommended:

- Lachman, L., Lieberman, H., Kanig, J.L. The Theory and Practice of Industrial Pharmacy.VarghesePublishingHouse, Bombay.
- Hickey,A.J.,DavidGanderton,D.PharmaceuticalProcessEngineering.CRCPress.
- Dean,D.A., Evans,E.R., Hall,I.H.PharmaceuticalPackagingTechnology.CRCPress.

- Aulton, M.E. Pharmaceutics: The Science of Dosage FormDesign.ChurchillLivingstone.

B.SC (H) Pharmaceutical Chemistry III Year			
Semester-5th	**L**	**T**	**C**
	3	0	3
Course Code: BPCH-501	CourseTitle:MedicinalChemistry-I		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

Unit I

Physicochemical and stereo chemical aspects of drugs including bioisosterism in relation tobiological activity, Types of Drug-Receptor interaction. Rationale methods of drug design(QSAR, Pharmacophoremapping, docking)Lead, Discovery ofLead,lead optimization.Vitamins: Water soluble and fat-soluble vitamins. Introduction, Structure, Stereochemistry,Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action,

Unit II

StructureActivity Relationships (if any) uses and Physicochemical properties of the following classesof drugs: Adrenergic and anti-adrenergic drugs including biosynthesis, storage, release andmetabolismofCatecholamine(Isoprenaline,Adrenaline,Salbutamol,propranolol).Cholinergic and Anticholinestarases including biosynthesis, storage, release and metabolismof acetylcholine (Atropine, Neostigmine bromide, Pyridostigmine Bromide).

Unit III

Antispasmodicand Antiulcer drugs (Propantheline bromide, Dicyclomine hydrochloride). Antiparkinsonismdrugs (levodopa and carbidopa). Neuromuscular blocking agents (Succinylcholine chloride,Gallaminetriethiodide).

Unit IV

AntihistaminesincludingH1receptorantagonistSodiumCromoglycate and Chloropheniramine. Prostaglandins and other Eicosanoids: Nomenclature,biosynthesisandbiologicalactivity.Analgesic-antipyreticsandNon-steroidalAnti-inflammatoryagents: (Indomethacin and Diclofenic sodium).

Recommende Book(s)Recommended:

- WilsonandGisvold'sTextbookofOrganicMedicinalandPharmaceuticalChemistry.Lippincot tWilliams &Wilkins,Philadelphia.
- Foye's,PrinciplesofMedicinalChemistry.Wolters Kluwer(India),Lea&Febiger,Philadelphia.

- HanschC.ComprehensivemedicinalChemistryVol.IV,QuantitativeDrugDesign.
- PovlKrogsgaard, Tommy, Textbook of Drug Design &Discovery, 3rd edition, 2004.
- SinghH,KapoorVK.MedicinalandPharmaceuticalChemistry,VallabhPrakashan.
- SriramD,YogeshwariP.MedicinalChemistry.

B.SC (H) Pharmaceutical Chemistry III Year			
Semester-5th	**L**	**T**	**C**
	2	0	2
Course Code: BPCH-551-P	Course Title: MedicinalChemistry-I lab		
Max Marks: 30+20	Time: 3H		

Exercises based on QSAR (Activity prediction of compounds by QSAR Model). Synthesis ofselecteddrugsfromthecoursecontent.Spectralanalysisofthedrugssynthesized.Establishingthep harmacopoeialstandardsofthedrugssynthesized.Determinationofpartitioncoefficient, dissociation constant and molarconstant.

Book(s)Recommended:

- FurnissBS,HannafordAJ,SmithPWG,TatchellAR.Vogel'sTextbookofPracticalOrganicChe mistry. John WileyandSons.
- SinghHK,KapoorVK.PracticalPharmaceuticalChemistry.VallabhPrakashan,NewDelhi.
- MannFG,SaundersBC.PracticalOrganicChemistry.OrientLongmanPvt.Ltd.,Hyderabad.
- KarA.AdvancedPracticalMedicinalChemistry.NewAgeInternational,NewDelhi.

B.SC (H) Pharmaceutical Chemistry III Year			
Semester-5th	**L**	**T**	**C**
	3	0	3
Course Code: BPCH-502	CourseTitle:PharmaceuticalAnalysis-II		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

Unit I

Non-aqueous Titrations: Theoretical consideration, scope and limitations, acid base equilibriainnonaqueousmedia,titrationofweakbases,titrationofweakacids,indicators,andpharmaceutic alproductsshouldbeselectedforillustration.MiscellaneousMethodsofAnalysis:Diazotisationtitration,Kj eldahlnitrogendetermination,

Unit II

Karl-Fischertitration,Oxygen flask combustion. Electrochemistry: The electric cell, electrode potential, half cells,types of half cells, sign convention, Nernst equation, the salt bridge, activity series,
standardpotential,standardhydrogenelectrode,measuringtherelativevoltageofhalfcells,calculationsofst andardpotential,referenceelectrodes,indicatorelectrodes.

Unit III

Theoretical consideration, ion-selective electrodes, measurement of potential, location of theend point, equipment, analytical applications, direct measurement of a metal concentration,differential curves, determination of Ksp, pH measurements, dead-stop titrations; pH meter,pH definition, relation of pH to potential, equipment, applications. b. conductometric andHigh Frequency Titrations and their Applications. Polarography and Its Applications: Theory,masstransportprocesses,currentprocesses,currentpotentialrelationship,polarization,choiceofel etrodes,effectofoxygen,instrumentation,calculationofconcentration,laboratory design and safety. Spectrophotometry: Theory, Principle and Instrumentation ofUV-VisibleSpectrophotometry,QualitativeandQuantitativedeterminationsusingPharmacopoeial UV based methods for single and multiple component formulations and rawmaterials.

Unit IV

Principle and Instrumentation of Infrared Spectrophotometry, Qualitativedeterminationsusing PharmacopoeialIRbased methods for identification and confirmationofpharmaceuticalrawmaterials.Theory,PrincipleandInstrumentationofNMRSpectrophotometry, Qualitative determinations using Pharmacopoeial NMR based methodsfor identification and confirmation of pharmaceutical raw materials. Theory, Principle andInstrumentationofMassSpectrophotometry,QualitativeandQuantitativedeterminationsusingPharmacopoeialMSbasedmethodsforidentificationandconfirmationofpharmaceuticalrawmaterials.LCMS:Instrumentation,workingandapplications.Extractions Procedures: Separation of drugs from excipients, The Craige method of multipleextraction, continuous counter - current extraction, effect of temperature, pH, inert solute,association, ion-pair formation, the emulsion problems in extractions. HPLC: HPLC-UV andHPLC-MSbase.

Book(s)Recommended:

- RaviShankar,Textbook ofPharmaceutical Analysis,RX Publisher.
- KambojPC.PharmaceuticalAnalysis– I,VallabhPrakashan.
- KambojPC.PharmaceuticalAnalysis – II,VallabhPrakashan.
- KambojPC.PharmaceuticalAnalysis –III, VallabhPrakashan.
- KastureAV,MahadikKR.PharmaceuticalAnalysisVol-I,Nirali Prakashan.
- KastureAV,MahadikKR. PharmaceuticalAnalysisVol-II,NiraliPrakashan.

B.SC (H) Pharmaceutical Chemistry III Year			
Semester-5th	**L**	**T**	**C**
	2	0	2
Course Code: BPCH-552-P	CourseTitle:PharmaceuticalAnalysis-II Lab		
Max Marks: 30+20	Time: 3H		

Preparationandstandardizationofperchloricacidandsodium/potassium/lithiummethoxidessolutions;EstimationsofsomePharmacopoeialproducts,PreparationsandstandardizationofEDTAsolution,someexercisesrelatedtoPharmacopoeialassaysbycomplexometric titrations, Miscellaneous Determinations: Exercises involving diazotisation,Kjeldahl, Karl- Fischer, Oxygen flask combustion and gasometry methods. Determination ofalcoholcontentinliquidgalenicals,Experimentsinvolvingseparationofdrugsfrom

excipients, Chromatographic analysis of some pharmaceutical products, Exercises based onacid base titration in aqueous and non-aqueous media, oxidation reduction, Titrations usingpotentiometric technique, Determination of acid-base disassociation constants and plotting oftitrationcurvesusingpHmeter,Exercisesinvolvingpolarimetry,Exercisesinvolvingconductometricand polarographic techniques.

Book(s)Recommended:

- KambojPC.PharmaceuticalAnalysis – I, IIand III,VallabhPrakashan.
- KastureAV,MahadikKR.PharmaceuticalAnalysisVol-I&II,NiraliPrakashan.

B.SC (H) Pharmaceutical Chemistry III Year			
Semester-5th	**L**	**T**	**C**
	3	0	3
Course Code: BPCH-503	CourseTitle:PharmaceuticalQualityAssurance		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

Unit I

Pharmaceutical Validation I: Definition, scope & organization, manufacturing process model,government regulations. Validation Master Plans, URS, DQ, IQ, and OQ & PQ of facilities,Equipment's, analytical instruments, computer systems and PLC. Utilities Validation andCleaningValidation:PharmaceuticalWaterSystem&puresteam,HVACsystemandCompressed air system validationoordination Chemistry 1

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Unit II

Pharmaceutical Validation II

Equipment, working area and cleaning area validation.Process Validation: Process validation of manufacturing process of different dosage formsincludingsamplingtechniquesasperguidelinesofUSFDA/WHOTRS.PharmaceuticalQuality Audits:Principle of Quality Audit. Quality improvement process, Quality in researchand development.

Unit III

Quality Management: Introduction, Quality Assurance, Quality Circl9000,DevelopmentsofISO9000Systems,ISO9001:2008.ComplaintsandRecalls:Evaluation of complaints, recall procedure, related records and documents. Quality ControlLaboratory–responsibilitiesandlaboratorypracticese.

Unit IV

Routinecontrolsoninstruments,reagents, sampling plans, standard test procedures and protocols,

control on animal house,data generation and storage, quality control documentation of QC facilities. Finished productrelease,qualityreview,andbatchreleasedocuments.

Recommended Texts:

- PharmaceuticalQualityAssurance,M.A.Potdar, NiraliPrakashan,Pune.
- GMPforPharmaceuticals,5thEdition,SidneyH. Willing,MarcelDecker Series
- TotalQualityManagementbyDaleH.Besterfield,Pearson Education,New Delhi.
- TotalQualityManagement byDr.DDSharma,Sultan Chand &Bros., NewDelhi.
- QualityAssuranceofPharmaceuticals:ACompendiumofGuidelines .

B.SC (H) Pharmaceutical Chemistry III Year			
Semester-5th	**L**	**T**	**C**
	3	0	3
Course Code: BPCH-504	CourseTitle:PharmaceuticalProcess-II		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

Unit I

Capsules:Introduction,types,advantagesanddisadvantages,materialandmethodofpreparation 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 insoftcapsules,evaluation,quality control,stability testing andstorageofcapsuledosageforms. Microencapsulation: Types of microcapsules, importance on microencapsulation inpharmacy, microencapsulation by phase separation, coacervation, multi orifice, spray drying,spray congealing, polymerization complex emulsion, air suspension technique, coating panandothertechniques,evaluationofmicrocapsules.

Unit II

Tablets:(a)Formulationofdifferenttypesof tablets,granulationtechnology or large scale by varioustechniques,physicsoftablets 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 coatedtablets. (c) Stability kinetics and quality assurance.

Unit III

Parenteral Products: (a) Preformulationfactors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles,isotonicity and methodsof its adjustment.(b) Formulation details,containers and closuresand selection. (c) Prefilling treatment, washing of containers and closures, preparation ofsolutionandsuspensions,fillingandclosingofampoules,vials,infusionfluids

Unit IV

solutionandsuspensions,fillingandclosingofampoules,vials,infusionfluids,lyophilization & preparation of sterile powders, equipment for large scale manufacture andevaluationofparenteralproducts.(d)AsepticTechniques:Sourceofcontaminationandmethodsofprevention, designofasepticarea, laminarflow benchservicesandmaintenance.

Book(s)Recommended:

- AultonME.Pharmaceutics-TheScienceof DosageFormDesign,ChurchillLivingstone.
- LachmanL,LiebermanHA,KanigJL.TheTheory&PracticeofIndustrialPharmacy,Currentedition, VargheseePublishingHouse,Bombay.
- BankerGS,RhodeCT.ModernPharmaceutics. InformaHealthcare,NewYork.
- LiebermanHA,LachmanL,SachwartzJB.PharmaceuticalDosageForms:Tablets,Currenteditiion, Marcel Dekker,N.Y.

B.SC (H) Chemistry3rd Year			
Semester-VI	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-601	Course Title: **DosageFormDesign**		
Max Marks: 60+40	Time: 3H		

THEORY **Marks: 100**

***Instruction*:** Section (A) is compulsory contain 15 question carrying weight of 2 marks each. Section (B) will contain 8 questions. Candidate will attempt any 5 questions, carrying weightage of 8 marks each.

Section (C) will contain 4 questions. Candidates will attempt any 2 questions each carrying a weight age of 15 marks.

UNIT-I

Preformulation studies: Study of physical properties of drugs like physical form, particle size,shape, density, wetting, dielectric constant. Solubility, dissolution and organoleptic propertyand their effect on formulation, stability and bioavailability. Study of chemical properties ofdrugslikehydrolysis,oxidation,reduction,racemisation,polymerizationetc.,andtheirinfluence on formulation and stability of products.

UNIT-II

Study of pro-drugs in solving problemsrelated to stability, bioavailability and elegancy of formulation. Design, development andprocessvalidationmethodsforpharmaceuticaloperationsinvolvedintheproductionofpharmaceuticalproductswithspecialreferencetotablets,suspensions.Stabilizationandstabilitytestingprotocolforvariouspharmaceuticalproducts.

UNIT-III

Performanceevaluationmethods: In vitro dissolution studies for solid oral dosage forms, Federal perspectives onImmediateRelease(IR)andExtendedRelease(ER)products.BriefConceptsofBiopharmaceuticsClassificationScheme(BCS),Lipinskiruleoffive,in-vitroin-vivocorrelationandbio-waiver.Importantfederalconsiderationsforbio-availability andbio-equivalencestudiesfororalproducts;StatisticalconsiderationsincludingCrossoverANOVA.

UNIT-IV

Introduction to Quality by Design and Optimization Techniques:Risk Assessment(Matrix,&FMEA),QualityTargetProductProfile,CriticalQualityAttributes,Critical Material Attributes, & Critical Process Parameters for various dosage forms. Concept ofoptimization, Optimization parameters, Design of Experiments, Statistical design, and otherapplications.

Book(s)Recommended:

- LachmanL,LiebermanHA,KanigJL.TheTheory&PracticeofIndustrialPharmacy.VargheseePublishingHouse, Bombay.
- BankerGS,RhodeCT.ModernPharmaceutics, 4thEd, InformaHealthcare,NewYork.
- JainNK.Controlled andnovel drugdelivery. CBSPublishers&Distributors,New Delhi.

B.SC (H) Chemistry 3rd Year			
Semester-VI	**L**	**T**	**C**
	0	0	2
Course Code: BPCH-651-P	Course Title: **DosageFormDesignLab**		
Max Marks: 30+20	Time: 3H		

1.

Preformulation studies including drug-excipient compatibility studies, effect of stabilizers,preservativesetc.indosageformdesign.Experimentsdemonstratingimprovementinbioavailability throughprodrug concept.Stability evaluationof variousdosage forms andtheir expiration dating.

2.

Dissolution testing and data evaluation for oral solid dosage forms.EvaluationofBioequivalenceofsomemarketedproducts.Design,developmentandevaluationof controlledreleaseformulations.

Book(s)Recommended:

- BachhavV.InnovativeDosageForms:DesignandDevelopmentatEarlyStage.Wiley.
- GibsonM.PharmaceuticalPreformulationandFormulation:APracticalGuide fromCandidateDrugSelection to Commercial Dosage Form. CRC Press.

B.SC (H) Chemistry3rd Year			
Semester-VI	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-602	Course Title: **MedicinalChemistry-II**		
Max Marks: 60+40	Time: 3H		

UNIT-I

Introduction, Structure,Stereochemistry, Nomenclature, Synthesis of specified drugs (giveninparenthesis),modeofaction,StructureActivityRelationships(ifany)usesandPhysicochemicalpropertiesof thefollowingclassesofdrugs:Steroids:BiosynthesisofCholesterol;Estrogens(Oestradiol),Nonsteroidalestrogens(Stilboesterol),Antiestrogens,Progestogens,(progesteronefromstigmasterol),SyntheticProgesterone(norethistero ne),antiprogestogens,oralcontraceptives,androgens(biosynthesisoftestosteroneanditssynthesisfromdiosgenin).

UNIT-II

GeneralAnaesthetics:Inhalationalanaesthetics,Intravenousanesthetics. Local Anaesthetics: Esters

(Benzocaine), Amides (Lignocaine). Hypnotics andSedatives:Barbiturates (Phenobarbitone); benzodiazepines (Nitrazepam).Anticonvulsants:Barbiturates; Hydantoin (Phenytoin); Oxazolidinediones (Troxidone); Benzodiazepines andCarbamazepine.Antitussive:CentrallyactingAntitussive,Opiumalkaloidsandrelatedagents and Synthetic Antitussives, Peripherally acting antitussives and Expectorants.

UNIT-III

CentralNervousSystemStimulants:NaturalandSynthetic(Nikethamide);methylxanthines(Theophyllines)andModifiedmethylxanthines.PsychopharmacologicalAgents:Antipsychotic agents: Phenothiazines (chlorpromazine); butyrophenones and miscellaneous;Antidepressants:Tricyclicantidepressants(Amitryptyline),Atypicalantidepressants;Monoamine oxidase inhibitors; Anxiolytics: Meprobamate and related drugs (Meprobamate);benzodiazepines(Diazepam).Diuretics:Carbonicanhydraseinhibitors(Acetazolamide);Thiazidesandrelateddrugs(Bendrofluazide);Highceilingdiuretics(Furosemide),Aldosteroneantagonists(spironolactone); otherpotassiumsparingdiureticsandosmoticdiuretics.

UNIT-IV

Cardiovascularagents:Cardiacglycosides;Antihypertensiveagents;Antianginalsandvasodilators; Antiarrhythmicdrugs; Antihyperlipidemicdrugs.

Book(s)Recommended:

- WilsonandGisvold'sTextbookofOrganicMedicinalandPharmaceuticalChemistry,LippincottWilliams &Wilkins,Philadelphia.
- Foye's,PrinciplesofMedicinalChemistry,SixthEdition,WoltersKluwer(India),Lea&Febiger,Philadelphia.
- SinghH,KapoorVK.MedicinalandPharmaceuticalChemistry,VallabhPrakashan,Delhi,2005.
- SriramD,YogeshwariP.MedicinalChemistry.DorlingKindersley,PearsonEducation,NewDelhi.

B.SC (H) Chemistry 3rd Year			
Semester-VI	**L**	**T**	**C**
	0	0	2
Course Code: BPCH-652 P	Course Title: **MedicinalChemistry-IILab**		
Max Marks: 30+20	Time: 3H		

1. Workshop on stereo model use of some selected drugs.

Synthesis of selected drugs from thecourse contentinvolving twoor more stepsandtheirspectralanalysis.

2. Establishing thePharmacopoeialstandards of thedrugs synthesized.

Book(s)Recommended:

- FurnissBS,HannafordAJ,SmithPWG,TatchellAR.Vogel'sTextbookofPracticalOrganicChemistry. John WileyandSons.
- SinghHK,KapoorVK.PracticalPharmaceuticalChemistry.VallabhPrakashan,NewDelhi.
- MannFG,SaundersBC.PracticalOrganicChemistry.OrientLongmanPvt.Ltd.,Hyderabad.
- KarA.AdvancedPracticalMedicinalChemistry.NewAgeInternational,NewDelhi.

B.SC (H) Chemistry3rd Year			
Semester-VI	**L**	**T**	**C**

	4	0	4
Course Code: **HPCH-603**	Course Title: **PharmaceuticalOperation-II**		
Max Marks: 60+40	Time: 3H		

UNIT-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, dimensionlessgroups,different typesofgraphic representation, mathematical problems.

UNIT-II

Heat Transfer:Sourceofheat,heattransfer,steamandelectricityasheatingmedia,determinationofrequirementofamountofsteam/electricalenergy,steampressure,Boilercapacity,Mathematical problems on heat transfer, pure steam & boiler act. Evaporation: Basic conceptof phase equilibrium, factor affecting evaporation, evaporators, film evaporators, single effectand multipleeffect evaporators,Mathematical problems on evaporation.

UNIT-III

Distillation:
Raoult'slaw,phasediagrams,volatility;simplesteamandflashdistillations,principlesofrectification,Calculationofnumberoftheoreticalplates,Azeotropicandextractivedistillation. Mathematical problems on distillation.

UNIT-IV

Drying: Moisture content and mechanismof 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 inpharmaceuticalindustriesand special drying methods. Mathematicalproblemson drying.
Size Reduction and Size Separation: Definition, objectives of size reduction, factors affectingsize reduction, laws governing energy and power requirements of mills including ball mill,hammer mill, fluid energy mill etc. Mixing: Theory of mixing, solid-solid, solid-liquid andliquid-liquidmixingequipments.

Book(s)Recommended:

- CarterSJ.Cooper&Gunn'sTutorialPharmacy.6thedition,CBSPublishers&Distributors,New Delhi.
- BadgerWL,BancheroJT.IntroductiontoChemicalEngineering.McGrawHillInternationalBook Co., London.
- PerryRH,GreenDW.ChemicalEngineersHandbook.McGrawHill,InternationalEditorsLtd,London.
- SubramanyamCVS,SettyJT,SureshS,DeviVK.PharmaceuticalEngineering-Principles&Practices. Vallabh Prakashan,Delhi.

B.SC (H) Chemistry3rd Year			
Semester-VI	**L**	**T**	**C**
	4	0	4
Course Code: BPCH-604	Course Title: **PharmaceuticalOperationManagement**		
Max Marks: 60+40	Time: 3H		

UNIT-I

ConceptofManagement:AdministrativeManagement(Planning,Organizing,Staffing,DirectingandControlling), Entrepreneurshipdevelopment,OperativeManagement(personnel,Materials,Production,Financial,Marketing,Ti

me/space,margin/Morale),Principles of Management (Co-ordination, Communication, Motivation, Decision Making,leadership, innovation, creativity, delegation of Authority/ Responsibility, Record keeping).

UNIT-II

Operations management: concept, functions; transformation process model: inputs, processand outputs; classification of operations; responsibilities of operations manager, contributionofhenryford,deming,crossby,taguchi.Processselection-project,job,batch,massandprocess types of production systems.

UNIT-III

Quality Management: Introduction, Meaning, QualityCharacteristicsofGoodsandServices,Juran‟sQuality Trilogy,Deming's14principles,Tools and Techniques for Quality Improvement, Statistical Process Control Chart, QualityAssurance,TotalQualityManagement(TQM)ModelConceptofSixSigmaanditsApplication. Acceptance Sampling – Meaning, Objectives, Single Sample, Double Sampleand Multiple Sample Plans with sated risk, Control charts for variables – Averages andRanges,ControlChartsforDefectives– FractionDefectiveandNumbersDefective.

UNIT-IV

ProductionManagement:AbriefexposureofthedifferentaspectsofProductionManagement-Visible&Invisibleinputs,methodologyofactivities,performanceevaluation techniques, process flow, process know- how, maintenance management. JIT andLean Production System:JITApproach,Implementation requirements, Services, KanbanSystem.

InventoryManagement:Concepts,Classification,Objectives,FactorsAffectingInventory Control Policy, Inventory Costs, Basic EOQ Model, Re-order level, ABC analysis.LogisticsandFranchising.PurchasingManagement–Objectives,Functions,Methods,Procedure, and Value Analysis: Concepts, Stock Control Systems, Virtual Factory ConceptandProduction Worksheets.

Book(s)Recommended:

- RobbinsSP,CoulterM. Management.PearsonPrenticeHall.
- RobbinsSP,JudgeTA.OrganizationalBehavior.PearsonPublication.
- KoontzH,WeihrichH.EssentialsofManagement. TataMcGrawHill