COURSE BOOK – 2021

Program: Bachelor of Pharmacy

GALGOTIAS UNIVERSITY

(Under the Uttar Pradesh Private Universities Act No. 12 of 2019)

Curriculum and syllabus

2021-2022

Department of Pharmacy

Vision: To be known globally for value-based education, research, creativity, and innovation in the field of Pharmaceutical Sciences.

Mission:

M1: To establish state-of-the-art facilities for education and research inPharmaceutical Sciences

M2: To involve in industry collaboration for curriculum development

M3: To bring excellence in Pharmacy leaders through patents and innovations

M4: To inculcate lifelong learning with high ethical and moral values.

Bacholer of Pharmacy (B.Pharm)

Program Educational Objectives:

Graduates shall

PEO1: Contribute synergistic and experiential learning as futuristic healthcare professionals and promote research in the field of Pharmacy profession

PEO2: Undertake higher education to expand knowledge and demonstrate skills in monitoring National Health Programmes

PEO3: Be involved in ethical, progressive and contemporary entrepreneurship

Program Outcomes

PO1	Pharmacy Knowledge	Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; Pharmaceutical sciences; behavioral, social, and administrative issues of Pharmacy sciences.
PO2	Planning Abilities	Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.
PO3	Problem Analysis	Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.
PO4	Modern Tool Usage	Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.
PO5	Leadership Skills	Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.
PO6	Professional Identity	Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
PO7	Pharmaceutical Ethics	Honor personal values Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.
PO8	Communication	Communicate effectively with the community and with society, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.
PO9	The Pharmacist and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
PO10	Environment and sustainability	Understand the impact of the professional pharmacy solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development.
PO11	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self access and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

CURRICULUM & PGROGRAMME STRUCTURE

As per course regulations 2014 and Scheme and syllabus implemented from 2017-18 academic sessions

Curriculum

			Semester 1							
Sl. No	Course Code	Name of the Course					Assessment Pattern			
			L	T	P	C	IA	Sessional exam	ETE	Total
1	BPHT1001	Human Anatomy and Physiology I– Theory	3	1		4	10	15	75	100
2	BPHT1002	Pharmaceutical Analysis I – Theory	3	1		4	10	15	75	100
3	BPHT1003	Pharmaceutics I – Theory	3	1		4	10	15	75	100
4	BPHT1004	Pharmaceutical Inorganic Chemistry – Theory	3	1		4	10	15	75	100
5	BPHT1005	Communication skills – Theory *	2	-		2	5	10	35	50
6	BPHT1006 BPHM1006	Remedial Biology/ Remedial Mathematics – Theory*	2	-		2	5	10	35	50
7	BPHP1007	Human Anatomy and Physiology – Practical		-	4	2	5	10	35	50
8	BPHP1008	Pharmaceutical Analysis I – Practical		-	4	2	5	10	35	50
9	BPHP1009	Pharmaceutics I – Practical		-	4	2	5	10	35	50
10	BPHP1010	Pharmaceutical Inorganic Chemistry – Practical		-	4	2	5	10	35	50
11	BPHP1011	Communication skills – Practical*			2	1	5	5	15	25
12	BPHR1012	Remedial Biology – Practical			2	1	5	5	15	25
		Total	16	4	20	30	80	130	540	750
Semester II										

Sl No	Course Code	Name of the Course						Assessment Pattern		
			L	T	P	C	IA	Sessional exam	ETE	Total
1	BPHT2001	Human Anatomy and Physiology II – Theory	3	1		4	10	15	75	100
2	BPHT2002	Pharmaceutical Organic Chemistry I – Theory	3	1		4	10	15	75	100
3	BPHT2003	Biochemistry – Theory	3	1		4	10	15	75	100
4	BPHT2004	Pathophysiology – Theory	3	1		4	10	15	75	100
5	BPHT2005	Computer Applications in Pharmacy – Theory *	3			3	10	15	50	75
6	BPHT2006	Environmental sciences – Theory *	3			3	10	15	50	75
7	BPHP2007	Human Anatomy and Physiology II –Practical			4	2	5	10	35	50
8	BPHP2008	Pharmaceutical Organic Chemistry I– Practical			4	2	5	10	35	50
9	BPHP2009	Biochemistry – Practical			4	2	5	10	35	50
10	BPHP2010	Computer Applications in Pharmacy – Practical*	2			1	5	5	15	25
		Total	18	4	12	29	80	125	520	725
Semester III										
Sl No	Course Code	Name of the Course					Assessment Pattern			
			L	T	P	C	IA	Sessional exam	ETE	Total
1	BPHT3001	Pharmaceutical Organic Chemistry II – Theory	3	1		4	10	15	75	100
2	BPHT3002	Physical Pharmaceutics I – Theory	3	1		4	10	15	75	100

3	BPHT3003	Pharmaceutical Microbiology – Theory	3	1		4	10	15	75	100
4	BPHT3004	Pharmaceutical Engineering – Theory	3	1		4	10	15	75	100
5	UHVE1001	Universal Human Values and Ethics			2	2	10	15	75	100
6	BPHP3005	Pharmaceutical Organic Chemistry II – Practical			4	2	5	10	35	50
7	BPHP3006	Physical Pharmaceutics I – Practical			4	2	5	10	35	50
8	BPHP3007	Pharmaceutical Microbiology – Practical			4	2	5	10	35	50
9	BPHP3008	Pharmaceutical Engineering – Practical			4	2	5	10	35	50
		Total	12	4	18	27	70	115	515	700
Semester IV										
Sl No	Course Code	Name of the Course					Assessment Pattern			
			L	T	P	C	IA	Sessional exam	ETE	Total
1	BPHT4001	Pharmaceutical Organic Chemistry III– Theory	3	1		4	10	15	75	100
2	BPHT4002	Medicinal Chemistry I – Theory	3	1		4	10	15	75	100
3	BPHT4003	Physical Pharmaceutics II – Theory	3	1		4	10	15	75	100
4	BPHT4004	Pharmacology I – Theory	3	1		4	10	15	75	100
5	BPHT40O5	Pharmacognosy and Phytochemistry I– Theory	3	1		4	10	15	75	100
6	BPHP4006	Medicinal Chemistry I – Lab			4	2	5	10	35	50

7	BPHP4007	Physical Pharmaceutics II – Lab			4	2	5	10	35	50
8	BPHP4008	Pharmacology I – Lab			4	2	5	10	35	50
9	BPHP4009	Pharmacognosy and Phytochemistry I – Lab			4	2	5	10	35	50
		Total	15	5	16	28	70	115	515	700
	Semester V									
Sl No	Course Code	Name of the Course					Assessment Pattern			
			L	T	P	C	IA	Sessional exam	ETE	Total
1	BPHT5001	Medicinal Chemistry II – Theory	3	1		4	10	15	75	100
2	BPHT5002	Industrial Pharmacy I– Theory	3	1		4	10	15	75	100
3	BPHT5003	Pharmacology II – Theory	3	1		4	10	15	75	100
4	BPHT5004	Pharmacognosy and Phytochemistry II– Theory	3	1		4	10	15	75	100
5	BPHT5005	Pharmaceutical Jurisprudence – Theory	3	1		4	10	15	75	100
6	BPHP5006	Industrial Pharmacy I – Lab			4	2	5	10	35	50
7	BPHP5007	Pharmacology II – Lab			4	2	5	10	35	50
8	BPHP5008	Pharmacognosy and Phytochemistry II – Lab			4	2	5	10	35	50
		Total	15	5	12	26	65	105	480	650
Semester VI										
Sl No	Course Code	Name of the Course					Assessment Pattern			
			L	T	P	C	IA	Sessional exam	ETE	Total
1.	BPHT6001	Medicinal Chemistry III – Theory	3	1		4	10	15	75	100

2.	BPHT6002	Pharmacology III – Theory	3	1		4	10	15	75	100
3.	BPHT6003	Herbal Drug Technology – Theory	3	1		4	10	15	75	100
4.	BPHT6004	Biopharmaceutics and Pharmacokinetics – Theory	3	1		4	10	15	75	100
5.	BPHT6005	Pharmaceutical Biotechnology – Theory	3	1		4	10	15	75	100
6.	BPHT6006	Quality Assurance – Theory	3	1		4	10	15	75	100
7	BPHP6007	Medicinal chemistry III – Lab			4	2	5	10	35	50
8.	BPHP6008	Pharmacology III – Lab			4	2	5	10	35	50
9	BPHP6009	Herbal Drug Technology- Lab			4	2	5	10	35	50
		TOTAL	18	6	12	30	75	120	555	750
Semester VII										
Sl No	Course Code	Name of the Course					Assessment Pattern			
			L	T	P	C	IA	Sessional exam	ETE	Total
1	BPHT7001	Instrumental Methods of Analysis – Theory	3	1		4	10	15	75	100
2	BPHT7002	Industrial Pharmacy II – Theory	3	1		4	10	15	75	100
3	BPHT7003	Pharmacy Practice – Theory	3	1		4	10	15	75	100
4	BPHT7004	Novel Drug Delivery System – Theory	3	1		4	10	15	75	100
5	BPHP7005	Instrumental Methods of Analysis – Practical			4	2	5	10	35	50
6	BPPS7006	Practice School				6		25	125	150
		Total	12	4	4	24	45	95	460	600
Semester VIII										

Sl No	Course Code	Name of the Course					Assessment Pattern			
			L	T	P	C	IA	Sessional exam	ETE	Total
1	BPHT8001	Biostatistics and Research Methodology	3	1		4	10	15	75	100
2	BPHT8002	Social and Preventive Pharmacy	3	1		4	10	15	75	100
3	BPPW8012	Project Work			12	6			150	150
		Total	6	2	12	14	20	30	300	350

List of Electives

Elective-1(Semester VII)

Sl No	**Course Code**	**Name of the Electives**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**Sessional Exam**	**ETE**	**Total**
1	BPMR7007	Medical sales representative	3	0		3	25	75	100
2	BPPM7008	Production and manufacturing							
3	BPQA7009	Quality assurance							
4	BPQC7010	Quality control							
5	BPMR7011	Medical sales representative-I Practical			4	2	15	35	50
6	BPPM7012	Production and manufacturing-I Practical							
7	BPQA7013	Quality assurance-I Practical							
8	BPQC7014	Quality control-I Practical							
		Total	6	0	2	7	40	110	150

Elective-2 (Semester VIII)

Sl No	**Course Code**	**Name of the Elective**					**Assessment Pattern**			Total
			L	**T**	**P**	**C**	IA	Sessional exam	ETE	
1	BPET8003	Pharma Marketing Management	3+3 =6	2		8	10 + 10	15+15	75 + 75	100 + 100
2	BPET8004	Pharmaceutical Regulatory Science								
3	BPET8005	Pharmacovigilance								
4	BPET8006	Quality Control and Standardization of Herbals.								

5	BPET8007	Computer Aided Drug Design								
6	BPET8008	Cell and Molecular Biology								
7	BPET8009	Cosmetic Science								
8	BPET8010	Experimental Pharmacology								
9	BPET8011	Advanced Instrumentation Techniques								
10	BPET8012	Dietary Supplements and Nutraceuticals								
11	BPET8013	Pharmaceutical product development								
12	BPMR8014	Medical Sales Representative-II	3	0		3		25	75	100
13	BPPM8015	Production and Manufacturing-II								
14	BPQA8016	Quality Assurance-II								
15	BPQC8017	Quality Control-II								
16	BPMR8018	Medical Sales Representative-II Lab			4	2		15	35	50
17	BPPM8019	Production and manufacturing- II Lab								
18	BPQA8020	Quality Assurance-II Lab								
19	BPQC8021	Quality Control- II Lab								
		Total	**9**	**2**	**4**	13	**20**	**70**	**260**	350

Detailed Syllabus

School of Medical and Allied Sciences
Department of Pharmacy

Name of The Course	Human Anatomy and Physiology-I			
Course Code	BPHT1001			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

Upon completion of this course the student should be able to

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system.

Course Outcomes

CO1	Student will able to understand the Cell and Tissues.
CO2	Students will able to analyze about Integumentary system, Skeletal system and Joints.
CO3	Student will able to analyze Body fluids and blood and Lymphatic system.
CO4	Student will able to analyze about Peripheral nervous system and Special senses.
CO5	Student will able to analyze the Cardiovascular system.
CO6	Student will able to develop relevance and need of recent trends in particular organ system.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Introduction 10 hours

- **Introduction to human body**
  Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.
- **Cellular level of organization**
  Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine
- **Tissue level of organization**
  Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II: **10 Hours**

- **Integumentary system**
  Structure and functions of skin
- **Skeletal system**
  Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system
  Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction
- **Joints**
  Structural and functional classification, types of joints movements and its articulation

Unit III:

10 Hours

Body fluids and blood:
Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system:
Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

Unit IV: **8 Hours**
• **Peripheral nervous system:** Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. • **Special senses** Structure and functions of eye, ear, nose and tongue and their disorders.
Unit V: **7 Hours**
Cardiovascular system Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.
Unit VI: **8 Hours**
Advances/Recent Trends in: cell signalling, cell communication, monitoring of Skeletal anatomy and physiology, blood transfusion, neurology, monitoring of special senses, cardiovascular imaging, cardiovascular function monitoring.

Suggested Reading

Text Books

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
4. Text book of Medical Physiology- Arthur C, Guyton andJohn.E.Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.

Reference Books

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata
4. Difore S.H. "Atlas of Normal Histology" – Lea & Febiger Philadelphia.

Name of The Course	PHARMACEUTICAL ANALYSIS-I			
Course Code	BPHT1002			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

1. Understand the principles of volumetric and electro chemical analysis

2. Carryout various volumetric and electrochemical titrations

3. Develop analytical skills

Course Outcomes

CO1	The students shall be able to remember the different techniques of analysis, methods of expressing concentration, primary and secondary standards, Sources of impurities in medicinal agents and limit tests.
CO2	The students shall be able to understand the basic principle of acid base titration and Non-aqueous titration.
CO3	The students shall be able to apply the basic principle of Precipitation titrations, Complexometric titration and Gravimetry.
CO4	The students shall be able to analyze the basic principle of Redox titrations.

CO5	The students shall be able to evaluate the basic principle of electrochemical methods of analysis.
CO6	The students shall be able to analyze Advancement in chromatography and Kinetic method of analysis

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Pharmaceutical analysis and errors 10 Hours
(a) Pharmaceutical analysis- Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate (b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures (c)Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.
Unit II: • Acid base titration and Non-aqueous titration 10 Hours
• Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves • Non-aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl
Unit III: Precipitation titrations, Complexometric titration and Gravimetry 10 Hours
• Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. • Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. • Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. • Basic Principles, methods and application of diazotisation titration.
Unit IV: Redox titrations 08 Hours
(a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate
Unit V: Electrochemical methods of analysis 07 Hours
• Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications. • Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. • Polarography - Principle, Ilkovic equation, construction and working of dropping mercury
Unit VI Chromatography and Kinetic method of analysis. 08 Hours
Advancement in chromatography-Supercritical fluid chromatography, Hydrophilic interaction chromatography, LCMS, Analysis of protein

biopharmaceuticals and conjugates. Process analytical technology, Kinetic method of analysis.

Suggested Reading

1. Mendhanm J, Denny R.C., Barnes J.D., Thomas M, Jeffery G.H., "Vogel's Textbook of Quantitative Chemical Analysis", Pearson Education Asia.
2. Conners K.A., "A Text book of Pharmaceutical Analysis", Wiley Inter-science.
3. Beckett, A.H., and Stenlake, J.B., Practical Pharmaceutical Chemistry, Vol. I&II. The Atherden Press of the University of London.
4. Alexeyev V. "Quantitative Analysis". CBS Publishers & Distributors.
5. Valentina D Atri, Szabolcs Fekete, Adrian Clarke, Jean-Luc Veuthey, and Davy Guillarme.Recent advances in chromatography for pharmaceutical analysis. Analytical Chemistry. 2018
6. Marin, G.B., Yablonsky, G.S. and Constales, D., 2019. Kinetics of chemical reactions: Decoding complexity. John Wiley & Sons.

Name of The Course	**Pharmaceutics I – Theory**			
Course Code	**BPHT1003**			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

Upon completion of this course the student should be able to:

1. Know the history of profession of pharmacy
2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
3. Understand the professional way of handling the prescription
4. Preparation of various conventional dosage forms

Course Outcomes

CO1	Recall History of Pharmacy, Pharmacopoeia, prescription and posology.
CO2	Demonstrate the powder dosage form, pharmaceutical calculation and liquid dosage form.
CO3	Identify various types of liquid dosage form.
CO4	Analyze the importance of Suppository and categorize the pharmaceutical incompatibilities.
CO5	Evaluate the various types of semisolid dosage form.
CO6	Elaborate the advances in in pharmaceutical dosage forms.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	15	75	100

Course Content:

Unit I: 10 Hours
• **Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. • **Dosage forms:** Introduction to dosage forms, classification and definitions • **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription. • **Posology:** Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.
Unit II: 10 Hours
• **Pharmaceutical calculations**: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof

spirit and isotonic solutions based on freezing point and molecular weight.

- **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.
- **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

Unit III: 8 Hours

- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type ofEmulsion, Methods of preparation & stability problems and methods to overcome.

Unit IV: 8 Hours

- **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
- **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

Unit V: 7 Hours

- **Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms

Unit VI: 8 Hours

Advancement in Pharmaceutical Formulation Development

- FDA requirement for Investigational New Drug Application.
- ICH guidelines for the stability studies of pharmaceutical products.
- Role of GMP in pharmaceutical preparation
- Introduction, advantages and limitations of novel drug delivery system.
- Introduction and advantages of parenteral drug delivery system.

Suggested Reading

Text Books

1. Carter S.J., “Cooper and Gunn’s Tutorial Pharmacy”, CBS Publishers, Delhi.
2. Rawlins E.A., “Bentley’s Text Book of Pharmaceutics”, ELBS Bailliere Tyndall.
3. Lachman L,Liberman H.A and Kanig J.L., “Theory and Practice of Industrial Pharmacy”, Lea and Febiger.
4. Cooper and Gunn’s Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.
5. Aulton, M.E, Text Book of Pharmaceutics, Vol., I & II. Churchill Livingstone

Reference Books

1. United States Pharmacopoeia (National Formulary).
2. Remington – “The science and practice of pharmacy” Vol. I & II. Mack Publishing Co., Pennsylvania.
3. Pharmacopoeia of India, The Controller of Publications, Delhi.
4. British Pharmacopoeia, Her Majesty’s Stationary Office, University Press, Cambridge

Other References

1. Bandawane, A. and Saudagar, R., 2019. A Review on Novel Drug Delivery System: A Recent Trend. Journal of Drug Delivery and Therapeutics, 9(3), pp.517-521.
2. Pagar, K.R. and Khandbahale, S.V., 2019. A Review on Novel Drug Delivery System: A Recent Trend. Asian Journal of Pharmacy and Technology, 9(2), pp.135-140.
3. Reyhaneh Azarmi and Ali Ashjaran. Type and application of some common surfactants. Journal of Chemical and Pharmaceutical Research, 2015, 7(2):632-640.
4. http://nanoparticles.org/pdf/Salager-E300A.pdf
5. Sunil Kumar. The Importance Of Antioxidant And Their Role In Pharmaceutical Science - A Review. Asian Journal of Research in Chemistry and Pharmaceutical Sciences. 1(1), 2014, 27 - 44.
6.https://www.intechopen.com/books/antioxidants/antioxidant-compounds-and-their-antioxidant-mechanism
7.http://shodhganga.inflibnet.ac.in/bitstream/10603/37740/6/06_chapter1.pdf
8. Chandra, A., Sharma, U., Jain, S.K. and Soni, R.K., 2013. Nanosuspension: an overview. Journal of Drug Delivery and Therapeutics, 3(6), pp.162-167.
9. Patel, R.P. and Joshi, J.R., 2012. An overview on nanoemulsion: a novel approach. International Journal of Pharmaceutical Sciences and Research, 3(12), p.4640.

Name of The Course	**PHARMACEUTICAL INORGANIC CHEMISTRY**			
Course Code	**BPHT1004**			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

Course Objectives

Upon completion of course student shall be able to

1. Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
2. Understand the medicinal and pharmaceutical importance of inorganic compounds

Course Outcomes

CO1	Remember the contents and role of pharmacopeia in pharmaceutical Science.
CO2	Understand the role of electrolyte in biological fluides and human body.
CO3	Apply the knowledge of Inorganic compounds in gastrointestinal disorders.
CO4	Analyse the use of inorganic compound in pharmacetical preparations
CO5	Assess the role of radioactive compounds in pharmaceuticals
CO6	Createing the concept for application of inorganic compound in pharmaceuticals

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	**15**	**75**	**100**

Course Content:

Unit-1 Introduction 10 hours
Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate . General methods of preparation, assay for the compounds superscripted with asterisk (*), properties and medicinal uses of inorganic compounds belonging to the following classes.
Unit II: 8 Hours
Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of

tonicity, calculations and methods of adjusting isotonicity. Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance. Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.
Unit III: 10 Hours
Gastrointestinal agents Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations
Unit-IV 08 Hours
Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333 Astringents: Zinc Sulphate, Potash Alum
Unit-V 07 Hours
Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions & pharmaceutical application of radioactive substances.
Unit IV 08 Hours
Recent Advances in Pharmaceutical Inorganic chemistry • Water for injection. • Radiopharmaceuticals used for drug discovery and development. • Inorganic compounds used in pharmaceutical preparations. • Mettalic compounds used in pharmaceutical preparations.

Suggested Reading

Text Book (s)

Text Book (s)

1. A.I. Vogel, Text Book of Quantitative Inorganic analysis
2. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
3. M.L Schroff, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. Anand & Chatwal, Inorganic Pharmaceutical Chemistry

Reference Book

1. Atherden L.M., Bentley and Drivers' "Text Book of Pharmaceutical Chemistry", Oxford University Press, London..
2. Indian Pharmacopoeia
1.https://www.drugs.com/pro/water-for-injection.html

2. WHO Guidelines. Production of water for injection by means other than distillation. https://www.who.int/medicines/areas/quality_safety/quality_assurance/QAS19_786_Rev_1_Water_for_Injection.pdf?ua=1

3. Radiopharmaceuticals: Drug Development and Regulatory Issues. https://link.springer.com/chapter/10.1007/978-3-540-

76735-0_20
4. Radioactive Drugs in Clinical Medicine. https://www.iaea.org/sites/default/files/15205681319.pdf
5.https://www.researchgate.net/publication/267961271_Metal_Based_Drugs_Current_Use_and_Future_Potential
Introduction to pharmaceutical inorganic chemistry.
6.http://www.bspublications.net/downloads/059c4987a9551e_Ch1_Pharmaceutical%20Inorganic%20Chemistry_2nd%20Ed._Algarsamy.pdf
7. Medicinal Uses of Inorganic Compounds - 1.https://www.ias.ac.in/article/fulltext/reso/011/04/0075-0090.

Name of The Course	**COMMUNICATION SKILLS (Theory) 30 hrs.**			
Course Code	**BPHT1005**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	0	2

Course Objectives:

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Course Outcomes

CO1	Student will be able to develop effective communication skills for professionals.
CO2	Students will be able to develop interview handling skills.
CO3	Students will be able to develop presentation skills.
CO4	Students will be able to develop the skills for meeting people and asking questions
CO5	Students will be develop the listening skills and and effective written communication.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	15	75	100

Unit-1Introduction **10 hours**
Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers
Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment
Unit-2 **10 Hours**
Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication **Communication Styles:** Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style
Unit-3 **08 Hours**
Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations **Effective Written Communication:** Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion’

Required, Shades of Meaning, Formal Communication **Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message
Unit-4 07 Hours
Interview Skills: Purpose of an interview, Do's and Dont's of an interview **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery
Unit-5
Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

Text Book (s)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010

Reference Book (s)

1. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011
2. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
3. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
4. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
5. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
6. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

Name of The Course	**REMEDIAL BIOLOGY (Theory) 30 hrs.**			
Course Code	**BPRT 1006**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	0	2

Course Objectives:

Upon completion of the course, the student shall be able to

1. know the classification and salient features of five kingdoms of life
2. understand the basic components of anatomy & physiology of plant
3. know understand the basic components of anatomy & physiology animal with special reference to human

Course Outcomes

The student shall be able to

CO1	Analyze basic classification of five kingdoms of life and morphology of flowering plants
CO2	Analyze components of body fluids, mechanism of breathing and respiration and role of digestiveenzymes in digestion and absorption
CO3	Apply the anatomy & physiology animal with special reference to human excretory system ,reproduction system,Endocrine glands.
CO4	Analyze/familiarize with plants and mineral nutrition and factors affecting photosynthesis.
CO5	Analyze the plant growth & structure, functions of cell and tissue.

CO6	Elaborate the skeletal system and joint with disorders.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
5	10	35	50

Course Content:

Unit I: Living world and Morphology of Flowering plants

7 Hours

Living world:
Definition and characters of living organisms
Diversity in the living world
Binomial nomenclature
Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus.

Morphology of Flowering plants :
Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones.

Unit II: Body fluids and circulation

7 Hours

Composition of blood, blood groups, coagulation of blood :
Composition and functions of lymph

Human circulatory system
Structure of human heart and blood vessels
Cardiac cycle, cardiac output and ECG

Digestion and Absorption
Human alimentary canal and digestive glands
Role of digestive enzymes
Digestion, absorption and assimilation of digested food

Breathing and respiration
Human respiratory system
Mechanism of breathing and its regulation
Exchange of gases, transport of gases and regulation of respiration
Respiratory volumes

Unit III:Excretory products and their elimination

7 Hours

Excretory products and their elimination :
Modes of excretion
Human excretory system- structure and function
Urine formation
Rennin angiotensin system

Neural control and coordination :
Definition and classification of nervous system
Structure of a neuron
Generation and conduction of nerve impulse
Structure of brain and spinal cord
Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation :
Endocrine glands and their secretions
Functions of hormones secreted by endocrine glands

Human reproduction :
Parts of female reproductive system
Parts of male reproductive system
Spermatogenesis and Oogenesis
Menstrual cycle

Unit IV: Plants and mineral nutrition

5 Hours

Plants and mineral nutrition:

Essential mineral, macro and micronutrients

Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

Unit V: Plant respiration

4 Hours

Plant respiration:
Respiration, glycolysis, fermentation (anaerobic).

Plant growth and development Phases and rate of plant growth, Condition of growth,Introduction to plant growth regulators **Cell - The MODULE of life** Structure and functions of cell and cell organelles.Cell division **Tissues** Definition, types of tissues, location and functions.
Unit VI: Skeletal System 8 Hours
Skeletal System: Structure and Functions of skeletal system, classification: Axial skeletal : cranium bones, facial bones, ribs, vertebral column, Hyoid bones and ear bones, Appendicular bones: upper limbs, lower limbs, pectoral and pelvic girdle. **J**oints & joint disorder**:** Definition , types of joints: Fibrous, cartilagenious and synovial joints, joint disorder.

Suggested Reading

Text Books

1. Text book of Biology by S. B. Gokhale
2. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.
3.A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate.
4. Garg K, Joshi M, Kundu S. Anatomy & Physiology. CBS Publishers & Distributors.
5. Murugesh N. Basic Anatomy And Physiology. Sathya Publisher.

Reference Books

1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C.Dutta
4. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.

Name of The Course	**REMEDIAL MATHEMATICS (Theory)**

	30 hrs.			
Course Code	**BPMT 1006**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	**0**	**2**

Course Objectives:

Upon completion of the course the student shall be able to:-

1. Know the theory and their application in Pharmacy

2. Solve the different types of problems by applying theory

3. Appreciate the important application of mathematics in Pharmacy

Course Outcomes

CO1	**The students will be able to use the statistical tools for pharmacy applications.**
CO2	**The students will be able to design the experiments and perform ANOVA analysis of the results.**

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	**15**	**75**	**100**

Unit-1 Introduction 06 hours
Partial fraction Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction , Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics
Logarithms Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.
Function:

Real Valued function, Classification of real valued functions, Limits and continuity : Introduction , Limit of a function, Definition of limit of a function
Unit-2 06 Hours
Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem,Applicationof Matrices in solving Pharmacokinetic equations
Unit-3 06 Hours
Calculus Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – Without Proof, Derivative of x^n *w.r.t*x,where *n* is any rational number, Derivative of e^x,, Derivative of loge *x* , Derivative of a^x,Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application
Unit-4 06 Hours
Analytical Geometry Introduction: Signs of the Coordinates, Distance formula, Straight Line : Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line Integration:
Introduction, Definition, Standard formulae, Rules of Method of Partial fractions, Integration by parts, definite
Unit-5 06 Hours
Differential Equations : Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations
Laplace Transform : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations

Text Book (s)

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.

Reference Book (s)

1. Integral Calculus by Shanthinarayan
2. Higher Engineering Mathematics by Dr.B.S.Grewal

Name of The Course	**HUMAN ANATOMY AND PHYSIOLOGY (Practical) -4 hrs/week**			
Course Code	**BPHP1007**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

To understand the anatomy and physiology, concepts of health and disease of human body

Course Outcomes

CO1	Students will able to analyze functional characteristics of cells and tissues, skeletal system, skeletal and smooth muscles.

CO2	Students will able to perform experiments of compositions, functions of blood and its elements.

Text Book (s)

- 1. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
- 2. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Book (s)

- 1. Physiological basis of Medical Practice- Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
- 2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
- 3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

Course Content

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. To study the integumentary and special senses using specimen, models, etc.,
7. To study the nervous system using specimen, models, etc.,
8. To study the endocrine system using specimen, models, etc
9. To demonstrate the general neurological examination
10. To demonstrate the function of olfactory nerve
11. To examine the different types of taste.
12. To demonstrate the visual acuity
13. To demonstrate the reflex activity
14. Recording of body temperature
15. To demonstrate positive and negative feedback mechanism.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	**PHARMACEUTICAL ANALYSIS –I (Practical)**			
Course Code	**BPHP1008**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

The basic objective of this course is to get familiar with titrations and analysis.

Course Outcomes

CO1	The student will be able to illustrate the limit test for identification and control of small amount impurity.
CO2	The student will be able to illustrate the preparation and standardization of different concentrations solutions.
CO3	The student will be able to illustrate the assay of the compounds along with standardization of Titrant.

CO4	The student will be able to illustrate the determination of normality by electro-analytical methods.

Text Book (s)

1. Mendhanm J, Denny R.C., Barnes J.D., Thomas M, Jeffery G.H., "Vogel's Textbook of Quantitative Chemical Analysis", Pearson Education Asia.
2. Conners K.A., "A Text book of Pharmaceutical Analysis", Wiley Inter-science.
3. Beckett, A.H., and Stenlake, J.B., Practical Pharmaceutical Chemistry, Vol. I&II. The Atherden Press of the University of London

Reference Book (s)

1. British Pharmacopocia, Her Majesty's Stationary Office, University Press, Cambridge.
2. Alexeyev V. "Quantitative Analysis". CBS Publishers & Distributors 6. The Pharmacopoeia of India.

Course Content

Limit Test of the following
(1) Chloride
(2) Sulphate
(3) Iron
(4) Arsenic

Preparation and standardization of
(1) Sodium hydroxide
(2) Sulphuric acid
(3) Sodium thiosulfate
(4) Potassium permanganate
(5) Ceric ammonium sulphate

Assay of the following compounds along with Standardization of Titrant
(1) Ammonium chloride by acid base titration
(2) Ferrous sulphate by Cerimetry
(3) Copper sulphate by Iodometry
(4) Calcium gluconate by complexometry
(5) Hydrogen peroxide by Permanganometry
(6) Sodium benzoate by non-aqueous titration
(7) Sodium Chloride by precipitation titration

- **Determination of Normality by electro-anal**

(1) Conductometric titration of strong acid against strong
(2) Conductometric titration of strong acid and weak acid
(3) Potentiometric titration of strong acid against strong b

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	10	35	50

Name of The Course	**PHARMACEUTICS-I (Practical)**
Course Code	**BPHP1009**
Prerequisite	
Corequisite	
Antirequisite	

	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

Upon completion of this course the student should be able to:

1. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
2. Understand the professional way of handling the prescription
3. Preparation of various conventional dosage forms

Course Outcomes

CO1	Students will be able to formulate liquid dosage form.
CO2	Students will be able to formulate solution.
CO3	Students will be able to formulate semi-solid dosage from.

Text Book (s)

1. Carter S.J., "Cooper and Gunn's Tutorial Pharmacy", CBS Publishers, Delhi.
2. Rawlins E.A., "Bentley's Text Book of Pharmaceutics", ELBS Bailliere Tyndall.
3. Lachman L,Liberman H.A and Kanig J.L., "Theory and Practice of Industrial Pharmacy", Lea and Febiger.
4. Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.

Reference Books

1. Aulton, M.E, Text Book of Pharmaceutics, Vol., I & II. Churchill Livingstone.
2. United States Pharmacopoeia (National Formulary).
3. Remington – "The science and practice of pharmacy" Vol. I & II. Mack Publishing Co., Pennsylvania.
4. Pharmacopoeia of India, The Controller of Publications, Delhi.
5. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.

1. Syrups a) Syrup IP b) Paracetamol pediatric syrup
2. Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir
3.Linctus Simple Linctus BPC
4. Solutions a) Strong solution of ammonium acetate b) Cresol with soap solution
5. Suspensions a) Calamine lotion b) Magnesium Hydroxide mixture **5. Emulsions** a) Turpentine Liniment b) Liquid paraffin emulsion
6. Powders and Granules a) ORS powder (WHO) b) Effervescent granules c)Dusting powder
7. Suppositories a) Glycero gelatin suppository b) Soap glycerin suppository
8. Semisolids a) Sulphur ointment b) Non staining iodine ointment with methyl salicylate c) Bentonite gel
9. Gargles and Mouthwashes a) Potassium chlorate gargle **b) Chlorhexidinemouthwash**

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	**PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)**				
Course Code	**BPHP 1010**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	4	2	

Course Objectives:

Physical & Chemical properties of inhalants, topical agents and imparts knowledge of inorganic compounds employed as Pharmaceuticals.

Course Outcomes

CO1	The student will be able to perform the Limit tests for ions.
CO2	The student will be able to perform the Identification tests for the inorganic compounds.
CO3	The student will be able to prepare the inorganic pharmaceutical compounds.

Text Book (s)

1.Block, J.H. Roche, E, Soine, T and Wilson, C., "Inorganic, Medicinal & Pharmaceutical Chemistry", Lea & Febiger.
2. Discher, C. A., et.al Modern Inorganic Pharmaceutical Chemistry, wave land press.

Reference Books

1. Pharmacopoceia of India, 1996 edition.
2. Atherden L.M., Bentley and Drivers' "Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

Course Content

List of Experiments
Limit tests for following ions 1. Limit test for Chlorides and Sulphates 2. Modified limit test for Chlorides and Sulphates 3. Limit test for Iron 4. Limit test for Heavy metals 5. Limit test for Lead 6. Limit test for Arsenic
Identification test 1. Magnesium hydroxide 2. Ferrous sulphate 3. Sodium bicarbonate 4. Calcium gluconate 5. Copper sulphate
Test for purity 1. Swelling power of Bentonite 2. Neutralizing capacity of aluminum hydroxide gel 3. Determination of potassium iodate and iodine in potassium Iodide
Preparation of inorganic pharmaceuticals 1. Boric acid 2. Potash alum 3. Ferrous sulphate

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	10	35	50

Name of The Course	**COMMUNICATION SKILLS (Practical)**			
Course Code	**BPHP 1011**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Objectives:

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Course Outcomes

CO1	Understand the behavioral needs for a Pharmacist to function effectively in the areas of Pharmaceutical operation
CO2	Communicate effectively (Verbal and Non Verbal)
CO3	Effectively manage the team as a team player
CO4	Develop interview skills
CO5	Develop Leadership qualities and essentials

Text Book (s)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013

Reference Book (s)

1. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010

2. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011
3. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
4. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
5. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
6. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
7. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

Course Content

Thefollowing learning modules are to be conducted using wordsworth® English language lab software
Basic communication covering the following topics Meeting People Asking Questions Making Friends What did you do? Do's and Dont's
Pronunciations covering the following topics
Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)
Advanced Learning Listening Comprehension / Direct and Indirect Speech Figures of Speech Effective Communication Writing Skills Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	**REMEDIAL BIOLOGY (Practical)**				
Course Code	**BPRP 1012**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:

Upon completion of the course, the student shall be able to

1. know the classification and salient features of five kingdoms of life
2. understand the basic components of anatomy & physiology of plant
3. know understand the basic components of anatomy & physiology animal with special reference to human

Course Outcomes

CO1	The student will be able to analyze basic components of anatomy & physiology of plant by using microscope ,section cutting techniques mounting and staining,slide preparation.
CO2	The student will be able to analyze classification and salient features of five kingdoms of life after microscopic study of cell ,stem, root, leaf & identification of tissues.
CO3	The student will be able to analyze basic components of anatomy & physiology animal with special reference to human bones and blood test .

Text Book (s)

1. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.

Reference Book (s)

1. Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi

Course Content

1. Introduction to experiments in biology a) Study of Microscope b) Section cutting techniques c) Mounting and staining d) Permanent slide preparation
2. Study of cell and its inclusions 3. Study of Stem, Root, Leaf and its modifications 4. Detailed study of frog by using computer models 5. Microscopic study and identification of tissues 6. Identification of bones 7. Determination of blood group 8. Determination of blood pressure 9. Determination of tidal volume

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	Human Anatomy and Physiology-II			
Course Code	BPHT2001			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

1. To familiarize the students with different systems of body.

Course Outcomes

CO1	The student will be able to apply basic knowledge of the Nervous system and understand their functions to know the actions of the drug.
CO2	The student will be able to Illustrate and recognize the major organs and components of the Digestive system with their functions.
CO3	The student will be able to illustrate the major organs and components of the Respiratory and Urinary system.
CO4	The student will be able to Illustrate and understand the functions of the Endocrine system.
CO5	The student will be able to Illustrate and recognize the major organs of the Reproductive system and understand their functions.
CO6	Student will able to develop relevance and need of recent trends in particular organ system.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Nervous system **10 Hours**
Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid.structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity).
Unit II: Digestive System **10 Hours**
Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestineand large intestine, anatomy and functions

of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. **Energetics** Formation and role of ATP, Creatinine Phosphate and BMR.
Unit III: Respiratory System 10 Hours
Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration, Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods. **Urinary system** Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of RAS in acid base balance, role of RAS in kidney and disorders of kidney.
Unit IV: Endocrine system 10 Hours
Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.
Unit V: Reproductive system 9 Hours
Reproductive system Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition **Introduction to genetics** Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.
Unit VI: 8 Hours
Advances/Recent Trends in: Neurology, gastroenterology, respiratory system and diseases, nephrology, endocrinology, diabetology, sex hormone treatment, treatment of infertility.

Suggested Reading

Text Books

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.

Reference Books

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata
4. Difore S.H. "Atlas of Normal Histology" – Lea & Febiger Philadelphia

Name of The Course	PHARMACEUTICAL ORGANIC CHEMISTRY –I			
Course Code	BPHT2002			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

1. The student will be able to relate the basic concept of organic chemistry.
2. The student will be able to analyze the reaction Mechanism.
3. The student will be able to understand the uses of different organic compound.
4. The student will be able to understand the name reactions.Course Outcomes

Course Outcomes

CO1	The student will be able to relate the basic concept of chemistry and its nomenclature to understand the complex chemistry.
CO2	The student will be able to analyze the effect of bonds in the basic skeleton of chemical structure
CO3	The student will be able to apply the concept of substitution/elimination reactions in the conversion of alkyl halides to the different functional group
CO4	The student will be able to analyze the role of carbonyl group and related functional group in the synthesis of newer molecules
CO5	The student will be able to assess the importance of carboxylic acid based molecules in the chemistry
CO6	The student will able to develop relevance and need of recent trends in organic chemistry

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Classification, nomenclature and isomerism 10 Hours
Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds
Unit II: Alkanes, Alkenes and Conjugated dienes 10 Hours
SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP2 hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangemen
Unit III: Alkyl halides and alcohol 10 Hours
SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. • Alcohols- Qualitative tests, Structure and uses of Ethyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol
Unit IV: Carbonyl compounds (Aldehydes and ketones) 08 Hours
Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde
Unit V: Carboxylic acids, Aliphatic amines 07 Hours
Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

• Aliphatic amines - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine
Unit VI: 06 Hours
Recent Discoveries and Future Challenges in Atmospheric Organic Chemistry

Suggested Reading

1. Mann, F.G, & Saunders, B.C., Practical Organic Chemistry, ELBS/ Longman.
2. Vogel A.I., Textbook of Practical Organic Chemistry, ELBS/Longman.
3. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
4. Reaction and reaction mechanism by Ahluwaliah/Chatwal.
5. Morrison, R.T., and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt. Ltd,

Name of The Course	Biochemistry				
Course Code	BPHT2003				
Prerequisite					
Co-requisite					
Anti-requisite					
	L	**T**	**P**	**C**	
	3	1	0	4	

Course Objective

Upon completion of course student shell able to

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. **Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins**

Course Outcomes

CO1	**To understand and Identify different metabolic pathways involved in Carbohydrate.**
CO2	**To understand and Identify different metabolic pathways involved in lipid and aminoacids.**
CO3	**To understand the Nucleic acid metabolism and genetic information**
CO4	**To understand and analyse the role of biomolecules and bioenergetics**
CO5	**To understand about the regulation of enzyme function, metals and vitamins as coenzymes.**
CO6	The students will be able to understand about recent development of biochemistry.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	15	75	100

Course Content:

Unit I: **Carbohydrate metabolism** **10 Hours**
Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus **Biological oxidation** Electron transport chain (ETC) and its mechanism. **Oxidative phosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers**
Unit II: **10 Hours**
Lipid metabolism β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid)

Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D
Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

Amino acid metabolism

General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders
Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)
Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline

Catabolism of heme; hyperbilirubinemia and jaundice

Unit III:

10 Hours

Nucleic acid metabolism and genetic information transfer

Biosynthesis of purine and pyrimidine nucleotides
Catabolism of purine nucleotides and Hyperuricemia and Gout disease
Organization of mammalian genome
Structure of DNA and RNA and their functions
DNA replication (semi conservative model)
Transcription or RNA synthesis

Genetic code, Translation or Protein synthesis and inhibitors

Unit IV : 8 **Hours**

Biomolecules

Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

Bioenergetics

Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.

Energy rich compounds; classification; biological significances of ATP and cyclic AMP

Unit V: 7 Hours

Enzymes

Introduction, properties, nomenclature and IUB classification of enzymes
Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)
Enzyme inhibitors with examples
Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation
Therapeutic and diagnostic applications of enzymes and isoenzymes

Unit VI : 5 **Hours**

Recent development of biochemistry.

References:

https://www.tandfonline.com/doi/abs/10.1080/10826068.2011.613976
https://link.springer.com/article/10.1007/s12010-008-8243-y

Name of The Course	Pathophysiology			
Course Code	BPHT2004			
Prerequisite				
Co-requisite				
Anti-requisite				
L	**T**	**P**	**C**	
3	1	0	4	

Course Objectives

1.Describe the etiology and pathogenesis of the selected disease states
2.Name the signs and symptoms of the diseases; and
3.Mention the complications of the diseases

Course Outcomes

CO1	Analyze pathogenesis of cell injury, adaptation and basic mechanism involved in theprocess of inflammation and repair
CO2	To Analyze the signs and symptoms of the diseases.
CO3	Analyze the concept of pathophysiology of disease involved in human body system

CO4	Analyze the complications of the diseases related to joints and cancer
CO5	Analyze the mode of transmission, its vector, causes of different infectious diseases andSexually transmitted diseases
CO6	Assess the recent advances in pathophysiology and wound healing

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Basic principles of Cell injury and Adaptation 10 Hours
Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury,Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage),Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia),Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis &Alkalosis,Electrolyte imbalance **Basic mechanism involved in the process of inflammation and repair:** Introduction, Clinical signs of inflammation, Different types of Inflammation,Mechanismof Inflammation – Alteration in vascular permeability and blood flow, migration ofWBC's,Mediators of inflammation,Basic principles of wound healing in theskin,Pathophysiology of Atherosclerosis
Unit II: Cardiovascular System8 Hours
Hypertension, congestive heart failure, ischemic heart disease (angina,myocardialinfarction, atherosclerosis and arteriosclerosis) **Respiratory system:**Asthma, Chronic obstructive airways diseases. **Renal system**:Acute and chronic renal failure

Unit III:Haematological Diseases. 10 Hours
Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia,thalasemia, hereditary acquired anemia, hemophilia **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression,schizophrenia and Alzheimer's disease. **Gastrointestinal system**: Peptic Ulcer
Unit IV: Disease of bones and joints 08 Hours
Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease. **Disease of bones and joints**: Rheumatoid arthritis, osteoporosis and gout **Principles of cancer**: classification, etiology and pathogenesis of cancer
Unit V: Infectious diseases 07 Hours
Meningitis,Typhoid, Leprosy, Tuberculosis , Urinary tract infections **Sexually transmitted diseases:**AIDS, Syphilis, Gonorrhea
Unit VI: Recent Advances in Pathophysiology 08 Hours
Recent advances in understanding human malignancy, Advances in wound healing and wound care, Autophagy and regulated necrosis, Recent advances in the pathophysiology of inherited metabolic diseases.

Suggested Reading

1.Chaurasia B.D, Human Anatomy, Regional &Applied Part I, II & III, CBS Publishers& Distributors, New Delhi.

2.C Simon Herrington[1] , Richard Poulsom[2] and Philip J Coates,Recent Advances in Pathology: the 2019 Annual Review Issue of The Journal of Pathology,*J Pathol*2019; 247: 535–538.

3. Patricia F. Schuck, Recent advances in the pathophysiology of inherited metabolic diseases, *Int J Dev Neurosci.* 2020;80:50–51.

4. Mariana Barreto Serra et al., From Inflammation to Current and Alternative Therapies Involved in Wound Healing,International Journal of Inflammation Volume 2017, Article ID 3406215, 17 pages.
5. Sujata Sarabahi. Recent advances in topical wound care,Indian J Plast Surg. 2012 May-Aug; 45(2): 379–387.

Name of The Course	**COMPUTER APPLICATIONS IN PHARMACY (Theory) 30 hrs**			
Course Code	**BPHT 2005**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

Upon completion of the course the student shall be able to

1. Know the various types of application of computers in pharmacy
2. Know the various types of databases
3. Know the various applications of databases in pharmacy

Course Outcomes Upon completion of this course the student should be able to:

CO1	know the various types of application of computers in pharmacy.
CO2	know the various types of databases
CO3	know the various applications of databases in pharmacy
CO4	To know the concept of bioinformatics related to pharmacy
CO5	Data analysis in preclinical development related to pharmacy.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term**	**Total Marks**
		Test (ETE)	
10	15	50	75

Course Content

Unit-1	**06 Hours**
Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division **Concept of Information Systems and Software : I**nformation gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	
Unit-2	**06 Hours**
Web technologies: Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	
Unit-3	**06 Hours**
Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	
Unit-4	**06 Hours**
Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	

Unit-5 06 Hours
Computers as data analysis in Preclinical development: Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS)

Text Book (s)

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.

2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA

3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1-A, 11 Darya Gani, New Delhi – 110 002(INDIA)

Reference Book (s)

1. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

Name of The Course	Environmental Sciences			
Course Code	BPHT 2006			
Prerequisite				
Co-requisite				
Anti-requisite				
L	**T**	**P**	**C**	
3			3	

Course Objectives

Upon completion of the course the student shall be able to:

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

Course Outcomes

CO1	The Environmental studies prepares students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective.
CO2	Students will describe and analyze the current national and global environmental problems; looking at the science behind them, the economics involved, and the policies regarding them.
CO3	Appraise the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural environment systems
CO4	Student will understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
CO5	Student will apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
CO6	Elaborate the impact of toxic chemicals on enzymes and biochemical effect of heavy metals.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	15	50	75

Course Content:

Unit I: Natural resources **10 Hours**

The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.
Unit II: Ecosystems 10 Hours
Ecosystems • Concept of an ecosystem. • Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
Unit III: Environmental Pollution 10 Hours
Environmental Pollution: Air pollution; Water pollution; Soil pollution
Unit VI: Chemical Toxicology**8 Hours**
Toxic chemicals in the environment, Impact of toxic chemicals on enzymes, biochemical effects of arsenic, cadmium, lead, chromium, mercury, biochemical effects of pesticides.

Suggested Reading

Text Books

1. anoharachary C., Reddy P. J., Principles of Environmental Studies, Pharma Book Syndicate, Hyderabad
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Publishing Company Ltd.
3. Rajagopalan R, Environmental Studies-From Crisis to Cure, Oxford University Press.
4. B. L. Valle & D. D Ulmen Biochemical Effects Of Lead, Cadmium & Mercury

Reference Book

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
2. Clark R.S., Marine Pollution, Clanderson Press Oxford
3. De A.K., Environmental Chemistry, Wiley Eastern Ltd.

Name of The Course	**HUMAN ANATOMY AND PHYSIOLOGY-II (Practical) 4 hrs/week**			
Course Code	**BPHP 2007**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

To understand the anatomy and physiology, concepts of health and disease of human body.

Course Outcomes Upon completion of this course the student should be able to:

CO1	Students will able to analyze Different Biological Values of Blood.
CO2	Students will able to analyze Different Biological Values of Vital Organs.

Text Books

1. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
2. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

Course Content

1. Introduction to hemocytometry. 2. Enumeration of white blood cell (WBC) count 3. Enumeration of total red blood corpuscles (RBC) count 4. Determination of bleeding time 5. Determination of clotting time 6. Estimation of hemoglobin content

7. Determination of blood group.
8. Determination of erythrocyte sedimentation rate (ESR).
9. Determination of heart rate and pulse rate.
10. Recording of blood pressure.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basal mass index .
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	10	35	50

Name of The Course	**PHARMACEUTICAL ORGANIC CHEMISTRY-I (Practical) 4 hrs/week**			
Course Code	**BPHP 2008**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

Identification of elements and functional groups in the given organic samples

and study of reactions involving acetylation, benzoylation, chlorination, oxidation & reduction.

Course Outcomes Upon completion of this course the student should be able to:

CO1	Analyze the unknown sample with respect to preliminary test
CO2	Analyze the unknown sample with respect to detection of elements.
CO3	Analyze the unknown sample with respect to functional group test.
CO4	Identification of the unknown
CO5	Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.

Text Books

1. Mann, F.G, & Saunders, B.C., Practical Organic Chemistry, ELBS/ Longman.
2. Vogel A.I., Textbook of Practical Organic Chemistry, ELBS/Longman.
3. Morrison, R.T., and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt. Ltd,
New Delhi.
4. Finar, I.L., Organic Chemistry, Vol. I & II, ELBS/Longman.
5. Jain, M.K. Organic Chemistry, Sohan Lal Nagin Chand & Co.
60 B, Bunglaw Road, Delhi.

Reference Books

1. Hendrikson, Organic Chemistry.
2. Godly, E.W. " Naming organic compounds".
3. Kalsi," Organic reactions Stereochemistry & Mechanism".

Course Content

I. Systematic qualitative analysis of unknown organic compounds like
1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
3. Solubility test
4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic

and Halogenated Hydrocarbons, Nitro compounds and Anilides.
5. Melting point/Boiling point of organic compounds
6. Identification of the unknown compound from the literature using melting point/ boiling point.
7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
8. Minimum 5 unknown organic compounds to be analysed systematically
II. Preparation of suitable solid derivatives from organic compounds
III. Construction of molecular models

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	BIOCHEMISTRY PRACTICAL 4 hrs./week				
Course Code	BPHP 2009				
Prerequisite					
Corequisite					
Antirequisite					
	L	T	P	C	
	0	0	4	2	

Course Objectives:
The basic objective of this course is to familiar with naming, mechanism of action and inhibition of enzymes, Metabolism of carbohydrates and lipids, Biological oxidation and energetic of oxidative phosphorylation and bio synthesis and catabolism of amino-acids.

Course Outcomes Upon completion of this course the student should be able to:

CO1	1. Student will gain proficiency in basic laboratory techniques in both chemistry and biology, and be able to apply the scientific method to the processes.
CO2	2. Students will use current biochemical and molecular techniques to plan and carry out experiments through various techniques.
CO3	Student will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data.
CO4	4. Students will analyze primary literature. This will include evaluation of experimental techniques.
CO5	5. Student will be able to analyze and estimate the various constituent in biological fluids..

Text Books

1. Stryer L., *Biochemistry*, WH, Freeman & Company, San Francisco.
2. Plummer, David J., *An Introduction to Practical Biochemistry*, Tata Mc Graw Hill,
New Delhi.
3. Singh S.P., *Practical Manual to Biochemistry*, CBS Publisher, New Delhi.

Reference Book

1. Harpers, *Review of Biochemistry*, Lange Medical Publication.
2. Conn E.E. & Stumph P.K., *Outline of Biochemistry*, John Willery & Sons, New York.
3. Nelson D.L. & Cox M.M., *Lehninger Principles of Biochemistry*, Macmillan Worth Publishers.

Course Content

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2. Identification tests for Proteins (albumin and Casein)

3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of blood creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of pH
9. Study of enzymatic hydrolysis of starch
10. Determination of Salivary amylase activity
11. Study the effect of Temperature on Salivary amylase activity.
12. Study the effect of substrate concentration on salivary amylase activity.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	10	35	50

Name of The Course	**COMPUTER APPLICATIONS IN PHARMACY (Practical) 2 hrs/week**				
Course Code	**BPHP 2010**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives: The basic objective of this course is to get familiar with computers and programming Language.

- **Course Outcomes** Upon completion of this course the student should be able to:

CO1	Student will develop a vocabulary of key terms related to the computer and to software program menus
CO2	Student will be able to demonstrate window and menu commands and how they are used.
CO3	Student will be able to demonstrate how to organize files and documents on a USB/hard drive.
CO4	Student will be able to compose, format and edit a word document.
CO5	Student will be able to navigate and search through the internet.

Text Book (s)

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1-A, 11 Darya Gani, New Delhi – 110 002(INDIA)

Reference Book (s)

1. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

Course Content

1. Design a questionnaire using a word processing package to gather information about a particular disease
2. Create a HTML web page to show personal information
3. Retrieve the information of a drug and its adverse effects using online tools

4. Creating mailing labels Using Label Wizard , generating label in MS WORD
5. Create a database in MS Access to store the patient information with the required fields Using access
6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	5	15	25

Name of The Course	Pharmaceutical Organic Chemistry-II			
Course Code	BPHT3001			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1		4

Course Objectives

1.Understand structure, name and the type of isomerism of the organic compound
2.Explain the orientation of organic reactions.
3.Observe the chemistry of Fats and Oils.
4.Understand the chemistry of polynuclear hydrocarbons.

Course Outcomes

CO1	Recall the basic knowledge of method of preparation, reactions and properties of Benzene and its derivatives
CO2	Demonstrate a high-level understanding of method of preparation, reactions and properties of phenols, aromatic amines and aromatic acids
CO3	Develop basic knowledge of fats and oils and their analytical constants
CO4	Analyze the synthesis, different reactions, properties, structure and medicinal uses of polynuclear hydrocarbons and substituted alkanes
CO5	Assess the stabilities, theory of strainless rings and reactions of cyclo alkanes
CO6	Discuss the newer reactions, determinations and uses of selected organic compounds

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Benzene and its derivatives 10 Hours
A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule. B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedelcrafts alkylation-reactivity, limitations, Friedelcrafts acylation. C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction. D. Structure and uses of DDT, Saccharin, BHC and Chloramine

Unit II: Phenols, Aromatic Amines, Aromatic Acids 10 Hours
A. Phenols- Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols B. Aromatic Amines - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts. C. Aromatic Acids –Acidity, effect of substituents on acidity and important reactions of benzoic acid
Unit III: Fats and Oils 10 Hours
A. Fatty acids – reactions. B. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. C. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination
Unit IV: Polynuclear hydrocarbons8 Hours
A.Synthesis, reactions B.Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives
Unit V: Cyclo alkanes 7 Hours
Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only
Unit VI: **Recent advancements in reactions and analytical methods of selected organic compounds 8 Hours**
A. Phenol derivatives from plant sources: structure and medicinal uses of Berberine, Carvacrol, thymol, B. New trends of diazonium chemistry in aqueous media C. New analytical methods in oils and fats:Determination of mono, diglycerides, triglycerides, tocopherols in fats and vegetable oils

Suggested Reading

1.Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl
2.Organic Chemistry by Morrison and Boyd
3.Indian Pharmacopoeia
4.Arenediazonium salts transformations in water media:Coming round to origins.M.E. Trusova et al. / Resource-Efficient Technologies; Science direct; 2 (2016) 36–42
5.Standard Methods for the Analysis of Oils, Fats and Derivatives. 1st Supplement to the 7th Edition. International Union of Pure and Applied Chemistry, Commission on Oils, Fats and Derivatives

Name of The Course	PHYSICAL PHARMACEUTICS-I			
Course Code	BPHT3002			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

1. To study the graphics techniques, packages and algorithms.
2. To enable the Students to understand the Graphics rendering and hardware.
3. To enable the Students to learn visualization techniques.

Course Outcomes

CO1	Student will able to understand the physicochemical properties of drug molecules, pH, solubility, distribution, adsorption, and stability parameters.
CO2	Students will able to analyze about different states of matter and principles of lyophilization, aerosols, condensed systems, phase diagram and their pharmaceutical applications
CO3	Student will able to analyze and explain the role of surfactants, interfacial phenomenon

	and thermodynamics in liquid dosage forms.
CO4	Student will able to analyze about concept and application of complexation, protein binding and crystallization.
CO5	Student will able to analyze about concept and application of complexation, protein binding and crystallization.
CO6	The students shall be able to analyze different physical properties with latest equipments.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Test	End Term Test (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Solubility of drugs 10 hours
Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications
Unit II: States of Matter and properties of matter 10 hours
State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols–inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid- crystalline, amorphous & polymorphism. Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.
Unit III: Surface and interfacial phenomenon 10 hours
Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.
Unit IV : Complexation and protein binding 8 hours
Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants
Unit V: pH, buffers and Isotonic solutions 7 hours
Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.
Unit VI: Advances in Physical Pharmaceutics 08 Hours
Advanced methods for the measurement of different physicochemical properties i.e. Surface tension, Viscosity, Refractive index etc, Software for the pseudo ternary phase diagram drawing, Utilization of MS-excel for different calculations.

Suggested Reading

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.

6. Physical Pharmaceutics by Ramasamy C and ManavalanR
7. Chemix software for phase diagram

Name of The Course	Pharmaceutical Microbiology			
Course Code	**BPHT3003**			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

Upon completion of the subject student shall be able to;

1. Students will be able to understand different types of microorganisms.
2. Students will be able to understand about staining, cultivation of microbes and methods of sterilization & sterility testing and microbiological assays.

CO1	The student will be able to understand different types of microorganisms, classification and taxonomy
CO2	The student will be able to understand about staining, cultivation of microbes and methods of sterilization Control
CO3	The student will be able to understand about disinfectants and antiseptics
CO4	The student will be able to understand about aseptic area, laminar flow and microbiological assays
CO5	The student will be able to understant about spoilage and application of cell cultures
CO6	The student will understand about recent microbiological based technique used in Diagnosis and Medical Sciences.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: 10 Hours
Introd **Introduction of Microbiology** Intr Introduction, history of microbiology, its branches, scope and its importance,Introduction to Prokaryotes and Eukaryotes.Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy, Nimbus.
Unit II: 10 Hours
Sterlization and Staining of Bacteria Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous,radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods Equipments employed in large scale sterilization. Sterility indicators
Unit III: **10Hours** **Disinfection, antiseptics and their evaluation** Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants

Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions

Evaluation of bactericidal & Bacteriostatic.

Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Unit IV 08 Hours

Aseptic area and different microbiological assay

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids.

Assessment of a new antibiotic.

Unit V: 07 Hours

Microbial contamination and spoilage.

– Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.

Unit VI 08 Hours

Recent Advances in Microbiology

Nucleic acid probing and amplification tests,

Cytometry-based antimicrobial resistance techniques,

Breath tests for detection of pathogenic microbes.

Bioanalytical sensors and Biodetection.

Vaccine

Microarray analysis:

Rapid antigen and antibody detection tests.

Name of The Course	Pharmaceutical Engineering			
Course Code	BPHT3004			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

Upon completion of the course, the student shall be able to understand:

1. To know various unit operations used in Pharmaceutical industries
2. To perform various processes involved in pharmaceutical manufacturing process
3. To understand the material handling techniques.
4. Pharmaceutical industries significance of plant lay out design for optimum use of resources.

Course Outcomes

CO1	The student will able to apply the knowledge to describe phenomenon of flow of fluids i.e., liquid and gases, size reduction and separation for effective good practices on pharmaceutical field
CO2	The student will able to understand and analyse the process and mechanism of heat transfer, evaporation and distillation
CO3	The student will able to apply the concept of drying and mixing process of developing formulation
CO4	The student will able to analyse the Pharmaceutical products by filtration and centrifugation processes
CO5	The student will able to understand basic materials, are used in materials of pharmaceutical plant construction, Corrosion and its prevention technology etc.

CO6	The student will able to creating and know recent advances in fine particle characterization..

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: 10 Hours

Flow of fluids, Size Reduction and Size Separation

Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.

Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

Unit II: 10 Hours

Heat Transfer, Evaporation and Distillation

Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

Distillation: Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

Unit III:

10Hours

Drying And Mixing

Drying: Objectives, applications & mechanism of drying process, measurements

& applications of Equilibrium Moisture content, rate of drying curve. principles,

construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier.

Unit IV 08 Hours

Filtration and Centrifugation

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter Medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

Unit V: 07 Hours

Materials of pharmaceutical plant construction, Corrosion and its prevention

Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant

construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems
Unit VI 08 Hours
Recent Advances in fine particle characterization: Importance of particle size in pharmaceutical industry, properties of fine particles, Establishing particle size specifications, Direct method, Brightfield illumination, oblique illumination, Phase contrast illumination, Differential interference contrast illumination, Indirect method,laser diffraction analysis, Advantages and disadvantages of micronization, operational integrity of fine particle, Wadell's true sphercity and circularity,Dallavalle's shape factor, effect of fine particle.

Name of The Course	Universal Human Values and Ethics			
Course Code	UHVE1001			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	0	0	2	2

Course Objectives

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.

2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession

3. To help students understand the meaning of happiness and prosperity for a human being.

4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.

5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Course Outcomes: The student will able to

CO1	Remember the need, basic guidelines, content and process of value education.
CO2	Understand how to initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession.
CO3	Apply the means of happiness and prosperity for a human being.
CO4	Analyze harmony at all the levels of human living, and live accordingly.
CO5	Evaluate the understanding of harmony in existence in their profession and lead an ethical life.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	15	75	100

Course Content:

Unit I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
1. Understanding the need, basic guidelines, content and process for Value Education 2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit II:Understanding Harmony in the Human Being - Harmony in Myself

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Swasthya

Unit III: III Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding harmony in the Family- the basic unit of human interaction
14.Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;
Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
15.Understanding the meaning of Vishwas; Difference between intention and competence
16.Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
17.Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
18.Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!

Unit IV Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
22.Holistic perception of harmony at all levels of existence

Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics

23. Natural acceptance of human values
24.Definitiveness of Ethical Human Conduct
25.Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26.Competence in Professional Ethics:
a)Ability to utilize the professional competence for augmenting universal human order,
b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models
27.Case studies of typical holistic technologies, management models and production systems
28.Strategy for transition from the present state to Universal Human Order:
a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations

Text Books

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Reference Books

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Name of The Course	Pharmaceutical Organic Chemistry II -Practical				
Course Code	BPHP3005				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
			0	4	2

LIST OF EXPERIMENTS:

I Experiments involving laboratory techniques Recrystallization Steam distillation

II Determination of following oil values (including standardization of reagents) Acid value Saponification value Iodine value

III Preparation of compounds Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction. Benzoic acid from Benzyl chloride by oxidation reaction. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions. Benzil from Benzoin by oxidation reaction. Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction Cinnammic acid from Benzaldehyde by Perkin reaction P-Iodo benzoic acid from P-amino benzoic acid

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	Physical Pharmaceutics				
Course Code	BPHP3006				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS:

Determination the solubility of drug at room temperature
4 Hrs/week
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch
equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl4 and water

5. Determination of % composition of NaCl in a solution using phenol-water system by
CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine
complex bysolubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine
complex bypH titration method

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	Pharmaceutical Microbiology			
Course Code	BPHP3007			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
		0	4	2

LIST OF EXPERIMENTS:

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motilitydetermination by Hanging drop method.
8. Sterilitytesting of pharmaceuticals.
9. Bacteriological analysis of water 10. Biochemical test.9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	Pharmaceutical Engineering			
Course Code	BPHP3008			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	4	2

LIST OF EXPERIMENTS:

Determination of radiation constant of brass, iron, unpainted and painted glass.
II. Steam distillation – To calculate the efficiency of steam distillation.

III. To determine the overall heat transfer coefficient by heat exchanger.
IV. Construction of drying curves (for calcium carbonate and starch).
V. Determination of moisture content and loss on drying.
VI. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic andlogarithmic probability plots.
IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajor equipment.
XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration
and Thickness/ viscosity
XII. To study the effect of time on the Rate of Crystallization.
XIII. To calculate the uniformity Index for given sample by using Double Cone
Blender.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	Pharmaceutical Organic Chemistry III– Theory
Course Code	BPHT4001
Prerequisite	
Co-requisite	
Anti-requisite	

	L	T	P	C
	3	1	0	4

Course Objectives

Upon completion of the course the student shall be able to
1. Understand the methods of preparation and properties of organic compounds
2. Explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. Know the medicinal uses and other applications of organic compounds
4. Study the mechanism of selected name reactions

Course Outcomes

Upon completion ofthe course, the student shall be able to:

CO1	Define various aspects of optical isomerism in organic compounds.
CO2	Demonstrate nomenclature and configuration of geometrical isomerism
CO3	Identify the methods of synthesis, reactions and uses of Pyrrole, Furan and Thiophene.
CO4	Compare the synthesis methods and medicinal uses of other heterocyclic compounds.
CO5	Assess the mechanisms of some name reactions of synthetic importance.
CO6	Develop method for synthetic of heterocyclic moiety.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I:Stereo isomerism-Optical isomerism 10 Hours
Optical isomerism: Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute.
Unit II:Stereo isomerism-Geometrical isomerism10 Hours
Geometrical isomerism: Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions.
Unit III:Heterocyclic compounds-I 10 Hours
Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene.
Unit IV: Heterocyclic compounds-II 08 Hours
Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives.

Unit V: Reactions of synthetic importance 07 Hours
Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction Beckmanns rearrangement and Schmidt rearrangement.Claisen-Schmidt condensation.
Unit VI: Synthesis and Medicinal importance of Imidazole moieties 08 Hours
Imidazoles – Development of synthesis methods, Pharmacological activities, biological significance of imidazole moieties.

Suggested Reading

1.Organic chemistry by I.L. Finar, Volume-I & II..
2. Advanced organic chemistry – Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal.
4. Organic Chemistry by Morrison and Boyd.
5. Mossaraf Hossain, Ashis Kumar Nanda. A Review on Heterocyclic: Synthesis and Their Application in Medicinal Chemistry of ImidazoleMoiety. Science Journal of Chemistry. Vol. 6, No. 5, 2018, pp. 83-94. doi: 10.11648/j.sjc.20180605.12.

Name of The Course	**Medicinal Chemistry-I (Theory)**				
Course Code	**BPHT4002**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	**1**	**0**	**4**	

Course Objective:

Understand the chemistry of drugs with respect to their pharmacological activity
Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
Know the Structural Activity Relationship (SAR) of different class of drugs

Write the chemical synthesis of some drugs.

Course Outcomes:

At the end of the course, students will be able to:

CO1	remember the concept of drug, receptor and its interaction.
CO2	understand the concept of drug metabolism and prodrug.
CO3	apply the concept of classification, Synthesis, MOA, SAR and uses of drugs acting on the Cholinergic and Adrenergic system.
CO4	apply the concept of classification, Synthesis, MOA, SAR and uses of drugs acting on CNS.
CO5	analyse the concept of classification, Synthesis, MOA, SAR and uses of drugs acting on CNS.
CO6	Create the concept of classification, Synthesis, MOA, SAR and uses of drugs acting on CNS.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Term**	**End Term Test (ETE)**	**Total Marks**
10	**15**	**75**	**100**

Unit –I: Introduction to Medicinal Chemistry
Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. Drug metabolism Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.
Unit -II: Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol. Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.
Unit -III: Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.
Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.
Parasympathomimetic agents: SAR of Parasympathomimetic agents
Direct acting agents: Acetylcholine, Carbachol, Bethanechol, Methacholine, Pilocarpine.
Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.
Cholinesterase reactivator: Pralidoxime chloride.
Cholinergic Blocking agents: SAR of cholinolytic agents
Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide.
Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

Unit -IV: Drugs acting on Central Nervous System

Unit -V: Drugs acting on Central Nervous System
General anesthetics:
Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride.*
Narcotic and non-narcotic analgesics
Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.
Narcotic antagonists: Nalorphine hydrochloride, Levallorphan

A. Sedatives and Hypnotics:
Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem
Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital.
Miscelleneous:
Amides & imides: Glutethmide.
Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.
B. Antipsychotics
Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.
Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.
Fluro buterophenones: Haloperidol, Droperidol, Risperidone.
Beta amino ketones: Molindone hydrochloride.
Benzamides: Sulpieride.
C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action
Barbiturates: Phenobarbitone, Methabarbital.
Hydantoins: Phenytoin*, Mephenytoin, Ethotoin
Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine*
Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

Unit -V: **Drugs acting on Central Nervous System**
General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane,Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra short acting barbitutrates: Methohexital sodium*,Thiamylal sodium, Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride.*
Narcotic and non-narcotic analgesics
Morphine and related drugs: SAR of Morphine analogues,Morphine sulphate, Codeine, Meperidine hydrochloride,Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.
Narcotic antagonists: Nalorphine hydrochloride, Levallorphan

Unit VI Molecular properties and drug design

a) Prediction and analysis of ADMET properties of new molecules and its importance in drug design.

b) De novo drug design: Receptor/enzyme-interaction and its analysis, receptor/enzyme cavity size prediction, predicting the functional components of cavities.

c) Introduction to homology modeling and generation of 3D-structure of protein.

Text Books

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.

Reference Books

1. Remington's Pharmaceutical Sciences.
2. Pharmacopoeia of India, The Controller of Publications, Delhi.
3. United States Pharmacopoeia (National Formulary).
4. Atherden L.M., Bentley and Drivers' "Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

Name of The Course	Physical Pharmaceutics-II			
Course Code	BPHT4003			
Prerequisite				
Co-requisite				
Anti-requisite				
L	**T**	**P**	**C**	
3	1	0	4	

Course Objectives

1. This subject deals with the following major objectives:
2. Understand various physicochemical properties of drug molecules in the designing the dosage forms
3. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
4. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms
5. To understand about the particles, their properties and the role of micromeretics in powder handling and formulation.
6. To understand about the newtonian systems, Law of flow, kinematic viscosity and complexation, classification of complexes.
7. To understand the colloidal dispersions and their properties with applications.

Course Outcomes

CO 1	Students will able to relate physicochemical properties and kinetics of colloidal dispersion which will help in designing of the dosage forms.
CO 2	Students will able to identify types of flow (rheology) and thixotropic/stability of dispersion and semisolid dosage forms.
CO 3	Students will able to organize the basics involved in formulation and evaluation of coarse dispersion like suspension and emulsion.
CO 4	Students will able to examine fundamental and derived properties of individual

	particles and powder involved in dosage form designing.
CO5	Students will able to interpret chemical kinetics for determining stability of dosage forms.
CO6	Students will able to develop microparticles

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	15	75	100

Course Content:

Unit I: 10 Hours
Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action
Unit II:10 Hours
Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers. Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.
Unit III: 10Hours Coarse dispersion Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

Unit IV 10 Hours
Micromeritics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties
Unit V: 10Hours Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention
Unit VI 08 Hours
Microparticles: Introduction, classifification, Advantages and disadvantages, Drug release mechanism, Formulation techniques, characterization, Application.

Name of The Course	Pharmacology-I Theory			
Course Code	BPHT4004			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	T	P	C
	3	1		4

Course Objectives

Upon completion ofthe course, thestudent shallbeable to understand:

1. Understand the pharmacological actions of different categories of drugs

2.Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels.
3.Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4.Observe the effect of drugs on animals by simulated experiments
5.Appreciate correlation of pharmacology with other bio medical sciences.

Course Outcomes

CO1	The student will able to analyse physicochemical properties and kinetics of colloidal dispersion which will help in designing and evaluating the dosage forms
CO2	The student will able to evaluate the types of flow (rheology) and their measurement, thixotropic/stability of dispersions and semisolids systems.
CO3	The student will able to analyse the basics involved in formulation and evaluation of coarse dispersion like suspension and emulsion.
CO4	The student will able to evaluate physicochemical properties of particles involved in dosage form designing.
CO5	The student will able to apply the principles of chemical kinetics for stability testing of products.
CO6	Students will able to understand guidelines for Animal for screening of drugs.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: 12 Hours
General Pharmacology a.Introduction to Pharmacology- Definition, historical landmarks and scope ofpharmacology, nature and source of drugs, essential drugs concept and routes ofdrug administration, Agonists, antagonists(competitive and non competitive), sparereceptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. b.Pharmacokinetics-Membrane transport, absorption, distribution, metabolism andexcretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination.
Unit II:08Hours
General Pharmacology a. Pharmacodynamics- Principles and mechanisms of drugaction. Receptor theoriesand classification of receptors,regulation of receptors. drug receptors interactionssignal transduction mechanisms, G-protein–coupled receptors, ion channel receptor,transmembrane enzyme linkedreceptors, transmembrane JAK-STAT bindingreceptor and receptors that regulate transcription factors, dose responserelationship, therapeutic index, combined effects of drugs and factors modifyingdrug action. b. Adverse drug reactions. c. Drug interactions (pharmacokinetic andpharmacodynamics) d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials andpharmacovigilance.
Unit III: 10Hours Pharmacology of drugs acting on peripheral nervous system a. Organization and function of ANS. b.Neurohumoraltransmission,co-transmission and classification of neurotransmitters. c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). e. Local anesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma
Unit IV 08 Hours
Pharmacology of drugs acting on central nervous system a. Neurohumoral transmission in the C.N.S.special emphasis on importance of variousneurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. b. General anesthetics and pre-anesthetics. c. Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics e. Alcohols and disulfiram
Unit V: 07 Hours Pharmacology of drugs acting on central nervous system a.Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents,anti-manics and hallucinogens. b. Drugs used in Parkinsons disease and Alzheimer's disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence.
Unit VI 07 Hours a. Handling and breeding techniques of laboratory animals. b. Regulations for laboratory c. Animal care and ethical requirements. d. CPCSEA guidelines for performing experiments on animals. Alternatives to animal studies**.**

Name of The Course	Pharmacognosy and Phytochemistry I-
Course Code	BPHT4005
Prerequisite	
Co-requisite	
Anti-requisite	

	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

1. The basic objective of this course is to get familiar with Phamacognosy, active constituents, phytochemical screening etc
2. To know the crude drugs, their uses and chemical nature
3. Know the evaluation techniques for the herbal drugs
4. To carry out the microscopic and morphological evaluation of crude drugs

Course Outcomes

CO1	The student will be able to interpret the quality control methods for natural drugs along with scope and development of Pharmacognosy.
CO2	The student will be able to make use of the basic knowledge of cultivation, collection, processing and storage of herbal drugs in the drug development.
CO3	The student will be able to utilize the basic of Plant Tissue Culture (PTC) and techniques involved in the PTC.
CO4	The student will be able to infer the various traditional medicinal systems and drugs used as secondary metabolites.
CO5	The student will be able to conclude the biological source, chemical nature and uses of drugs of natural drugs.
CO6	The students will be able to design novel neutraceuticals.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	15	75	100

Course Content:

Unit I: Introduction to Pharmacognosy **10 Hours**

Introduction to pharmacognosy:
(a) Definition, history, scope and development of Pharmacognosy
(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture
(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).
Classification of drugs:
Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs
Quality control of Drugs of Natural Origin:
Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.
Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

Unit II: Cultivation, Collection, Processing and storage of drugs of natural origin. 10Hours

Cultivation and Collection of drugs of natural origin
Factors influencing cultivation of medicinal plants.
Plant hormones and their applications.
Polyploidy, mutation and hybridization with reference to medicinal plants

Unit III: **Plant tissue culture 7 hours**

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.
Applications of plant tissue culture in pharmacognosy.
Edible vaccines

Unit IV: Pharmacognosy in various systems of medicine: Introduction to secondary metabolites 8 hours

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins.
Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Unit V: Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs:
08 Hours

Plant Products: Fibers - Cotton, Jute, Hemp
Hallucinogens, Teratogens, Natural allergens
Primary metabolites:
General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:
Carbohydrates: Acacia, Agar, Tragacanth, Honey
Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).
Lipids(Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax
Marine Drugs:
Novel medicinal agents from marine sources

Unit VI Neutraceuticals 08 Hours

Genaral introduction, Classification, Inorganic mineral supplements , Vitamin supplements, Digestive enzymes , Probiotics, Prebiotics, Dietery fibres, Ceareals and grains . Antioxidants , Polyunsaturated fatty acids , Herbs as functional foods.

Suggested Reading

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co.,London, 2009.
2. Trease G.E., & Evans W.C., Evans, W.C., Pharmacognosy, Bailliere Tindall east Baorne, U.K.
3. Wallis. T.E., Text Book of Pharmacognosy, J&A Churchill Ltd. London.
4. Tyler V.E. et al, Pharmacognosy, Lea & Febiger, Philadelphia.
5. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, NewDelhi.

6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th edition, NiraliPrakashan, New Delhi.

Name of The Course	Medicinal Chemistry I – Practical			
Course Code	BPHP4006			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
			4	2

Course Objectives

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship (SAR) of different class of drugs
4. Write the chemical synthesis of some drugs.

Course Outcomes

At the end of the course, students will be able to:

CO1	The student will be able to apply the principles of medicinal chemistry to prepare drugs/intermediates.
CO2	The student will be able to apply the concept of assay of drugs.
CO3	The student will be able to apply the concept of determination of Partition coefficient.

Text Books

1. Remington's Pharmaceutical Sciences.
2. Martindale's extra pharmacopoeia.

Course Content

1	Preparation of 1,3-pyrazole
2	Preparation of 1,3-oxazole
3	Preparation of Benzimidazole
4	Preparation of Benztriazole
5	Preparation of 2,3- diphenyl quinoxaline
6	Preparation of Benzocaine
7	Preparation of Phenytoin
8	Preparation of Phenothiazine
9	Preparation of Barbiturate
10	Assay of Chlorpromazine
11	Assay of Phenobarbitone
12	Assay of Atropine
13	Assay of Ibuprofen
14	Assay of Aspirin; Assay of Furosemide
15	Determination of Partition coefficient for any two drugs

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	PHYSICAL PHARMACEUTICS-II (Practical)				
Course Code	BPHP4007				
Prerequisite					
Corequisite					
Antirequisite					
	L	T	P	C	
	0	0	4	2	

List of Experiments:

Determination of particle size, particle size distribution using sieving method

2. Determination of particle size, particle size distribution using Microscopic method

3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of
single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	PHARMACOLOGY-I			
Course Code	BPHP4008			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	4	2

List of Experiments:

Introduction to experimental pharmacology.

2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
10	15	75	100

Name of The Course	Pharmacognosy and Phytochemistry			
Course Code	BPHP4009			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	4	2

LIST OF EXPERIMENTS:

1. Analysis of crude drugs by chemical tests: (i)Tragaccanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index.
3. Determination of vein islet number, vein islet termination and paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer.
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
10	15	75	100

Name of The Course	Medicinal Chemistry-II			
Course Code	BPHT5001			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	T	P	C
	3	1	0	4

Course Objectives

Upon completion of the course the student shall be able to
1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

Course Outcomes

Upon completion ofthe course, thestudent shallbeable to:

CO1	Understand the basic concepts of cancer, allergy and proton pump in addition to drugs used for their treatment.
CO2	Illustrate the chemical group responsible for evoking a target biological (anti-anginal, antidiuretic and antihypertensive drugs).
CO3	Develop a high level understanding of structure, reactions and mechanism of action in medicinal chemistry (Cardiovascular drugs).
CO4	Analyze the pharmacological actions of drugs acting on endocrine system.
CO5	Determine the basic cause of diabetes, different anti-diabetic drugs and structure activity relationship of local anaesthetics.
CO6	Develop an understanding on biomarker in the treatment of Cardiovascular diseases.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: 10 Hours
Antihistaminic agents: Histamine, receptors and their distribution in the human body **H1–antagonists:**Diphenhydramine hydrochloride*,Dimenhydrinate, Doxylaminescuccinate,Clemastinefumarate,Diphenyl phyraline hydrochloride, Tripelenamine hydrochloride,Chlorcyclizinehydrochloride, Meclizine hydrochloride,Buclizine

hydrochloride,Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate,Cyproheptadinehydrochloride,Azatidinemaleate, Astemizole,Loratadine,Cetirizine,LevocetrazineCromolyn sodium

H2-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Antineoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin,Doxorubicin, Bleomycin

Plant products: Etoposide,Vinblastinsulphate,Vincristinsulphate

Miscellaneous: Cisplatin, Mitotane

Unit II: 10 Hours

Antianginal agents:

Vasodilators: Amylnitrite,Nitroglycerin*,Pentaerythritoltetranitrate,Isosorbide dinitrite*, Dipyridamole.

Calcium channelblockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine,Nimodipine.

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics:Furosemide*, Bumetanide, Ethacrynicacid.

PotassiumsparingDiuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics:Mannitol

Anti-hypertensive Agents: Timolol, Captopril,Lisinopril,Enalapril,Benazepril hydrochloride,Quinaprilhydrochloride,Methyldopate hydrochloride,* Clonidine hydrochloride,Guanethidine monosulphate,Guanabenzacetate,Sodium nitroprusside, Diazoxide,Minoxidil, Reserpine, Hydralazine hydrochloride.

Unit III: 10Hours

Anti-arrhythmicDrugs: Quinidine sulphate,Procainamidehydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainidehydrochloride,Mexiletine hydrochloride,Lorcainide hydrochloride, Amiodarone, Sotalol.

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol

Coagulant & Anticoagulants: Menadione,Acetomenadione, Warfarin*, Anisindione, clopidogrel

Drugsusedin CongestiveHeartFailure: Digoxin,Digitoxin,Nesiritide, Bosentan, Tezosentan.

Unit IV 08 Hours

Drugs acting onEndocrinesystem

Nomenclature, Stereochemistryand metabolismof steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril,Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

Thyroid andantithyroiddrugs:L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

Unit V: 07 Hours
Antidiabeticagents: Insulin and its preparations **Sulfonyl ureas:** Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. **Biguanides:** Metformin. **Thiazolidinediones:** Pioglitazone, Rosiglitazone. **Meglitinides:** Repaglinide, Nateglinide. Glucosidase inhibitors: Acrabose,Voglibose. **Local Anesthetics:**SARofLocalanesthetics **BenzoicAciddderivatives;**Cocaine,Hexylcaine,Mepry lcaine,Cyclomethycaine, Piperocaine. **AminoBenzoicacidderivatives:**Benzocaine*,Butam ben,Procaine*,Butacaine, Propoxycaine, Tetracaine, Benoxinate. **Lidocaine/Anilidederivatives:**Lignocaine, Mepivacaine, Prilocaine, Etidocaine. **Miscellaneous:**Phenacaine, Diperodon, Dibucaine.*
Unit VI 08 Hours
Advancement in biomarker for cardiovascular diseases: Definition, Types, Characterstics, merits and demerits of ideal biomarker; Evaluation and application of biomarker of inflammation, plaque destabilization, Mocardial Ischemia, cardiac necrosis, haemodynamic stress.

Suggested Reading

1.Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.

2. Foye's Principles of Medicinal Chemistry.

3. Burger's Medicinal Chemistry, Vol I to IV.

4. Introduction to principles of drug design- Smith and Williams.

5. Future biomarkers in cardiology, European Heart Journal Supplements (2018) 20 (Supplement G), G37–G44

Name of The Course	Industrial Pharmacy-I
Course Code	BPHT5002

Prerequisite				
Co-requisite				
Anti-requisite				
L	**T**	**P**	**C**	
3	1	0	4	

Course Objectives

Upon completion of the course the student shall be able to

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course Outcomes

CO 1	The student will be able to understand the concept of physicochemical properties of drug substances and application of preformulation in designing of different dosage form.
CO 2	The student will be able to illustrate different methods for formulation and evaluation of tablets and liquid dosage forms.
CO 3	The student will be able to identify specific techniques for formulation and evaluation of capsule shells & pellets.
CO 4	The student will be able to distinguish quality requirements for formulation and evaluation of parenteral and ophthalmic dosage forms in all aspects.
CO 5	The student will be able to analyse about the importance of formulation and evaluation of cosmetics, pharmaceutical aerosols and packaging in growth of pharmaceutical industry.
CO 6	Students will be able to understand the Formulation designing, Application of aquasomes.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: 10 Hours

PreformulationStudies: Introduction topreformulation,goalsandobjectives,studyof physicochemical characteristics of drugsubstances.
a.Physicalproperties:Physicalform(crystal&amorphous),particlesize,**shape,**flow properties, solubilityprofile (pKa, pH, partition coefficient), polymorphism
b. Chemical Properties:Hydrolysis, oxidation, reduction, racemisation, polymerization. BSC classification of drug and its significance.
Applicationofpreformulationconsiderationsinthedevelopmentofsolid,liquidoraland parenteral dosageformsand its impact on stabilityofdosage forms.

Unit II: 10 Hours

Tablets:
Introduction,idealcharacteristicsof tablets,classificationof tablets.Excipients, Formulationof tablets,granulationmethods,compressionandprocessingproblems. Equipments and tablet tooling.
Tablet coating: Types of coating, coating materials, formulation of coating composition, methods ofcoating,equipment employedand defectsin coating.
Qualitycontrol tests: In process andfinishedproduct tests
Liquidorals: Formulationandmanufacturingconsiderationofsyrups and elixirs suspensionsand emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia
.

Unit III:
10Hours
Capsules

a.
Hardgelatincapsules: Introduction,Productionofhardgelatincapsuleshells.size ofcapsules,Filling,finishingandspecialtechniquesofformulation ofhard gelatin capsules,manufacturingdefects.
Inprocessandfinalproductqualitycontroltests for capsules.
b. Soft gelatin capsules: Nature of shell and capsule content, size of capsules,importance ofbaseadsorptionandminim/gramfactors,production, in processandfinalproductqualitycontroltests.Packing,storageandstabilitytesting ofsoft gelatin capsules and their applications.
Pellets: Introduction, formulation requirements,pelletization process,equipmentsfor manufactureofpellets
.

Unit IV Hours

Parenteral Products: a.Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles,additives, importanceofisotonicity
b.Production procedure,productionfacilitiesandcontrols, asepticprocessing
c.Formulation of injections, sterile powders, large volumeparenterals and lyophilized products.
d.Containersandclosuresselection,fillingandsealingofampoules,vialsandinfusion fluids. Qualitycontrol tests of parenteral products**.**
OphthalmicPreparations: Introduction,formulation considerations;formulationof eye drops,eye ointmentsandeye lotions;methodsof preparation;labeling,containers; evaluation of ophthalmicpreparations.

Unit V: 10Hours
Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks,shampoos,coldcreamand vanishing cream,toothpastes,hairdyesand sunscreens.

PharmaceuticalAerosols: Definition, propellants,containers,valves,types ofaerosol systems; formulation andmanufacture of aerosols; Evaluation of aerosols; Quality control and stabilitystudies. **PackagingMaterialsScience:**Materialsusedforpackaging ofpharmaceuticalproducts, factorsinfluencing choiceofcontainers,legalandofficialrequirementsforcontainers, stabilityaspects of packagingmaterials, qualitycontrol tests.
Unit VI 08 Hours
Novel Formulation: Aquasomes:-Introduction to novel drug delivery system, Importance, Advantages and Disadvantages, Literurate discussion, Excepient used of formulation, Formulation designing, Application of aquasomes.

Name of The Course	**PHARMACOLOGY- III (Theory)**			
Course Code	**BPHT5003**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

Course Objectives:

Upon completion of this course the student should be able to

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course Outcomes

CO1	The student will be able to illustrate the general concepts of pharmacodynamics and pharmacokinetics of drugs acting on CVS
CO2	The student will be able to analyze the mechanism of action, uses and adverse effects of drugs acting on hemopoietic system, coagulants, anticoagulants, fibriniolytics and urinary system
CO3	The student will be able to apply the pharmacological knowledge of drugs acting on autacoids, NSAIDS, antigout and antirheumatic drugs dealing with the mechanism of action, uses, interactions and side effects of drugs on body
CO4	The student will be able to apply the pharmacological knowledge of drugs acting on endocrine system
CO5	The student will be able to apply the pharmacological knowledge of principles and applications of bioassay, bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis
CO6	The Students will be able to understand about pharmacology of free radical and their role in pathogenesis of various diseases and also know about antioxidant.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	**15**	**75**	**100**

Unit-1 10 hours
1. Pharmacology of drugs acting on cardio vascular system a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic drugs.

Unit-2 10 Hours
1. Pharmacology of drugs acting on cardio vascular system a. Drug used in the therapy of shock. b. Hematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders 2. Pharmacology of drugs acting on urinary system a. Diuretics b. Anti-diuretics.
Unit-3 10 Hours
Autocoids and related drugs a. Introduction to autacoids and classification b. Histamine, 5-HT and their antagonists. c. Prostaglandins, Thromboxanes and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. e. Non-steroidal anti-inflammatory agents f. Anti-gout drugs g. Antirheumatic drugs
Unit-4 8 Hours
Pharmacology of drugs acting on endocrine system a. Basic concepts in endocrine pharmacology. b. Anterior Pituitary hormones- analogues and their inhibitors. c. Thyroid hormones- analogues and their inhibitors. d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. d. Insulin, Oral Hypoglycemic agents and glucagon. e. ACTH and corticosteroids.
Unit-5 7 Hours
Pharmacology of drugs acting on endocrine system a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus. Bioassay
a. Principles and applications of bioassay. b.Types of bioassay c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT
Unit 6 Free radiclals Pharmacology, Generation of free radicals, role of free radiclas in etiopathology of various disease such as diabetes, neurodegenerative disorders and cancer. Protective activity of certain important antioxidant, Recent advancment in treatment of Alzheimer disease, Parkinson disease, cancer and Diabetes mellitus.

Text Book (s)

Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,
Churchil Livingstone Elsevier
Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc
Graw-Hill.
Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

Reference Book (s)

Goodman and Gilman's, The Pharmacological Basis of Therapeutics
Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A.
K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point
Lippincott Williams & Wilkins.
Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical
Publishers (P) Ltd, New Delhi.

Name of The Course	Pharmacognosy and PhytochemistryII-Theory			
Course Code	BPHT5004			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	T	P	C
	3	1	0	4

Course Objectives

1. Know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
2. Understand the preparation and development of herbal formulation
3. Understand the herbal drug interactions
4. Carryout isolation and identification of phytoconstituents

Course Outcomes

CO1	The students will be able to idfentify the biogenetic and biosynthetic pathways involved in higher plants
CO2	The students will be able to identify the drugs of natural origin by chemical tests, organoleptic, morphological, miscroscopical, characters. Also apply these parameters to distinguish drug from possible adulterant.
CO3	The students will be able to conclude the isolation, Identification and Analysis of Phytoconstituents
CO4	The students will be able to justify Industrial production, estimation and utilization of the following phytoconstituents
CO5	The students will be able to analyze the methods of extraction, spectroscopy , chromatography and electrophoresis
CO6	The students will be able to design methods in Pharmacovigilance of Drugs of Natural Origin.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Metabolic pathways in higher plants and their determination 08 Hours
a)Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways-Shikimic acid pathway, Acetate pathways and Amino acid pathway. b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.
Unit II:General introduction, composition, chemistry& chemical classes, bio sources, therapeutic uses and commercial applications of following secondary metabolites: 10 Hours
Alkaloids: Vinca, Rauwolfia, Belladonna, Opium, Phenylpropanoids and Flavonoids:Lignans, Tea,Ruta Steroids, Cardiac Glycosides& Triterpenoids:Liquorice, Dioscorea, Digitalis Volatileoils:Mentha, Clove, Cinnamon,Fennel, Coriander, Tannins: Catechu,Pterocarpus Resins: Benzoin,Guggul,Ginger, Asafoetida, Myrrh, Colophony Glycosides:Senna, Aloes,Bitter Almond Iridoids,Otherter penoids & Naphtha quinones: Gentian, Artemisia, taxus, carotenoids
Unit III: Isolation, Identification and Analysis of Phytoconstituents 10 Hours
a) Terpenoids: Menthol, Citral, Artemisin b) Glycosides: Glycyrhetinicacid &Rutin c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine

d) Resins: Podophyllotoxin, Curcumin
Unit IV: Industrial production, estimation and utilization of the following phytoconstituents 10 Hours
Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine,Podophyllotoxin,Caffeine, Taxol,Vincristine and Vinblastine
Unit V: Basics of Phytochemistry 07Hours
Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.
Unit VI: Pharmacovigilance of Drugs of Natural Origin 08 Hours
Pharmacovigilance of Drugs of Natural Origin WHO and AYUSH guidelines for safety monitoring of natural medicine Spontaneous reporting schemes for bio-drug adverse reactions Bio drug-drug and bio drug-food interactions with suitable examples

Suggested Reading

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co.,London, 2009.
2. Trease G.E., & Evans W.C., Evans, W.C., Pharmacognosy, Bailliere Tindall east Baorne, U.K.
3. Wallis. T.E., Text Book of Pharmacognosy, J&A Churchill Ltd. London.
4. Tyler V.E. et al, Pharmacognosy, Lea & Febiger, Philadelphia.
5. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, NewDelhi.
6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th edition, NiraliPrakashan, New
Delhi.

Name of The Course	Pharmaceutical Jurisprudence

Course Code	BPHT5005			
Prerequisite				
Co-requisite				
Anti-requisite				
L	**T**	**P**	**C**	
3	1	0	4	

Course Objectives

Upon completion ofthe course, thestudent shallbeable to understand:

1.ThePharmaceutical legislationsand theirimplications in the development and marketingof pharmaceuticals.
2.VariousIndian pharmaceutical Acts andLaws
3.The regulatoryauthorities and agenciesgoverningthe manufactureandsaleof pharmaceuticals
4.The codeofethics duringthe pharmaceutical practice

Course Outcomes

CO1	Student will be to conclude the basic concept of different pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
CO2	Students will be able to compare various acts and laws of Indian pharmaceutical.
CO3	Students will be able to identify the importance and role of different regulatory authorities and other governing agencies in the manufacture and sale of pharmaceuticals.
CO4	Students will be able to classify the drug & magic remedies act and animal ethics committee.
CO5	Students will be able to classify the code of ethics in pharmaceutical practice.
CO6	Students will be able to know new amendments of different acts.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**

10	25	75	100

Course Content:

Unit I: 10 Hours

Drug and Cosmetic Act 1940 and its rules 1945: Objectives, Definitions, Legal definitions of schedules to the Act andRules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties. Manufacture of drugs Prohibition of manufacture and sale of certain drugs,

Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loanlicense and repacking license.

Unit II: 10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945: Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penaltiesLabeling & Packing of drugs- General labeling requirements and specimen labels fordrugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugsLaboratory, Drugs Consultative Committee, Government drug analysts, Licensingauthorities, controlling authorities, Drugs Inspectors.

Unit III:
10Hours

Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; itsconstitution and functions, Education Regulations, State and Joint state pharmacycouncils; constitution and functions, Registration of Pharmacists, Offences and Penalties.

Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outsidebond, Export of alcoholic preparations,Manufacture ofAyurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives,Definitions, Authorities and Officers, Constitution and Functions of narcotic &Psychotropic Consultative Committee, National Fund for Controlling the DrugAbuse, Prohibition, Control and Regulation, opium poppy cultivation and productionof poppy straw, manufacture, sale and export of opium, Offences and Penalties.

Unit IV 08 Hours

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes ofExempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960: Objectives, Definitions, InstitutionalAnimal Ethics Committee, CPCSEA guidelines for Breeding and Stocking ofAnimals,Performance of Experiments, Transfer and acquisition of animals forexperiment, Records, Power to suspend or revoke registration, Offences and Penalties

National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations,Retail price and ceiling price of scheduled formulations, National List of EssentialMedicines (NLEM)

Unit V: 07 Hours

Pharmaceutical Legislations – A brief review,Introduction, Study of drugs enquirycommittee, Health survey and development committee, Hathi committee andMudaliar committee **Code of Pharmaceutical ethics:** Definition, Pharmacist in relation to his job, trade, medical profession and hisprofession, Pharmacist's oath **Medical Termination of Pregnancy Act** **Right to Information Act** **Introduction to Intellectual Property Rights (IPR)**
Unit VI 08 Hours
Amendments of Act: Drugs andCosmetics Act, 1940 andits rules 1945, MedicinalandToiletPreparationAct–1955, PreventionofCrueltytoanimalsAct, Drugs Prices Control, Drugs and Magic Remedies Act and its rules, Medical TerminationofPregnancy Act

Name of The Course	**Industrial Pharmacy-I Lab**			
Course Code	**BPHT5006**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Content

1.Preformulation studies on paracetamol/aspirin/or any other drug

2Preparation and evaluation of Paracetamol tablets
3.Preparation and evaluation of Aspirin tablets
4.Coating of tablets- film coating of tables/granules
5.Preparation and evaluation of Tetracycline capsules
6.Preparation of Calcium Gluconate injection
7.Preparation of Ascorbic Acid injection
8.Qulaity control test of (as per IP) marketed tablets and capsules
9.Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	**10**	**35**	**50**

Name of The Course	**Pharmacology II – Lab**			
Course Code	**BPHT5007**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Content

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart**.**
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of PA_2 value of prazosin using rat anococcygeus muscle (by

Schilds plot method).
12. Determination of PD_2 value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	**10**	**35**	**50**

Name of The Course	Pharmacognosy and Phytochemistry II - Lab				
Course Code	**BPHT5008**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	**0**	**4**	**2**	

Course Content

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
   a) Caffeine - from tea dust.
   b) Diosgenin from Dioscorea
   c) Atropine from Belladonna
   d) Sennosides from Senna
3. Separation of sugars by Paper chromatography.
4. TLC of herbal extract.
5. Distillation of volatile oils and detection of phytoconstitutents by TLC.
6. Analysis of crude drugs by chemical tests:
   i. Asafoetida
   ii. Benzoin
   iii. Colophony
   iv. Aloes
   v. Myrrh

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	**10**	**35**	**50**

Name of The Course	Medicinal Chemistry-III				
Course Code	BPHT6001				
Prerequisite					
Co-requisite					
Anti-requisite					
	L	**T**	**P**	**C**	
	3	1	0	4	

Course Objectives

Upon completion of the course the student shall be able to

1. Understand the importanceofdrugdesign anddifferent techniques of drug design.
2. Understand thechemistryofdrugswithrespect to theirbiologicalactivity.
3. Knowthe metabolism, adverse effects and therapeuticvalue ofdrugs.
4. Knowthe importanceofSAR of drugs

Course Outcomes:

Upon completion ofthe course, thestudent shall be able to:

CO1	Relate the fundamental knowledge and effects of β-lactam antibiotics, aminoglycosides and tetracyclines.
CO2	Relate the fundamental knowledge including stereochemistry, structure activity relationship, and classification of antimalarial and antibiotic agents.
CO3	Build the SAR of anti-tubercular, urinary tract anti-infective and anti-viral agents.
CO4	Analyze the role of anti-fungal and anti-protozoal agents.
CO5	Evaluate the concepts of drug designing and combinatorial chemistry.
CO6	Develop an understanding on molecular properties used in drug design.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: 10 Hours

Antibiotics

Historicalbackground,Nomenclature, Stereochemistry, Structure activity relationship,Chemicaldegradationclassificationandimportantproductsof the followingclasses.

β-Lactam antibiotics: Penicillin,Cepholosporins,β-Lactamaseinhibitors, Monobactams

Aminoglycosides:Streptomycin,Neomycin,Kanamycin

Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline,Doxycycline

Unit II: 10 Hours

Antibiotics

Historicalbackground,Nomenclature, Stereochemistry, Structure activity relationship,Chemicaldegradationclassificationandimportantproductsof the followingclasses.

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application ofprodrugsdesign.

Antimalarials: Etiologyofmalaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrinehydrochloride, Mefloquine.

Biguanides anddihydrotriazines: Cycloguanilpamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether,Atovoquone.

Unit III: 10Hours

Anti-tubercular Agents

Synthetic anti tuberculara gents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

Anti-tubercular antibiotics: Rifampicin, Rifabutin, CycloserineStreptomycine, Capreomycinsulphate.

Urinary tract anti-infectiveagents

Quinolones:SARofquinolones,NalidixicAcid,Norfloxacin,Enoxacin, Ciprofloxacin*, Ofloxacin,Lomefloxacin,Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

Amantadine hydrochloride, Rimantadinehydrochloride, Idoxuridinetrifluoride, Acyclovir*, Gancyclovir,Zidovudine,Didanosine,Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

Unit IV 08 Hours

Antifungal agents:

Antifungal antibiotics: Amphotericin-B,Nystatin, Natamycin, Griseofulvin.

SyntheticAntifungalagents: Clotrimazole, Econazole,Butoconazole, OxiconazoleTioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole,Fluconazole, Naftifinehydrochloride, Tolnaftate*.

Anti-protozoalAgents: Metronidazole*,Tinidazole,Ornidazole,Diloxanide, Iodoquinol, PentamidineIsethionate, Atovaquone,Eflornithine.

Anthelmintics: Diethylcarbamazinecitrate*,Thiabendazole,Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal,Ivermectin.

Sulphonamides andSulfones

Historicaldevelopment,chemistry,classificationandSARofSulfonamides:
Sulphamethi Sulfisoxazole Sulphamethi Sulfacetami SulphapyridiSulfamethoxaSulphadiazinMefeniaceta Sulfasalazin

Folatereductaseinhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

Unit V: 07 Hours

Introduction to Drug Design

Various approaches in drug design

Physicochemical parameters usedin quantitativestructure activity relationship(QSAR) such aspartition coefficient, Hammet'selectronic parameter,Tafts stericparameterand Hanschanalysis.

Pharmacophoremodelingand dockingtechniques.

Combinatorial Chemistry: Concept andapplications of combinatorial chemistry: solid phaseand solution phasesynthesis.

Unit VI 08 Hours

Molecular properties and drug design

a) Prediction and analysis of ADMET properties of new molecules and its importance in drug design.

b) De novo drug design: Receptor/enzyme-interaction and its analysis, receptor/enzyme cavity size prediction, predicting the functional components of cavities.

c) Introduction to homology modeling and generation of 3D-structure of protein.

Suggested Reading

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.

Name of The Course	**PHARMACOLOGY-III (Theory)**			
Course Code	**BPHT6002**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

Course Objectives:

Upon completion of this course the student should be able to:

1. Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. Comprehend the principles of toxicology and treatment of various poisonings and
3. Appreciate correlation of pharmacology with related medical sciences.

Course Outcomes

CO1	Analyze the pharmacology of drugs acting on respiratory system, as well as Correlate the Pharmacology of drugs like anti-emetics, anti - ulcerative agents acting on the Gastrointestinal Tract
CO2	Relate the pharmacology of chemotherapeutic agents like Penicillin,

	cephalosporin, chloramphenicol, macrolides, quinolones, fluoroquinolone, tetracycline and aminoglycosides
CO3	Analyze the pharmacology of chemotherapeutic agents – Anti tubercular, anti leprotic antifungal, antiviral drugs, anthelmintic, antimalarial drugs, anti-amoebic agents.
CO4	Correlate the pharmacology of chemotherapy with Urinary tract infections and sexually transmitted diseases
CO5	Analyze the principles of toxicology for the treatment and management of barbiturates, morphine, organo-phosphosphorus compound and lead, mercury and arsenic poisoning.
CO6	Analyze novel advancements and correlate the CPCSEA guidelines

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	**15**	**75**	**100**

Unit-1 10 hours
1. Pharmacology of drugs acting on Respiratory system a. Anti -asthmatic drugs b. Drugs used in the management of COPD c. Expectorants and antitussives d. Nasal decongestants e. Respiratory stimulants 2. Pharmacology of drugs acting on the Gastrointestinal Tract a. Antiulcer agents. b. Drugs for constipation and diarrhoea. c. Appetite stimulants and suppressants. d. Digestants and carminatives.

e. Emetics and anti-emetics.
Unit-2 10 Hours
Chemotherapy a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides
Unit-3 10 Hours
Anti-tubercular Agents Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate. Urinary tract anti-infective agents Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine. Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.
Unit-4 8 Hours
Chemotherapy a. Antitubercular agents b. Antileprotic agents c. Antifungal agents d. Antiviral drugs e.Anthelmintics f. Antimalarial drugs g. Antiamoebic agents

Urinary tract infections and sexually transmitted diseases. m. Chemotherapy of malignancy. Immunopharmacology a. Immunostimulants b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars
Unit-5 7 Hours
. Principles of toxicology a. Definition and basic knowledge of acute, subacute and chronic toxicity. b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity c. General principles of treatment of poisoning d Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning. 6. Chronopharmacology a.Definition of rhythm and cycles. b.Biological clock and their significance leading to chronotherapy. Mode of Evaluation: The theory and lab performance of students are evaluated separately.
Unit- 6
a. CPCSEA guidelines b. Recent advancement technologies in the treatment of hypertension and viral diseases. Mode of Evaluation: The theory and lab performance of students are evaluated separately

Text Book (s)

Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,
Churchil Livingstone Elsevier
Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc
Graw-Hill.
Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

Reference Book (s)

Goodman and Gilman's, The Pharmacological Basis of Therapeutics
Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A.
K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point
Lippincott Williams & Wilkins.
Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical
Publishers (P) Ltd, New Delhi.

Name of The Course	Herbal Drug Technology-Theory			
Course Code	BPHT6003			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objective

1. Student should gain knowledge of basic understanding of herbal drug industry, the quality of raw material
2. Students should be familiar with guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc.
3. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Course Outcomes

CO1	understand raw material as source of herbal drugs from cultivation to herbal drug product

CO2	know the WHO and ICH guidelines for evaluation of herbal drugs
CO3	know the herbal cosmetics, natural sweeteners, nutraceuticals
CO4	appreciate patenting of herbal drugs, GMP
CO5	Understand the parts and function of herbal industry
CO6	Students will Industrial design of proprietary herbal medicine and their application

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam ()**	**End Term Exam (ETE)**	**Total Marks**
10	15	75	100

Course Content:

Unit I: 11 Hours

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials Processing of herbal raw material.

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy

b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.

Unit II: 7 Hours

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina.

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

Unit III: 10 Hours

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

Herbal excipients:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations :

Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

Unit IV : 10 **Hours**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs

Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy

b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

Unit V: 7 Hours

General Introduction to Herbal Industry Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Schedule T – Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.
Unit VI : 8 **Hours**
Industrial design of proprietary herbal medicine
References: 1. Textbook of Pharmacognosy by Trease & Evans. 2. Textbook of Pharmacognosy by Tyler, Brady & Robber. 3. Pharmacognosy by Kokate, Purohit and Gokhale 4. Essential of Pharmacognosy by Dr.S.H.Ansari 5. Pharmacognosy & Phytochemistry by V.D.Rangari

Name of The Course	Biopharmaceutics and Pharmacokinetics			
Course Code	BPHT6004			
Prerequisite				
Co-requisite				
Anti-requisite				
L	**T**	**P**	**C**	
3	1	0	4	

Course Objectives

Upon completion of the course, the student shall be able to understand:

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination
3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
4. Understand various pharmacokinetic parameters, their significance & applications.

Course Outcomes

CO1	Student will be able to compare the basic concept of in biopharmaceutics and pharmacokinetics and their significance.
CO2	Students will be able to develop different pharmacokinetics parameters through drug plasma concentration and time data.
CO3	Students will be able to develop concepts of bioavailability and bioequivalence of drug products and their significance.
CO4	Students will be able to identify various pharmacokinetic parameters, their significance & applications.
CO5	Students will be able to classify the different factor responsible for the nonlinear Pharmacokinetics and their significance.
CO6	The student will able to creating and know recent advances in clinical Pharmacokinetices..

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	15	75	100

Course Content:

Unit I: 10 Hours
Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

Unit II: 10 Hours

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

Unit III: 10Hours

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E ,t1/2,Vd,AUC,Ka, Clt and CL_R- definitions methods of eliminations, understanding of their significance and application.

Unit IV 08 Hours

Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.

Unit V: 07 Hours

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity.

c.Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Unit V: 07 Hours

Recent approach in Clinical Pharmacokinetics,Significance of clinical pharmacokinetics,Linear Pharmacokinetics,Therapeutic drug monitoring.

Name of The Course	Pharmaceutical Biotechnology			
Course Code	BPHT6005			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

Upon completion of the subject student shall be able to;

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technologyCourse Outcomes

CO1	Scientific application of biotechnology in the field of genetic engineering,

	medicine and fermentation technology makes the subject interesting.
CO2	Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs.
CO3	Biotechnology has already produced, Immunology andtransgenic crops and animals and the future promises lot more.
CO4	It is basically a research-based Immuno assay and immuno blotting
CO5	Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting.
CO6	Students will be able to know new amendments of Biotechnology and their Application

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
10	25	75	100

Course Content:

Unit I: 10 Hours

Introduction of biotechnology their application

a)Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
b)Enzyme Biotechnology- Methods of enzyme immobilization and applications.
c)Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
d)Brief introduction to Protein Engineering.
e)Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
f) Basic principles of genetic engineering.

Unit II: 10 Hours

Recombinant DNA technology and Genetics engineering

a) Study of cloning vectors, restriction endonucleases and DNA ligase.
b) Recombinant DNA technology. Application of genetic engineering in medicine.
c) Application of r DNA technology and genetic engineering in the production of:
i) Interferon ii) Vaccines- hepatitis- B iii) Hormones- Insulin.
d) Brief introduction to PCR

Unit III:
10Hours
Immunology and their application

Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins
b) Structure and Function of MHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines
f) Hybridoma technology- Production, Purification and Applications g) Blood products and Plasma Substituties.

Unit IV 08 Hours

Imuuno Assay and immuno blotting technique

Immuno blotting techniques- ELISA, Western blotting, Southern blotting. b)Genetic organization of Eukaryotes and Prokaryotes
c)Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.d) Introd uction to Microbial biotransformation and applications.
e)Mutation: Types of

mutation/mutants.

Unit V: 07 Hours

Fermentation Technology and their applcation
Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls. c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.
Unit VI 08 Hours
Recent devlopment of Biotechnology and their application in Pharmacy, Medicine, Vaccine, Fermentation,Agriculture, Diary Etc

Name of The Course	PHARMACEUTICAL QUALITY ASSURANCE			
Course Code	BPHT6006			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

1. Understanding of cGMP aspects in a pharmaceutical industry
2. Appreciate the importance of documentation
3. Understanding the scope of quality certifications applicable to pharmaceutical industries
4. Understanding the responsibilities of QA & QC departments

Course Outcomes

CO1	The students are able to understand the cGMP aspects in a pharmaceutical industry
CO2	The students are able to understand importance of documentation
CO3	The students are able to understand the scope of quality certifications applicable to pharmaceutical industries
CO4	The students are able to understand responsibilities of QA & QC departments
CO5	The students are able to understand validation of instruments
CO6	The students are able to apply different software for experimental design and quality assurance processes

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Test (Sessional Exam)**	**End Term Test (ETE)**	**Total Marks**
10	**15**	**75**	**100**

Course Content:

Unit-1 **10 hours**
Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP **Total Quality Management (TQM):** Definition, elements, philosophies **ICH Guidelines:** purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines **Quality by design (QbD):** Definition, overview, elements of QbD program, tools **ISO 9000 & ISO14000:** Overview, Benefits, Elements, steps for registration **NABL accreditation** : Principles and procedures
Unit II: **10 Hours**
Organization and personnel: Personnel responsibilities, training, hygiene and personal records. Premises: Design, construction and plant layout, maintenance, sanitation, environmental

control, utilities and maintenance of sterile areas, control of contamination. Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.
Unit III: 10 Hours
Quality Control: Quality control test for containers, rubber closures and secondary packing materials. Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities
Unit IV: 08 Hours
Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.
Unit V: 07Hours
Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation. Warehousing: Good warehousing practice, materials management
Unit VI Advancements in Quality Assurance: 07 Hours
Calculation of stability parameters by conventional method and Arrhenius method, Different models for experimental design, Software for implementation of QbD.

Suggested Reading

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. Good laboratory Practices – Marcel Deckker Series
8. ICH guidelines, ISO 9000 and 14000 guidelines

Name of The Course	**Medicinal Chemistry-III (Practical)**				
Course Code	**BPHT6007**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	**0**	**4**	**2**	

Course Content

I	Preparation of drugs and intermediates
1	Sulphanilamide
2	7-Hydroxy, 4-methyl coumarin
3	Chlorobutanol
4	Triphenyl imidazole
5	Tolbutamide
6	Hexamine
II	Assay of drugs
1	Isonicotinic acid hydrazide
2	Chloroquine
3	Metronidazole
4	Dapsone
5	Chlorpheniramine maleate

6 Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening(LipinskiesRO5)

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	PHARMACOLOGY-III (Practical)			
Course Code	BPHT6008			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	4	2

Course Content

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and
NSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi- autoanalyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology (student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	HERBAL DRUG TECHNOLOGY (Practical)			
Course Code	BPHT6009			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	4	2

Course Content

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.

5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
5	**10**	**35**	**50**

Name of The Course	Instrumental Methods of Analysis – Theory			
Course Code	BPHT7001			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objective

Upon completion of the course the student shall be able to

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis

2. Understand the chromatographic separation and analysis of drugs.

3. Perform quantitative & qualitative analysis of drugs using various analytical instruments

Course Outcomes

CO1	Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
CO2	Understand the application of spectrophotometric techniques
CO3	Illustrate the chromatographic separation and analysis of drugs.
CO4	Perform quantitative & qualitative analysis of drugs using various analytical instruments
CO5	Apply analytical knowledge in solving drug interaction problems
CO6	Develop the concept for application of recent advances in analysis

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam ()	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: 10 Hours
UV Visible spectroscopy Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications - Spectrophotometric titrations, Single component and multi component analysis Fluorimetry Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications
Unit II: 10 Hours
IR spectroscopy Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer,

Thermocouple, Thermister, Pyroelectric detector and applications Flame Photometry-Principle, interferences, instrumentation and applications Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications Nepheloturbidometry- Principle, instrumentation and applications
Unit III: 10 Hours
Introduction to chromatography Adsorption and partition column chromatography- Methodology, advantages, disadvantages and applications. Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications. Paper Chromatography- Introduction, methodology, development techniques, advantages, disadvantages and applications Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications
Unit IV : 8 Hours
Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications High performance liquid chromatography (HPLC)- Introduction, theory, instrumentation, advantages and applications.
Unit V: 7 Hours
Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications Gel chromatography- Introduction, theory, instrumentation and applications Affinity chromatography- Introduction, theory, instrumentation and applications

Unit VI : 8 **Hours**
Scanning Electron Microscopy and Transmission electron Microscopy: Principle of Image formation, Concept of resolution and magnification, Intrumentation and its application in pharmacy.
References: 1. Instrumental Methods of Chemical Analysis by B.K Sharma 2. Organic spectroscopy by Y.R Sharma 3. Text book of Pharmaceutical Analysis by Kenneth A. Connors 4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel 5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 6. Organic Chemistry by I. L. Finar 7. Organic spectroscopy by William Kemp 8. Quantitative Analysis of Drugs by D. C. Garrett 9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi 10. Spectrophotometric identification of Organic Compounds by Silverstein 11. Skoog, Douglas A., F. James Holler, and Stanley R. Crouch. Principles of instrumental analysis. Cengage learning, 2017. 12. Braun, R.D. and Braun, R.D., 1987. Introduction to instrumental analysis.

Name of The Course	Industrial Pharmacy-II			
Course Code	BPHT7002			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

1.Know the process of pilot plant and scale up of pharmaceutical dosage forms

2.Understand the process of technology transfer from lab scale to commercial batch

3.Know different Laws and Acts that regulate pharmaceutical industry

4. Understand the approval process and regulatory requirements for drug products

Course Outcomes

CO1	Students will be able to recall the process of pilot plant scale up of pharmaceutical products
CO2	Students will be able to illustrate the process oftechnology transfer from lab scale tocommercialization
CO3	Students will be able to apply the concept of Regulatory affairs for drug approval
CO4	Students will be able to assess the concept of Quality by Design
CO5	Students will be able to apprise the approval procedure for new drugs
CO6	Students will be able to compile the recent advances in drug development process

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam)	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit I: Pilot plant scale up techniques 10 Hours
General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology
Unit II: Technology development and transfer: WHO guidelines for Technology Transfer(TT) 10 Hours
Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues
Unit III:Regulatory affairs10 Hours
Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals **Regulatory requirements for drug approval:** Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.
Unit IV: Quality management systems 08Hours
Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP
Unit V: Indian Regulatory Requirements 07 Hours

Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.
Unit VI: Recent Advances in Industrial Pharmacy 08 Hours
Recent Advances in Pilot Plant scale up techniques, Applications of Quality by design technique in pharmaceutical product development, ICH guidelines for stability, Recent advances in platform technique.

Suggested Reading

1.Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.

2.Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm..

3. Dimple modi et al., Accelerate development of topical cream drug product using a common platform base formulation, Pharmaceutical Development and Technology, vol. 25, 2020.

4. AvinashV.Dhobale*1, Arun M.Mahale2 , Mrunal Shirsat3 , Shriram Pethkar4 , Vijay Chakote5, RECENT ADVANCES IN PILOT PLANT SCALE UP TECHNIQUES - A Review, Indo American Journal of Pharmaceutical Research, 2018.

5. Michele Herneisey 1 , Eric Lambert 1 , Allison Kachel 1 , Emma Shychuck 1 , James K. Drennen III 1 and Jelena M. Janjic1,2, Quality by Design Approach Using Multiple Linear and Logistic Regression Modeling Enables Microemulsion Scale Up, Molecules 2019, 24, 2066; doi:10.3390/molecules24112066.

Name of The Course	Pharmacy Practice

Course Code	BPHT7003			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objective

- Know various drug distribution methods in a hospital
- Appreciate the pharmacy stores management and inventory control
- Monitor drug therapy of patient through medication chart review and clinical review
- Identify drug related problems.

Course Outcomes

CO1	Analyze the classification, organization, functions of hospital pharmacy, ADRs, drug interactions and its management.
CO2	Analyze the types of drug distribution system, hospital formulary and its preparation, therapeutic drug monitoring, medication adherence, patient medication history.
CO3	Analyze the work of Pharmacy and therapeutic committee, Drug information services, Patient counseling, medication order and communication skills
CO4	Evaluate Budget preparation and implementation, and analyze the concept of clinical pharmacy for Pharmaceutical care and rational use of over the counter
CO5	Analyze drug store management and inventory control as well as Investigational use of drugs.
CO6	The students will be able to understand about Telepharmacy and epidemiological studies.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam ()**	**End Term Exam (ETE)**	**Total Marks**

10	15	75	100

Course Content:

Unit I: 10 Hours

A)Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions..

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c)Adverse drug reaction

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II:Principles and significance of professional Ethics.

10 Hours

a) Drug distribution system in a hospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.

b) Hospital formulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

c) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medication adherence

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

e) Patient medication history interview

Need for the patient medication history interview, medication interview forms.

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements

Unit III: 10 Hours

a) Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Drug information services

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

c) Patient counseling

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

d) Education and training program in the hospital

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

e) Prescribed medication order and communication skills

Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.
Unit IV : 8 Hours
Budget preparation and implementation b) Clinical Pharmacy Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. c) Over the counter (OTC) sales Introduction and sale of over the counter, and Rational use of common over the counter medications..
Unit V: 7 Hours
a) Drug store management and inventory control Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure b) Investigational use of drugs Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. b) Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis.
Unit VI : 8 Hours
Epidemiological study design, Home Care, Self Prescription, TelePharmacy
References: Pharmacy Practice Edited by Kevin M.G.Taylor, School of Pharmacy, University of London, London, UK and Geoffrey Harding Department of General Practice and Primary Care, St Bartholomew's and the Royal London School of Medicine and Dentistry Queen Mary, University of London, London, UK https://www.youtube.com/watch?v=bg-LnEIFxpw , https://www.youtube.com/watch?v=MEFTuDJnfOY

Name of The Course	Novel Drug Delivery System – Theory			
Course Code	BPHT7004			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives

Upon completion of the course, the student shall be able to understand:

1. Basic principles and concepts for the manufacturing of controlled drug delivery systems.
2. Application of principles of control delivery for the design of different novel drug delivery systems.
3. The evaluation techniques for different novel drug delivery systems.

Course Outcomes

CO1	The student will be able to apply the concepts of controlled drug delivery systems for the formulation of therapeutic systems.
CO2	The student will be able to apply the concepts of microencapsulation, mucosal delivery and implants for different pathological conditions.
CO3	The student will be able to apply the concept of transdermal, nasopulmonary and gastroretentive drug delivery systems.
CO4	The student will be able to relate the formulation concepts for the preparation of different systems for targeted drug delivery.

CO5	The student will be able to apply the concepts of ocular and intrauterine delivery of related therapeutics.
CO6	The student will be able to formulate and evaluate the graphene based drug delivery systems.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit- 1: 10 Hours
Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design controlled release formulations based on diffusion, dissolution and ion-exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations **Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.
Unit-2 10 hours
Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications **Mucosal Drug Delivery system:** Introduction, Principles of bio-adhesion/ muco-adhesion, concepts, advantages and disadvantages, trans mucosal permeability and formulation considerations of buccal delivery systems **Implantable Drug Delivery Systems:** Introduction, advantages and disadvantages, concept of implants and osmotic pump
Unit-3 10 hours
Trans-dermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches **Gastro-retentive drug delivery systems:** Introduction, advantages, disadvantages, approaches for GRDDS–Floating, high density systems, inflatable and gastro adhesive systems and their applications **Naso-pulmonary drug delivery system:** Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers.
Unit-4 8 hours
Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications.
Unit-5 7 hours
Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome – Preliminary study, ocular formulations and ocuserts Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intrauterine devices (IUDs) and applications
Unit-6 8 hours
Graphene and carbon Nano tubes: Introduction to Graphene and Carbon nano tubes based drug delivery systems. Types, synthesis, classification and application, Its advantages, disadvantages and side effects.

Name of The Course	**INSTRUMENTAL METHODS OF ANALYSIS (Practical)**				
Course Code	**BPHP7005**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	**0**	**4**	**2**	

Course Objectives:

To get familiar with the analysis of drugs based on their spectral data. To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.

Course Outcomes

CO1	The student will be able to analyze the quantitative estimation of drugs by UV spectroscopy and estimation of dextrose and sulfanilamide by colorimetry.
CO2	The student will be able to illustrate about quenching of fluorescence and estimation of quinine sulfate by fluorimetry.
CO3	The student will be able to analyze sodium, potassium, chlorides and sulphates by flame photometry and nepheloturbidometry.
CO4	The student will be able to analyze the separation of amino acids, sugars and plant pigments by paper, thin layer and column chromatography.
CO5	The student will be able to illustrate about demonstration experiment on HPLC and gas chromatography.

Text Book (s):

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors

Reference Book (s)

1. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
2. Organic Chemistry by I. L. Finar
3. Organic spectroscopy by William Kemp
4. Quantitative Analysis of Drugs by D. C. Garrett

List of Experiments	
1	Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2	Estimation of dextrose by colorimetry
3	Estimation of sulfanilamide by colorimetry
4	Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5	Assay of paracetamol by UV-Spectrophotometry
6	Estimation of quinine sulfate by fluorimetry
7	Study of quenching of fluorescence
8	Determination of sodium by flame photometry
9	Determination of potassium by flame photometry
10	Determination of chlorides and sulphates by nepheloturbidometry
11	Separation of amino acids by paper chromatography
12	Separation of sugars by thin layer chromatography
13	Separation of plant pigments by column chromatography

14	Demonstration experiment on HPLC
15	Demonstration experiment on Gas Chromatography

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
5	10	35	50

Name of The Course	MEDICAL SALES REPRESENTATIVE-I			
Course Code	BPMR7007			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	T	P	C
	4	0	0	4

Course Objectives

Upon completion of the course, the student shall be able to understand:

1. Personality development and fluent communication to build confidence and developing presentation skills
2. Deliver presentations to doctor, sell and promotion of pharmaceutical products and services as well as everyday connection with different professionals
3. Understand Role of MSR and code of conduct guidelines for MSR.
4. Organizing medical conferences and promotional events as well as Market research and Analysis.

Course Outcomes

CO1	Student will able to Apply the knowledge of basic english grammar and basic of communication for English Speaking and Personality Development.
CO2	Student will able to Apply Public speaking english for everyday communication to sell and promote medical products, pharmaceutical products and deliver presentations to doctors.
CO3	Student will able to Apply knowledge to Maintain knowledge of key persons at hospitals, pharmacies and dealers.
CO4	Student will able to learn Distribution system of pharmaceutical products and Organizing medical conferences and promotional events.
CO5	Student will able to Analyze the Therapeutics drug classes and catagories and Core skill professional skills related to organizing medical conferences and promotional events.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
	25	75	100

Course Content:

Unit I: 10 Hours
English Speaking and Personality Development **Basics of communication** Introduction to communication Building Vocabulary. Sentence construction. Basic English Grammar Noun, pronoun, Adjective, Verb, Tenses, Preposition, Articles, Conjunction, Punctuation. Grammar usage in sentences.
Unit II: 10 Hours
Public speaking skills Extempore and Group discussion. Email drafting, Business correspondence.

Avoiding spelling mistakes and mispronunciations. Letter writing practice.

Speaking English for the real world

Everyday communication - Introduction, Shopping Meeting friends, Traveling, Visiting a doctor Telephonic communication, Negotiation, At the movie Theatre, at the office, Meeting relatives etc.

Unit III:

10Hours

ORIENTATION MODULE

Maintain knowledge of key persons at hospitals, pharmacies and dealers, gain knowledge about the Overview of Healthcare Ecosystem including relevant Govt. Scheme, social security benefits, ESI, CGHS and Overview about Life Sciences Industry in Indian and Global Context which would enable him/her

Stay informed about health and other relevant standards and the possible company's tie up with various regulatory bodies and authorities, know basic knowledge about Regulatory Authorities and Government Policies, rules and Regulations (CDSCO/NPPA/ MRTP Act) and their impact on business dynamics, relevant to Life Sciences Industry

Understand Role of MSR and code of conduct guidelines for MSR.

Perform the occupations effectively as per company's standard guidelines; gain orientation with Existing Organisation in Life Sciences Industry (in context of Large/Medium/ Small Enterprises): Their Organization Structure, Benefits and typical sales function in a Life Sciences organization and understand the Role of a MSR and required skills and knowledge (As per Qualification Pack) and its Career Path as well as know the MCI Code of Conduct guidelines for MSR and UCP-MP Act

.

Unit IV 8 Hours

Distribution system of pharmaceutical products.

Maintain knowledge of key persons at hospitals, pharmacies and dealers and to ensure smooth coordination with product distribution related stakeholders; gain the understanding of Distribution System of Pharmaceutical Products and role of various stakeholders involved like CFA, Distributor, Stockist, and Liasoning Agents.

.

Market research and Analysis and RCPA

Monitor competitor's products and selling and promotional activities and gather current market information on pricing, new products, delivery schedules, promoting techniques, etc, know the techniques of Market Research .

Conduct the retail chemist prescription audit effectively and to identify needs of potential customers by going through the prescriptions given by the doctors in the defined geography to their patients, know how to conduct and analyse retail call audits and how to use IT to Capture Market information and also gain the orientation with Physician and Pharmacist needs and working environment **Understanding of human body: Anatomy and** physiology

Understand technical/ scientific data presentations and briefings about product and market, know the basics of general Anatomy and general Physiology, and learn various systems of the Human body in tandem with physiology of that organ and system as whole and Familiarise with medical specialities and their common diseases.

Basic of pharmacology

Understand technical/ scientific data presentations and briefings and to understand and interpret clinical data supplied by company, learn fundamentals of pharmacology; understand related terms and their significance and understand basics of Drug metabolism

Overview of drug administration

Understand technical/ scientific data presentations and briefings and to understand and interpret clinical data supplied by company, know what is drug

administration, How drug is transported within the Human Body, Mechanism of drug absorption mechanism in the Human body and know Methods of drug administration and various routes of drug administration

Unit V: 7 Hours Module V

Therapeutics drug classes and catagories

Understand technical/ scientific data presentations and briefings, know about the Therapeutic Drug Classes & Categories and their use in understanding the Product

Drug formularies ad their relevance for MSR

Understand technical/ scientific data presentations and briefings and to deliver convincing presentations to doctors, pharmacists and other potential customers gain knowledge about Drug Formularies and their relevance for MSR

Orientation on pharmacovigilance

Follow company's legal guidelines and pharmacovigilance process, know that what comprise the field of pharmacovigilance and its related fields, understand its relevance & potential for MSR's role, know common terms used and their reference, understand the scope of Pharmacovigilance as a system, know about National & International pharmacovigilance regulatory Authorities and learn basic processing of a typical pharmacovigilance case" through case studies.

Orientation of disease management

Understand technical/ scientific data presentations and briefings about product and market and to monitor the activities of health services in a specific area, learn the concept of disease management & Its Importance, know about process & factors influencing the disease management processes at gross level, gain knowledge for Disease management for common diseases and various projects being run Nationally and internationally

Organization policy and internal processes at work

Follow the company's guidelines, process and standard gain the orientation with generic Organizational Policy & various internal Process relevant for MSR

Name of The Course	**Production And Manufacturing** I			
Course Code	BPPM7008			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	4	0	0	4

Course Objectives

1. Students will be able to know about fundamentals of production process for API.
2. Students will be able to know about fundamentals of production process for formulations.
3. Students will be able to know about fundamentals of production process for sterile dosage form.

Course Outcomes

After completion of course student shall be able to

CO1	Define the life science industry and sub sectors.
CO2	Demonstrate the fundamentals of pharmaceutical production process.
CO3	Organize the production process for API.
CO4	Analyze the production process for formulations.
CO5	Explain the production process for sterile dosage form.
CO6	Elaborate the advancement in pharmaceutical formulation development.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
	25	75	100

Course Content:

Unit I: Orientation Module 12 **Hours**

Industry, its sub-sectors

 Know about Regulatory Authorities and Government Policies, rules and Regulations and their impact on manufacturing in Life Sciences Industry in India and Emerging Markets (Both Regulated and Semi Regulated)

 Know about Standards for Manufacturing in Life Sciences like cGMP, ISO, etc. Orientation with Pharmacopeia and how to read them.

 Understand Existing Organization in Life Sciences Industry (in context of Large/Medium/ Small Enterprises): Their Organization Structure and Benefits. Know the typical manufacturing function in a Life Sciences organization.

 Understand the Role of a Production Chemist and required skills and knowledge (As per Qualification Pack) and career path.

Unit II: Fundamentals of Pharmaceutical Production 12 Hours

Know about Basics of Pharmaceutical Science inclusive of Organic Nomenclature System, Organic Reaction Mechanism, and Basic Chemistry fundamentals

 Know about Quality Management System for Production in Life Sciences Industry including its introduction and importance, QC and QA Systems, Productivity norms and calculate the overall equipment efficiency (OEE)

 Know the Techniques of improving productivity (Lean and 6 sigma), and Techniques to control the rejects, Quality by Design. Know and
apply the techniques to control and predict the breakdown, Handle the market complaints.

 Know and follow Deviation ,incident and change control procedure and Required Documentation practices by QMS, and implement these at shop floor

 Learn and apply the concepts and practical skills of Quality Risk Management and Data Integrity aligned to cGMP in the context of Indian Culture.

 Learn and follow the documentation practices required by cGMP and implement these learnings at shop floor

Unit III: Production Process for API 12 Hours

Know and apply the Fundamental Science in API Production including Size Separation, Mixing and homogenization Process, Mass Transfer, Fluid Flow, Heat Transfer, Size Reduction, Role of API in typical Pharmaceutical Manufacturing and role of API particle size in formulations

 Know in detail and follow Production Process of API with an in depth understanding and practical skills on following:

(1) Unit processes: Oxidation, Reduction, Hydrogenation, Sulfonation, Nitration, and Halogenation.

(2) Bulk organic chemicals as building blocks for manufacture of drugs and drug intermediates

(3) Catalysis and Bio catalysis in Industrial production.

(4) Downstream processes like Filtration, Centrifugation, Extraction, Evaporation, Crystallization, Drying and Size reduction

(5) Pharmaceutical Manufacturing Equipment's

(6) Chemical Technologies for selected drugs.

Unit IV: Production Process for Formulations 12Hours

Know in detail about Basics of Formulations including Route of Drug Administration and Various Dosage Forms like Oral Solid Dosage, Liquid Oral Dosage, Sterile Dosage, Dermatological Dosage and their relevant benefits and practice Assay calculation procedure and assay role in formulation, Standard weight procedure or standard quantity effect in formulation

 Learn and apply the conceptual and practical skills about Production process of Oral Solid Dosage including Process of Granulation, Compression, Coating, Capsule Filling

Learn and apply the conceptual and practical skills about Production process of Liquid Oral Dosage covering aspects like:

Types of oral liquids

Types of Monophasic liquid dosage forms

Theoretical aspects of vehicles and additives for Monophasic liquid oral dosage forms

Mixing processes

Filtration : Definition, theory, filter media, selection of the filter media and filter aid
Operation, cleaning and maintenance of filter press
Biphasic dosage forms : Suspensions:
Preparation of suspensions
Types of suspensions
Adjuvants used in suspension, types, selection, quantity used in formulation
Biphasic dosage forms : Emulsions:
Preparation of Emulsions
Formulation of different types of emulsions
Selection of Emulsifying agents based on HLB values
Machineries required for preparation of Emulsions
In process control parameters for Emulsions
Processing of Liquid Orals Operation, cleaning and maintenance of Filling Lines
Cleaning of manufacturing tanks and validation of cleaning process.

Unit V: Production Process for sterile dosage formulation 12 Hours

To learn the conceptual and practical skills about Production process of Sterile Dosage covering aspects like:
Definition and scope of Aseptic and terminally sterilized processing
Water for injection production, testing and maintenance
Gowning procedures
Good aseptic techniques
Basic microbiology and environmental monitoring
Sterilization techniques and sterilization qualification
Operation and maintenance of autoclave
Liquid Filtration and filter integrity testing
Lyophilisation , Manage SIP and CIP processes
Components preparations
Operation and maintenance of Laminar flow hood
Operation and maintenance of Isolators
Filling of ampoules, vials prefilled syringes, bags
Facility Design and HEPA system
Handle Change Parts- SMED concept
Good documentation practices
Environmental Data trending and excursion analysis
Testing of ampoules and vials for particulate matter.
Equipment handling skills used in the Sterile Dosage production

Unit VI Advancement in Pharmaceutical Formulation Development 8 Hours

• FDA requirement for Investigational New Drug Application
• ICH guidelines for the stability studies of pharmaceutical products
• Role of GMP in pharmaceutical preparation
• Introduction, advantages and limitations of novel drug delivery system
• Introduction and advantages of parenteral drug delivery system

Suggested Reading

Text Book (s):

1. Carter S.J., "Cooper and Gunn's Tutorial Pharmacy", CBS Publishers, Delhi.
2. Rawlins E.A., "Bentley's Text Book of Pharmaceutics", ELBS Bailliere Tyndall.
3. LachmanL,Liberman H.A and Kanig J.L., "Theory and Practice of Industrial Pharmacy", Lea and Febiger.
4. Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.

Reference Book (s)

1. United States Pharmacopoeia (National Formulary).
2. Remington – "The science and practice of pharmacy" Vol. I & II. Mack Publishing Co., Pennsylvania.
3. Pharmacopoeia of India, The Controller of Publications, Delhi.
4. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge

Other References:

1. Holbein, M.B., 2009. Understanding FDA regulatory requirements for investigational new drug applications for sponsor-investigators. Journal of investigative medicine, 57(6), pp.688-694.

2. ICH guidelines https://www.ich.org/page/quality-guidelines.
3. Haleem, R.M., Salem, M.Y., Fatahallah, F.A. and Abdelfattah, L.E., 2015. Quality in the pharmaceutical industry–A literature review. Saudi Pharmaceutical Journal, 23(5), pp.463-469.
4. Patel, K.T. and Chotai, N.P., 2008. Pharmaceutical GMP: past, present, and future–a review. Die Pharmazie-An International Journal of Pharmaceutical Sciences, 63(4), pp.251-255.
5. Shukla, A., Vishnoi, G. and Das, D.R., 2016. Current good manufacturing guidelines for medicinal product. Journal of Drug Delivery and Therapeutics, 6(2), pp.57-61.
6. Bhagwat, R.R. and Vaidhya, I.S., 2013. Novel drug delivery systems: An overview. International Journal of pharmaceutical sciences and research, 4(3), p.970.
7. Banode, S.R., Attar, M.S. and Picche, G., brief review of different types of parentral devices.
8.http://www.pharmatips.in/Articles/Pharmaceutics/Parenteral/Advantages-And-Disadvantage-Of-Parenteral-Administered.aspx.

Name of The Course	**Quality assurance**			
Course Code	**BPQA7009**			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	4	**0**	**0**	4

Course Objectives

1. Know the Regulatory Authorities and Government Policies
2. Understand the Production Process & Packaging operation for Life Sciences Industry
3. Understand the Fundamentals of Analytical to Quality Assurance

4. Carryout Process Validation and Exhibit staging for Quality Assurance

Course Outcomes

CO1	The student will be able to relate the Regulatory Authorities and Government Policies and their impact on manufacturing in Life Sciences Industry.
CO2	The student will be able to categorise the Production Process & Packaging operation of Life Sciences Industry.
CO3	The student will be able to apply the fundamentals of analytical to quality assurance personnel for life sciences industry.
CO4	The student will be able to apply the validation process and exhibit staging for quality assurance.
CO5	The student will be able to conclude the documentation for quality assurance.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
-	**25**	**75**	**100**

Course Content:

Unit I: 14 Hours
Regulatory Authorities and Government Policies Know about Regulatory Authorities and Government Policies, rules and Regulations and their impact on manufacturing in Life Sciences Industry • Understand the Standards for Manufacturing in Life Sciences like cGMP, ISO, GLP, GDP etc. Orientation of Pharmacopeia • Know about the Existing Organization in Life Sciences Industry (in context of Large/Medium/ Small Enterprises): Their Organization Structure and Benefits. Orientation on typical manufacturing function in a Life Sciences organization. • Know and Perform the Role of a Quality Assurance Chemist and required skills and knowledge (As per Qualification Pack) and its Career Path

Unit II: 14 Hours
Overview of Production Process & Packaging operation for Life Sciences Industry : Learn and Apply the Fundamental Science in API and Formulation Production, packaging including review skills in PAS/X activities, potency calculation for active materials, procedures and initiate the changes where ever applicable. Co-ordination for self-inspection audit. Addressing of incidents, investigations, CAPA follow-up and closure. Review and approval of Operational specification, UAT, Master batch records, executed batch report and executed dispensing report in PAS/X. Role of API in typical Pharmaceutical Manufacturing and role of API particle size in formulations, Knowledge on Critical Quality Attributes (CQA), Critical Process Parameters (CPP) and Critical Process Controls(CPC). Know and apply the Basics of Formulations including Route of Drug Administration and Various Dosage Forms like Oral Solid Dosage, Liquid Oral Dosage, Sterile Dosage, Dermatological Dosage and their relevant benefits, line clearance of various manufacturing and packing operations, routine sampling of in-process and its checks, validation and finished product samples. Collection of stability and control samples during packing operations. Know pack stock checks, batch documents, control on OSD, review and trending of Annual Product Quality Reviews. Gain Knowledge about Quality Management System for Production in Life Sciences Industry including its introduction and importance, QC and QA Systems, Detail aspects of cGMP, GLP, ISO with reference of quality assurance, On the Job Training, material verification, in-process labelling and status of material, release, process validation and stability protocols/reports, with drawl of reserve and stability samples from the production shop floor. Review of SOP, following safety, health and environmental procedures and practices.
Unit III: 14 Hours
Fundamentals of Analytical to Quality Assurance personnel for Life Sciences Industry Know and apply the Basics of Pharmaceutical Science and Chemistry inclusive of Organic Nomenclature System, Organic Reaction Mechanism, and Basic Analytical Chemistry fundamentals like including balancing chemical equations, chemical equilibria, acid and base chemistry, stoichiometric calculations, reduction and oxidation chemistry and interaction of light with matter. • Gain and apply knowledge of compilation of stability data and its verification, addressing the Quality impacting and non-impacting incidents, deviations, OOS, OOT, CAPA follow-up and closure, stability protocol certification of commercial and validation batches, ensuring the GMP compliance and control of data integrity issues in QC, analytical reports, knowledge on SAP, verification of standard operating procedures/ standard testing procedures/work sheets/ Analytical report before approval. • Gain and apply the knowledge of release process of Certificate of analysis for blend, API & finished products, vendor specifications for trending of Out of Trending (OOT) results, notification closures, Quality management systems, stability master data, pulls & maintenance. Knowledge on in-process checks during manufacturing and packing operations. • Conduct verification of material damage report, review knowledge on Raw material/In-process/Finished products/ Packing materials/ Stability specifications before approval, detail aspects like cGMP, GLP, ISO with reference of quality assurance. Learn and apply practical skill for Complex and Non-Complex Techniques
Unit IV: 15 Hours
Process Validation and Exhibit staging for Quality Assurance •Gain and apply the knowledge on hold time data, SHE report availability, compliance in master production records, vendor status of raw material prior to start of new product and before validation

batch start, method transfer, method validation and calibration reports. • Review and approve Master production records, change controls, bill of material, performance qualification protocols and reports, analytical reports related to exhibit/ submission batches, regulatory dossiers of various markets. • Gain and apply knowledge on R&D development strategy, technology transfer, production and manufacturing assurance for execution of process performance qualification and verification of batches, Quality impacting and non-impacting incidents, deviations, OOS, OOT, CAPA follow-up and closure, detail aspects like cGMP, GLP compliance.
Unit V: 15Hours
Documentation for Quality Assurance Control, issue, archive and distribute records/ reports/ filing, art works, packing standards, protocols, drug calculations, upload and maintain batch documents in database and SAP, monitor the documents and their controls, control and issue SOP/STP/ Protocols/work sheets/BMR/BPR and record of analysis, design training matrix. • Prepare, compile and approve annual product quality review as per schedule, evaluate control charts for API, In-process and finished product. • Conduct incidents, deviations, OOS, OOT, CAPA follow-up and closure, detail aspects like cGMP, Good Documentation Practice compliance.

Name of The Course	Quality Control–I Theory			
Course Code	BPQC7010			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	4	0	0	4

Course Objectives

Upon completion of the course the student shall be able to

1. Understand various regulatory authorities in life science sector
2. Explain the processes involved in the manufacturing of pharmaceuticals
3. Know the dosage forms and the role of quality management system during the manufacturing
4. Understand the quality control processes and the operating knowledge of instruments required.

Course Outcomes

Upon completion of the course, thes tudent shall be able to:

CO1	Define the basic role of quality control chemist.
CO2	Demonstrate the production process of Life science industry
CO3	Identify the fundamentals of Instrumental Analysis of the Life Sciences Industry
CO4	Compare the Operating Knowledge of Analytical Instruments.
CO5	Assess Quality Checks in Quality Control Process.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Exam (ETE)**	**Total Marks**
0	25	75	100

Course Content:

Unit I:Orientation Module 14 Hours
•Understand Brief outline of Life Sciences Industry, its sub-sectors • Gain knowledge of Regulatory Authorities and Government Policies, rules and Regulations and their impact on manufacturing in Life Sciences Industry • Know the Standards for Manufacturing in Life Sciences like CGMP, ISO, GLP, GDP etc. Gain orientation with Pharmacopeia and how to read them

• Know about Existing Organisation in Life Sciences Industry (in context of Large/Medium/ Small Enterprises): Their Organization Structure and Benefits. Orientation on typical manufacturing and Quality function in a Life Sciences organization.
• Know about Role of a Quality Control Chemist and required skills and knowledge (As per Qualification Pack) and its Career Path.

Unit II:Overview of Production Process for Life Sciences Industry14Hours

Know about Fundamental Science in API Production including Size Separation, Mixing and homogenization Process, Mass Transfer, Fluid Flow, Heat Transfer, Size Reduction, Role of API in typical Pharmaceutical Manufacturing and role of API particle size in formulations, Knowledge on Critical Quality Attributes (CQA), Critical Process Parameters (CPP) and Critical Process Controls(CPC).
• Know about Basics of Formulations including Route of Drug Administration and Various Dosage Forms like Oral Solid Dosage, Liquid Oral Dosage, Sterile Dosage, Dermatological Dosage and their relevant benefits, Assay calculation procedure and assay role in formulation, Standard weight procedure or standard quantity effect in formulation.
• Know about Quality Management System for Production in Life Sciences Industry including its introduction and importance, QC and QA Systems, Detail aspects of CGMP, GLP, ISO withreference o quality control Fundamentals of Instrumental Analysis for Life Sciences Industry
Learn and apply Basics of Pharmaceutical Science and Chemistry inclusive of Organic Nomenclature System, Organic Reaction Mechanism, and Basic Analytical Chemistry fundamentals including balancing chemical equations, chemical equilibria, acid and base chemistry, stoichiometric calculations, reduction and oxidation chemistry and interaction of light with matter.

Unit III:Fundamentals of Instrumental Analysis for Life Sciences Industry 14 Hours

Know and apply the detailed understanding of basic principles of Separation Sciences, critical system parameters and their Industrial use in Quality Control analysis for Life Sciences Industry, Sample Preparation, preservation and Storage
Know and apply the basics of Sample Preparation, preservation and storage, Handling Glassware in Laboratory, Calibration of Glassware. Guidelines for Weighing and measuring the samples, safety precautions while handling sample and understanding the toxicity and carcinogenicity while handling critical samples.
• Know about Standards and guidelines for sample handling in Pharmaceutical and Biopharmaceutical Industry and perform sample handling and preparation.
• Gain detailed knowledge of Good Storage Practice, how to know stability of sample and process of sample stabilization, before storage of sample and apply the learned practices while sample storage.

Unit IV: Operating Knowledge of Analytical Instruments15 Hours

•Gain detailed knowledge about Molecular, Atomic near Infrared spectroscopy and Vibrational spectroscopy and the analysis of metals and apply leraning while operating analytical instruments.
• Gain Conceptual Scientific Knowledge and skills and operate analytical Equipment and Machinery like Fourier Transfer-Infrared (FT-IR), Inductively Coupled Plasma (ICP), Auto-Titration, UV-Visible, mass spectrophotometer detector, pH meter.
• Gain knowledge and skills about Chromatography including Basic principles of chromatography, Thin Layer Chromatography, Gas Chromatography and Liquid Chromatography, High performance Liquid

Chromatography, Preparatory, High performance Liquid Chromatography. • Operate analytical Equipment and Instruments like Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC).
Unit V: Perform Quality Checks in Quality Control Process15 Hours
Learn and Perform Quality Check (Inspection and Analysis) in QC, compare results with statistical limits, Calibrations, IQ, OQ, PQ and techniques for improving instrumental analysis. Handle Exceptions. Operate the instruments like stability chambers, BOD incubators and Photoflourometer. Knowledge of QC analysis Checklist for all relative instruments. • Know about and Productivity norms and calculate the overall equipment efficiency (OEE), practice Techniques of improving productivity (Lean and 6 sigma), Techniques to control the rejects. Learn and apply Techniques to control the breakdown, Handling of market complaints, Deviation, incident and change control procedure and Required Documentation practices by QMS, CGMP. • Carry out Statistical Analysis of Laboratory data: Gain Knowledge of Calculations and Use of QC Statistics like Levey-Jennings Charts &Westgard Rules, CV, Comparative Evaluations, CVR, SDI. • Learn and apply Fundamentals of Advance QC approaches like Quality by Design and Process Analytical Technology, Method Transfer Process and how to manage the Quality Risk. • Practice Practical problem solving/ trouble shooting in QC Analysis.

Suggested Reading

1. Textbook of Quality control chemist, LSSSDC
2. Remington: The Science and Practice of Pharmacy.

Name of The Course	**MEDICAL SALES REPRESENTATIVE- I**
Course Code	**BPMR7011**
Prerequisite	
Corequisite	
Antirequisite	

	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Objectives:

Upon completion of the subject student shall be able to understand;

1. Personality development and fluent communication
2. To develop conversation techniques to influence the potential customers.
3. Understanding of Distribution System of Pharmaceutical Products.
4. To become more effective in meetings, in making presentations and in their use of informal English

Course Outcomes

CO1	Apply comminication skill, group tasking, to become more effective in meetings,and making presentations
CO2	Analyze a strong cross-cultural element, giving participants an ideal opportunity to see issues from an entirely new perspective

Text Book (s):

1. Mastering the Complex Sale Second Edition by Jeff Thull.
2. How to Master the Art of Selling by Tommy Hopkins
3. How to Win Friends and Influence People by Dale Carnegie.

Reference Book (s)

1. **Secrets of Closing the Sale by ZigZiglar.**
2. Smart Guide to Becoming a Medical Sales Representative (English, Paperback, Penny Dhanjal)
3. How to Master the Art of Selling by Tommy Hopkins.

List of Experiments	
1	Discussion, brainstorming and debates. Group work and tasks
2	Communication exercises and Reading and listening comprehension.

3	Communication exercises and Reading and listening comprehension.
4	Vocabulary and written exercises and Role playing
5	Selected grammar where required and Conversation techniques.
6	Company visit and/or guest speaker and Individual and group presentations
7	Introduction to Personality Development and Interview skills
8	Introduction to hospitals, pharmacies and dealers and Understanding of Distribution System of Pharmaceutical Products.
9	Role of various stakeholders involved like CFA, Distributor, Stockist, and Liasoning Agents and Introduction to products and selling and promotional activities.
10	19. Introduction to Conduct the retail chemist prescription audit (RCPA) and Introduction to basics of general Anatomy and general Physiology.
11	Introduction to various systems of the Human body in tandem with physiology of that organ and system and Introduction to scientific data presentations and briefings.
12	Introduction to fundamentals of pharmacology.
13	Introduction to various routes of drug administration and drug absorption.
14	Introduction to Therapeutics drug classes and catagories.
15	Introduction to pharmacovigilance.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Examination	End Term Test (ETE)	Total Marks
0	**15**	**35**	**50**

Name of The Course	**Production and Manufacturing-I (Practical)**
Course Code	**BPPM7012**

Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Objectives:

Upon completion of the subject student shall be able to understand;

1. Develop skills and knowledge of production chemist.
2. Understand the professional way of handling various equipment required at production shop floor.
3. Develop skills required for troubleshooting

Course Outcomes

CO1	Students will be able to gain knowledge about various regulatories agency working for pharmaceutical industry.
CO2	Students will be able to prepare SOP
CO3	Students will be able to develop knowledge about GMP, GLP and cGMP

Text Book (s):

1. Carter S.J., “Cooper and Gunn’s Tutorial Pharmacy”, CBS Publishers, Delhi.
2. Rawlins E.A., “Bentley’s Text Book of Pharmaceutics”, ELBS Bailliere Tyndall.
3. LachmanL,Liberman H.A and Kanig J.L., “Theory and Practice of Industrial Pharmacy”, Lea and Febiger.
4. Cooper and Gunn’s Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.

Reference Book (s)

1. Aulton, M.E, Text Book of Pharmaceutics, Vol., I & II. Churchill Livingstone.

2. United States Pharmacopoeia (National Formulary).
3. Remington – "The science and practice of pharmacy" Vol. I & II. Mack Publishing Co., Pennsylvania.

List of Experiments	
1	To study abo+C33:T47ut the various regulatory authorities governing Pharmaceutical industry.
2	To study about the GMP, GLP and cGMP.
3	To study about the required skills and knowledge of production chemist.
4	To study the importance of production department in Pharmaceutical industry.
5	To study the various technique to improve productivity in Pharmaceutical Industry.
6	To study the process of breakdown and handling during manufacturing process.
7	To study the fundamentals science in size separation and size reduction.
8	To study the working of ball mill
9	To study the effect of surface area on the rate of evaporation.
10	To study the effect of temperature on the rate of evaporation.
11	To study the basics of various route of administration.
12	To prepare solid oral tablet dosage form.
13	To prepare liquid oral suspension
14	To study granulation technique to prepare tablet dosage form.
15	To study the working of friabilator.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Examination	End Term Test (ETE)	Total Marks
	15	**35**	**50**

Name of The Course	**Quality Assurance-I Practical**				
Course Code	**BPQA7013**				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives:

Course Outcomes

CO1	The student will be able to apply the basics of quality assurance to evaluate the various dosage form.
CO2	The student will be able to classify the GMP and GLP guidelines.
CO3	The student will be able to perform calibration of various equipment.
CO4	The student will be able to apply the concept of validation reports.

Text Book (s):

1. Quality Planning and Analysis / Edition 3 by J. M. Juran, Frank M.
2. An Introduction to Quality Assurance in Health Care by M Perides

Reference Book (s)

1. Remington's Pharmaceutical Sciences.
2. Pharmacopoeia of India, The Controller of Publications, Delhi.
3. United States Pharmacopoeia (National Formulary).

List of Experiments	
1	To study the fundamental science in API formulation production.
2	To study about hardness tester.
3	To observe coating machine
4	To perform pharmacopeia assay of D.T apparatus
5	To study the capsule the capsule filling machine
6	To study the autoclave

7	To study the calibration report of pharmaceutical method
8	To study different sample labels
9	To study the validation reports
10	To study about pharmacological assay of different doses forms
11	To prepare BMR.
12	To study about sample validation reports
13	To study particle size analyzer
14	To study GMP and GLP guidelines
15	To study hardness tester

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Examination**	**End Term Test (ETE)**	**Total Marks**
	15	**35**	**50**

Name of The Course	**Quality Control-Practical**			
Course Code	**BPQC7014**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Objectives:

The main purpose of subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the pharmaceutical industry. It helps in the understanding of the role of quality control chemist in the coordination of an organization.

Course Outcomes

CO1	The student will be able to perform the Quantitativetive test for theanalysis of the drug.
CO2	The student will be able to perform the Qualititative tests of the given drug.
CO3	The student will be able to execute the demo process with the GMP (Good Manufacturing Practices) and GLP (Good Laboratory Practices).

Text Book (s):

1. Textbook of Quality control chemist, LSSSDC
2. Remington: The Science and Practice of Pharmacy

List of Experiments	
1	To Study the importance of GLP
2	To study the essential parameters of QC chemist
3	To study the Importance of API for the efficient functioning of any industry .
4	To Determine the effect of Self Inspection and Quality control..
5	To determine the purity of marketed drug through UV.
6	To determine the purity of marketed drug through IR.
7	To study the Importance safty of the workers for good organisation.
8	To prepare and check 50 ml chloroform water IP 1966.
9	To prepare and check 20 ml of aqueous iodine solution IP.
10	To prepare and check 20 g of simple syrup IP.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Examination**	**End Term Test (ETE)**	**Total Marks**
	15	**35**	**50**

Name of The Course	BIOSTATISITCS AND RESEARCH METHODOLOGY			
Course Code	BPHT8001			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	T	P	C
	3	1	0	4

Course Objectives

Upon completion of the course, the student shall be able to:

• Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)

• Know the various statistical techniques to solve statistical problems

• Appreciate statistical techniques in solving the problems.

Course Outcomes

CO1	Students will be able to apply the concept correlation, dispersion and frequency distribution to the given data.
CO2	Students will be able to apply the parametric tests, probability formulae and they will also be able to calculate regression.
CO3	Students will be able to apply the non parametric tests, design research methodology and to make graph
CO4	Students will be able to apply the concept of regression modeling and to understand practical components of industrial and clinical trials problems.
CO5	Students will be able to analyze and design experiments.
CO6	Students will be able to explore to create trend/innovation for different novel research methodology and to learn futuristic biostatistics problem.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Exam (ETE)	Total Marks
10	15	75	100

Course Content:

Unit- 1: **10 Hours**
Statistics, Biostatistics, Frequency distribution Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems **Correlation:** Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples
Unit-2 **10 hours**
Regression: Curve fitting by the method of leasts quares, fitting the lines y=a+bxandx a+by, Multiple regression, standard error ofregression– Pharmaceutical Examples Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties – problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples Parametrictest: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference
Unit-3 **12 hours**
Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plotgraph Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational

studies, Experimental studies, Designing clinical trial, various phases.
Unit-4 08 hours
Blocking and confounding system for Two-level factorials Regression modeling: Hypothesis testing in Simple and Multiple regression models Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGNOFEXPERIMENTS, R- Online Statistical Software's to Industrial and Clinical trial approach
Unit-5 07 hours
Design and Analysis of experiments: Factorial Design: Definition, 2^2, 2^3 design. Advantage of factorial design Response Surface methodology: Central composite design, Historical design, Optimization Techniques
Unit-6 8 hours
Recent advancement in Research Methodology and Biostatistics: Innovative trend analysis methodology, The quantity synthesis of single subject research: Methodology and validation, The future of biostatistics: expecting the unexpected.

Suggested Readings:

Text Books

1.Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.
2.Fundamental of Statistics– Himalaya Publishing House- S.C.Guptha
3.Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,

Reference Books

1. Design andAnalysis ofExperiments– WileStudents Edition, Douglasand C. Montgomery

Name of The Course	**SOCIAL AND PREVENTIVE PHARMACY**
Course Code	**BPHT8002**
Prerequisite	
Corequisite	
Antirequisite	

L	**T**	**P**	**C**
3	1	0	4

Course Objectives:

After the successful completion of this course, the student shall be able to: Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.Have a critical way of thinking based on current healthcare development. Evaluate alternative ways of solving problems related tohealth and pharmaceutical issues.

Course Outcomes

CO1	The student will able to understanding the concept of prevention and control of disease, social causes of diseases, sociology and health of the ill person
CO2	The student will able to apply the concept of preventive medicine
CO3	The student will able to identify and explore the awareness of preventive medicine with the help of objectives scheduled and functioning of National health programme of many diseases i.e., TB, leprosy etc
CO4	The student will able to interpret and analyze the different health intervention program and analyze the role of WHO in Indian national program for preventive medicine
CO5	The student will able to relate the functioning of national urban health mission and health promotion and education in school
CO6	The student will able to create healthy community

Text Books

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition,
2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy RabindraNath, SahaIndranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th

Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, HiremathLalita D, HiremathDhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications

Reference Books

1. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
2. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

MODULE-I	**10 Hours**
Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of thesick. **Social and health education:** Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. **Sociology and health:** Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Povertyand health **Hygiene and health:** personal hygiene and healthcare; avoidable habits	
MODULE–II	**10 hours**
Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse	
MODULE-III	**10 Hours**
National health programs, its objectives, functioning and out come of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), Nationall eprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.	
MODULE-IV	**08 Hours**
National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the healthcare for the elderly, Social health programme; role of WHO in Indian national program.	
Module-5	**07 Hours**
Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	15	75	100

Name of The Course	**PHARMA MARKETING MANAGEMENT (Theory)**			
Course Code	**BPHT8003**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives:

The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

Course Outcomes

CO1	The student will be able to relate the basic concept of pharmaceutical marketing.
CO2	The student will be able to analyze the requirements for product design.
CO3	The student will be able to apply the concept of promotion for pharmaceutical products
CO4	The student will be able to identify the marketing channels and understand the role of professional sales representative.

CO5	The student will be able to apply the concepts of drug pricing as per Drug Price Control Order.

Text Books

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche : Marketing Strategy-Planning and Implementation, Tata
MC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective, IndianContext,Macmilan India, New Delhi.

Reference Books

1. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
2. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

MODULE-I 10 Hours

Marketing

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical Marketing

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market;Role of market research.

MODULE–II 10 hours

Product Decision

Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

MODULE-III 10 Hours

Promotion

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

MODULE-IV 08 Hours

Pharmaceutical marketing channels:

Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Module-5 07 Hours

Pricing:

Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing:

Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
10	15	75	100

Name of The Course	PHARMACEUTICAL REGULATORY SCIENCE (Theory)			
Course Code	BPHT8004			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	1	0	4

Course Objectives:

Uponcompletion ofthe subject student shall be able to;

1. Know about the process of drug discovery and development
2. Knowthe regulatoryauthorities and agenciesgoverningthemanufactureand sale ofpharmaceuticals
3. Knowthe regulatoryapproval process and their registration in Indian and international markets

Course Outcomes

CO1	The student will be able to relate the basic concept of drug development process.
CO2	The student will be able to identify the regulatory bodies for the approval of new drugs/products.
CO3	The student will be able to understand the process of registration of Indian drug product in overseas market.
CO4	The student will be able to apply the basic concepts of clinical trials.
CO5	The student will be able to analyze the regulatory requirements in pharmaceutical industry.

Text Books

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and
Isader Kaufer, Marcel Dekker series, Vol.143

Reference Books

1. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance
By Fay A. Rozovsky and Rodney K. Adams
2. Principles and Practices of Clinical Research, Second Edition Edited by John I.
Gallin and Frederick P. Ognibene
3. Drugs: From Discovery to Approval, Second Edition By Rick Ng

MODULE-I	**10 Hours**
NewDrug Discovery and development Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.	
MODULE–II	**10 hours**
Regulatory Approval Process Approval processes and time lines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA /ANDA. **Regulatory authorities and agencies** Over view of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)	
MODULE-III	**10 Hours**
Registration of Indian drug product in overseas market Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.	
MODULE-IV **08 Hours**	

Clinical trials Developing clinicaltrial protocols, Institutional Review Board/Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors &Monitors, Managing and Monitoring clinical trials, Pharmacovigilance-safety monitoring in clinical trials
Module-5 07 Hours
Regulatory Concepts Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, CodeofFederal Regulatory, Purple book.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	15	75	100

Name of The Course	**PHARMACOVIGILANCE (Theory)**			
Course Code	**BPHT8005**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives:

At completion of this paper it is expected that students will be able to(know, do, and appreciate):

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance
3. National and international scenario of pharmacovigilance
4. Dictionaries, coding and terminologies used in pharmacovigilance
5. Detection of new adverse drug reactions and their assessment
6. International standards for classification of diseases and drugs
7. Adverse drug reaction reporting systems and communication in pharmacovigilance
8. Methods to generate safety data during preclinical, clinical and postapproval phases of drugs' life cycle
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
10. Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
11. ICH guidelines for ICSR, PSUR, expeditedre porting, pharmacovigilance planning
12. CIOMS requirements forADRreporting
13. Writing case narratives of adverse events and their quality.

Course Outcomes

CO1	Student will able to learn about development of pharmacovigilance as a science and monitor adverse drug reactions
CO2	Students will able to evaluate adverse reactions, will have understanding of drugs and diseases
CO3	Students will able to assess casualty, signal detection, role of drug safety in the successful development and usage of medicine to the benefit of patients
CO4	Students will able to evaluate good clinical practice in pharmacovigilance studies and understand the concept of pharmacovigilance system in India and its regulation
CO5	Student will able to understand global scenario of Pharmacovigilance and train students

Text Books

1. Textbook of Pharmacovigilance: SK Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from AtoZ By Barton Cobert, PierreBiron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance: Elizabeth B. Andrews,Nicholas, WileyPublishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller, WileyPublishers.

6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert, Jones & Bartlett Publishers.

Reference Books

1. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen EKimmel, Sean Hennessy, WileyPublishers.
2. A Textbook of Clinical Pharmacy Practice-Essential Concepts and Skills: G.
Partha sarathi, Karin Nyfort Hansen, Milap C. Nahata
3. National Formulary of India

MODULE-I **10 Hours**

Introduction to Pharmacovigilance
History and development of Pharmacovigilance
Importance of safety monitoring of Medicine
WHO international drug monitoring programme
Pharmacovigilance Program of India(PvPI)
Introduction to adversedru reactions
Definitions and classification of ADRs
Detectionandreporting
Methods in Causality assessment
Severity and seriousness assessment
Predictability and preventability assessment
Management of adverse drug reactions
Basic terminologies used in pharmacovigilance
Terminologies of adverse medication related events
Regulatory terminologies

MODULE–II **10 hours**

Drug and disease classification
Anatomical, therapeutic and chemical classification of drugs
International classification of diseases
Daily defined doses
International Non proprietary Names for drugs
Drug dictionaries and coding in pharmacovigilance
WHO adverse reaction terminologies
MedDRA and Standardised MedDRA queries
WHO drug dictionary
Eudravigilance medicinal product dictionary
Information resources in pharmacovigilance
Basic drug information resources
Specialised resources for ADRs
Establishing pharmacovigilance programme
Establishing in a hospital
Establishment & operation of drug safety department in industry
Contract Research Organisations (CROs)
Establishing a national programme

MODULE-III **10 Hours**

Vaccine safety surveillance
Vaccine Pharmacovigilance
Vaccination failure
Adverse events following immunization
Pharmacovigilance methods
Passive surveillance – Spontaneous reports and case series
Stimulated reporting
Active surveillance – Sentinel sites, drug event monitoring and registries
Comparative observational studies – Cross sectional study, case control study and cohort study
Targeted clinical investigations
Communication in pharmacovigilance
Effective communication in Pharmacovigilance
Communication in Drug Safety Crisis management
Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

MODULE-IV **08 Hours**

Safety datageneration
Preclinicalphase
Clinicalphase
Postapprovalphase (PMS)
ICH Guidelines for Pharmacovigilance
Organization and objectives of ICH
Expeditedreporting
Individualcasesafetyreports
Periodic safety update reports
Post approval expedited reporting
Pharmacovigilance planning
Good clinical practice in pharmacovigilance studies

Module-5 **07 Hours**

Pharmacogenomicsofadversedrugreactions
Geneticsrelated ADR withexample focusingPKparameters.
Drug safetyevaluation inspecialpopulation
Paediatrics

Pregnancyand lactation Geriatrics **CIOMS** CIOMS WorkingGroups CIOMS Form **CDSCO (India) and Pharmacovigilance** D&C Act and Schedule Y Differences in Indian and global pharmacovigilance requirements

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
10	15	75	100

Name of The Course	QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)				
Course Code	BPHT8006				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	1	0	4

Course Objectives:

Upon completion of the subject student shall be able to;

1. Know WHO guidelines for quality control of herbal drugs
2. Know Quality assurance in herbal drug industry
3. Know the regulatory approval process and their registration in Indian and international markets
4. Appreciate EU and ICH guidelines for quality control of herbal drugs

Course Outcomes

CO1	The student will be able to utilize the basic knowledge of standardization of plant material as per WHO guidelines.
CO2	The student will be able to apply the analysis of official formulations derived from crude drugs as per cGMP, GAP and GLP in traditional system of medicines.
CO3	The student will be able to apply the basic concept of safety and efficacy of herbal crude drugs as per ICH guidelines.
CO4	The student will be able to apply the knowledge of documentation of stability testing and analysis of the active plant constituents as per GMP requirements.
CO5	The student will be able to explain and utilize the knowledge of chemical and biological markers in safety monitoring of herbal products as per WHO guidelines.

Text Books

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I, Carrier Pub, 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals.Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998.WHO.Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.

Reference Books

1. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
2. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.

3. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
4. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

MODULE-I	**10 Hours**
Basictestsfordrugs–Pharmaceuticalsubstances,Medicinalplantsmaterialsanddosage forms WHO guidelines for qualitycontrol of herbal drugs. Evaluation of commercial crudedrugs intendedfor use	
MODULE–II	**10 hours**
Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACPforMedicinal Plants.	
MODULE-III	**10 Hours**
EUand ICHguidelines forqualitycontrol of herbal drugs. ResearchGuidelines forEvaluatingthe Safetyand EfficacyofHerbal Medicines	
MODULE-IV	**08 Hours**
Stabilitytesting of herbalmedicines. Application of various chromatographic techniques in standardization ofherbal products. Preparation of documents for new drugapplication and export registration. GMP requirementsand Drugs&Cosmetics Act provisions.	
Module-5	**07 Hours**
Regulatory requirements for herbal medicines.WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias.Role of chemical and biological markers in standardization of herbal products.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term**	**Total Marks**
		Test (ETE)	
10	15	75	100

Name of The Course	**COMPUTER AIDED DRUG DESIGN (Theory)**			
Course Code	**BPHT8007**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives:

Upon completion of the course, the student shall be able to understand
Design and discovery of lead molecules
The role of drug design in drug discovery process
The concept of QSAR and docking
Various strategies to develop new drug like molecules.
The design of new drug molecules using molecular modeling software

Course Outcomes

The student will be able to illustrate about lead discovery and analog based drug design.
The student will be able to illustrate about structure activity relationship (SAR), quantitative structure activity relationship (QSAR) and 3D quantitative structure activity relationship (3D QSAR).
The student will be able to illustrate about molecular docking and virtual screening techniques .
The student will be able to illustrate about Informatics and methods in drug design.
The student will be able to illustrate about molecular mechanics and quantum mechanics.

Text Books

1. Robert GCK, ed., “Drug Action at the Molecular Level” University Prak Press Baltimore.
2. Martin YC. “Quantitative Drug Design” Dekker, New York.
3. Delgado JN, Remers WA eds “Wilson &Gisvolds’s Text Book of Organic

Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
4. Foye WO "Principles of Medicinal chemistry 'Lea &Febiger.
5. Korolkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley
Interscience.
6. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry"
John Wiley & Sons, New York.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert, Jones & Bartlett Publishers.

Reference Books

1. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University
Press.
2. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design"
Wright Boston.
3. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action"
Academic Press New York.

MODULE-I	**10 Hours**
Introduction to Drug Discovery andDevelopment Stages of drugdiscoveryand development **Lead discovery and AnalogBased Drug Design** Rational approaches to lead discoverybased on traditional medicine, Randomscreening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation. **Analog Based Drug Design:** Bioisosterism, Classification, Bioisosteric replacement. Any three case studies	
MODULE–II	**10 hours**
Quantitative Structure Activity Relationship (QSAR) SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.	
MODULE-III	**10 Hours**
Molecular Modeling and virtual screening techniques **Virtual Screening techniques:** Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening, **Molecular docking**: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design.	
MODULE-IV	**08 Hours**
Informatics &Methods indrug design Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.	
Module-5	**07 Hours**
Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	15	75	100

Name of The Course	**CELL AND MOLECULAR BIOLOGY (Elective subject)**			
Course Code	BPHT8008			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives:

Upon completion of the subject student shall be able to;

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.

- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.
- Summarize the Cell Cycle

Course Outcomes

CO1	Student will able to remember Cell and molecular biology
CO2	Student will understand molecular infromation
CO3	Student will able to illustrate regularities in protein pathways
CO4	Student will able to analyse genomics
CO5	Assess the cell signaling pathways

Text Book (s)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.

Reference Book (s)

1. Rose: Industrial Microbiology.
2. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
3. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
4. Peppler: Microbial Technology.
5. Edward: Fundamentals of Microbiology.
6. . N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
7. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
8. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and
9. Applications of RecombinantDNA: ASM Press Washington D.C.
10. RA Goldshy et. al., : Kuby Immunology.

Unit-1	**10 hours**
a) Cell and Molecular Biology: Definitions theory and basics and Applications. b) Cell and Molecular Biology: History and Summation. c) Properties of cells and cell membrane. d) Prokaryotic versus Eukaryotic e) Cellular Reproduction f) Chemical Foundations – an Introduction and Reactions (Types)	
Unit-2	**10 Hours**
a) DNA and the Flow of Molecular Information b) DNA Functioning c) DNA and RNA d) Types of RNA e) Transcription and Translation	
Unit-3	**10 Hours**
a) Proteins: Defined and Amino Acids b) Protein Structure c) Regularities in Protein Pathways d) Cellular Processes e) Positive Control and significance of Protein	
Unit-4	**8 Hours**
a) Science of Genetics b) Transgenics and Genomic Analysis c) Cell Cycle analysis d) Mitosis and Meiosis e) Cellular Activities and Checkpoints	
Unit-5	**7 Hours**
a) Cell Signals: Introduction b) Receptors for Cell Signals c) Signaling Pathways: Overview d) Misregulation of Signaling Pathways e) Protein-Kinases: Functioning	

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	15	75	100

Name of The Course	**COSMETIC SCIENCE(Theory)**
Course Code	BPHT8009

Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives:

The basic objective of this course is to get familiar with cosmetic science.

Course Outcomes

CO1	The student will able to plan and employ the concept of cosmetic formulation and building blocks of skin care products
CO2	The student will able to apply the concept of preventive medicine
CO3	The student will able to apply the knowledge of herbs in the formulation of herbal cosmetics
CO4	The Student will able to evaluate the different cosmetic products
CO5	The students will able to apply the knowledge of cosmetic problem associated with different cosmetic products

Text Book (s)

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.

2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.

Reference Book (s)

1) Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers.

Unit-1	**10 hours**
Classification of cosmetic and cosmeceutical products Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs **Cosmetic excipients:** Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application **Skin:** Basic structure and function of skin. **Hair:** Basic structure of hair. Hair growth cycle.	

Oral Cavity: Common problem associated with teeth and gums	
Unit-2	**10 Hours**
Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages.Application of these products in formulation of cosmecuticals. **Antiperspants & deodorants**- Actives & mechanism of action. **Principles of formulation and building blocks of Hair care products:** Conditioning shampoo, Hair conditioner,anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.	
Unit-3	**10 Hours**
Sun protection, Classification of Sunscreens and SPF. **Role of herbs in cosmetics:** Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove **Analytical cosmetics:** BIS specification and analytical methods for shampoo, skin- cream and toothpaste**.**	
Unit-4	**8 Hours**
Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benfits.	
Unit-5	**7 Hours**
Oily and dry skin, causes leading to dry skin, skin moisturization. Basic understanding of the terms Comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.	

Antiperspirants and Deodorants- Actives and mechanism of action

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
10	15	75	100

Name of The Course	EXPERIMENTAL PHARMACOLOGY			
Course Code	BPHT8010			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	1	0	4

Course Objectives:

Upon completion ofthe coursethe student shall be able to,

- Appreciatethe applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in preclinical research
- Appreciate and demonstrate the importance of biostatistics and research methodology
- Designand execute are search hypothesis independently

Course Outcomes

CO1	Analyze CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals.
CO2	Analyze the pre clinical studies for CNS activity as well as learn about research methodologies.
CO3	Analyze the pre clinical studies for ANS activity on lab animals.
CO4	Analyze the pre clinical studies for CVS activity on lab animals.
CO5	To analyze pre-clinical data analysis and interpretation using Students ‘t’ test and One-way ANOVA.

Text Book (s)

1. Fundamentals ofexperimental Pharmacology-byM.N.Ghosh
2. Hand book of Experimental Pharmacology-
3. CPCSEA guidelines for laboratoryanimal
4. DrugdiscoveryandEvaluation byVogel H.G.
5. DrugScreeningMethodsbySuresh
6. Introduction to biostatistics and research Richard

Unit-1	**10 hours**
Laboratory Animals: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.	
Unit-2	**10 Hours**
a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study. b. Study of screening animal models for Diuretics, nootropics, anti-Parkinson’s,antiasthmatics, **Preclinical screening models:** for CNS activity-analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer’s disease	
Unit-3	**10 Hours**
Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics,	

skeletal muscle relaxants, drugs acting on eye, local anaethetics.
Unit-4 8 Hours
Preclinical screening models: for CVS activity-antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.
Unit-5 7 Hours
Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
10	15	75	100

Name of The Course	ADVANCED INSTRUMENTATION TECHNIQUES			
Course Code	BPHT8011			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	1	0	4

Course Objectives:

Upon completion of the course the student shall be able to

- understand the advanced instruments used and its applications in drug analysis
- understand the chromatographic separation and analysis of drugs.
- understand the calibration of various analytical instruments
- know analysis of drugs using various analytical instruments.

Course Outcomes

CO1	Students will be able to interpret the NMR & Mass Spectra.
CO2	Students will be able to analyze the samples thermal methods of analysis & X-ray diffraction methods.
CO3	Students will be able to apply the concept of calibration and validation.
CO4	Students will be able to apply the radioimmunoassay and extraction techniques.
CO5	Students will be able to analyze the compounds through hyphenated techniques like LC-MS/MS, GC-MS/MS and HPTLC-MS.

Text Book (s)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.

Reference Book (s)

1.Instrumental Methodsof Chemical AnalysisbyB.K Sharma
2.Organic spectroscopybyY.R Sharma
3.Text book of Pharmaceutical AnalysisbyKenneth A. Connors
4.Vogel's Text book of Quantitative ChemicalAnalysis byA.I. Vogel
5.Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6.Organic Chemistry by I.L. Finar
7.Organic spectroscopybyWilliam Kemp
8.Quantitative AnalysisofDrugs byD. C. Garrett
9.Quantitative AnalysisofDrugs in PharmaceuticalFormulations byP. D. Sethi
10. Spectrophotometric identification of OrganicCompoundsbySilverstein

Unit-1 10 hours

Nuclear MagneticResonancespectroscopy Principlesof H-NMRandC-NMR,chemicalshift, factors affecting chemical shift,coupling constant,Spin-spincoupling,relaxation,instrumentation and applications **Mass Spectrometry**-Principles, Fragmentation, Ionization techniques– Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications
Unit-2 **10 Hours**
Thermal Methods of Analysis: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) **X-RayDiffractionMethods:**OriginofX-rays,basicaspectsofcrystals,X-ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.
Unit-3 **10 Hours**
Calibrationandvalidation-as perICH andUSFDA guidelines **Calibrationof followingInstruments** Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC
Unit-4 **8 Hours**
Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immunoassay **Extraction techniques**: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction
Unit-5 **7 Hours**
Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS. Mode of Evaluation: The theory and lab performance of students are evaluated separately

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term**	**Total Marks**
		Test (ETE)	
10	15	75	100

Name of The Course	**DIETARY SUPPLEMENTS AND NUTRACEUTICALS**			
Course Code	BPHT8012			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives:

This module aims to provide an understandingofthe conceptsbehind thetheoretical applications of dietarysupplements. Bythe end of the course, students should be able to :

1. Understand the need of supplements bythe different groupof people to maintain healthylife.
2. Understand the outcomeofdeficiencies in dietarysupplements.
3. Appreciatethe components in dietarysupplements andthe application.
4. Appreciatethe regulatoryand commercial aspectsofdietarysupplements including health claims.

Course Outcomes

CO1	Students will be able to understand the need of supplements by the different group of people to maintain healthy life.
CO2	Students will be able to develop a high level understanding of occurrence, chemical nature and medicinal benefits a phytochemicals as nutraceuticals.
CO3	Students will be able to analyze the introduction, basic mechanism of free radicals and need of dietary fibres and complex carbohydrates.
CO4	Students will be able to analyze the role of free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer and Atherosclerosis and basic mechanism of natural and synthetic antioxidants.

CO5	Students will be able to understand the need of regulatory aspects; FSSAI, FDA, FPO, MPO, AGMARK, HACCP and GMPs on Food safety and Pharmacopoeial specifications for dietary supplements and nutraceuticals.

Text Book (s)

1. Dietetics bySriLakshmi
2. RoleofdietaryfibresandneutraceuticalsinpreventingdiseasesbyK.TAgustiand P.Faizal:BSPunblication.
3. AdvancedNutritional Therapies byCooper. K.A.,(1996).
4. The Food PharmacybyJean Carper, Simon &Schuster, UKLtd., (1988).
5. PrescriptionforNutritionalHealingbyJamesF.Balchand PhyllisA.Balch2ndEdn., AveryPublishingGroup,NY (1997).
6. G. Gibson and C.williams Editors*2000 Functional foods*WoodheadPubl.Co.London.
7. Goldberg,I.*Functional Foods*. 1994. Chapman and Hall,NewYork.
8.Labuza,T.P.2000FunctionalFoodsandDietary Supplements:Safety,Good Manufacturing Practice(GMPs) andShelfLifeTesting in*EssentialsofFunctional Foods* M.K. Sachmidl and T.P.Labuza eds.Aspen Press.
9. Handbook ofNutraceuticals and Functional Foods, Third Edition (ModernNutrition)
10. Shils,ME,Olson, JA,Shike,M.1994*ModernNutritioninHealthandDisease*. Eighth edition.Lea andFebige

Unit-1	**10 hours**
a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc. b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.	

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds
Unit-2 **10 Hours**
Phytochemicals asnutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following a) Carotenoids-α and β-Carotene,Lycopene, Xanthophylls, leutin b) Sulfides: Diallyl sulfides, Allyltrisulfide. c) Polyphenolics: Reservetrol d) Flavonoids- Rutin ,Naringin, Quercitin, Anthocyanidins, catechins,Flavones e) Prebiotics / Probiotics.: Fructo oligosaccharides,Lacto bacillum f) Phytoestrogens :Isoflavones, daidzein, Geebustin, lignans g) Tocopherols h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functionalfoods: oats, wheat bran, ricebran, seafoods, coffee, tea and the like.
Unit-3 **10 Hours**
a) Introductiontofree radicals:Free radicals,reactive oxygenspecies,productionof free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates,nucleicacids.b) Dietary fibres and complex carbohydrates as functional food ingredients.
Unit-3 **8 Hours**
a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidneydamage, muscledamage.Freeradicals involvement in otherdisorders.Free radicalstheoryof ageing. b)Antioxidants: Endogenous antioxidants–enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E,α-Lipoicacid, melatonin Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxyl Anisole. c) Functional foods forchronic diseaseprevention
Unit-5 **7 Hours**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
10	15	75	100

Name of The Course	Pharmaceutical product development				
Course Code	BPET8013				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	1	0	4	

Course Objectives:

Upon completion of the course student shall be able

1. To understand various approaches for development of pharmaceutical product.
2. To understand the criteria for selection of drugs and excipient for the development of their formulation and evaluation

Course Outcomes

CO1	Students will be able to understand the objectives, introduction to pharmaceutical product development and quality control testing of different types of dosage forms.
CO2	Students will be able to develop a high level understanding of advanced study of pharmaceutical excipients in pharmaceutical product development with a special reference
CO3	Students will be able to analyze the selection and application of excipients in pharmaceutical formulations with specific industrial applications.
CO4	Students will be able to analyze the optimization techniques in pharmaceutical product development.
CO5	Students will be able to understand the selection and quality control testing of packaging materials for pharmaceutical product development and regulatory consideration.

Text Book (s)

1. Pharmaceutical Statistics Practical and Clinical Applications by Stanford Bolton, CharlesBon; Marcel Dekker Inc.
2. Encyclopedia of Pharmaceutical Technology, edited by James swarbrick, Third Edition,Informa Healthcare publishers.
3. Pharmaceutical Dosage Forms, Tablets, Volume II, edited by Herbert A. Lieberman andLeon Lachman; Marcel Dekker, Inc.
4. The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by Roop kKhar, S P Vyas, Farhan J Ahmad, Gaurav K Jain; CBS Publishers and Distributors Pvt.Ltd. 2013.
5. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, edited by Patrick J. Sinko, BI Publications Pvt. Ltd.
6. Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyas and R. K.Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012.
7. Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V. Allen Jr., Nicholas B.Popovich, Howard C. Ansel, 9th Ed. 40
8. Aulton's Pharmaceutics – The Design and Manufacture of Medicines, Michael E. Aulton,3rd Ed.
9. Remington – The Science and Practice of Pharmacy, 20th Ed.

10. Pharmaceutical Dosage Forms – Tablets Vol 1 to 3, A. Liberman, Leon Lachman andJoseph B. Schwartz
11. Pharmaceutical Dosage Forms – Disperse Systems Vol 1 to 3, H.A. Liberman, Martin, M.R and Gilbert S. Banker.
12. Pharmaceutical Dosage Forms – Parenteral Medication Vol 1 & 2, Kenneth E. Avis andH.A. Libermann.
13. Advanced Review Articles related to the topics.

Unit-1	**10 hours**
Introduction to pharmaceutical product development, objectives, regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms	
Unit-2	**10 Hours**
An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Solvents and solubilizers ii. Cyclodextrins and their applications iii. Non - ionic surfactants and their applications iv. Polyethylene glycols and sorbitols v. Suspending and emulsifying agents vi. Semi solid excipients	
Unit-3	**10 Hours**
An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Tablet and capsule excipients ii. Directly compressible vehicles iii. Coat materials iv. Excipients in parenteral and aerosols products v. Excipients for formulation of NDDS Selection and application of excipients in pharmaceutical formulations with specific industrial applications	
Unit-4	**8 Hours**
Optimization techniques in pharmaceutical product development.A study of various optimization techniques for pharmaceutical product development with specific examples.Optimization by factorial designs and their applications.A study of QbD and its application in pharmaceutical product development.	
Unit-5	**7 Hours**
Selection and quality control testing of packaging materials for pharmaceutical product development-regulatory consideration	

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
10	15	75	100

Name of The Course	Project Work			
Course Code	BPPW8012			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
			12	6

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Exam**	**End Term Test (ETE)**	**Total Marks**
		150	150

Name of The Course	**MEDICAL SALES REPRESENTATIVE-II**			
Course Code	BPMR8014			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	4	0	0	4

Course Objectives:
This subject involves analysis of overall personality development, better comunication, marketing reserch, public relation, professional relation with medical

companies, hospitals to conduct smooth work flow by a MSR.

Course Outcomes

CO1	Student will able to Apply the knowledge for Personality Development.
CO2	Student will able to Apply knowledge to Orientation with presales activities.
CO3	Student will able to Apply Core skills and professional skills related to promoting and selling pharmaceutical products to potential customers and for providing after sales service.
CO4	Student will able to Apply knowledge toOrganizing medical conferences and promotional events
CO5	Student will able to Analyze the Core skill professional skills related to organizing medical conferences and promotional events.

Text Book (s)

Mastering the Complex Sale Second Edition by Jeff Thull.

How to Master the Art of Selling by Tommy Hopkins.

How to Win Friends and Influence People by Dale Carnegie.

Secrets of Closing the Sale by Zig Ziglar.

Reference Book (s)

Smart Guide to Becoming a Medical Sales Representative (English, Paperback, Penny Dhanjal)

How to Master the Art of Selling by Tommy Hopkins.

Unit-1	**20 hours**
Personality Development. - Manners & Etiquettes. - Building confidence and developing presentation skills. - Dress code and color pattern. Interview skills Resume writing. - Interview question and answers. - Mock sessions.	

Core skills and professional skills related to gathering information about product and competitor To effectively gather information about the product and competitors know the required skill set and learn application of related Core Skills and Professional Skills like Reading, writing, listening and speaking, Critical thinking, problem solving, decision making, customer centricity, plan and organizing, Analytical thinking **Pharmaceutical marketing** To develop strategies to increase opportunities to meet and connect with contacts in the medical and healthcare sector; understand Role of Marketing across Product lifecycle; gain knowledge about trends in Pharmaceutical Marketing and implications of changing marketplace on promotional activities in Pharma and gain knowledge about Patient-Physician relationship and Physician-MSR relationship.	
Unit-2	**20 hours**
Orientation with presales activities To sell and promote medical products and services and to arrange appointments with medical professionals gain orientation with Pre-Sales Activity in reference to Communication strategies for products To deliver presentations to doctors, pharmacists and other potential customers , learn basics of effective business communication and learn how to conduct effective business meetings **Sales in life sciences** To sell and promote medical and pharmaceutical products and services learn basics of Selling Process. To develop strategies to increase opportunities to meet and connect with contacts in the medical and healthcare sector understand different Sales Approaches in Pharma To engage the potential customers using various methods, tolls and approaches to convince him/her to prescribe your products learn how to effectively handle Objections, basics of Emotional Quotient (EQ)	
Unit-3	**12 hours**
To ensure the target orientation to reach sales and collection targets learn the process and importance of daily reporting for MSR	

To follow company's legal guidelines and pharmacovigilance process while selling products and providing after-sales service, including channeling queries through the company defined process understand

To deliver presentations to doctors, pharmacists and other potential customers , learn basics of effective business communication and learn how to conduct effective business meetings

Core skills and professional skills related to promoting and selling pharmaceutical products to potential customers and for providing after sales service

To promote and sell Pharmaceutical Products to potential customers and for providing after sales service, know the required skill set and learn the application of Core Skills and Professional Skills like Reading, writing, listening, speaking, Plan and organize, Critical thinking, problem solving, decision making, customer centricity and their application at workplace

Unit-4 **10 hours**

Organizing medical conferences and promotional events

To establish contact with maximum people within and outside the company to gather inputs on arranging the conference/ promotional event (CMEs) learn techniques for Collaborating with Other Groups and Divisions, understand the importance of collaboration for MSR

To gain and spread knowledge from the event related to business/ brand/ company learn how to Identify Partnering Opportunities during meetings/ seminars

To manage arrangements within the approved budget learn how to achieve Resource Optimisation at work

To cover all important aspects related to the topic of the conference in the agenda/ theme of promotional event and to plan and complete all logistical arrangements to execution learn the application of Planning & Organizing Skills at work and learn how to effectively use Information Technology in organising conferences and events (CMEs).

Unit-5 **20 hours**

Core skill professional skills related to organizing medical conferences and promotional events

Organize Medical Conferences and promotional events (CMEs), by applying Core Skills and Professional Skills like Reading, writing, listening, speaking Analytical thinking, problem solving, decision making, customer centricity.

Information technology skills

Compile and analyse the reports and deliver presentations using Basic Computer operating Skills like Ms Office (Word, Excel, Power point and Outlook); know to work on Internet i.e. searching information on search engine, mail writing

To communicate on email learn how to write mails

To analyse the reports and deliver presentations how to compile office presentations, How to make the online sales reporting and facilitate the online product surveys

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
	25	75	100

Name of The Course	Production and Manufacturing-II				
Course Code	BPPM8015				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	4	0	0	4	

Course Objectives:

Course Outcomes

CO1	The student will be able to develop dermatological dosage form.
CO2	The student will be able to supervise production process in Pharmaceutical industry.

CO3	The student will be able to validate safety and emergency protocols and tools at production soft floor.
CO4	The student will be able to analyze the importance of QMS and SOP in Pharmaceutical industry.
CO5	The student will be able to operate the basic computer tools.

Text Book (s)

Carter S.J., "Cooper and Gunn's Tutorial Pharmacy", CBS Publishers, Delhi.
Rawlins E.A., "Bentley's Text Book of Pharmaceutics", ELBS Bailliere Tyndall.
Lachman L,Liberman H.A and Kanig J.L., "Theory and Practice of Industrial Pharmacy", Lea and Febiger.
Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.

Reference Book (s)

United States Pharmacopoeia (National Formulary).
Remington – "The science and practice of pharmacy" Vol. I & II. Mack Publishing Co., Pennsylvania.
Pharmacopoeia of India, The Controller of Publications, Delhi.
British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge

Unit-1	**12 hours**
Production Process for Dermatological formulation Learn and apply the conceptual and practical skills about Production process of Dermatological Formulations covering aspects like: Definition of Dermatological products Classification and types of dermatological products Dermatological product formulations Excipients used in formulation and their characteristics Process flow chart Manufacturing equipment's and process for different types of Dermatological products Filling line equipment's and processes Cleaning and disinfection of the manufacturing and filling equipment's In process testing for Dermatological Common manufacturing and filling defects and trouble shooting Critical process parameters and critical	
Unit-2	**12 hours**
Supervising a Production Team Learn and apply the concept and practical skills for Production Planning, monitor shift-wise production and practice required documentation like scheduled reports, weekly and monthly review and analysis reports, DPRs etc. Learn and apply the key concept and practical skills for Training, Supervising and delegating & monitoring in a manufacturing shop floor of Life Sciences Industry including the practical use of psychological concepts Learn and apply the concepts and practical skills for the required documentation in various production process. Check documents like log book, BMR /BPR, On line documentation entries. Learn and apply the Concepts of GDP and respond to an audit query from QA. Know and follow generic Organizational Policy & various internal Process. relevant for Production Chemist Learn and practice related Core Skills and Professional Skills: Reading, writing, listening and speaking, Observation &Critical thinking, problem solving, decision making, customer centricity, plan and organizing, Analytical thinking, Execution	
Unit-3	**12 hours**
Maintain a healthy, safe and secure working environment in the pharmaceutical manufacturing facility Learn the Basic Concepts of Safety including Hazards, Accidents, Safety Signs and Signals and Henriech Pyramid and follow and practice same at shop floor Know about Water Systems at Plant, Engineering related tools and techniques to operate the machine	

safely. Understand the clean room classifications and requirements, Know and follow Clean room behaviour practices

Use Material Data Safety Sheet, and follow the Process of Safety Analysis. Know and follow the Fire Safety concepts and prepare oneself to act in case of Fire Emergency at shop floor. Know about various PPEs used in different production operations and do Job Safety Analysis for Various production machines/ equipment and provide these critical information to concerned team members.

Learn and follow the Basic Concepts and practical skills for managing Emergency Procedures and how to do first aid

Learn and practice Related Core Skills and Professional Skills: Reading, writing, listening, speaking, Plan and organize, Critical thinking, problem solving, decision making, customer centricity

Unit-4
12 hours

Coordinate with Shift Supervisor, cross functional teams and within the team

Manage Supervisor- Reportee Relationship and identify Partnering Opportunities at work; know and follow General reporting process, protocol and escalation policy. Understand Importance of reports and communication with Supervisor including DPR handover

Learn and Use techniques for Collaborating with Other Groups and Divisions in order to achieve organizational goals

Learn and follow the conceptual and practical skills required by Production Chemist in Audits:

Importance of cGMP/QMS/ SOP related documentation

Method to Respond to Audit Queries

How to Face Internal Audit Interactions

Use of IT in communication and coordination

Learn and practice Related Core Skills and Professional Skills: Reading, writing, listening, speaking, Analytical thinking, problem solving, decision making, customer centricity.

Unit-5
12 hours

Information Technology Skills

Apply Basic Computer Skills (Ms Office, Internet) at Work. Use Lab Management Information System in a Production plant

Mode of Evaluation: The theory and lab performance of students are evaluated separately.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
0	25	75	100

Name of The Course	Quality Assurance-II			
Course Code	BPQA8016			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	4	0	0	4

Course Objectives:
Course Outcomes

CO1	The student will be able to relate the Regulatory Authorities and Government Policies and their impact on manufacturing in Life Sciences Industry.
CO2	The student will be able to categorise the Production Process & Packaging operation of Life Sciences Industry.
CO3	The student will be able to apply the fundamentals of analytical to quality assurance personnel for life sciences industry
CO4	The student will be able to apply the validation process and exhibit staging for quality assurance.
CO5	The student will be able to employ the documentation for quality assurance

Text Book (s):

1. Quality Planning and Analysis / Edition 3 by J. M. Juran, Frank M.
2. An Introduction to Quality Assurance in Health Care by M Perides

Reference Book (s)

1. Remington's Pharmaceutical Sciences.
2. Pharmacopoeia of India, The Controller of Publications, Delhi.
3. United States Pharmacopoeia (National Formulary).

Unit-1Introduction	**14 hours**
Documentation for Quality Assurance • Handle vendor & market complaints, provide justification or clarification for customer queries, change controls, internal & external audits. **Engineering Skills for Quality Assurance** Learn and apply the concept and practical skills for engineering, HVAC, AHU, water systems, compressed air, electricity, and facility requirements, documentation in various process like reporting defects/problem/incidents/quality issues/test results. • Follow the detailed concepts and guidelines of Good Documentation Practices and documentation requirement for Good Manufacturing Practices, building management systems, environment management systems etc • Give an audit justification given for wrong entry done in qualification documents, response to production team and conduct audits for facility, equipment and utilities on periodic basis, understanding on action plans and sticking to the time lines. • Rreview and approve Qualification protocols and calibration schedules of equipment and facility, preventive maintenance procedures, design qualification, SOP/URS/Standard control practices, layouts, cleaning validation documents.	
Unit-2	**14 hours**
Ensure Cleanliness in the work area Gain and apply knowledge of different Material, chemicals and equipment and their cleaning procedure as per manufacturer's guide • Gain and apply Knowledge about Electronic and Optical Sensors in laboratory equipment • Follow the methodology for storage area inspection with methods and materials required for cleaning variety of surfaces and equipment, methods to check the treated surface and equipment on completion of cleaning, disposal methods for waste, used/ unused solutions and relevant SOP, Procedures for reporting any unidentified soiling and Escalation procedures for soils or stains that could not be removed • Practice Related Core Skills and Professional Skills at work like; Reading, writing, listening and speaking, Critical thinking, problem solving, decision making, customer centricity, plan and organizing.	
Unit-3	**14 hours**
Maintain a healthy, safe and secure working environment in the pharmaceutical manufacturing facility and laboratory Learn and apply the Basic Concepts of Safety including Hazards, Accidents, Safety Signs and Signals and Henriech Pyramid • Know about Water Systems at Plant, Engineering related tools and techniques to operate the machine safely • Use Material Data Safety Sheet, follow Process of Safety Analysis. Learn and apply Fire Safety concepts and act in case of Fire Emergency at shop floor. Use various PPEs in different production operations and to do Job Safety Analysis for Various production machines/ equipment • Learn and apply the Basic Concepts and practical skills for managing Emergency Procedures and how to do first aid. Practice Related Core Skills and Professional Skills at work like: Reading, writing, listening, speaking, Plan and organize, Critical thinking, problem solving, decision making, customer centricity.	
Unit-4	**15 hours**
Coordinate with Supervisor, within team and cross functional the teams Manage Supervisor- Reportee Relationship including identify Partnering Opportunities at work; orientation on General reporting process, protocol	

and escalation policy and Importance of reports and communication with Supervisor □ Interact with cross functional teams while conducting internal audits and communicate the audit observations □ Use the techniques for Collaborating with Other Groups and Divisions □ Apply the conceptual and practical skills required by QC Chemist in Audits □ Know about Importance of cGMP/ GLP/ GDP/QMS/ SOP/ regulatory requirements related documentation □ Follow the Method to Respond to Audit Queries □ Face Internal Audit Interactions □ Use IT in communication and coordination □ Practice Related Core Skills and Professional Skills at work: Reading, writing, listening, speaking, Analytical thinking, problem solving, decision making, customer centricity
Unit-5 **15 hours**
Information Technology Skills Use Basic Computer Skills (Ms Office, Internet)+ Typing at Work □ Handle different software's used to operate the QC instruments □ Apply the knowledge on 21 CFR Part 11 compliance system and its requirements.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
0	25	75	100

Name of The Course	Quality Control-II			
Course Code	BPQC8017			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	4	0	0	4

Course Objectives:

The student will be able to understand the whole process of the quality control department.

Course Outcomes

CO1	The student will be able to understand the basic role of quality control chemist
CO2	The student will be able to understand the production process of Life scence industry.
CO3	The student will be able to understand the fundamentals of Instrumental Analysis of the Life Sciences Industry
CO4	The student will be able to analyze the Operating Knowledge of Analytical Instruments
CO5	The student will be able to Perform Quality Checks in Quality Control Process

Text Book (s):

1. Textbook of Quality control chemist, LSSSDC
2. Remington: The Science and Practice of Pharmacy

Unit-1Introduction **14 hours**
Documentation for Quality Control Learn the concept and practical skills for Work Planning of Quality Control and required documentation in various Quality Control Process like reporting defects/problem/incidents/quality issues/test results considering Data integrity aspects and follow the learnings while documentation for quality control. Learn and follow the detailed concepts of Good Documentation Practices and Knowledge about importance of Data Integrity and how to complete documentation in line with Good Laboratory Practices and Good Manufacturing Practices. Provide a detailed response to an audit / process related query fom any cross-functional team and Quality assurance team. Know and follow generic Organizational Policy & various internal Process relevant for QC Chemist like reporting unresolved issues, hazards, escalations, test point recording requirements etc. Learn and practice Related Core Skills and Professional Skills: Reading, writing, listening and

speaking, Critical thinking, problem solving, decision making, customer centricity, plan and organizing, Analytical thinking.

Unit-2 **14 hours**

Maintain a healthy, safe and secure working environment in the pharmaceutical manufacturing facility and laboratory

Learn and follow the Basic Concepts of Safety including Hazards, Accidents, Safety Signs and Signals and Henriech Pyramid and use the PPE and safety tools like eye shower etc.

 Know about Water Systems at Plant, Engineering related tools and techniques to operate the machine safely.

 Use Material Data Safety Sheet, follow the Process of Safety Analysis, Handle Hazardous Material in Lab, know and follow Fire Safety concepts and how to act in case of Fire Emergency at shop floor. Know about various PPEs used in different production operations and do Job Safety Analysis for Various production machines/ equipment.

 Learn and follow the Basic Concepts and practical skills for managing Emergency Procedures and how to do first aid.

Practice Related Core Skills and Professional Skills: Reading, writing, listening, speaking, Plan and organize, Critical thinking, problem solving, decision making, customer centricity.

Unit-3 **14 hours**

Ensure Cleanliness in the work area.

Gain Knowledge of different Material, chemicals and equipment and their cleaning procedure as per manufacturer's guide.

Gain Knowledge about Electronic and Optical Sensors in laboratory equipment and their operations as per the manual.

Know and Follow methodology for storage area inspection with methods and materials required for cleaning variety of surfaces and equipment, methods to check the treated surface and equipment on completion of cleaning, disposal methods for waste, used/ unused solutions and relevant SOP, Procedures for reporting any unidentified soiling and Escalation procedures for soils or stains that could not be removed.

 Practice Related Core Skills and Professional Skills: Reading, writing, listening, speaking, Plan and organize, Critical thinking, problem solving, decision making, customer centricity.

Unit-4 **15 hours**

Coordinate with Supervisor, within team and cross functional the teams.

Manage Supervisor- Reportee Relationship including identify Partnering Opportunities at work; Know and follow General reporting process, protocol and escalation policy and Importance of reports and communication with Supervisor.

 Apply techniques for Collaborating with Other Groups and Divisions.

 Learn and follow the conceptual and practical skills required by QC Chemist in Audits:

Importance of CGMP/ GLP/ GDP/QMS/ SOP related documentation

Method to Respond to Audit Queries

How to Face Internal Audit Interactions

Use of IT in communication and coordination. and Professional Skills: Reading, writing, listening, speaking, Analytical thinking, problem solving, decision making, customer centricity.

Unit-5 **15 hours**

Information Technology Skills

Apply Basic Computer Skills (Ms Office, Internet)+ Typing Practice at Work.

 Handle different software's used to operate the QC instruments.

 Gain and apply Knowledge about 21 CFR Part 11 compliance system and its requirements.

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Exam	End Term Test (ETE)	Total Marks
0	25	75	100

Name of The Course	Medical Sales Representative-II Lab
Course Code	BPMR8018

Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

This subject involves the practical aspects in personality development, better comunication, marketing reserch, public relation, professional relation with medical companies, hospitals to conduct smooth work flow by a MSR.

Course Outcomes

CO1	Apply comminication skill, group tasking, to become more effective in meetings,and making presentations
CO2	Analyze a strong cross-cultural element, giving participants an ideal opportunity to see issues from an entirely new perspective

Text Book (s):

1. Mastering the Complex Sale Second Edition by Jeff Thull.
2. How to Master the Art of Selling by Tommy Hopkins
3. How to Win Friends and Influence People by Dale Carnegie.

Reference Book (s)

1. Secrets of Closing the Sale by ZigZiglar.
2. Smart Guide to Becoming a Medical Sales Representative (English, Paperback, Penny Dhanjal)
3. How to Master the Art of Selling by Tommy Hopkins.

List of Experiments	
1	Offer an opportunity to share the experiences of others who are at a similar stage of their careers.
2	Help participants to become more effective in meetings, in making presentations and in their use of informal English.
3	Have a strong cross-cultural element, giving participants an ideal opportunity to see issues from an entirely new perspective.
4	Have an external component, such as a specialist speaker, workshop or external visit.
5	Develop the practical skills required for participants to succeed in a constantly-evolving global workplace.
6	Introduce of basic knowledge about Regulatory Authorities and Government Policies
7	Introduce of rules and Regulations (CDSCO/NPPA/ MRTP Act)
8	Introduction to Organization Structure, Benefits and typical sales function in a Life Sciences organization.
9	Introduction the Role of a MSR.
10	Introduction to MCI Code of Conduct guidelines for MSR and UCP-MP Act.
11	Introduction to develop strategies to increase opportunities to meet and connect with contacts in the medical and healthcare sector.
12	Deliver presentations to doctors, pharmacists and other potential customers. Introduction to develop strategies to increase opportunities to meet and connect with contacts in the medical and healthcare sector.
13	Organizing medical conferences and promotional events. Arranging the conference/ promotional event (CMEs)
14	Core skill professional skills related to organizing medical conferences and promotional events
15	Information technology skills. Introduction to analyse the reports and deliver presentations.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Examination**	**End Term Test (ETE)**	**Total Marks**
	15	35	50

Name of The Course	Production and manufacturing-II Lab			
Course Code	BPPM8019			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

Course Outcomes

CO1	Students will be able to prepare liquid dosage form.
CO2	Students will be able to prepare SOP
CO3	Students will be able to develop knowledge about BPR/BMR/DPR.

Text Book (s):

1. Quality Planning and Analysis / Edition 3 by J. M. Juran, Frank M.
2. An Introduction to Quality Assurance in Health Care by M Perides

Reference Book (s)

1. Remington's Pharmaceutical Sciences.
2. Pharmacopoeia of India, The Controller of Publications, Delhi.
3. United States Pharmacopoeia (National Formulary).

List of Experiments	
1	To prepare and evaluate pharmaceutical suspension
2	To study the importance of SOP
3	To study the difference between Type A and Type B cleaning
4	To study the importance of DPR.
5	To study the effect of various emulsifying agent in the stability of emulsion.
6	To study the various document such as log book and BMR/BPR.
7	To study the effect of various suspending agent in the stability of suspension.
8	To study the working of turbidity meter.
9	To prepare and submit zinc oxide paste.
10	To prepare and submit potassium permanganate gargles.
11	To study the importance of log book in Pharmaceutical industry.
12	To study about the line clearance.
13	Study about various possible chances of errors in product packaging.
14	To prepare and submit bulk powder.
15	To draw a schematic diagram of homogenizer

Continuous Assessment Pattern

Internal Assessment (IA)	Sessional Examination	End Term Test (ETE)	Total Marks
	15	35	50

Name of The Course	Quality Assurance-II Lab			
Course Code	BPQA8020			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

Course Outcomes

CO1	The student will be able to perform and study about various instruments like FTIR, UV etc.
CO2	The student will be able to perform the process of safety analysis.
CO3	The student will be able to perform calibration of various equipments.
CO4	The student will be able to apply the concept of various types of cleaning procedure as per manufacturers guidelines.

CO5	The student will be able to employ standard operating procedure.

Text Book (s):

1. Quality Planning and Analysis / Edition 3 by J. M. Juran, Frank M.
2. An Introduction to Quality Assurance in Health Care by M Perides

Reference Book (s)

1. Remington's Pharmaceutical Sciences.
2. Pharmacopoeia of India, The Controller of Publications, Delhi.
3. United States Pharmacopoeia (National Formulary).

List of Experiments	
1	To study and perform conductivity meter
2	To study about the filling machine
3	To study and perform type filling machine
4	To study the calorimeter
5	To perform assay by UV analyzer
6	To study the FT-IR
7	To perform the sieve shaker
8	To study the polarimeter
9	To study and perform bulk density and tapped density tester.
10	To study the melting point apparatus
11	To study about friabilator
12	To perform test of Karl Fisher apparatus
13	To study the process of safety analysis
14	To study about various types of cleaning procedure as per manufacturers guidelines
15	Give detail about sample engineering layouts

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Examination**	**End Term Test (ETE)**	**Total Marks**
	15	35	50

Name of The Course	Quality Control- II Lab			
Course Code	BPQC8021			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:

The main purpose of subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the pharmaceutical industry. It helps in the understanding of the role of quality control chemist in the coordination of an organization.

Course Outcomes

CO1	The student will be able to perform the Quantitativetive test for theanalysis of the drug.
CO2	The student will be able to perform the Qualititative tests of the given drug.
CO3	The student will be able to execute the demo process with the GMP (Good Manufacturing Practices) and GLP (Good Laboratory Practices).

Text Book (s):

1. Textbook of Quality control chemist, LSSSDC
2. Remington: The Science and Practice of Pharmacy

List of Experiments	
1	To Study the importance of GLP
2	To study the essential parameters of QC chemist
3	To study the Importance of API for the efficient functioning of any industry .
4	To Determine the effect of Self Inspection and Quality control..
5	To determine the purity of marketed drug through UV.

6	To determine the purity of marketed drug through IR.
7	To study the Importance safty of the workers for good organisation.
8	To prepare and check 50 ml chloroform water IP 1966.
9	To prepare and check 20 ml of aqueous iodine solution IP.
10	To prepare and check 20 g of simple syrup IP.

Continuous Assessment Pattern

Internal Assessment (IA)	**Sessional Examination**	**End Term Test (ETE)**	**Total Marks**
	15	35	50