Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	**BP101T**	**Title of the Course**	**HUMAN ANATOMY & PHYSIOLOGY-I**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	I		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--					
Course Objective	1. Structure and function of Human body at cellular level. 2. Describe the various homeostatic mechanisms and their imbalance. 3. Appreciate the coordinated working pattern of different organs of each system							

Course Outcomes	
CO1	Gain knowledge of the basic structural organization of the human body; Understand the levels of organization at cellular level.
CO2	Understand the structural and functional classification of skeletal system
CO3	Learn the role of blood and lymph; Understand the function of Lymphatic system
CO4	Learn the concepts of Peripheral Nervous System and special senses
CO5	Understand the structural and functional classification of Cardiovascular system

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Introduction to human body Cellularlevel of organization Tissue level of organization**	Definition and scope of anatomy and physiology, levels of structural Organization and body systems, basic life processes, homeostasis, basic anatomical terminology. 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 Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	10	1	3.3, 3.4, 3.b
2	**Integumentary and skeletal system**	Structure and functions of skin**.** 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	10	2	3.6, 3.b
3	**Body fluids and blood**	Body fluids, composition and functions of blood, haemopoeisis, 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	10	3	3.3, 3.4, 3.b
4	**Peripheral nervous system Special senses**	Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Structure and functions of eye, ear, nose and tongue and their disorders.	8	4	3.4, 3.b
5	**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.	7	5	3.4, 3.b
6	**Introduction to human body Cellularlevel of organization Tissue level of organization**	Definition and scope of anatomy and physiology, levels of structural Organization and body systems, basic life processes, homeostasis, basic anatomical terminology. 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 Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	10	1	3.3, 3.4, 3.b

Reference Books:

Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.

Human Physiology (Vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata.

e-Learning Source:

https://www.academia.edu/40518139/Ross_willson_anatomy_and_physiology

Integral University, Lucknow

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	1	1	1	-	1	3	2	1	1	1	1	1	1	-	-	-
CO2	-	-	2	3	-	-	2	-	-	-	-	-	-	1	-	-	-
CO3	-	-	1	1	1	-	1	-	-	-	-	-	-	1	-	-	-
CO4	1	-	1	1	-	-	3	1	-	-	1	1	-	1	-	-	-
CO5	-	-	2	1	-	-	1	-	-	-	-	-	-	1	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP102T**	**Title of theCourse**	**PHARMACEUTICAL ANALYSIS**	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
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	Understand the knowledge on preparatory pharmacy and professional way of evaluating various conventional drugs, raw materials and formulations.
CO2	Explain the theoretical basis of commonly used statistical methods & correctly analyze & interpret the results of statistical data from surveys, experiments & observational studies.
CO3	Illustrate sources of errors in analytical techniques, methods to minimize them.
CO4	Describe the various titrimetric and electrochemical methods of analysis and their application in quality control of pharmaceuticals
CO5	Describe gravimetry and limit tests-principles and applications.
CO6	Differentiate between the ability and limitations of all the methods and be able to choose a suitable method, when needed

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Pharmaceutical analysis**	Definition and scope Different techniques of analysis Methods of expressing concentration Primary and secondary standards. Pre paration and standardization of various molar and normal solutions Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate Errors: Sources of errors, types of errors, methods of minimizing errors,accuracy, precision and significant figures Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.	10	1,2,3,4,5,6
2	**Acid base titration Non-aqueous 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 Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10	1,2,3,4,5,6
3	**Precipitation titrations Complexometric titration Gravimetry**	Mohr's method, Volhard's, Modified, Volhard's, Fajans method, estimation of sodium chloride. Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. 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.	10	1,2,3,4,5,6
4	**Redox titrations**	Concepts of oxidation and reduction Types of redox titrations (Principles and applications): Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate	08	1,2,3,4,5,6
5	**Electrochemical methods of analysis: Conductometry Potentiometry Polarography**	Introduction, Conductivity cell, Conductometric titrations, applications. 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 potentiometrititration and applications. Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications	07	1,2,3,4,5,6
6	**Pharmaceutical analysis**	Definition and scope Different techniques of analysis Methods of expressing concentration Primary and secondary standards. Pre paration and standardization of various molar and normal solutions Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate Errors: Sources of errors, types of errors, methods of minimizing errors,accuracy, precision and significant figures Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.	10	1,2,3,4,5,6

Reference Books:

A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London

A.I. Vogel, Text Book of Quantitative Inorganic analysis

P. Gundu Rao, Inorganic Pharmaceutical Chemistry

Bentley and Driver's Textbook of Pharmaceutical Chemistry John H. Kennedy, Analytical chemistry principles

Indian Pharmacopoeia.

e-Learning Source:

Integral University, Lucknow

https://www.sciencedirect.com/science/article/pii/S1878535213001056

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO2	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO3	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO4	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO5	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO6	3	2	3	3	1	2	1	3	2	3	2	3	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP103T**	**Title of theCourse**	**PHARMACEUTICS-I**	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**1**	**-**	**4**
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Know the history of profession of pharmacy 2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and 3. pharmaceutical calculations 4. Understand the professional way of handling the prescription 5. Preparation of various conventional dosage forms						

Course Outcomes	
CO1	Explain career opportunities in pharmacy, different types of dosage form and how dose can be calculated on the basis of age, body weight and body surface area of the patient.
CO2	Describe powder and liquid dosage forms, excipients used in liquid dosage forms and solubility enhancement techniques.
CO3	Understand monophasic and biphasic liquid formulations along with their preparation methods.
CO4	Define and evaluate suppository, displacement value and pharmaceutical incompatibilities.
CO5	Discuss semisolid dosage forms, its preparation methods and evaluation parameters.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Historical background and development of Profession of pharmacy, Dosage forms, Prescription, Posology**	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. Introduction to dosage forms, classification and definitions Definition, Parts of prescription, handling of Prescription and Errors in prescription. Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area	10	1, 2
2	**Pharmaceutical calculations, Powders Liquid, dosage forms**	Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.	10	3, 4
3	**Monophasic liquids, Biphasic liquids, Suspensions, Emulsions**	a) Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. b) Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. c) Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	10	5, 6
4	**Suppositories, Pharmaceutical incompatibilities**	a) Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. b) Definition, classification, physical, chemical and therapeutic incompatibilities with examples	8	7, 8
5	**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	7	9

Reference Books:

H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams andWalkins, New Delhi.

Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.

M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.

Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.

Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.

E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.

Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.

Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.

e-Learning Source:

https://drive.google.com/file/d/1uQyrQF_84rkbBTcMAbenkThi3VSi8a07/view

Integral University, Lucknow

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	1	3	3	-	2	3	1	2	-	2	3	-	3	-	-	-
CO2	2	2	1	3	-	3	3	-	3	-	2	3	3	3	-	-	-
CO3	2	3	1	1	-	2	3	-	-	-	2	3	2	3	-	-	-
CO4	2	3	1	1	1	2	3	1	3	-	2	3	2	3	-	-	-
CO5	2	3	1	1	-	2	3	-	-	-	2	3	-	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP104T**	**Title of theCourse**	**PHARMACEUTICAL INORGANIC CHEMISTRY**	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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	Study the monographs of inorganic drugs and pharmaceuticals.
CO2	Distinguish the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
CO3	Recognize the medicinal and pharmaceutical importance of inorganic compounds.
CO4	Know the method of preparation, physical and chemical properties, medicinal and pharmaceutical importance of inorganic compounds.
CO5	Study of radioisotopes, properties, storage conditions, precautions and pharmaceutical applications of radioactive substances.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Impurities in pharmaceutical Substances**	**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.	10	1
2	**Acids, Bases and Buffers, Major extra and intracellular electrolytes, Dental products**.	**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.	10	2
3	**Gastrointestinal agents**	**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.	10	3
4	**Miscellaneous compounds**	**Miscellaneous compounds** **Expectorants:** Potassium iodide, Ammonium chloride*. **Emetics:** Copper sulphate*, Sodium potassium tartrate. **Hematinics:** Ferrous sulphate*, Ferrous gluconate. **Poison and Antidote:** Sodium thiosulphate*, Activated charcoal, Sodium nitrite333. **Astringents**: Zinc Sulphate, Potash Alum.	8	4
5	**Radiopharmaceuticals**:	**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.	7	5

Reference Books:

A.H.Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.

A.I. Vogel, Text book of quantitative Inorganic analysis.

P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd edition

M.L. Schroff, Inorganic Pharmaceutical Chemistry

Bentley and Driver's Textbook of Pharmaceutical Chemistry

Anand & Chatwal, Inorganic Pharmaceutical Chemistry

Indian Pharmacopoeia

e-Learning Source:

Impurities in Pharmaceuticals: **https://drive.google.com/file/d/1rIsnjteYvocP6X29T06PjjPQeuqRzObF/view?usp=share_link**

Acid, Base & Buffers: **https://drive.google.com/file/d/1VvoJ8ocAlQHp2k0ymD12iKb19Q9z1Z1l/view?usp=share_link**

Major Intra and Extra cellular electrolytes: **https://drive.google.com/file/d/1QN5D9jpqTtsdfk2xerg0BP27Rk39eQJM/view?usp=share_link**

Gastrintestinal Agents: **https://drive.google.com/file/d/1y8eMrniHKwVcyO1ggMJWpY6wMEWESv48/view?usp=share_link**

Dental Products: **https://drive.google.com/file/d/1tB7LINZ81mxDzByLueRAeyUExcovQDSC/view?usp=share_link**

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	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	2	1	3	2	3	2	1	2	3	-	-	-
CO2	3	2	3	3	1	2	1	3	2	3	2	1	3	3	-	-	-
CO3	3	2	3	3	1	2	1	3	2	3	2	1	3	3	-	-	-
CO4	3	2	3	3	1	2	1	3	2	3	2	1	2	3	-	-	-
CO5	3	2	3	3	1	2	1	3	2	3	2	1	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	**BP105T**	**Title of the Course**	**COMMUNICATION SKILL**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	I		2	-	-	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--					
Course Objective	1. Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation 2. Communicate effectively (Verbal and Non Verbal) 3. Effectively manage the team as a team player 4. Develop interview skills 5. Develop Leadership qualities and essentials							

Course Outcomes	
CO1	Students will learn basic concepts/ knowledge of Communication process, its types, Barriers to communication and Perspectives in communication
CO2	Students will learn Elements of communication: Tone, body language, gesture, communication styles, Verbal and Non-verbal mode of communication
CO3	Students will learn about Basic Listening skills: active listening, listening in difficult situations, Written communication: shades of meaning, complexity of topic, Audience factor, organization of the message
CO4	Students will be made aware about Interview skills, Do's and Don'ts of an interview, Presentation skills: planning and structuring, delivery and techniques of presentation as well
CO5	Students will be made aware about Group Discussion and its nuanced aspects: role of communication skills in GD and Do's and Don'ts of GD

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**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	7	1	
2	**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	7	2	
3	**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	7	3	
4	**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	5	4	
5	**Group Discussion**	Introduction, Communication skills in group discussion, Do's and Dont's of group discussion	4	5	

Reference Books:

Andreja. J., Basic communication skills for Technology, Ruther Ford, 2nd Edition, Pearson Education, 2011

Gill Hasson., Brilliant- Communication skills, , 1stEdition, Pearson Life, 2011

Kumar, Sanjay and Pushp Lata, Communication Skills. Oxford University Press, Oxford, 2011.

Mitra, Barun K., Personality development and soft skills, 1stEdition, Oxford Press, 2011

e-Learning Source:

https://www.academia.edu/26711514/Basic_English_Grammar_Book_1

Integral University, Lucknow

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	-	2	2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	3	3	3	3	-	-	-	-	-	-	-	-	-
CO3	-	-	2	2	2	1	1	3	-	-	-	-	-	-	-	-	-
CO4	-	3	2	3	3	3	1	3	-	-	-	-	-	-	-	-	-
CO5	-	2	3	-	3	3	3	3	2	-	-	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP106RBT**	**Title of theCourse**	**REMEDIAL BIOLOGY**	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**2**	**-**	**-**	**2**
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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	Students will be able to learn about basic concept/ Knowledge of animal cell, Aminal Tissue, cell division and cell organelles'
CO2	Students will be able to learn about basic concept/ Knowledge of plant respiration, plant growth and development, plant and mineral nutrition, photosynthesis
CO3	Students will be able to learn about classifications & salient feature of five kingdoms of life Anatomy and Physiology human, anatomy and physiology of plant
CO4	Students will be able to learn about circulatory, digestive, respiratory and excreatory system of human
CO5	Students will be able to learn about Morphology of plant, Root, Stem, Leaf and its modification

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Living World** **Morphology of flowering plants**	Definition and characters of living organisms Diversity in the living world Binomial nomenclature Five kingdom of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia, and plantae, virus, Morphology of different parts of flowering plants-Root, stem, inflorescence, flower, leaf, fruit, seed. General anatomy of Root, stem, leaf of monocotyledons and Di cotyledons	7	1, 2
2	**Body fluids and circulation** **Digestion and Absorption** **Breathing and respiration**	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. Human alimentary canal and digestive glands Role of digestive enzymes Digestion, absorption and assimilation of digested food Human respiratory system Mechanism of breathing and its regulation Exchange of gases, Transport of gases and regulation of respiration Respiratory volumes.	7	2, 3
3	**Excretory products Neural control and coordinating Chemical coordination and regulation Human reproduction**	Modes of excretion Human excretory system- structure and function Urine formation Rennin angiotensin system. 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 Endocrine glands and their secretions Functions of hormones secreted by endocrine glands Parts of female reproductive system Parts of male reproductive system Spermatogenesis and Oogenesis Menstrual cycle	7	2, 3
4	**Plants and mineral nutrition Photosynthesis**	Essential mineral, macro and micronutrients Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.	5	3, 4
5	**Plant respiration Plant growth and development Tissues**	Respiration, glycolysis, fermentation (anaerobic). Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life Structure and functions of cell and cell organel1es.Cell division Definition, types of tissues, location and functions.	4	2, 5

Reference Books:

Text books a. Text book of Biology by S.B.Gokhale b. A Text book of Biology by Dr.Thulajappa and Dr. Seetaram

A Text book of Biology by B.V.Sreenivasa Naidu, A Text book of Biology by Naidu and Murthy.

Botany for Degree students By A.C.Dutta. Outlines of Zoology by M.Ekambaranatha ayyer and T.N.Ananthakrishnan.

A manual for pharmaceutical biology practical by S.B.Gokhale and C.K.Kokate.

e-Learning Source:

https://biology.org.ua/files/lib/Raven_Johnson_McGraw-Hill_Biology.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	-	2	2	2	2	3	2	3	-	-	-	3	2	3	-	-	-
CO2	-	-	-	-	3	3	3	3	-	-	-	2	3	2	-	-	-
CO3	-	-	2	2	2	1	1	3	-	-	-	2	1	2	-	-	-
CO4	-	3	2	3	3	3	1	3	-	-	-	2	2	2	-	-	-

CO5	-	2	3	-	3	3	3	3	2	-	-	2	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP107P**	**Title of the Course**	**HUMAN ANATOMY & PHYSIOLOY**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	I	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Structure and function of Human body at cellular level. 2. Describe the various homeostatic mechanisms and their imbalance. 3. Appreciate the coordinated working pattern of different organs of each system 4. Explain the gross morphology, structure and functions of various organs of the human body. 5. Identify the various tissues and organs of different systems of human body. 6. Perform the various experiments related to special senses and nervous system..						

Course Outcomes	
CO1	Students will be able to learn about basic concept/ Knowledge of animal cell, Aminal Tissue, cell division and cell organelles'
CO2	Students will be able to learn about basic concept/ Knowledge of plant respiration, plant growth and development, plant and mineral nutrition, photosynthesis
CO3	Students will be able to learn about classifications & salient feature of five kingdoms of life Anatomy and Physiology human, anatomy and physiology of plant
CO4	Students will be able to learn about circulatory, digestive, respiratory and excreatory system of human
CO5	Students will be able to learn about Morphology of plant, Root, Stem, Leaf and its modification

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Microscope**	Study of compound microscope.	4	1
2.	**Tissues**	Microscopic study of epithelial and connective tissue	4	1, 4
3.	**Tissues**	Microscopic study of muscular and nervous tissue	4	1, 4
4.	**Skeletal system**	Identification of axial bones.	4	2
5.	**Skeletal system**	Identification of appendicular bones.	4	2
6.	**Blood & lymphatic system**	Introduction to hemocytometry.	4	3
7.	**Blood & lymphatic system**	Enumeration of white blood cell (WBC) count	4	3
8.	**Blood & lymphatic system**	Enumeration of total red blood corpuscles (RBC) count	4	3
9.	**Blood & lymphatic system**	Determination of bleeding time	4	3
10.	**Blood & lymphatic system**	Determination of clotting time	4	3
11.	**Blood & lymphatic system**	Estimation of hemoglobin content	4	3
12.	**Blood & lymphatic system**	Determination of blood group	4	3
13.	**Blood & lymphatic system**	Determination of blood group	4	3
14.	**Cardiovascular system**	Determination of pulse rate and heart rate.	4	5
15.	**Cardiovascular system**	Recording the blood pressure.	4	5
e-Learning Source:				
https://recnotes.com/category/pharm-d-lab-experiment/pharm-d-1st-yearlab-experiments/pharmaceutical-inorganic-chemistry-practical/				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO2	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO3	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO4	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO5	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO6	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP108P**	**Title of the Course**	**PHARMACEUTICAL ANALYSIS**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	I	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
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	Understand the knowledge on preparatory pharmacy and professional way of evaluating various conventional drugs, raw materials and formulations.
CO2	Explain the theoretical basis of commonly used statistical methods & correctly analyze & interpret the results of statistical data from surveys, experiments & observational studies.
CO3	Illustrate sources of errors in analytical techniques, methods to minimize them.
CO4	Describe the various titrimetric and electrochemical methods of analysis and their application in quality control of pharmaceuticals
CO5	Describe gravimetry and limit tests-principles and applications.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Limit Test**	Chloride Sulphate Iron	4	1,2
2.	**Limit Test**	Arsenic	4	1,2
3.	**Limit Test**	Chloride Sulphate Iron	4	1,2
4.	**Limit Test**	Arsenic	4	1,2
5.	**Preparation and standardization**	Sodium hydroxide	4	3,4
6.	**Preparation and standardization**	Sulphuric acid	4	3,4
7.	**Preparation and standardization**	Sodium thiosulfate	4	3,4
8.	**Preparation and standardization**	Potassium permanganate	4	3,4
9.	**Preparation and standardization**	Ceric ammonium sulphate	4	3,4
10.	**Assay of Standardization**	Ammonium chloride by acid base titration	4	4,5
11.	**Assay of Standardization**	Ferrous sulphate by Cerimetry	4	4,5
12.	**Assay of Standardization**	Copper sulphate by Iodometry	4	4,5
13.	**Assay of Standardization**	Calcium gluconate by complexometry	4	4,5
14.	**Assay of Standardization**	Sodium benzoate by non-aqueous titration	4	4,5
15.	**Assay of Standardization**	Hydrogen peroxide by Permanganometry	4	4,5
16.	**Assay of Standardization**	Sodium Chloride by precipitation titration	4	4,5
17.	**Determination of Normality by electro- analytical methods**	Conductometric titration of strong acid against strong base	4	1,2,5
18.	**Determination of Normality by electro- analytical methods**	Conductometric titration of strong acid and weak acid against strong base	4	1,2,5
19.	**Determination of Normality by electro-analytical methods**	Potentiometric titration of strong acid against strong base	4	1,2,5
e-Learning Source:				
https://gtu.ge/Agro-Lib/Vogels_TEXTBOOK_OF_QUANTITATIVE_CHEMICAL_ANALYSIS_5th_ed_-_G_H_Jeffery.MsuCity.pdf				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO2	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO3	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO4	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO5	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP109P**	**Title of the Course**	**PHARMACEUTICS-I**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	I	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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	Describe about powders and liquid dosage forms, excipients used in formulation of liquid dosage forms and solubility enhancement techniques.
CO2	Explain the different types of monophasic liquids formulations along with their preparation methods.
CO3	To understand the Pharmaceutical calculations, its different system along with methods of calculation.
CO4	Explain the biphasic liquids formulations, stability problems associated with these formulations and the methods to overcome these problems.
CO5	To know about suppository, its methods of preparation, Displacement value & its calculations.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Syrup**	To Prepare & submit 10 ml simple syruyp IP' 66	4	1
2.	**Syrup**	To prepare and submit 20ml Ferrous phosphate syrup BPC'68	4	1
3.	**Elixir**	To prepare and submit 20ml Paracetamol pediatric elixir.	4	4
4.	**Elixir**	To prepare and submit 20ml Piperazine citrate elixir.	4	4
5.	**Linctus**	To prepare and submit 10 ML Iodine throat paint.	4	2
6.	**Linctus**	To prepare and submit 20ml Terpentine Liniment.	4	2
7.	**Solutions**	To prepare and submit 20ml strong ammonium acetate solution.	4	2,4
8.	**Solutions**	To prepare and submit 20ml cresol with sope solution.	4	2,4
9.	**Solutions**	To prepare and submit 10ml Lugol's solution	4	2,4
10.	**Suspension**	To prepare and submit 20ml calamine lotion.	4	4
11.	**Suspension**	To prepare and submit 20 ml aluminium hydroxide suspension.	4	4
12.	**Suspension**	. To prepare and submit 20 ml magnesium hydroxide mixture.	4	4
13.	**Emulsion**	To prepare and submit 20ml Terpentine Liniment.	4	4
14.	**Emulsion**	To prepare and submit 20 ml Liquid paraffin emulsion.	4	4
15.	**Powders & granules**	To prepare and submit 10gm of eutectic powder.	4	1
16.	**Powders & granules**	To prepare and submit 10gm of effervescent powder.	4	1
17.	**Powders & granules**	To prepare and submit 10gm of divided powder.	4	1
18.	**Powders & granules**	To prepare and submit 10gm of dusting powder.	4	1
19.	**Suppositories**	To prepare and submit 6 Boric acid suppositories (calculate for 8)	4	5
20.	**Suppositories**	To prepare and submit 6 zinc oxide suppositories (calculate for 8)	4	5
21.	**Semisolids**	To prepare and submit 20gm Sulphur ointment	4	5
22.	**Gargles & Mouthwash**	To prepare and submit 10 ml iodine gargle	4	2
e-Learning Source:				
https://www.google.co.in/books/edition/Lachman_Lieberman_s_the_Theory_and_Pract/EyXwngEACAAJ?hl=en				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	1	1	2	1	2	2	2	3	2	1	3	-	3	-	-	-
CO2	2	1	1	2	1	2	2	2	3	2	1	3	3	3	-	-	-
CO3	2	3	1	1	-	2	3	-	-	-	2	3	2	3	-	-	-
CO4	2	1	1	2	1	2	2	2	3	2	1	3	2	3	-	-	-
CO5	2	1	1	2	1	2	2	2	3	2	1	3	-	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Name & Sign of Program Coordinator	Sign & Seal of HOD

Effective from Session: 2016-17							
Course Code	**BP110P**	**Title of the Course**	**PHARMACEUTICAL INORGANIC CHEMISTRY**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	I	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Upon completion of the course the student shall be able to: - Know the theory and their application in the pharmaceutical industry 2. Solve the different types of problems by applying practical knowledge. 3. Understand the different strategies for the preparation of Inorganic Pharmaceuticals.						

Course Outcomes	
CO1	Knowledge about the techniques that how impurity of some samples may be finding out by performing limit test & identification of some inorganic compounds.
CO2	Test for purity by various techniques.
CO3	Comprehend the strategies for the preparation of some inorganic Pharmaceuticals.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Limit tests for following ions**	Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic	20	1
2.	**Identification test**	Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate	20	3
3.	**Test for purity**	Swelling power of Bentonite Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodate and iodine in potassium Iodide	20	2
4.	**Preparation of inorganic pharmaceuticals**	Boric acid Potash alum Ferrous sulphate	20	3
e-Learning Source:				
https://www.researchgate.net/publication/338447994_Practical_Manual_of_Pharmaceutical_Inorganic_Chemistry				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO2	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO3	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HOD

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP112RBP**	**Title of the Course**	**REMEDIAL BIOLOGY**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	I	-	-	3	0
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Study of natural sources such as plant and animal origin. 2. This subject has been introduced to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. 3. This subject gives basic foundation to Pharmacognosy.						

Course Outcomes	
CO1	Students will be able to learn about basic concept/ Knowledge of animal cell and cell organelles'
CO2	Students will be able to learn about basic concept/ Knowledge of animal tissue and their types.
CO3	Students will be able to learn about internal morphology (Anatomy and Physiology) of frog which can correlate with human anatomy and physiology
CO4	Students will be able to learn about Animal Kingdom and Taxonomy.
CO5	Students will be able to learn about Morphology of plant, Root, Stem, Leaf and its modification

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Microscope**	Study of microscope	3	2
2.	**Section cutting**	To study the techniques involve in section cutting, mounting and staining	3	1
3.	**Permanent slide**	Preparation of permanent slide	3	5
4.	**Cell**	Study of cell and its inclusions	3	5
5.	**Stem**	Study of stem, root, leaf	3	5
6.	**Frog**	Detailed study of frog	3	5
7.	**Tissues**	Identification of different tissues	3	3
8.	**Bones**	Identification of bones	3	5
9.	**Blood group**	Determination of blood group	3	3
10.	**Blood pressure**	Determination of blood pressure	3	3
11.	**Tidal volume**	Determination of tidal volume	3	3

e-Learning Source:

https://pharmacyinfoline.com/remedial-mathematics-biology-pharm-d/

https://byjus.com/ncert-books-class-11-biology/

https://biology.org.ua/files/lib/Raven_Johnson_McGraw-Hill_Biology.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	1	2	1	1	2	1	1	1	1	1	1	2	1	-	-	-
CO2	2	2	1	2	1	1	2	1	1	1	1	1	1	2	-	-	-
CO3	2	1	1	1	2	1	1	1	1	1	1	2	1	1	-	-	-
CO4	3	1	1	2	2	1	1	1	1	1	1	2	1	1	-	-	-
CO5	2	1	2	1	1	1	1	2	1	1	2	1	1	1	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	**BP201T**	**Title of the Course**	**HUMAN ANATOMY & PHYSIOLOGY-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	II		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--					
Course Objective	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 hematological tests like blood cell counts, hemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume. 5. Appreciate coordinated working pattern of different organs of each system 6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.							

Course Outcomes	
CO1	Understand fundamental concepts and structures related to the nervous system, as well as the functions and interactions within the CNS. They would be able to apply this knowledge to explain the processes of nerve impulse transmission, synaptic communication, and reflex activity.
CO2	Knowledge about the anatomy and physiology of gastrointestinal system and its accessory organ, including common disorders of the GI tract. Additionally, they will acquire knowledge about the Energetics.
CO3	Provide basic knowledge of anatomy and physiology of respiratory system and urinary system. They will also be familiar with common disorders of the kidney and their potential treatments.
CO4	Learn about anatomy and physiology of endocrine system and hormones produced by endocrine glands and their roles in regulating various physiological processes, including common disorders of the endocrine system.
CO5	Understanding of the reproductive system, including the anatomy, functions, and hormonal regulation of the male and female reproductive systems. Additionally, students will have an introduction to the basic concepts of genetics.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Nervous system**	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)	10	1	3.4, 3.5, 3.b, 3.d
2	**Digestive system and Energetics**	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 intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. Formation and role of ATP, Creatinine Phosphate and BMR.	06	2	3.3, 3.4, 3.b, 3.d
3	**Respiratory system and Urinary system**	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. 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 kidneys in acid base balance, role of RAS in kidney and disorders of kidney.	10	3	3.3, 3.b, 3.d
4	**Endocrine system**	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.	10	4	3.4, 3.b, 3.d
5	**Reproductive system and Introduction to genetics**	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 Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	9	5	3.3, 3.7, 3.b, 3.d

Reference Books:

Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.

Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.

Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.

e-Learning Source:

https://training.seer.cancer.gov/anatomy/

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https://www.sciencedirect.com/science/article/abs/pii/B9780122386626500057
https://medictests.com/units/introduction-to-a-p
https://www.registerednursing.org/teas/endocrine-system/
https://www.kenhub.com/en/library/anatomy/human-body-systems

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	3	3	2	2	3	3	1	1	1	2	3	2	-	-	-
CO2	3	3	2	3	2	3	3	2	1	1	1	2	3	2	-	-	-
CO3	3	3	3	2	2	3	3	2	1	1	1	3	2	3	-	-	-
CO4	3	3	3	2	3	3	3	2	1	1	1	2	3	2	-	-	-
CO5	3	3	3	2	2	3	3	2	1	1	1	3	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	**BP202T**	**Title of the Course**	**PHARMACEUTICAL ORGANIC CHEMISTRY-I**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	II		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	Correlating the organic chemistry with pharmaceuticals					
Course Objective	1. Write the structure, name and the type of isomerism of the organic compound 2. Write the reaction, name the reaction and orientation of reactions 3. Account for reactivity/stability of compounds, 4. Identify/confirm the identification of organic compound							

Course Outcomes	
CO1	Recognize the classification, nomenclature and structural isomerism in organic compounds.
CO2	Account the preparation and reactions of alkanes, alkenes and conjugated dienes.
CO3	Explore the methods of synthesis, reactions and uses of alkyl halides and alcohols.
CO4	Investigate the synthetic routes, nucleophilic addition reactions, qualitative tests utilized for carbonyl compounds.
CO5	Evaluate the preparation, effect of substituents on reactivity, structure and uses of carboxylic acids & aliphatic amines.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Classification, nomenclature and isomerism:**	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	7	1	13.b
2	**Alkanes, Alkenes and Conjugated dienes**	sp^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, sp^2 hybridization in alkenes. E^1 and E^2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E^2 reactions, Factors affecting E^1 and E^2 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 rearrangement	10	2	13.b
3	**Alkyl halides** **Alcohols**	SN^1 and SN^2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN^1 versus SN^2 reactions, Factors affecting SN^1 and SN^2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol	10	3	13.a, 13.b
4	**Carbonyl compounds (Aldehydes and ketones)**	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.	10	4	13.a, 13.b
5	**Carboxylic acids** **Aliphatic amines**	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, Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	8	5	13.b

Reference Books:

Organic Chemistry byMorrison and Boyd

Organic Chemistry by I.L. Finar , Volume-I

Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.

Organic Chemistry by P.L.Soni

Practical Organic Chemistry byMann and Saunders.

Vogel's text book of Practical Organic Chemistry

Advanced Practical organic chemistry by N.K.Vishnoi.

Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

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Reaction and reaction mechanism by Ahluwaliah/Chatwal.
e-Learning Source:
https://chem.libretexts.org/Bookshelves/Organic_Chemistry
https://www.masterorganicchemistry.com/
https://www.google.co.in/books/edition/Advanced_Practical_Organic_Chemistry_Thi/lpv9D2hin6gC?hl=en&gbpv=1&dq=organic+chemistry&printsec=frontcover
https://www.google.co.in/books/edition/Intermediate_Organic_Chemistry/2YdxBgAAQBAJ?hl=en&gbpv=1&dq=organic+chemistry&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	1	1	3	3	3	2	3	3	3	3	3	-	-	-
CO2	3	3	3	1	1	3	3	3	2	3	3	3	3	3	-	-	-
CO3	3	3	3	1	1	3	3	3	2	3	3	3	3	3	-	-	-
CO4	3	3	3	1	1	3	3	3	2	3	3	3	3	3	-	-	-
CO5	3	3	3	1	1	3	3	3	2	3	3	3	3	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	**BP203T**	**Title of the Course**	**BIOCHEMISTRY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	II		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	Understand the importance of metabolism of substrates and their bioregulation
CO2	Will acquire chemistry and biological importance of biological macromolecules
CO3	Acquainted with qualitative and quantitative estimation of the biological macromolecules
CO4	Know, understand and apply the interpretation of data emanating from a Diagnostic Test Lab
CO5	To know how physiological conditions and their variation influence the structures and reactivities of biomolecules
CO6	To understand the basic principles of protein and polysaccharide structure

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Biomolecules Bioenergetics**	Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. 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	08	1,2,3,4,5,6	3.4, 3.b
2	**Carbohydrate metabolism Biological oxidation**	Glycolysis – Pathway, 22nergetic and significance Citric acid cycle- Pathway, 22nergetic 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 Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate Phosphorylation. Inhibitors ETC and oxidative phosphorylation/Uncouplers level	10	1,2,3,4,5,6	3.4, 3.b
3	**Lipid metabolism Amino acid metabolism**	Formation and utilization of ketone bodies; ketoacidosis ß-Oxidation of saturated fatty acid (Palmitic acid) 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. 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	10	1,2,3,4,5,6	3.3, 3.4, 3.b
4	**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	10	1,2,3,4,5,6	3.1, 3.3, 3.b
5	**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 Coenzymes –Structure and biochemical functions	07	1,2,3,4,5,6	3.1, 3.3, 3.4, 3.b

Reference Books:

Principles of Biochemistry by Lehninger.

Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.

Biochemistry by Stryer.

Biochemistry by D. Satyanarayan and U.Chakrapani

Textbook of Biochemistry by Rama Rao.

Textbook of Biochemistry by Deb.

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Outlines of Biochemistry by Conn and Stumpf
Practical Biochemistry by R.C. Gupta and S. Bhargavan.
Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
Practical Biochemistry by Harold Varley.
e-Learning Source:
https://www.researchgate.net/publication/347983332_Biochemistry_Basics

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	1	1	2	2	3	2	3	2	3	-	-	-
CO2	3	2	3	3	1	1	1	2	2	3	2	3	2	3	-	-	-
CO3	3	2	3	3	1	1	1	2	2	3	2	3	2	3	-	-	-
CO4	3	2	3	3	1	1	1	2	2	3	2	3	2	3	-	-	-
CO5	3	2	3	3	1	1	1	2	2	3	2	3	2	3	-	-	-
CO6	3	2	3	3	1	1	1	2	2	3	2	3	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	**BP204T**	**Title of the Course**	**Pathophysiology**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	II		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	Basic principles of cell injury, adaptation along with basic mechanism involved in the process of inflammation and repair.
CO2	Students will be demonstrated with a basic understanding of the concepts and elements and will learn also learn about various diseases of the cardiovascular system
CO3	Students will understand the mechanisms, the diagnosis, and the treatment of diseases of the haematological and endocrine system and they will understand the mechanisms, the diagnosis, and the treatment of diseases of the nervous and gastrointestinal system
CO4	Students will learn about different infectious diseases and they will get preliminary information about the sexually transmitted disease
CO5	Students will develop basic understanding of the concepts and elements of Inflammatory and liver disease. They will develop a basic understanding of cancer and the disease of bones and joints.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Basic principles of Cell injury and Adaptation**	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, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis	10	1	3.4, 3.b, 3.d
2	**Cardiovascular System:**	Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) Respiratory system: Asthma, Chronic obstructive airways diseases. Renal system: Acute and chronic renal failure.	10	2	3.3, 3.4, 3.b, 3.d
3	**Hematological Diseases:**	Iron deficiency, megaloblastic anaemia (Vit B12 and folic acid), sickle cell anaemia, thalassemia, hereditary acquired anaemia, haemophilia 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	10	3	3.3, 3.4, 3.b, 3.d
4	**Inflammatory Diseases**	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, aetiology and pathogenesis of cancer	8	4	3.3, 3.5, 3.b, 3.d,
5	**Infectious diseases**	Meningitis, Typhoid, Leprosy, Tuberculosis, Urinary tract infections Sexually transmitted diseases: AIDS, Syphilis, Gonorrhoea	7	5	3.3, 3.7, 3.b, 3.d

Reference Books:

Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.

HarshMohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.

Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.

Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; United States;

Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.

Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.

Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Well, L. Michael Posey. Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.

V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.

Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

e-Learning Source:

Integral University, Lucknow

https://www.researchgate.net/publication/332099805_PATHOPHYSIOLOGY
https://books.google.co.in/books?id=KwYIsLRyDp4C&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	-	-	-	-	-	-	-	-	-	1	-	1	3	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	1	-	1	3	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	1	-	1	3	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	1	-	1	3	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	1	-	1	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP207P**	**Title of the Course**	**HUMAN ANATOMY & PHYSIOLOGY-II**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	II	-	-	4	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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 hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume. 5. Appreciate coordinated working pattern of different organs of each system 4. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.						

Course Outcomes	
CO1	The chief objective of the unit was to provide basic knowledge about the anatomy and physiology of nervous system
CO2	This subject is designed to impart basic knowledge about the anatomy and physiology of gastrointestinal system and its accessory organ.
CO3	The chief objective of this unit is to provide basic knowledge of functioning of respiratory system and urinary system.
CO4	This subject is designed to impart basic knowledge on the area of endocrinology. To study the anatomy and physiology of various endocrine glands
CO5	The chief objective of the unit was to provide basic knowledge of anatomy and physiology of male and female reproductive system

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Integumentary System**	To study the Integumentary System with the help of chart & model.	4	1
2.	**Integumentary System**	To record body temperature.	4	1
3.	**Nervous System**	To study the nervous system with the help of chart & model.	4	1
4.	**Endocrine System**	To study the endocrine system with the help of chart & model.	4	4
5.	**Neurological Experiment**	To demonstrate the general neurological examination.	4	1
6.	**Neurological Experiment**	To demonstrate positive & negative feedback mechanism.	4	1
7.	**Olfactory Nerve**	To demonstrate the function of olfactory nerve.	4	1
8.	**Olfactory Nerve**	To demonstrate the visual & reflect activity.	4	1
9.	**Tongue (Sense Organ)**	To examine the different type of taste with the help of chart & model.	4	5
10.	**Tongue (Sense Organ)**	To study the special sense organ.	4	5
11.	**Tidal Volume, Vital Capacity & Basal Mass Index**	Determination of Tidal volume & Vital capacity. Recording of Basal Mass Index	4	2
12.	**Digestive System**	To study the digestive system with help of chart & model.	4	5
13.	**Respiratory System**	To study the respiratory system with help of chart & model	4	3
14.	**Cadiovascular System**	To study the cardiovascular system with help of chart & model	4	3
15.	**Urinary Sstem**	To study the urinary system with help of chart & model	4	3
16.	**Reproductive System & Family Planning Devices**	To study the reproductive system with help of chart & model	4	5
17.	**Reproductive System & Family Planning Devices**	To study of family planning devices & pregnancy diagnostic test.	4	5
18.	**Blood cell count & Permanent slides of vital organ**	Demonstration of total blood count by cell analyser .	4	5
19.	**Blood cell count & Permanent slides of vital organ**	Permanent slides of vital organ & gonads	4	5

e-Learning Source:

https://www.researchgate.net/publication/320452449_A_Practical_Book_of_Human_Anatomy_Physiology_-_II

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	3	3	2	2	3	3	1	1	1	-	-	-	-	-	-
CO2	3	3	2	3	2	3	3	2	1	1	-	-	-	-	-	-	-
CO3	3	3	3	2	2	3	3	2	1	1	-	-	-	-	-	-	-
CO4	3	3	3	2	3	3	3	2	1	1	-	-	-	-	-	-	-
CO5	3	3	3	2	2	3	3	2	1	1	-	-	-	-	-	-	-

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1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP208P**	**Title of the Course**	**PHARMACEUTICAL ORGANIC CHEMISTRY-I**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	II	-	-	4	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Predict atomic structure, chemical bonding, and molecular geometry based on the accepted model. 2. Able to identify and characterize the organic compound by various qualitative tests. 3. Follow the safety procedure to set up glassware and apparatus to conduct experiments in organic chemistry. 4. Adopt proper skills to present the results of a practical investigation concisely by referring to the available resources. 5. Able to communicate the hazardous effect of overuse of organic products in daily life.						

Course Outcomes	
CO1	To Follow the safety procedure to set up glassware and apparatus to conduct experiments in organic chemistry. Adopt proper skills to present the results of a practical investigation concisely by referring to the available resources.
CO2	To identify and characterize the organic compound by various qualitative tests.
CO3	To analyze some unknown organic compounds
CO4	To prepare some important organic compounds by adopting simple synthetic protocols and procedures. Able to communicate the hazardous effect of overuse of organic products in daily life.
CO5	Predict atomic structure, chemical bonding, and molecular geometry based on the accepted model.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Systematic qualitative analysis of unknown organic compounds like**	Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.	4	1,2
2.	**Detection of elements**	Nitrogen, Sulphur and Halogen by Lassaigne's test	4	1,2
3.	**Solubility test**	Solubility test	4	1,2
4.	**Functional group test**	Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.	4	1,2
5.	**Melting point/Boiling point**	organic compounds	4	1,2
6.	**Melting point/Boiling point**	the literature using melting point/ boiling point.	4	1,2
7.	**Preparation of derivatives**	confirmation of the unknown compound by melting point/ boiling point.	4	1,2,3
8.	**Analysis of organic compounds**	Minimum 5 systematically.	4	1,3
9.	**Preparation of suitable solid derivatives from organic compounds**	Preparation of suitable solid derivatives from organic compounds	4	4
10.	**Construction of molecular models**	Construction of molecular models	4	5
e-Learning Source:				
https://www.researchgate.net/publication/320452449_A_Practical_Book_of_Human_Anatomy_Physiology_-_II				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	1	1	1	3	3	3	3	1	3	-	-	-
CO2	3	2	3	3	1	1	1	1	1	1	3	3	1	3	-	-	-
CO3	3	2	3	3	1	1	1	1	1	1	3	3	1	2	-	-	-
CO4	3	3	2	3	1	1	1	1	2	1	3	3	1	2	-	-	-
CO5	3	2	3	3	2	2	1	1	1	1	3	3	1	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**BP209P**	**Title of the Course**	**BIOCHEMISTRY**	**L**	**T**	**P**	**C**
Year	`I	**Semester**	II	-	-	4	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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	Understand the importance of metabolism of substrates and their bio regulation
CO2	Will acquire chemistry and biological importance of biological macromolecules
CO3	Acquainted with qualitative and quantitative estimation of the biological macromolecules
CO4	Know, understand and apply the interpretation of data emanating from a Diagnostic Test Lab
CO5	To know how physiological conditions and their variation influence the structures and relativities of biomolecules

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Qualitative test of carbohydrates**	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)	4	2
2.	**Qualitative test of Proteins**	Identification tests for Proteins (albumin and Casein)	4	4
3.	**Qualitative test of reducing sugars.**	Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)	4	2
4.	**Qualitative analysis of urine**	Qualitative analysis of urine for abnormal constituents of urine.	4	2
5.	**Blood Creatinine estimation**	Determination of blood creatinine	4	5
6.	**Blood sugar estimation**	Determination of blood sugar	4	5
7.	**Total cholesterol estimation.**	Determination of serum total cholesterol	4	5
8.	**Introduction of buffers**	Preparation of buffer solution and measurement of pH	4	1
9.	**Hydrolysis of starch**	Study of enzymatic hydrolysis of starch	4	2
10.	**Amylase activity**	Determination of Salivary amylase activity	4	4
11.	**Effect of temperature on enzymes.**	Study the effect of Temperature on Salivary amylase activity.	4	3
12.	**Effect of concentration on enzymes.**	Study the effect of substrate concentration on salivary amylase activity.	4	3

e-Learning Source:

https://www.amazon.in/Practical-Biochemistry-Damodaran-Geetha-K/dp/9351529940

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	1	1	2	2	3	2	-	-	-	-	-	-
CO2	3	2	3	3	1	1	1	2	2	3	2	-	-	-	-	-	-
CO3	3	2	3	3	1	1	1	2	2	3	2	-	-	-	-	-	-
CO4	3	2	3	3	1	1	1	2	2	3	2	-	-	-	-	-	-
CO5	3	2	3	3	1	1	1	2	2	3	2	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18								
Course Code	**BP301T**	**Title of the Course**	**PHARMACEUTICAL ORGANIC CHEMISTRY-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	III		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Write the structure, name and the type of isomerism of the organic compound 2. Write the reaction, name the reaction and orientation of reactions 3. Account for reactivity/stability of compounds, 4. Prepare organic compounds							

Course Outcomes	
CO1	Understand the concept of aromaticity, structure and general reactions of Benzene.
CO2	Recognize different reactions given by different acidic and basic aromatic compounds.
CO3	Learn about lipids, their types and different analytical constants to find the quality of lipids.
CO4	Learn about polynuclear hydrocarbons, their reactions and structure elucidation.
CO5	Learn about cycloalkanes and different theories for the stabilities of cycloalkanes.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Benzene and its derivatives**	Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule Reactions of benzene - nitration, sulphonation, halogenationreactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction Structure and uses of DDT, Saccharin, BHC and Chloramine	10	1, 2, 3, 4, 5	13.a, 13.b
2	**Phenols Aromatic Amines Aromatic Acids**	Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts Acidity, effect of substituents on aci dit y and important reactions of benzoic acid.	10	1, 2, 3, 4, 5	13.a, 13.b
3	**Fats and Oils**	Fatty acids – reactions. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.	10	1, 2, 3, 4, 5	13.a, 13.b
4	**Polynuclear hydrocarbons:**	Synthesis, reactions Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives	08	1, 2, 3, 4, 5	13.a, 13.b
5	**Cyclo alkanes**	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	07	1, 2, 3, 4, 5	13.a, 13.b

Reference Books:

Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz. Organic Chemistry by Morrison andBoyd

Organic Chemistry by I.L. Finar , Volume-I

Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.

Organic Chemistry by P.L.Soni

Practical Organic Chemistry by Mann and Saunders.

Vogel's text book of Practical Organic Chemistry

Advanced Practical organic chemistry by N.K.Vishnoi.

e-Learning Source:

https://www.researchgate.net/publication/348961390_PHARMACEUTICAL_ORGANIC_CHEMISTRY-II_Theory_Practical

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO2	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO3	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO4	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-
CO5	3	2	3	3	1	2	1	3	2	3	2	3	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18								
Course Code	**BP302T**	**Title of the Course**	**PHYSICAL PHARMACEUTICS**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	III		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Upon the completion of the course students shall be able to understand various physicochemical properties of drug molecules in the designing of the dosage forms. 2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations. 3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.							

Course Outcomes	
CO1	Understand the mechanisms of solute solvent interactions, different factors which improve solubility of drugs and diffusion principles in biological systems.
CO2	Explain states and properties of matter, eutectic mixtures and various physicochemical properties of drug molecules.
CO3	Define surface tension, differentiate between surface and interfacial tension and how to measure surface and interfacial tension by different methods.
CO4	Describe complexation and protein binding, and how protein binding effect on drug action.
CO5	Discuss buffer isotonic solutions, purpose behind maintaining the isotonicity of drug solution.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Solubility of drugs**	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 EDsolution temperature and applications. Distribution law, its limitations and applications.	10	1	9.5 9.b
2	**States of Matter and properties of matter, Physicochemical properties of drug molecules**	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. Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.	10	2	9.1 9.5 9.b
3	**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.	10	3	9.1 9.5 9.b
4	**Complexation and protein binding**	Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.	8	4	9.1 9.5 9.b
5	**pH, buffers and Isotonic solutions**	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.	7	5	9.1 9.5 9.b

Reference Books:

Physical Pharmacy by Alfred Martin

Experimental Pharmaceutics by Eugene, Parott

Tutorial Pharmacy by Cooper and Gunn.

Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.

Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.

Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.

Physical Pharmaceutics by Ramasamy C and ManavalanR.

Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee

Physical Pharmaceutics by C.V.S. Subramanyam

e-Learning Source:

http://nootanpharmacy.in/public/upload/KzFTMriwTT6t928jUA8reSCEVXpyDNoknUmMvdCv.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)

Integral University, Lucknow

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	-	1	2	3	3	1	2	-	2	3	-	3	-	-	-
CO2	3	3	1	2	3	3	3	-	3	-	2	3	2	3	-	-	-
CO3	2	3	1	2	3	2	3	-	-	-	2	3	3	2	-	-	-
CO4	3	3	1	1	1	3	3	1	3	-	2	3	-	3	-	-	-
CO5	2	3	1	1	-	3	3	-	-	-	1	3	2	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18								
Course Code	**BP303T**	**Title of the Course**	**PHARMACEUTICAL MICROBIOLOGY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	III		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. To know the methods of identification, cultivation and preservation of various microorganisms, importance and implementation of sterlization in pharmaceutical processing and industry. 2. To understand the sterility testing of pharmaceutical products, carried out microbiological standardization of Pharmaceuticals.							

Course Outcomes	
CO1	The students should understand the methods of identification, cultivation and preservation of various microorganisms.
CO2	The students should understand about Staining, sterilization and Evaluation of the efficiency of sterilization methods.
CO3	To understand about disinfectants, and their evaluation, sterility testing methods of pharmaceutical products.
CO4	The students should understand about aseptic area, sources of contamination, clean area classification and microbiological standardization methods of Pharmaceuticals.
CO5	The students should understand the microbial spoilage of pharmaceutical products, Preservation of pharmaceutical products, cell culture technology and its applications in pharmaceutical industries.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Introduction, history of microbiology**	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.	10	1	
2	**Identification of bacteria using staining techniques**	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.	10	2	
3	**Study of morphologyclassification, reproduction/replication and cultivation of Fungi and Viruses.**	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.	10	3	
4	**Designing of aseptic area, laminar flow equipments**	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.	08	4	
5	**Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types**	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. Application of cell cultures in pharmaceutical industry and research.	07	5	

Reference Books:

W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.

Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.

Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.

Rose: Industrial Microbiology.

e-Learning Source:

https://www.researchgate.net/publication/283463951_Pharmaceutical_Microbiology_Book

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)

Integral University, Lucknow

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	2	1	1	2	1	2	2	2	2	1	2	-	-	-
CO2	3	2	2	3	1	2	2	1	2	1	2	2	1	2	-	-	-
CO3	3	2	2	3	1	2	2	1	2	2	3	2	1	3	-	-	-
CO4	3	2	2	3	1	2	2	1	2	3	1	2	1	2	-	-	-
CO5	3	1	1	2	1	2	2	1	2	3	2	3	1	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Course Code	BP304T	Title of the Course	PHARMACEUTICAL ENGINEERING	SDG Goals	L	T	P	C
Year	`II	Semester	III		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	Co-requisite						
Course Objective	1. To develop the understanding and applications of different unit operations employed during pharmaceutical manufacturing.							

Course Outcomes	
CO1	Recognize the importance of size reduction, size separation and fluid flow during pharmaceutical manufacturing
CO2	Schematize and apply the principles of different heat processes used in pharmaceutical industries
CO3	Describe the mechanisms and applications of drying and mixing processes
CO4	Solve the issues related to filtration and centrifugation
CO5	Apply different preventive methods used for the control of corrosion in pharmaceutical plants

UnitNo.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**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 Rotameter. 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.	10	1	9.5 9.b 9.2
2	**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.	10	2	9.1 9.5 9.b 9.2
3	**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.	10	3	9.b 9.4 9.5
4	**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.	8	4	9.a 9.1 9.2 9.4
5	**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.	7	5	9.1 9.3 9.5 9.b

Reference Books:

Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition

Solid phase extraction. Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.

Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al. C.V.S Subrahmanyam et al., Latest edition. Remington practice of pharmacy- Martin, Latest edition.

Introduction to chemical engineering – Walter L Badger & Julius Bancher

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Unit operation of chemical engineering – Mcabe Smith, Latest edition.
e-Learning Source:
https://www.scribd.com/document/481648503/Pharmaceutical-engineering-pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	3	2	3	3	2	2	3	3	3	2	3	-	-	-
CO2	3	3	3	3	2	3	3	3	2	3	3	3	3	3	-	-	-
CO3	3	3	3	3	3	3	3	3	2	3	3	3	2	3	-	-	-
CO4	3	3	3	3	2	3	3	2	2	3	3	3	3	3	-	-	-
CO5	3	3	3	3	3	3	2	2	3	3	3	3	3	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP305P**	**Title of the Course**	**PHARMACEUTICAL ORGANIC CHEMISTRY-II**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	III	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. To prepare different medicinal and pharmaceutical compounds. 2. To study the reaction, name the reaction and orientation of reactions involved in experiments. 3. To account for reactivity/stability of compounds, study different reagents, solvents, their uses and purpose of selectivity. 4. To prepare organic compounds and study its medicinal property.						

Course Outcomes	
CO1	Students should be able to evaluate the quality of fats and oils by determining acid value, saponification value, and iodine value as per pharmacopeia.
CO2	Students should be able to synthesize the various organic compounds and understands the reaction mechanism involved in the synthesis
CO3	Calculate the percentage yields of the products obtained by synthesis.
CO4	Purify organic compounds using various procedures like recrystallization and steam distillation.
CO5	Apply recrystallization and steam distillation methods for the purification of synthesized organic compounds

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Experiments involving laboratory techniques**	Recrystallization	4	4, 5
2.	**Experiments involving laboratory techniques**	Steam distillation	4	4, 5
3.	**Determination of following oil values (including standardization of reagents)**	Acid value	4	1
4.	**Determination of following oil values (including standardization of reagents)**	Saponification value	4	1
5.	**Determination of following oil values (including standardization of reagents)**	Iodine value	4	1
6.	**Preparation of compounds**	Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol/Aniline by acylation reaction.	4	2,3
7.	**Preparation of compounds**	2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline	4	2,3
8.	**Preparation of compounds**	Acetanilide by halogenation (Bromination) reaction.	4	2,3
9.	**Preparation of compounds**	5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid /Nitro benzene by nitration reaction.	4	2,3
10.	**Preparation of compounds**	Benzoic acid from Benzyl chloride by oxidation reaction.	4	2,3
11.	**Preparation of compounds**	Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.	4	2,3
12.	**Preparation of compounds**	1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.	4	2,3
13.	**Preparation of compounds**	Benzil from Benzoin by oxidation reaction.	4	2,3
14.	**Preparation of compounds**	Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction	4	2,3
15.	**Preparation of compounds**	Cinnammic acid from Benzaldehyde by Perkin reaction	4	2,3
16.	**Preparation of compounds**	*P*-Iodo benzoic acid from *P*-amino benzoic acid	4	2,3

e-Learning Source:

https://www.researchgate.net/publication/348961390_PHARMACEUTICAL_ORGANIC_CHEMISTRY-II_Theory_Practical

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	2	1	1	1	2	2	3	3	1	2	-	-	-
CO2	3	2	3	3	2	1	1	1	2	2	3	3	1	2	-	-	-
CO3	3	2	3	3	2	1	1	1	2	2	3	3	1	2	-	-	-
CO4	3	2	3	3	2	1	1	1	2	2	3	3	1	2	-	-	-
CO5	3	2	3	3	2	1	1	1	2	2	3	3	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP306P**	**Title of the Course**	**PHYSICAL PHARMACEUTICS**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	III	-	-	4	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Understand various physicochemical properties of drug molecules in the designing the dosage forms 2. Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations 3. Demonstrate use of physicochemical properties in the formulation Development and evaluation of dosage forms.						

Course Outcomes	
CO1	Learn about techniques to calculate solubility of given drug sample.
CO2	Explore the significance of partition coefficient in pharmaceuticals
CO3	Explore the significance of surface tension in pharmaceuticals
CO4	Understand the importance of surfactants and HLB and their role in stabilization of dosage forms
CO5	Calculation of stability constant and donor acceptor ratio of complexes

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Solubility**	Determination of the solubility of drug at room temprtature.	4	1
2.	**Surface Tension**	Determination of Surface tension of given sample by drops count method.	4	3
3.	**Surface Tension**	Determination of Surface tension of given sample by drops weight method.	4	3
4.	**Partition co-efficient**	Determination of Partition co-efficient of benzoic acid in benzene and water.	4	2
5.	**Partition co-efficient**	Determination of Partition co-efficient of Iodine in CCl4 and water.	4	2
6.	**Surfactant**	Determination of Critical micelle concentration (CMC) of surfactants.	4	1, 3
7.	**Phase conversion**	Determination of % composition of Nacl in a solution using Phenol-Water system by CST method.	4	1, 5
8.	**Adsorption**	Determination of Freundlich and Langmuir constants using activated charcoal.	4	1, 5
9.	**Surfactant**	Determination of HLB number of a surfactant by saponification method.	4	4
10.	**Solubility**	Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method.	4	1, 5
11.	**Solubility**	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by solubility method.	4	1, 5
e-Learning Source:				
https://jru.edu.in/studentcorner/lab-manual/bpharm/Lab%20Manual%20Physical%20Pharmaceutics%20I.pdf				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	1	-	-	-	2	1	1	2	-	1	-	-	-	-
CO2	3	3	3	1	-	-	-	2	1	1	2	-	1	-	-	-	-
CO3	3	2	3	1	-	-	-	2	1	1	2	-	1	-	-	-	-
CO4	3	3	3	1	-	-	-	2	1	1	2	-	1	-	-	-	-
CO5	3	2	3	1	-	-	-	2	1	1	2	-	1	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP307P**	**Title of the Course**	**PHARMACEUTICAL MICROBIOLOGY**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	III	-	-	4	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Understand methods of identification, cultivation and preservation of various micro-organism 2. To understand the importance and implementation of sterilization in pharmaceutical processing and industry 3. Learn sterility testing of pharmaceutical products 4. Carried out microbiological standardization of pharmaceuticals 5. Understand the cell culture technology and its application in pharmaceutical industries						

Course Outcomes	
CO1	Understand the different equipment's and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes etc.
CO2	Understand Sterilization of glassware, preparation and sterilization of media, Sub culturing of bacteria and fungus, Nutrient stabs and slants preparations, Motility determination by Hanging drop method.
CO3	Understand Staining methods- Simple, Grams staining and acid fast staining
CO4	Understand Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
CO5	Understand Microbiological assay of antibiotics by cup plate method and other methods, Sterility testing of pharmaceuticals etc.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Microscopes**	To study the different types of microscopes used in experimental microbiology	4	1
2.	**Apparatus study**	To study the apparatus used in experimental microbiology	4	1
3.	**Study of motility of bacteria**	To study the motility of bacteria with the help of Hanging drop method	4	2
4.	**Staining of bacteria**	To perform the simple staining of given microorganism	4	3
5.	**Staining of bacteria**	To perform the negative staining of the given culture of micro- organism	4	3
6.	**Staining of bacteria**	To perform the gram staining of given culture	4	3
7.	**Nutrient broth**	To prepare nutrient broth	4	2
8.	**Sterilization**	To perform the moist heat sterilization of the given media and glass wares by Autoclave	4	2
9.	**Aseptic transfer**	To perform aseptic transfer of nutrient broth	4	2
10.	**Nutrient agar**	To prepare nutrient Agar	4	2
11.	**Inoculation of bacteria**	To perform inoculation of agar plate by Spread plate method	4	4
12.	**Isolation of bacteria**	To perform isolation of bacteria from given culture by streaking plate method	4	4
13.	**Sterility testing**	To perform sterility testing of pharmaceutical products	4	5
14.	**Antibiotic susceptibility test**	To perform Antibiotic susceptibility test by antibiotic disc method (Kirby-Bauer method)	4	5
e-Learning Source:				
https://www.researchgate.net/publication/339927351_A_Practical_Book_on_Pharmaceutical_Microbiology				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	1	1	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	1	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	1	-	2	3	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	2	3	-	-	-	-	-	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP308P**	**Title of the Course**	**PHARMACEUTICAL ENGINEERING**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	III	-	-	4	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. To know various unit operations used in Pharmaceutical industries. 2. To understand the material handling techniques. 3. To perform various processes involved in the pharmaceutical manufacturing process. 4. To carry out various test to prevent environmental pollution. 5. To appreciate and comprehend significance of plant lay out design for optimum use of resources. 6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.						

Course Outcomes	
CO1	Analyze the effects of different factors on rate of filtration and evaporation.
CO2	Execute the process of size reduction and size distribution analysis.
CO3	Determine the basic parameters of different heat processes.
CO4	Demonstrate the working aspects of different pharmaceutical machineries.
CO5	Evaluate the process of mixing and moisture content determination during pharmaceutical manufacturing.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Radiation constant**	Determination of radiation constant of brass, iron, unpainted and painted glass.	4	3
2.	**Steam distillation**	To calculate the efficiency of steam distillation.	4	1,3
3.	**Heat transfer**	To determine the overall heat transfer coefficient by heat exchanger.	4	3
4.	**Drying**	Construction of drying curves (for calcium carbonate and starch).	4	5
5.		Determination of moisture content and loss on drying.	4	5
6.	**Humidity determination**	Determination of humidity of air – i) From wet and dry bulb temperatures – use of Dew point method.	4	5
7.	**Description of Pharmaceutical machineries**	Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.	4	4
8.	**Size analysis**	Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.	4	2
9.	**Size reduction**	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.	4	2
10.	**Demonstration of equipments**	Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.	4	4
11.	**Filtration & Evaporation factors**	Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity.	4	1
12.	**Crystallization**	To study the effect of time on the Rate of Crystallization.	4	1
13.	**Mixing**	To calculate the uniformity Index for given sample by using Double Cone Blender.	4	5

e-Learning Source:

https://books.google.co.in/books?id=fOi6UCHF3-cC&printsec=frontcover#v=onepage&q&f=false

https://www.google.co.in/books/edition/Practical_Manual_Of_Pharmaceutical_Engin/fOi6UCHF3-cC?hl=en&gbpv=1&dq=Pharmaceutical+engineering+practical+manual&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	3	3	2	3	3	2	3	3	-	3	2	-	-	-
CO2	3	3	3	3	3	2	3	3	2	3	3	-	3	2	-	-	-
CO3	3	3	3	3	2	3	3	2	2	3	3	-	3	3	-	-	-
CO4	3	3	3	3	2	3	3	3	2	3	3	-	3	2	-	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18								
Course Code	**BP401T**	**Title of the Course**	**PHARMACEUTICAL ORGANIC CHEMISTRY-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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							

Course Outcomes	
CO1	Understand the concept of stereoisomerism, especially optical isomerism.
CO2	Identify & describe the concept of geometrical and conformational isomerism
CO3	Classify chemical reactions & providenomenclature of heterocyclic compounds.
CO4	Remember different reactions and medicinal uses of larger heterocyclic compounds
CO5	Explain the concept of reduction, oxidation, rearrangement reactions and describe their applications

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Stereo isomerism**	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	10	1,2,3,4,5	13.3, 13.a
2	**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	10	1,2,3,4,5	13.3, 13.a
3	**Heterocyclic compounds**	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	10	1,2,3,4,5	13.a
4	**Synthetic reactions nd 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	10	1,2,3,4,5	13.a
5	**Reaction of synthetic compounds and its importance**	Metal hydride reduction (NaBH and $LiALH_4$ reduction), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction, Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation	10	1,2,3,4,5	13.3, 13.a

Reference Books:

Organic chemistry by I.L. Finar, Volume-I & II.

A text book of organic chemistry – Arun Bahl, B.S. Bahl. Heterocyclic Chemistry by Raj K. Bansal

Organic Chemistry by Morrison and Boyd Heterocyclic Chemistry by T.L. Gilchrist

e-Learning Source:

https://www.researchgate.net/publication/343318646_PHARMACEUTICAL_ORGANIC_CHEMISTRY-II

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	2	2	2	3	2	3	2	2	-	3	2	-	-	-
CO2	3	3	2	2	3	2	3	3	3	2	2	-	3	2	-	-	-
CO3	2	2	3	3	3	3	2	2	3	3	3	-	3	2	-	-	-
CO4	3	2	3	2	3	2	3	2	3	2	3	-	3	2	-	-	-
CO5	3	3	2	2	3	2	3	2	3	2	3	-	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP402T**	**Title of theCourse**	**MEDICINAL CHEMISTRY-I**	**L**	**T**	**P**	**C**
Year	II	**Semester**	I	**3**	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. To know about the fundamental knowledge on the structure, chemistry and therapeutic value of drugs. 2. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs						

Course Outcomes	
CO1	Well acquainted with chemistry of general anesthetics, Narcotics, Non-narcotics & Anti- inflammatory agents.
CO2	Well acquainted with the chemistry of cholinergic and anticholinergic drugs.
CO3	To understand chemistry of drugs acting on Autonomic nervous system.
CO4	Have basic knowledge, chemistry of drugs acting on CNS like sedatiives, hypnotics, antipsychotic & anticonvulsant.
CO5	Understand basic concept of medicinal chemistry physicochemical properties and drug metabolism.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**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.	10	1
2	**Adrenergic Neurotransmitters: Sympathomimetic agents:**	Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Ephedrine, Metaraminol. Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	10	2
3	**Cholinergic neurotransmitters: Parasympathomimetic agents: SAR of Parasympathomimetic agents**	Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. 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.	10	3
4	**Drugs acting on Central Nervous System**	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. Antipsychotics Phenothiazeines: SAR of Phenothiazeines- Promazine hydrochloride, Chlorpromazine hydrochloride*, Trifluprомazine, 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. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action Barbiturates: Phenobarbitone, Methabarbital. Hydantoins: Phenytoin*, Mephenytoin, Ethotoin Oxazolidine	08	4

		diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate		
5	**Drugs acting on Central Nervous System**	General anesthetics: Dissociative anesthetics: Ketamine hydrochloride.* Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium. Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. 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 tartarate, Naloxone hydrochloride. Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.	07	5

Reference Books:

Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.

Foye's Principles of Medicinal Chemistry.

Burger's Medicinal Chemistry, Vol I to IV.

Introduction to principles of drug design- Smith and Williams.

Remington's Pharmaceutical Sciences.

Martindale's extra pharmacopoeia.

e-Learning Source:

https://www.amazon.in/Gisvolds-Textbook-Medicinal-Pharmaceutical-Chemistry/dp/0781779294

https://www.elsevier.com/books/medicinal-chemistry/barret/978-1-78548-288-5

https://www.science.org/content/blog-post/medicinal-chemistry-books-2019

https://ilizone.in/mod/resource/view.php?id=172237

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	1	1	1	2	2	2	2	-	2	2	1	1	2	2	-	-	-
CO2	2	-	1	2	1	1	2	-	1	2	2	1	3	2	-	-	-
CO3	1	1	2	2	1	1	2	-	1	1	2	1	3	2	-	-	-
CO4	1	1	2	2	1	1	2	-	1	2	2	1	3	2	-	-	-
CO5	2	1	2	2	1	1	2	-	1	2	2	1	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18								
Course Code	**BP403T**	**Title of the Course**	**PHYSICAL PHARMACEUTICS-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV		3	1	1	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Understand various physicochemical properties of drug molecules in the designing the dosage form 2. Understand the concept of viscosity and flow behavior in the formulation development and evaluation of dosage forms. 3. Knowledge of physicochemical properties, formulation factors and instability markers in development of biphasic liquid dosages forms. 4. Demonstrate the application of particle size in designing the dosages forms. 5. Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation							

Course Outcomes	
CO1	Understand various physicochemical properties of drug molecules in designing the dosage form
CO2	Understand the concept of viscosity and flow behaviour in the formulation development and evaluation of dosage forms.
CO3	Knowledge of physicochemical properties, formulation factors and instability markers in the development of biphasic liquid dosages forms.
CO4	Demonstrate the application of particle size in designing the dosages forms.
CO5	1.Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Colloidal dispersions**	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.	7	1	9.3 9.4 9.5 9.a
2	**Rheology** **Deformation of solids:**	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 Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus	10	2	9.1 9.2 9.3 9.a
3	**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.	10	3	9.1 9.2 9.3 9.5
4	**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.	10	4	9.1 9.2 9.3 9.b
5	**Drug stability**	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	10	5	9.2 9.3 9.5

Reference Books:

Physical Pharmacy by Alfred Martin, Sixth edition

Physical Pharmaceutics by RamasamyC, and Manavalan R

Tutorial pharmacy by Cooper and Gunn.

Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.

e-Learning Source:

https://www.academia.edu/26735219/Martins_physical_pharmacy_and_pharmaceutical_sciences_6th_edition

Integral University, Lucknow

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-	-
CO2	2	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-	-
CO3	2	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-	-
CO4	2	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-	-
CO5	2	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18								
Course Code	**BP404T**	**Title of the Course**	**PHARMACOLOGY-I**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV		2	1	1	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Have sound knowledge of fundamental principles and their applications in the area of Pharmaceutical Sciences and Technology. 2. Develop ability for in - depth analytical and critical thinking in order to identify, formulate and solve the issues related to Pharmaceutical Industry, Regulatory Agencies, and Hospital Pharmacy & Community Pharmacy and also in depth knowledge to design synthetic and analytical processes to perform experiments on synthesis, design, pharmaceutical analysis, pharmacological evaluation and formulation problems. 3. Develop an ability to use lab equipment and different kinds of simulation software with an ability to solve, analyze and interpret data generated from Formulation Development, Quality Control & Quality Assurance. 4. Develop written and oral communication skills in order to communicate effectively the outcomes of the Pharmaceutical problems. They also learn to acquire sound knowledge in order to execute the responsibilities successfully towards developing expertise as per the needs of industry and academia. 5. Develop team spirit, apart from responding to the social needs and professional ethics and also develop an aptitude along with problem-solving skills and aptitude to participate and succeed in competitive examinations for lifelong learning and continuous professional development. 6. Develop an understanding for the need of pharmaceutical sciences and technology towards giving quality life to people in society and also demonstrate knowledge of Research & Development in different disciplines of Pharmaceutical Sciences and Technology.							

Course Outcomes	
CO1	Understand the pharmacological actions of different categories of drugs
CO2	Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels
CO3	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases
CO4	Observe the effect of drugs on animals by simulated experiments
CO5	Appreciate correlation of pharmacology with other biomedical sciences

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**General Pharmacology:**	Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination	2	1	3.5, 3.b, 3.d
2	**Adverse drug reactions.**	Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classi- fication of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. Drug interactions (pharmacokinetic and pharmacodynamic) Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.	2	2	3.b, 3.d
3	**Pharmacology of drugs acting on peripheral nervous system**	. Organization and function of ANS. Neurohumoral transmission,co-transmission and classification of neurotransmitters. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anesthetic agents. Drugs used in myasthenia gravis and glaucoma	2	3	3.4, 3.5, 3.b, 3.d
4	**Pharmacology of drugs acting on central nervoussystem**	Neurohumoral transmission in the C.N.S.special emphasis on importance of various neurotrans- mitters like with GABA, Glutamate, Glycine, serotonin, dopamine. General anesthetics and pre-anesthetics. Sedatives, hypnotics and centrally acting muscle relaxants. Anti-epileptics Alcohols and disulfiram	2	4	3.4, 3.5, 3.b,3.d
5	**Pharmacology of drugs acting on central nervous system**	Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. Drugs used in Parkinsons disease and Alzheimer's disease. CNS stimulants and nootropics. Opioid analgesics and antagonists Drug addiction, drug abuse, tolerance and dependence.	2	5	3.4,.3.5, 3.a, 3.b, 3.d,
Reference Books:					

Tripathi, K.D., 2013. Essentials of medical pharmacology. JP Medical Ltd.
Rang, H.P., Dale, M.M., Ritter, J.M., Flower, R.J. and Henderson, G., 2011. Rang & Dale's pharmacology. Elsevier Health Sciences.
Katzung, B.G., Masters, S.B. and Trevor, A.J. eds., 2004. Basic & clinical pharmacology.
Goodman, L.S., 1996. Goodman and Gilman's the pharmacological basis of therapeutics (Vol. 1549, pp. 1361-1373). New York: McGraw-Hill.
e-Learning Source:
https://www.academia.edu/26735219/Martins_physical_pharmacy_and_pharmaceutical_sciences_6th_edition

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	2	2	2	1	1	1	1	2	1	3	3	-	-	-
CO2	3	3	2	2	2	2	1	1	1	1	2	2	3	3	-	-	-
CO3	3	3	2	2	2	2	1	1	1	1	2	3	3	2	-	-	-
CO4	3	3	2	2	2	2	1	1	1	1	2	2	3	2	-	-	-
CO5	3	3	2	2	2	2	1	1	1	1	2	1	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18								
Course Code	**BP405T**	**Title of the Course**	**PHARMACOGNOSY & PHYTOCHEMISTRY-I**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV		3	1	1	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1.To know the techniques in the cultivation and production of crude drugs 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	Gain knowledge on biological source, active constituents and uses of crude drug; Understand the techniques of evaluation of crude drugs as per the WHO guidelines.
CO2	Understand the basic principles of cultivation, collection and storage of crude drugs; Application of the crop improvement concepts involved in techniques for improvement of quality of medicinal plants.
CO3	Exploring the tissue culture technique in medicinal plants.
CO4	Appreciate the applications of Primary &Secondary metabolites of the plant and explore its medicinal importance.
CO5	Understand the principles and application of different system of alternative medicine.
CO6	Explore novel medicinal agents from different sources of natural origin.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Introduction to Pharmacognosy**	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.	10	1	
2	**Cultivation, Collection, Processing and storage of drugs of natural origin:**	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 Conservation of medicinal plants	10	2	
3	**Plant tissue culture:**	Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines	7	3	
4	**Pharmacognosy in various systems of medicine**	Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine. Introduction to secondary metabolites: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins	10	4	
5	**Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs 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	8	5	

Reference Books:

1.W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders &Co., London, 2009.

2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.

3. Text Book of Pharmacognosy by T.E.Wallis

e-Learning Source:

https://www.researchgate.net/publication/320452634_Text_Book_of_Pharmacognosy_and_Phytochemistry

Integral University, Lucknow

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	1	1	1	-	1	3	2	1	1	2	1	1	2	-	-	-
CO2	-	-	2	3	-	-	2	-	-	-	-	-	2	-	-	-	-
CO3	-	-	1	1	1	-	1	-	-	-	-	-	1	-	-	-	-
CO4	1	-	1	1	-	-	3	1	-	-	1	-	1	1	-	-	-
CO5	-	-	2	1	-	-	1	-	-	-	-	-	2	-	-	-	-
CO6	**1**	-	-	2	-	-	-	-	-	-	-	-	1	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP406P**	**Title of the Course**	**MEDICINAL CHEMISTRY-I**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV	-	-	3	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	Familiarity with the chemical structures of pharmaceutical substances				
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	
CO1	Understand basic concept of medicinal chemistry, physicochemical properties and drug metabolism.
CO2	Well acquainted with the chemistry of cholinergic and anti-cholinergic drugs.
CO3	To understand chemistry of drugs acting on autonomic nervous system.
CO4	Have basic knowledge, chemistry of drugs acting on CNS like sedatives, hypnotics, antipsychotic & anticonvulsant.
CO5	Well acquainted with the chemistry of general anesthetics, Narcotic & Non-narcotics and Anti-inflammatory agents.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Preparation of drugs/ intermediates**	1,3-pyrazole 1,3-oxazole Benzimidazole Benztriazole 2,3- diphenyl quinoxaline	08	1
2.	**Preparation of drugs/ intermediates**	Benzocaine Phenytoin Phenothiazine Barbiturate	08	2
3.	**Assay of drugs**	Chlorpromazine Phenobarbitone Atropine	05	3
4.	**Assay of drugs**	Ibuprofen Aspirin Furosemide	05	4
5.	**Determination of Partition coefficient for any two drugs**	Paracetamol Diclofenac	04	5

e-Learning Source:

https://www.chemcome.com/wp-content/uploads/2020/11/Principles-of-Instrumental-Analysis-7th-edition-Skoog-by-Douglas-A.-Skoog-F.-James-Holler-Stanley-R.-Crouch-z-lib.org_.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	1	1	1	2	2	2	2	-	2	2	1	-	2	3	-	-	-
CO2	2	-	1	2	1	1	2	-	1	2	2	-	2	3	-	-	-
CO3	1	1	2	2	1	1	2	-	1	1	2	-	2	3	-	-	-
CO4	1	1	2	2	1	1	2	-	1	2	2	-	2	3	-	-	-
CO5	2	1	2	2	1	1	2	-	1	2	2	-	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP407P**	**Title of the Course**	**PHYSICAL PHARMACEUTICS-II**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Understand various physicochemical properties of drug molecules in the designingthe dosage forms 2. Know the principles of chemical kinetics & to use them for stabilitytesting nad determination of expiry date of formulations 3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.						

Course Outcomes	
CO1	Understand various physicochemical properties of drug molecules in the designing the dosage form
CO2	Understand the concept of viscosity and flow behaviour in the formulation development and evaluation of dosage forms.
CO3	Knowledge of physicochemical properties, formulation factors and instability markers in development of biphasic liquid dosages forms.
CO4	Demonstrate the application of particle size in designing the dosages forms.
CO5	Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Micromeritics**	Determination of particle size distribution using sieving method.	4	1
2.	**Micromeritics**	Determination of particle size distribution in disperse medium using microscopic method.	4	1
3.	**Micromeritics**	Determination of bulk density, true density and porosity.	4	1
4.	**Density & Porosity**	Determination of angle of repose of the given powder sample.	4	2
5.	**Rheology & Deformation of solids**	Determination of viscosity of liquid using ostwald's viscometer.	4	2
6.	**Rheology & Deformation of solids**	Determination of viscosity of semi-solid by using Brookfield viscometer.	4	3
7.	**Coarse dispersion**	Determination of sedimentation volume with effect of different suspending agent.	4	3
8.	**Drug stability**	Determination of reaction rate constant for first order reaction.	4	5
9.	**Drug stability**	Determination of reaction rate constant for second order reaction.	4	5
10.	**Drug stability**	Determination of shelf life of aspirin and accelerated stability studies.	4	5
11.	**Drug stability**	Accelerated stability studies	4	5
12.	**Coarse dispersion**	Determination sedimentation volume with effect of different concentration of single suspending agent	4	4

e-Learning Source:

https://innocentbalti.files.wordpress.com/2015/01/martins-physical-pharmacy-6th-ed-2011-dr-murtadha-alshareifi.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO2	3	2	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO3	3	2	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO4	3	2	2	2	2	3	2	1	2	3	3	3	3	3	-	-	-
CO5	3	2	2	2	2	3	2	1	2	3	3	3	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP408P**	**Title of the Course**	**PHARMACOLOGY-I**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. To understand the fundamental of experimental pharmacology. 2. To perform the different activities of drugs acting on CNS, GIT etc. on different animal models (simulation)						

Course Outcomes	
CO1	Conceptual knowledge of experimental pharmacology basics
CO2	Understand the CPCSEA guidelines for laboratory animal facility.
CO3	Precise knowledge about commonly used instruments in pharmacological laboratory.
CO4	Observe the effect of drugs on animals by simulated experiments by software's and videos.
CO5	To understand the different methods of local anesthetics.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Basics of pharmacology**	Introduction to experimental pharmacology	4	1
2.	**Instrument**	Commonly used instruments in experimental pharmacology.	4	3
3.	**Lab.animals**	Study of common laboratory animals.	4	1
4.	**CPCSEA rules**	Maintenance of laboratory animals as per CPCSEA guidelines.	4	2
5.	**Lab.techniques**	Common laboratory techniques Blood withdrawal. serum and plasma separation anesthetics and euthanasia used for animal studies.	4	2
6.	**Drug administration**	Study of different routes of drugs administration in mice/rats.	4	1
7.	**Effect of enzyme inducer**	Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleep time in mice.	4	4
8.	**Ciliary motility**	Effect of drugs on ciliary motility of frog oesophagus.	4	4
9.	**Mydriasis**	Effect of drugs on rabbit eye	4	5
10.	**Relaxant effect**	Effects of skeletal muscle relaxants using rota-rod apparatus	4	5
11.	**Motor activity**	Effect of drugs on locomotor activity using actophotometer.	4	5
12.	**Anticonvulsant**	Anticonvulsant effect of drugs by MES and PTZ method:	4	5
13.	**Anticatatonic**	Study of stereotype and anti-catatonic activity of drugs on rats/mice.	4	5
14.	**Anxiolytic**	Study of anxiolytic activity of drugs using rats/mice:	4	5
15.	**Local anesthesia**	Study of local anesthetics by different methods.	4	3
e-Learning Source:				
https://www.pragationline.com/wp-content/uploads/2020/03/N3992-Practical-Book-of-Pharmacology-2.pdf				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	2	3	2	2	3	-	-	-	-	-	-	-	-
CO2	3	2	3	3	2	2	1	3	2	-	-	-	-	-	-	-	-
CO3	3	3	2	3	2	3	2	1	3	-	-	-	-	-	-	-	-
CO4	3	1	2	2	2	1	1	1	2	-	-	-	-	-	-	-	-
CO5	3	2	3	3	2	2	1	1	2	-	-	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	**BP409P**	**Title of the Course**	**PHARMACOGNOSY & PHYTOCHEMISTRY**	**L**	**T**	**P**	**C**
Year	`II	**Semester**	IV	-	-	4	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. To know the techniques in the cultivation and production of crude drugs 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 drugs						

Course Outcomes	
CO1	Identification of the crude drugs through chemical test
CO2	Macroscopic and microscopic evaluation of crude drugs
CO3	Use of special equipment for microscopic evaluation
CO4	Evaluation of crude drugs through physiochemical evaluation
CO5	To evaluate crude drugs against adulteration

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Microscope study**	To study about the compound microscope and its parts	3	3
2.	**Chemical test**	To perform the chemical test of Agar	3	1
3.	**Chemical test**	To perform the chemical test of Tragacanth	3	1
4.	**Chemical test**	To perform the chemical test of Acacia	3	1
5.	**Chemical test**	To perform the chemical test of Starch	3	1
6.	**Chemical test**	To perform the chemical test of Castor oil.	3	1
7.	**Chemical test**	To perform the chemical test of Honey	3	1
8.	**Swelling factor**	To determine the swelling factor of isapgol seeds.	3	5
9.	**Ash value**	To determine the ash value of given sample.	3	5
10.	**Extractive value**	To determine the alcohol soluble extractive value of the given powdered drug.	3	3
11.	**Moisture content**	To determine the moisture content of given crude drug	3	3
12.	**Stomatal number**	To determine the stomatal number of given leaf	3	2
13.	**Stomatal index**	To determine the stomatal index of given leaf	3	2

e-Learning Source:

https://www.researchgate.net/publication/338832332_Practical_Handbook_of_Pharmacognosy_and_Phytochemistry-I

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	1	1	1	-	1	3	2	1	1	2	-	1	2	-	-	-
CO2	-	-	2	3	-	-	2	-	-	-	-	-	2	-	-	-	-
CO3	-	-	1	1	1	-	1	-	-	-	-	-	1	-	-	-	-
CO4	1	-	1	1	-	-	3	1	-	-	1	-	1	1	-	-	-
CO5	-	-	2	1	-	-	1	-	-	-	-	-	2	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP501T**	**Title of the Course**	**MEDICINAL CHEMISTRY-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	V		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	
CO1	Know the types of biological targets in humans and the structural requirement of drugs interacting with them and comprehend & correlate the biological systems involved in drug action for drugs acting as Antihistamines, Gastric Proton pump inhibitors, Antineoplastics, Diuretics, CVS drugs, Steroids, Thyroids and antithyroids, Antidiabetics and Local Anesthetics.
CO2	Explain chemical interactions of endogenous molecules with specific receptors or enzymes and the molecular effects of their respective agonists and antagonists through Structure Activity relationship studies of drugs for the following category of drugs Antihistamines, Gastric Proton pump inhibitors, Antineoplastics, Diuretics, CVS drugs, Steroids, Thyroids and antithyroids, Antidiabetics and Local Anesthetics.
CO3	Justify the absorption, distribution and selectivity of drugs based on chemical structure for the following category of drugs Antihistamines, Gastric Proton pump inhibitors, Antineoplastics, Diuretics, CVS, Steroids, Thyroids and antithyroids, Antidiabetics and Local Anesthetics.
CO4	Predict the drug metabolic pathways, adverse effect and therapeutic value from the structure of drugs and provide information on the storage of drugs based on the chemical stability. Antihistamines, Gastric Proton pump inhibitors, Antineoplastics, Diuretics, CVS, Steroids, Thyroids and antithyroids, Antidiabetics and Local Anesthetics.
CO5	Demonstrate knowledge of chemical synthesis of important drugs such as Cimetidine, Mechlorethamine, Mercaptopurine, Methotrexate, Acetazolamide, Chlorothiazide, Furosemide, Methyl dopa, Nitroglycerin, Isosorbide, Disopyramide, Warfarin, Tolbutamide, Benzocaine, Procaine and Dibucaine.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Antihistaminic agents, Anti-neoplastic agents,**	Histamine, receptors and their distribution in the human body. H1–antagonist: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamine succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Triphelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartrate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrizine Cromolyn sodium. H2-antagonists: Cimetidine*, Famotidine, Ranitidine. Gastric proton-pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole. Anti-neoplastic 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, Vinblastine sulphate, Vincristine sulphate. Miscellaneous: Cisplatin, Mitotane.	10	1	**3.4**
2	**Anti-anginal**, **Diuretics, Anti-hypertensive Agents**	Anti-anginal, Vasodilators: Amyl Nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. Calcium channel blockers: 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, Ethacrynic acid. Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol. Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril Hydrochloride, Methyldopate Hydrochloride* Clonidine hydrochloride, Guanethidine Monosulphate, Guanabenz Acetate, Sodium Nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.	10	2	**3.4**
3	**Anti-arrhythmic Drugs**, **Anti-hyperlipidemic agents**, **Coagulant & Anticoagulants**, **Drugs used in Congestive Heart Failure**	Anti-arrhythmic Drugs: Quinidine Sulphate, Procainamide Hydrochloride, Disopyramide Phosphate*, Phenytoin Sodium, Lidocaine Hydrochloride, Tocainide Hydrochloride, Mexiletine Hydrochloride, Lorcainide Hydrochloride, Amiodarone, Sotalol. Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholestyramine and Colestipol. Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, Clopidogrel. Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.	10	3	**3.4**

4	**Drugs acting on Endocrine system**:	Drugs acting on Endocrine system: Nomenclature, Stereochemistry and metabolism of steroids. Sex hormones: Testosterone, Andralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl Stilbestrol. Drugs for erectile dysfunction: Sildenafil, Tadalafil. Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone. Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.	08	4	**3.4**
5	**Antidiabetic agents, Local Anesthetics:**	Antidiabetic agents: Insulin and its preparations. Sulfonylureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone, Meglitinides, Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, Voglibose. Local Anesthetics: SAR of Local anesthetics. Benzoic acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine. Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. Miscellaneous: Phenacaine, Diperodon, Dibucaine.	07	5	**3.4**

Reference Books:

Wilson and Gisvold's Organic Medicinal and Pharmaceutical Chemistry

Foye's Principles of Medicinal Chemistry

Burger's Medicinal Chemistry

Introduction to Principles of Drug Design

Organic Chemistry by I.L. Finar,

The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1 to 5.

The Pharmacopoeia of India.

Elementary Practical Organic Chemistry by Vogel A

e-Learning Source:

https://www.carewellpharma.in/B_Pharmacy/Notes/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	2	3	3	1	1	3	2	3	-	1	2	-	-	-
CO2	3	2	3	3	3	2	2	3	3	2	3	-	1	3	-	-	-
CO3	3	2	3	3	3	2	2	3	3	2	3	-	1	3	-	-	-
CO4	3	2	3	3	3	2	2	3	3	2	3	-	1	2	-	-	-
CO5	3	2	3	3	1	1	3	1	2	3	3	-	1	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP502T**	**Title of the Course**	**INDUSTRIAL PHARMACY-I**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	V		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	
CO1	Acquire the knowledge of physicochemical properties of drugs (Preformulations) as a tool in the optimization of solid and liquid dosage forms.
CO2	Formulate and prepare tablets, capsules and liquid orals using established procedures and technology.
CO3	Understand the various considerations in development of Capsules and Pellets.
CO4	Plan and prepare different types of parenteral and ophthalmic dosage forms.
CO5	Select and formulate cosmetics products and appropriate packaging materials.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Preformulation Studies, Physical properties, Chemical Properties, Application of preformulation**	Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms	10	1	**9.1 9.3 9.4 9.5**
2	**Tablets, Introduction, Excipients, Tablet coating, Liquid orals**	Tablets: a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. c. Quality control tests: In process and finished product tests Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia	10	2	**9.1 9.2 9.4 9.a**
3	**Introduction Capsules, Packing, Pellets**	Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. Soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets	08	3	**9.1 9.2 9.4 9.b**
4	**Parenteral Products, advantages and limitations, Production procedure, Ophthalmic preparations**	Parenteral Products: a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations	10	4	**9.1 9.3 9.4 9.a**
5	**Introduction Cosmetics Formulation, Pharmaceutical Aerosols, Packaging Materials**	Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens. Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.	10	5	**9.2 9.3 9.4 9.a**

Reference Books:

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition

Integral University, Lucknow

e-Learning Source:
https://www.researchgate.net/publication/319980566_PREFORMULATION_STUDIES

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	2	2	2	3	1	1	2	1	2	3	3	-	-	-
CO2	3	3	2	3	2	3	3	3	1	2	1	1	3	3	-	-	-
CO3	3	3	2	3	2	3	3	3	2	2	1	2	3	3	-	-	-
CO4	3	3	2	3	2	3	3	3	1	2	1	1	3	3	-	-	-
CO5	3	3	2	3	2	2	3	2	1	2	1	2	3	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP503T**	**Title of the Course**	**PHARMACOLOGY-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	V		4	-	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	Discuss & Interpret about the application of various blood forming agents and their role in treatment of cardiovascular disorders. Further able to analyze the importance of Diuretics in certain CVDs.
CO2	Explain about the mechanism of drug action and its relevance in the treatment of different diseases.
CO3	Apply their knowledge to understand and describe about how Autocoids involved in development of inflammatory disorders like Gout and Arthritis and their treatment.
CO4	Demonstrate about endocrine hormones and their physiological role and can justify the uses of Insulin, OHA,Corticosteroids, Thyroid hormone regulators in various disorders.
CO5	Detect the role of sex hormones and their applications as in Oral contraceptives. Define Bioassay types and methods for specific drug.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Pharmacology of drugs acting on cardio vascular system**	Introduction to hemodynamic and electrophysiology of heart. Drugs used in congestive heart failure Anti-hypertensive drugs. Anti-anginal drugs. Anti-arrhythmic drugs. Anti-hyperlipidemic drugs	10	3	**3.4, 3.b, 3.d**
2	**Pharmacology of drugs acting on cardio vascular system**	Drug used in the therapy of shock. Hematinics, coagulants and anticoagulants. Fibrinolytics and anti-platelet drugs Plasma volume expanders Pharmacology of drugs acting on urinary system Diuretics Anti-diuretics	10	3	**3.3, 3.4, 3.b, 3.d**
3	**Autocoids and related drugs**	Introduction to autacoids and classification Histamine, 5-HT and their antagonists. Prostaglandins, Thromboxanes and Leukotrienes. Angiotensin, Bradykinin and Substance P. Non-steroidal anti-inflammatory agents Anti-gout drugs Antirheumatic drugs	10	3	**3.4, 3.6, 3.b, 3.d**
4	**Pharmacology of drugs acting on endocrine system**	Basic concepts in endocrine pharmacology. Anterior Pituitary hormones- analogues and their inhibitors. Thyroid hormones-analogues and their inhibitors. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. Insulin, Oral Hypoglycemic agents and glucagon. ACTH and corticosteroids.	8	2	**3.4, 3.b, 3.d**
5	**Pharmacology of drugs acting on endocrine system**	Androgens and Anabolic steroids. Estrogens, progesterone and oral contraceptives. Drugs acting on the uterus. Bioassay Principles and applications of bioassay. Types of bioassay Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine, digitalis, histamine and 5-HT	7	3	**3.4, 3.7, 3.b, 3.d**

Reference Books:

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.

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

e-Learning Source:

https://www.researchgate.net/publication/319980566_PREFORMULATION_STUDIES

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	2	3	2	2	2	3	2	3	3	3	2	-	-	-
CO2	3	3	3	2	3	3	2	3	3	3	3	3	2	3	-	-	-
CO3	3	3	3	2	3	3	2	2	3	2	3	3	2	2	-	-	-
CO4	3	3	3	3	3	2	2	2	3	3	3	3	3	3	-	-	-

CO5	3	3	3	2	3	2	2	2	3	2	3	3	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP504T**	**Title of the Course**	**PHARMACOLOGNOSY & PHYTOCHEMISTRY-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	V		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	To know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents							

Course Outcomes	
CO1	Discuss the general technique of biosynthesis of phytoconstituents in plants.
CO2	Apprehended the composition, chemistry & chemical classes, bio-sources, therapeutic uses and commercial applications of different plants secondary metabolites.
CO3	Accomplished in the Isolation, Identification and Analysis of Phytoconstituents.
CO4	Accomplished in the production estimation and utilization of phytoconstituents in industrial scale.
CO5	Accomplished in the estimation and analysis of the different phytoconstituents with help of instrument based on chromatography and spectroscopy.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Metabolic pathways in higher plants and their determination**	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.	7	**1**	**----**
2	**General introduction, Alkaloids, Phenylpropanoids and Flavonoids**	General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites: Alkaloids: Vinca, Rauwolfia, Belladonna, Opium, Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander, Tannins: Catechu, Pterocarpus Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony Glycosides: Senna, Aloes, Bitter Almond Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids	14	**2**	**----**
3	**Isolation, Identification and Analysis of Phytoconstituents**	Isolation, Identification and Analysis of Phytoconstituents a) Terpenoids: Menthol, Citral, Artemisin b) Glycosides: Glycyrhetinic acid & Rutin c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine d) Resins: Podophyllotoxin, Curcumin	06	**3**	**----**
4	**Industrial production, estimation and utilization phytoconstituents**	Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine	10	**4**	**15.9, 15.b**
5	**Basics of Phytochemistry**	Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.	08	**5**	**----**

Reference Books:

W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.

Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.

Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007

Remington's Pharmaceutical sciences.

e-Learning Source:

https://www.iptsalipur.org/wp-content/uploads/2020/08/BP504T_PGPC_UNIT_II.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	3	3	1	2	2	2	2	2	2	2	2	2	-	-	-
CO2	3	2	3	3	2	3	2	2	3	3	2	2	3	2	-	-	-
CO3	3	3	2	2	2	2	3	2	2	3	1	1	3	2	-	-	-
CO4	2	2	3	3	1	2	2	3	3	3	1	1	3	2	-	-	-
CO5	3	3	3	3	2	3	2	2	2	2	2	2	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Course Code	BP505T	Title of the Course	PHARMACEUTICAL JURISPRUDENCE	SDG Goals	L	T	P	C
Year	`III	Semester	V		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	Co-requisite						
Course Objective	1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals. 2. Various Indian pharmaceutical Acts and Laws 3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals 4. The code of ethics during the pharmaceutical practice							

Course Outcomes	
CO1	Remember the pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals
CO2	Gain information on various Indian Pharmaceutical Laws
CO3	Describe the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
CO4	Understand the code of ethics to be followed during pharmacy practice
CO5	Know the various Intellectual Property Rights
CO6	Understand various offences and penalties in contravention to different Act

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**Drugs and Cosmetics Act, 1940 and its rules 1945**	Objectives, Definitions, Legal definitions of schedules to the Act and Rules 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, loan license and repacking license.	10	1,3,6	16.1 16.5 16.10 16.b
2	**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 penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors	10	1,3,6	16.1 16.5 16.10 16.b
3	**Pharmacy Act, Medicinal and Toilet Preparation Act, Narcotic Drugs and Psychotropic substances Act**	Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties . Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, 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 Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties	10	1,2,3,4,5,6	16.1 16.3 16.10 16.b
4	**Drugs and Magic Remedies Act, Prevention of Cruelty to animals Act, DPCO**	Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, 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 Essential Medicines (NLEM)	08	1,2,3,4,6	16.1 16.3 16.7 16.10 16.b
5	**Pharmaceutical Legislations, IPR**	Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee 1. Code of Pharmaceutical ethics D efinition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath 2. Medical Termination of Pregnancy Act 3. Right to Information Act 4. Introduction to Intellectual Property Rights (IPR)	07	1,4,5	16.1 16.3 16.10 16.b

Reference Books:

Forensic Pharmacy by B. Suresh

Integral University, Lucknow

Text book of Forensic Pharmacy by B.M. Mithal
Hand book of drug law-by M.L. Mehra
A text book of Forensic Pharmacy by N.K. Jain
e-Learning Source:
DTAB: https://cdsco.gov.in/opencms/opencms/en/dcc-dtab-committee
Drugs and Cosmetics Act: https://cdsco.gov.in/opencms/opencms/en/Acts-and-rules/Drugs-and-Cosmetics-Act/
Cosmetics Rules: https://cdsco.gov.in/opencms/opencms/en/Acts-and-rules/Cosmetics-Rules/
WIPO: https://www.wipo.int/academy/en/

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	1	3	3	-	2	3	1	2	-	2	-	3	-	-	-	-
CO2	2	2	1	3	-	3	3	-	3	-	2	-	3	-	-	-	-
CO3	2	3	1	1	-	2	3	-	-	-	2	-	3	-	-	-	-
CO4	2	3	1	1	1	2	3	1	3	-	2	-	3	2	-	-	-
CO5	2	3	1	1	-	2	3	-	-	-	2	-	3	-	-	-	-
CO6	2	3	1	1	-	2	3	-	1	-	2	-	3	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**BP506P**	**Title of the Course**	**INDUSTRIAL PHARMACY-I**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	V	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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	
CO1	Acquire the knowledge of Preformulation study
CO2	Students able to know about Tablet, Syrup, Suspensions and Emulsions formulation development and manufacturing technique.
CO3	Know various considerations in development of Capsules and Pellets.
CO4	Understand the Ophthalmic and Prenterals dosage forms and their manufacturing techniques.
CO5	Able to formulate Cosmetic products and also understand about Pharmaceutical packaging

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
14.	**Tablet**	To perform the preformulation studies of paracetamol/aspirin drug.	4	1
15.	**Tablet**	To prepare and evaluate paracetamol granules by wet granulation method.	4	2
16.	**Tablet**	To prepare and evaluate aspirin tablets.	4	2
17.	**Tablet**	To perform the film coating of tablets/granules	4	2
18.	**Capsule**	To prepare and evaluate tetracycline capsules.	4	3
19.	**Capsule**	To evaluate glass containers used as packaging material and distinct the type-1, type-2 and type-3 glass.	4	3
20.	**Parenterals**	To prepare and submit 10 ml of Ascorbic acid injection.	4	4
21.	**Parenterals**	To prepare and submit 10ml of calcium gluconate injection.	4	4
22.	**Cosmetic**	To prepare and submit 10 gm Cold Cream	4	5
23.	**Cosmetic**	To prepare and submit 10 gm Vanishing Cream	4	5
24.	**Ophthalmic Preparation**	To prepare zinc sulphate eye drop.	4	4
25.	**Ophthalmic Preparation**	To prepare chloramphenicol eye ointment.	4	4

e-Learning Source:

https://www.google.co.in/books/edition/The_Theory_and_Practice_of_Industrial_Ph/p_VsAAAAMAAJ?hl=en&gbpv=1&bsq=Theory+And+Practice+of+Industrial+Pharmacy+By+Liberman+%26+Lachman&dq=Theory+And+Practice+of+Industrial+Pharmacy+By+Liberman+%26+Lachman&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	2	2	2	3	1	1	2	1	2	3	3	-	-	-
CO2	3	3	2	3	2	3	3	3	1	2	1	1	3	3	-	-	-
CO3	3	3	2	3	2	3	3	3	2	2	1	2	3	3	-	-	-
CO4	3	3	2	3	2	3	3	3	1	2	1	1	3	3	-	-	-
CO5	3	3	2	3	2	2	3	2	1	2	1	2	3	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**BP507P**	**Title of the Course**	**PHARMACOLOGY-II**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	V	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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	Discuss & Interpret about the application of various blood forming agents and their role in treatment of cardiovascular disorders. Further able to analyze the importance of Diuretics in certain CVDs.
CO2	Explain about the mechanism of drug action and its relevance in the treatment of different diseases
CO3	Apply their knowledge to understand and describe about how Autocoids involved in development of inflammatory disorders like Gout and Arthritis and their treatment.
CO4	Demonstrate about endocrine hormones and their physiological role and can justify the uses of Insulin , OHA,Corticosteroids, Thyroid hormone regulators in various disorders.
CO5	Detect the role of sex hormones and their applications as in Oral contraceptives. Define Bioassay types and methods for specific drug

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Pharmacology introduction**	Introduction to in-vitro pharmacology and physiological salt solutions.	4	1
2.	**Drugs effect**	Effect of drugs on isolated frog heart.	4	1
3.	**drugs effect**	Effect of drugs on blood pressure and heart rate of dog.	4	1
4.	**Diuretic activity**	Study of diuretic activity of drugs using rats/mice.	4	2
5.	**Acetylcholine DRC**	DRC of acetylcholine using frog rectus abdominis muscle.	4	2
6.	**Drugs effect**	Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.	4	2
7.	**Matching bioassay**	Bioassay of histamine using guinea pig ileum by matching method.	4	3
8.	**Interpolation bioassay**	Bioassay of oxytocin using rat uterine horn by interpolation method.	4	3
9.	**Three point bioassay**	Bioassay of serotonin using rat fundus strip by three-point bioassay.	4	3
10.	**Four point bioassay**	Bioassay of acetylcholine using rat ileum/colon by four-point bioassay.	4	4
11.	**PA2**	Determination of PA2 value of prazosin using rat anococcygeus muscle (by Schild plot method).	4	4
12.	**PD2**	Determination of PD2 value using guinea pig ileum.	4	4
13.	**Drug effect**	Effect of spasmogens and spasmolytic using rabbit jejunum.	4	5
14.	**Drug activity**	Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.	4	5
15.	**Drug activity**	Analgesic activity of drug using central and peripheral methods	4	5
e-Learning Source:				
Animal simulation Ex- Pharm				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	2	2	3	2	1	2	1	3	-	-	-	-	-	-
CO2	3	3	3	3	2	3	2	2	1	1	3	-	-	-	-	-	-
CO3	3	3	2	3	1	3	2		1	1	3	-	-	-	-	-	-
CO4	3	3	2	3	2	2	2	3	2	-	3	-	-	-	-	-	-
CO5	3	3	2	3	2	2	1	2	2	1	3	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**BP508P**	**Title of the Course**	**PHARMACOGNOSY & PHYTOCHEMISTRY-II**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	V	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. To know the modern extraction techniques characterization and identification of the herbal drugs and phytoconstituents. 2. To understand the preparation and development of herbal formulation. 3. To understand the herbal drug interactions. 4. To carry out isolation and identification of phytoconstituents.						

Course Outcomes	
CO1	Students apprehend the extraction and isolation techniques of the phytoconstituents.
CO2	Apprehended the assessment of different identification test of phytoconstituents.
CO3	Apprehended the estimation of different phytoconstituents by TLC methods.
CO4	Accomplished in the isolation techniques of volatile oils.
CO5	Accomplished and assesses the estimation of different sugars by paper chromatography.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Morphology,histol ogy and powder characteristics of crude drugs**	Morphology,histology and powder characteristics and extraction and detection of cinchona,cinnamon,senna,clove,ephedra,fennel and coriander.	15	1
2.	**Isolation and detection of active principles**	To isolate caffeine from tea dust. To isolate diosgenin from dioscorea. To isolate atropine from belladonna. To isolate sennosides from senna.	12	1
3.	**Paper chromatography**	Separation of sugars by paper chromatography.	3	5
4.	**TLC**	To determinr the Rf value of given sample.	3	3
5.	**Distillation**	Distillation of volatile oils and detection of phytoconstituents by TLC.	3	4
6.	**Chemical test**	To perform the chemical test of Asafoetida,Benzoin,Colophony,Aloes,Myrrh	6	2
e-Learning Source:				
https://www.miperknlapindia.ac.in/BP508P-pharmacognosy-phytochemistry2.pdf				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	3	2	2	1	2	3	2	2	-	-	-	-	-	-	-
CO2	3	2	3	3	3	1	2	2	3	3	-	-	-	-	-	-	-
CO3	2	3	2	3	3	1	3	3	2	3	-	-	-	-	-	-	-
CO4	2	2	3	3	3	1	2	3	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	1	3	2	2	2	-	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP601T**	**Title of the Course**	**MEDICINAL CHEMISTRY-III**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Understand the importance of drug design and different techniques of drug design. 2. Understand the chemistry of drugs with respect to their biological activity. 3. Know the metabolism, adverse effects and therapeutic value of drugs. 4. Know the importance of SAR of drugs.							

Course Outcomes	
CO1	Know the types of biological targets in humans and the structural requirement of drugs interacting with them and comprehend and correlate the biological systems involved in drug action for drugs acting as Antibiotics, Anti-infective – Antibacterial, Antiprotozoals, Antivirals, Antifungals and Anthelmintics
CO2	Explain chemical interactions of endogenous molecules with specific receptors or enzymes and the molecular effects of their respective agonists and antagonists through Structure Activity relationship studies of drugs for the following category of drugs: Antibiotics, Anti-infective – Antibacterial, Antiprotozoals, Antivirals, Antifungals and Anthelmintics
CO3	Predict the drug metabolic pathways, adverse effect and therapeutic value from the structure of drugs and provide information on the storage of drugs based on the chemical stability.
CO4	Demonstrate knowledge of chemical synthesis of important drugs such as Chloramphenicol, Chloroquine, Pamaquine, Isoniazid, Para amino salicylic acid, Ciprofloxacin, Nitrofurantoin, Acyclovir, Miconazole, Metronidazole, Diethylcarbamazine, Mebendazole, Sulfacetamide, Sulfamethoxazole, Dapsone.
CO5	Explain physicochemical properties related to QSAR and Describe various approaches and designing of drug molecules including prodrug and Combinatorial chemistry

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Antibiotics**	Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. β-Lactam antibiotics: Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline	10	1	3.3
2	**Antibiotics**	Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. Macrolide: Erythromycin Clarithromycin, Azithromycin. Miscellaneous: Chloramphenicol*, Clindamycin. Prodrugs: Basic concepts and application of prodrugs design. Antimalarials: Etiology of malaria. Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil. Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone	10	2	3.3
3	**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	10	3	3.3
4	**Antifungal agents**	Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*. Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin. Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine. Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole. Sulfones: Dapsone	08	4	3.3
5	**Introduction to Drug Design**	Introduction to Drug Design Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. Combinatorial Chemistry: Concept and applications chemistry: solid	07	5	3.3, 3.4

		phase and solution phase synthesis. of combinatoria			

Reference Books:
Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
Foye's Principles of Medicinal Chemistry.
Burger's Medicinal Chemistry, Vol I to IV.
Introduction to principles of drug design- Smith and Williams.
Remington's Pharmaceutical Sciences
Martindale's extra pharmacopoeia
Organic Chemistry by I.L. Finar, Vol. II
e-Learning Source:
https://books.google.co.in/books/about/Wilson_and_Gisvold_s_Textbook_of_Organic.html?id=CIpWhgWV5q0C
https://books.google.co.in/books/about/Foye_s_Principles_of_Medicinal_Chemistry.html?id=R0W1ErpsQpkC

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	2	3	3	1	1	3	2	3	-	3	1	3	-	-
CO2	3	2	3	3	3	2	2	3	3	2	3	-	3	1	3	-	-
CO3	3	2	3	3	3	2	2	3	3	2	3	-	3	1	2	-	-
CO4	3	2	3	3	3	2	2	3	3	2	3	-	3	1	2	-	-
CO5	3	2	3	3	1	1	3	1	2	3	3	-	3	1	2	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP602T**	**Title of the Course**	**PHARMACOLOGY-III**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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 poisoningsand 3. Appreciate correlation of pharmacology with related medical sciences							

Course Outcomes	
CO1	The chief objective of the unit was to provide basic knowledge about the disease of respiratory system / gastrointetinal system and drugs used in these problems.
CO2	The chief objective of the unit was to provide basic knowledge about the disease arises due to infections by bacteria / virus and drugs used in these problems. Mechanism of action, adverse effect, drug interaction, contraindication arises due to use of Penicillins, cephalosporins, chloramphenicol, macrolides,quinolones and fluoroquinolins, tetracycline and aminoglycosides drugs and their management .
CO3	The chief objective of this unit is to provide basic knowledge of drugs used in the treatment of tuberculosis,leprosy,viral infection, worm infestation,fungal and amoebic infection
CO4	This subject is designed to impart basic knowledge on the area of medicine used in malignancy, sexually transmitted diseases, transplantation and immunity enhancer agents. The chief objective of the unit was to provide basic knowledge about the anticancer drugs, drugs used in sexually transmitted diseases, immunostimulants and immunosuppressants drugs. Mechanism of action, adverse effect, drug interaction, contraindication arises due to use of these drugs and their management
CO5	The chief objective of the unit was to provide basic knowledge about the of acute, subacute and chronic toxicity and drugs used in these problems. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity,General principles of treatment of poisoning, Clinical symptoms and management of barbiturates, morphine,organophosphosphorus compound and lead, mercury and arsenic poisoning. Definition of rhythm and cycles.Biological clock and their significance leading to chronotherapy.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Pharmacology of drugs acting on Respiratory system**	Anti -asthmatic drugs Drugs used in the management of COPD Expectorants and antitussives d. Nasal decongestants Respiratory stimulants Pharmacology of drugs acting on the Gastrointestinal Tract Antiulcer agents. Drugs for constipation and diarrhoea. Appetite stimulants and suppressants. Digestants and carminatives. Emetics and anti-emetics.	10	3	3.3
2	**Chemotherapy**	General principles of chemotherapy. Sulfonamides and cotrimoxazole. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides	10	3	3.3
3	**Chemotherapy**	Antitubercular agents Antileprotic agent . Anti-gout drugs . Antirheumatic drugs Antifungal agents Antiviral drugs Anthelmintics Antimalarial drugs Antiamoebic agents	10	3	3.3
4	**Chemotherapy Immuno pharmacol ogy**	Urinary tract infections and sexually transmitted diseases. m. Chemotherapy of malignancy. Immunopharmacology Immunostimulants Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars	8	2	3.3
5	**Principles of toxicology Chronopharmac ology**	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. Chronopharmacology a. Definition of rhythm and cycles. b. Biological clock and their significance leading to chronotherapy.	7	3	3.3, 3.4

Reference Books:

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.

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

e-Learning Source:

https://drive.google.com/drive/folders/169qOfL9G-zeJ6SQ9c6f-YDySX6GN_EjU?usp=share_link

Integral University, Lucknow

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	2	3	3	1	1	3	2	3	-	2	3	3	-	-
CO2	3	2	3	3	3	2	2	3	3	2	3	-	3	2	2	-	-
CO3	3	2	3	3	3	2	2	3	3	2	3	-	3	3	2	-	-
CO4	3	2	3	3	3	2	2	3	3	2	3	-	2	2	2	-	-
CO5	3	2	3	3	1	1	3	1	2	3	3	-	3	2	3	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP603T**	**Title of the Course**	**HERBAL DRUG TECHNOLOGY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. To know the WHO and ICH guidelines for the evaluation of herbal drugs, herbal cosmetics, nutraceuticals and appreciate patenting of herbal drugs, GMP.							

Course Outcomes	
CO1	Discuss the crude drug raw material as a source of herbal drugs by cultivation process and knowledge of traditional system of medicine.
CO2	Apprehended the role of Nutraceuticals in the treatment of various diseases and Herbal-Drug and Herb-Food Interactions.
CO3	Apprehended the role of natural excipients in Herbal formulations and cosmetics.
CO4	Accomplished the Patenting aspects, Regulatory Issues, and WHO and ICH guidelines for the evaluation and assessment of Traditional drugs and Natural Products.
CO5	Discuss the General Introduction to the Herbal Industry and Good Manufacturing Practices of Indian systems of medicine.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Herbs as raw materials**	**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.	11	1	-----
2	**Nutraceuticals**	**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.	07	2	3.1, 3.4, 3.8, 3.9
3	**Herbal Cosmetics**	**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	10	3	-----
4	**Evaluation of Drugs, Regulatory Issues**	**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.	10	4	3.b
5	**General Introduction to Herbal Industry**	**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 – GoodManufacturing 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.	07	5	-----
Reference Books:					

W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
Textbook of Pharmacognosy by Tyler, Brady & Robber.
Essentials of Pharmacognosy, Dr. SH. Ansari, IInd edition, Birla publications, New Delhi, 2007
Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
e-Learning Source:
https://www.intechopen.com/chapters/53301

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	1	3	2	1	2	1	1	2	2	2	2	2	3	2	-	-
CO2	3	1	3	3	2	3	2	2	3	3	2	2	3	2	3	-	-
CO3	2	2	2	2	2	2	3	2	2	3	1	1	3	2	3	-	-
CO4	2	2	3	3	1	2	2	3	3	3	1	1	2	3	2	-	-
CO5	3	2	3	3	2	3	1	2	2	2	2	2	2	2	3	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**BP604T**	**Title of the Course**	**BIOPHARMACEUTICS & PHARMACOKINETICS**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	Understand the mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT.
CO2	Explain metabolic pathways, factors affecting renal excretion of drugs and different terms of bioavailability.
CO3	Describe compartmental modeling, various pharmacokinetic parameters, their significance and applications..
CO4	Evaluate kinetics of multiple dosing, loading and mainetnance doses and their significance.
CO5	Understand the concept of non-linear pharmacokinetics and remember factors causing non-linearity and Michaelis-menton method of estimating parameters.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Introduction to Biopharmaceutics, Absorption & Distribution**	Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, 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.	10	1, 2	9.5 9.b
2	**Elimination, Bioavailability and Bioequivalence**	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 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.	10	3, 4	9.5 9.b
3	**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 - KE ,t1/2,Vd,AUC,Ka, Clt and CLR- definitions methods of eliminations, understanding of their significance and application	10	5	9..1 9.5 9.b
4	**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 settings	8	6	9.1 9.5 9.b
5	**Nonlinear Pharmacokinetics**	Introduction, Factors causing Non-linearity, Michaelis-menton method of estimating parameters, Explanation with example of drugs.	7	7	9.5 9.b

Reference Books:

Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.

Biopharmaceutics and Pharmacokinetics; By Robert F Notari

Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA.

Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi.

Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.

Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press..

Biopharmaceutics; By Swarbrick

Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.

Remington's Pharmaceutical Sciences, ByMack Publishing Company, Pennsylvnia

e-Learning Source:

https://drive.google.com/file/d/1PuOdN2CUMvjnUNse5PTYAXkfSImTGqjW/view?usp=sharing

https://ptabdata.blob.core.windows.net/files/2017/IPR2017-00854/v34_Exhibit%201034%20-%20Gibaldi.PDF

https://accesspharmacy.mhmedical.com/content.aspx?bookid=513&sectionid=41488019#56601005

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	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	-	-	1	-	1	1	1	1	2	1	-	1	1	1	-	-
CO2	2	-	-	1	-	1	1	1	1	2	1	-	1	1	1	-	-
CO3	2	-	-	1	-	1	1	1	1	2	1	-	1	1	1	-	-
CO4	2	-	-	1	-	1	1	1	1	2	1	-	1	1	1	-	-
CO5	2	-	-	1	-	1	1	1	1	2	1	-	1	1	1	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP605T**	**Title of the Course**	**PHARMACEUTICAL BIOTECHNOLOGY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	Understanding the importance of Immobilized enzymes in Pharmaceutical Industries, Genetic engineering applications in relation to production of pharmaceuticals, immune system and vaccine, Importance of Monoclonal antibodies in Industries, fermentation technology							

Course Outcomes	
CO1	Understanding the basics of biotechnology including genetic engineering, Protein Engineering and Production of Enzymes, enzymes immobilization and biosensors.
CO2	Understanding Genetic engineering, Study of Recombinant DNA technology, PCR and production of biotechnological products.
CO3	Understanding the immune system, Hypersensitivity reactions, Monoclonal antibodies and vaccines.
CO4	Know the importance of various immunological techniques i.e. Microbial genetics, Microbial biotransformation and Mutation.
CO5	Study of fermentation technology, production of various pharmaceutical products and Collection, Processing and Storage of Blood Products.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Brief introduction to Biotechnology**	Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. Enzyme Biotechnology- Methods of enzyme immobilization and applications. Biosensors- Working and applications of biosensors in Pharmaceutical Industries. Brief introduction to Protein Engineering. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering.	10	**1**	
2	**Recombinant DNA technology**	Study of cloning vectors, restriction endonucleases and DNA ligase. Recombinant DNA technology. Application of genetic engineering in medicine. Application of r DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. Brief introduction to PCR	10	**2**	
3	**Immune System**	Structure of Immunoglobulins Structure and Function of MHC Hypersensitivity reactions, Immune stimulation and Immune suppressions. General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. Storage conditions and stability of official vaccines Hybridoma technology- Production, Purification and Applications Blood products and Plasma Substituties.	10	**3**	
4	**Blotting Techniques**	Immuno blotting techniques- ELISA, Western blotting, Southern blotting. Genetic organization of Eukaryotes and Prokaryotes Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. Introduction to Microbial biotransformation and applications. Mutation: Types of mutation/mutants.	08	**4**	
5	**Fermentation methods**	Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.	07	**5**	

Reference Books:

B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.

RA Goldshy et. al., : Kuby Immunology.

J.W. Goding: Monoclonal Antibodies.

J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.

Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.

S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.

Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

e-Learning Source:

https://www.google.co.in/books/edition/Molecular_Biotechnology/icV6EAAAQBAJ?hl=en&gbpv=1&dq=Biotechnology:+Principles+and+Applications&printsec=frontcover

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https://www.google.co.in/books/edition/Biopharmaceutical_Drug_Design_and_Develo/D5iHKLX-GOYC?hl=en&gbpv=1&dq=B.R.+Glick+and+J.J.+Pasternak:+Molecular+Biotechnology:+Principles+and+Applications+of+RecombinantDNA:+ASM+Press+Washington+D.C.&printsec=frontcover
https://www.google.co.in/books/edition/A_Textbook_of_Biotechnology/-7qcEAAAQBAJ?hl=en&gbpv=1

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	1	1	2	2	-	-	-	-	-	-	3	1	3	-	-
CO2	3	2	1	1	2	1	-	-	-	-	-	-	3	1	3	-	-
CO3	3	3	1	1	1	2	-	-	-	-	-	-	2	1	2	-	-
CO4	3	3	1	1	2	2	-	-	-	-	-	-	3	1	3	-	-
CO5	3	2	1	1	1	1	-	-	-	-	-	-	3	2	2	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19								
Course Code	**BP606T**	**Title of the Course**	**QUALITY ASSURANCE**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	Understand the cgmp aspects in a pharmaceutical industry Appreciate the importance of documentation Understand the scope of quality certifications applicable to pharmaceutical industries Understand the responsibilities of QA & QC departments							

Course Outcomes	
CO1	Understand the scope of quality certifications applicable to pharmaceutical industries and the role of regulatory agencies in deciding quality standards.
CO2	Know the responsibilities of personnel, environmental monitoring and sterilization of the area as well as raw materials and equipment.
CO3	Apply the cGMP aspects in the pharmaceutical industry and analyse the responsibilities of QA & QC departments.
CO4	Appreciate the importance of documentation.
CO5	Analyse the significance of validation in quality assurance.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Concepts of Pharmaceutical Assurance and Quality Management**	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	10	1	
2	**Organization and personnel Premises Equipments and raw materials**	Personnel responsibilities, training, hygiene and personal records. Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination. Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.	10	2	
3	**Quality control test for packaging materials Understanding of Good Laboratory Practices**	Quality control test for containers, rubber closures and secondary packing materials. 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	10	3	
4	**Pharmaceutical Complaints Document maintenance in pharmaceutical industry**	Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.	08	4	
5	**Concepts Calibration & Validation** **Warehousing**	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. Good warehousing practice, materials management	07	5	

Reference Books:
Quality Assurance Guide by organization of Pharmaceutical Products of India.
Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
How to Practice GMP's – P P Sharma..
ISO 9000 and Total Quality Management – Sadhank G Ghosh
Good laboratory Practices – Marcel Deckker Series
ICH guidelines, ISO 9000 and 14000 guidelines
e-Learning Source:
https://pharmonly.net/wp-content/uploads/2022/08/Industrial-Pharmacy-Lachman-Libbermann-4th-edition.pdf
https://www.iso.org/home.html
https://nablwp.qci.org.in/Home/index
https://www.piramalpharmasolutions.com/themes/zen/assets/misc/whitepapers/Quality

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https://www.researchgate.net/publication/308595149_A_Model_of_Pharmaceutical_Customer_Complaints_and_Redressal_System
https://www.researchgate.net/publication/354722731_DOCUMENTATION_IN_PHARMACEUTICAL_INDUSTRY

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	1	2	1	1	1	1	1	2	2	3	1	2	-	-	-
CO2	2	3	1	2	1	1	1	1	1	2	2	3	1	2	-	-	-
CO3	2	3	1	2	1	1	1	1	1	2	2	3	1	2	-	-	-
CO4	2	3	1	2	1	1	1	1	1	2	2	3	1	2	-	-	-
CO5	2	3	1	2	1	1	1	1	1	2	2	3	1	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**BP607P**	**Title of the Course**	**MEDICINAL CHEMISTRY-III**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. learn the basic laboratory skills, laboratory equipments and laboratory reagents involved in synthesis and assay procedure of some drugs and their intermediates necessary in medicinal chemistry 2. Set up a safe experimental procedure to avoid a risk of an accident and keep concerned about human health and the environment. 3. Understand the proper procedures for the safe use of chemicals and can follow the proper procedures for chemical waste disposal and synthesize chemical compounds and intermediates. 4. Draw chemical structures and reactions by using chem. Draw software. Also students able to calculate various physicochemical properties by using Chem Draw software. 5. Adopt proper communication skills by expressing theoretical and practical knowledge through viva-voce.						

Course Outcomes	
CO1	To Understand how to make correct use of various equipments & take safety measures while working in a medicinal chemistry laboratory.
CO2	To Synthesize, recrystallize and understand reaction mechanisms involved in the synthesis of medicinally important compounds.
CO3	To know about different type assay procedures to check the purity of drug and also to perform assay procedure of some drugs by using different analytical procedures.
CO4	Comprehend the techniques of microwave-assisted synthesis and explain applications of microwave-assisted synthesis in pharmaceutical research.
CO5	Students able to draw structures and reactions using Chem draw.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Preparation of drugs and intermediates**	Sulphanilamide	4	1,2
2.	**Preperation of drug**	7-Hydroxy, 4-methyl coumarin	4	1,2
3.	**Preperation of drug**	Chlorobutanol	4	1,2
4.	**Preperation of drug**	Triphenyl imidazole	4	1,2
5.	**Preperation of drug**	Tolbutamide	4	1,2
6.	**Preperation of drug**	Hexamine	4	1,2
7.	**Assay of drugs**	Isonicotinic acid hydrazide	4	1,3
8.	**Assay**	Chloroquine	4	1,3
9.	**Assay**	Metronidazole	4	1,3
10.	**Assay**	Dapsone	4	1,3
11.	**Assay**	Chlorpheniramine maleate	4	1,3
12.	**Assay**	Benzyl penicillin	4	1,3
13.	**Preparation of medicinally important compounds or intermediates by Microwave irradiation technique**	Preparation of medicinally important compounds or intermediates by Microwave irradiation technique	4	1,2,4
14.	**Drawing structures and reactions using chem draw®**	Drawing structures and reactions using chem draw®	4	5
15.	**Determination o**	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 (Lipinskies RO5)	4	5
e-Learning Source:				
https://www.ncbi.nlm.nih.gov/books/NBK55884/				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	3	1	2	2	1	1	2	3	-	3	2	3	-	-
CO2	3	3	3	3	1	2	2	1	1	2	3	-	3	2	3	-	-
CO3	3	2	3	3	1	2	1	1	1	2	3	-	2	1	3	-	-
CO4	3	2	3	3	1	2	1	1	1	2	3	-	2	1	3	-	-
CO5	3	1	3	3	2	1	1	2	1	1	3	-	2	1	3	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**BP608P**	**Title of the Course**	**PHARMACOLOGY-III**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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 3. Appreciate correlation of pharmacology with related medical sciences.						

Course Outcomes	
CO1	The chief objective of the unit was to provide basic knowledge about the disease of respiratory system/gastrointetinal system B8and drugs used in these problems.
CO2	This subject is designed to impart basic knowledge on the area of medicine used in infectious problems. The chief objective of the unit was to provide basic knowledge about the disease arises due to infections by bacteria/virus and drugs used in these problems. Mechanism of action, adverse effect, drug interaction, contraindication arises due to use of Penicillins, cephalosporins, chloramphenicol, macrolides,quinolones and fluoroquinolins, tetracycline and aminoglycosides drugs and their management .
CO3	The chief objective of this unit is to provide basic knowledge of drugs used in the treatment of tuberculosis,leprosy,viral infection, worm infestation, fungal and amoebic infection
CO4	This subject is designed to impart basic knowledge on the area of medicine used in malignancy, sexually transmitted diseases, transplantation and immunity enhancer agents. The chief objective of the unit was to provide basic knowledge about the anticancer drugs, drugs used in sexually transmitted diseases, immunostimulants and immunosuppressants drugs. Mechanism of action, adverse effect, drug interaction, contraindication arises due to use of these drugs and their management.
CO5	The chief objective of the unit was to provide basic knowledge about the of acute, subacute and chronic, toxicity and drugs used in these problems. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity,General principles of treatment of poisoning,Clinical symptoms and management of barbiturates, morphine,organophosphosphorus compound and lead, mercury and arsenic poisoning. Definition of rhythm and cycles.Biological clock and their significance leading to chronotherapy.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Dose calculation**	Dose calculation in pharmacological experiments.	4	1
2.	**Antiallergic activity**	Anti-allergic activity by mast cell stabilization assay.	4	1
3.	**Pylorus ligation**	Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.	4	1
4.	**Drug effect**	Study of effect of drugs on gastrointestinal motility.	4	2
5.	**Drug effect**	Effect of agonist and antagonists on guinea pig ileum.	4	2
6.	**Serum biochemical estimation**	Estimation of serum biochemical parameters by using semi-autoanalyzer.	4	2
7.	**Purgative effect**	Effect of saline purgative on frog intestine.	4	3
8.	**Hypoglycemic effect**	Insulin hypoglycemic effect in rabbit.	4	3
9.	**Pyrogen test**	Test for pyrogens (rabbit method).	4	3
10.	**Toxicity study**	Determination of acute oral toxicity (LD50) of a drug from a given data.	4	4
11.	**Skin irritation**	Determination of acute skin irritation / corrosion of a test substance.	4	4
12.	**Eye irritation**	Determination of acute eye irritation / corrosion of a test substance.	4	4
13.	**Pharmacokinetic study**	Calculation of pharmacokinetic parameters from a given data.	4	5
14.	**ANOVA test**	Biostatistics methods in experimental pharmacology (student's t test, ANOVA).	4	5
15.	**Biostats**	Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test).	4	5

e-Learning Source:

Animal simulation Ex- Pharm

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	3	3	2	2	3	3	1	1	1	-	-	-	-	-	-
CO2	3	3	2	3	2	3	3	2	1	1	-	-	-	-	-	-	-
CO3	3	3	3	2	2	3	3	2	1	1	-	-	-	-	-	-	-
CO4	3	3	3	2	3	3	3	2	1	1	-	-	-	-	-	-	-
CO5	3	3	3	2	2	3	3	2	1	1	-	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**BP609P**	**Title of the Course**	**HERBAL DRUG TECHNOLOGY**	**L**	**T**	**P**	**C**
Year	`III	**Semester**	VI	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. To understand rawmaterial as a source of herbal drugs from cultivation to herbal drug product. 2. To know the WHO and ICH guidelines for evaluation of herbal drugs. 3. To know the herbal cosmetics,natural sweeteners.nutraceuticals. 4. To appreciate patenting of herbal drugs,GMP						

Course Outcomes	
CO1	To discuss the preliminary phytochemical screening of crude drugs.
CO2	Accomplished the determination of alcohol content of Asava and Arishthas.
CO3	Accomplished the determination of Aldehyde content,Phenol content,Alkaloid content in herbal drugs and formulations.
CO4	Prepared and standardized extract in formulations like syrups,mixtures and tablets and their evaluation.
CO5	Incorporation of prepared and standardized extract in cosmetic formulations like creams,lotions and shampoos.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**Phtochemical screening**	To perform the preliminary phytochemical screening of crude drugs.	3	1
2.	**Alcohol content**	To determine the alcohol content in asava and Arista.	6	2
3.	**Incorporation preparation and Standardization**	Incorporation of prepared and standardized extract in cosmetic formulations like creams,lotions and shampoos	9	5
4.	**Evaluation**	Evaluation of excipients of natural origin.	9	1
5.	**Incorporation preparation and standardisation**	Incorporation of prepared and standardized extract in formulations like syrups,mixtures,and tablets.	9	4
6.	**Aldehyde content**	To determine the aldehyde content in the given sample.	3	3
7.	**Phenol content**	To determine the phenol content in the given sample.	3	3
8.	**Alkaloid content**	To determine the total alkaloid content in the given sample	3	3
e-Learning Source:				
https://www.hindawi.com/journals/tswj/2017/5873648/				

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	3	3	2	1	2	2	3	2	2	-	-	-	-	-	-	-
CO2	3	2	3	3	1	3	2	2	3	3	-	-	-	-	-	-	-
CO3	2	3	2	3	1	2	3	3	2	3	-	-	-	-	-	-	-
CO4	2	2	3	3	1	2	2	3	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	1	3	3	2	2	2	-	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP701T**	**Title of the Course**	**INSTRUMENTAL METHOD OF ANALYSIS**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	Investigate the pharmaceutical substances by UV Visible and fluorescence spectroscopy.
CO2	Analyze the essentials of nepheloturbidometry, flame photometry and atomic absorption spectroscopy.
CO3	Apprehend the analysis of pharmaceutical substances by chromatographic techniques and electrophoresis.
CO4	Recognize the principle, instrumentation and applications of gas chromatography & high performance liquid chromatography.
CO5	Deal with the fundamentals of ion exchange, affinity chromatography and gel chromatography.

UnitNo.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**UV Visible spectroscopy and Fluorimetry**	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 multicomponent analysis Fluorimetry: Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications	10	1	9.2, 9.4, 9.5, 9.b
2	**IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy and Nephelo turbidometr y**	IR spectroscopy: Introduction, fundamental modes of vibrations in polyatomic 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	10	2	9.2, 9.4, 9.5, 9.b
3	**Adsorption and Partition column chromatography, Thin layer chromatography, Paper chromatography and Electrophoresis**	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	10	3	9.2, 9.4, 9.5, 9.b
4	**Gas chromatography and High performance liquid chromatography**	Gas chromatography: Introduction, theory, instrumentation, Derivatization, temperature programming, advantages, Disadvantages and applications. High performance liquid chromatography (HPLC)> Introduction, theory, Instrumentation, Advantages and applications	8	4	9.2, 9.4, 9.5, 9.b
5	**Ion exchange chromatography, Gel chromatography and Affinity chromatography**	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	7	5	9.2, 9.4, 9.5, 9.b

Reference Books:

Instrumental Methods of Chemical Analysis by B.K Sharma

Organic spectroscopy by Y.R Sharma

Text book of Pharmaceutical Analysis by Kenneth A. Connors

Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel

Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake

Organic Chemistry by I.L. Finar

Organic spectroscopy by William Kemp

Quantitative Analysis of Drugs by D. C. Garrett

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Quantitative Analysis of Drugs in Pharmaceutical Formulations by P.D. Sethi
Spectrophotometric identification of Organic Compounds by Silverstein
e-Learning Source:
https://www.classcentral.com/course/swayam-spectroscopic-techniques-for-pharmaceutical-and-biopharmaceutical-industries-14301
https://www.sciencedirect.com/science/article/pii/S1878535213001056
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6258797/
https://www.google.co.in/books/edition/Pharmaceutical_Analysis/Ub8wod1CJ50C?hl=en&gbpv=1&dq=pharmaceutical+analysis+spectral+chromatography&printsec=frontcover
https://www.google.co.in/books/edition/Pharmaceutical_Analysis_E_Book/YExgDAAAQBAJ?hl=en&gbpv=1&dq=pharmaceutical+analysis+spectral+chromatography&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	-	-	3	3	1	2	3	3	3	3	3	-	3	3	3	-	-
CO2	-	-	3	3	1	2	3	3	3	3	3	-	3	3	3	-	-
CO3	3	3	3	3	1	2	3	3	3	3	3	-	3	3	3	-	-
CO4	3	3	3	3	1	2	3	3	3	3	3	-	3	3	3	-	-
CO5	3	3	3	3	1	2	3	3	3	3	3	-	3	3	3	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP702T**	**Title of the Course**	**INDUSTRIAL PHARMACY-II**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	Discuss the process of pilot plant scale up of pharmaceutical dosage forms.
CO2	Demonstrate the process of technology development and transfer from lab scale to commercial.
CO3	Explain the approval process and regulatory requirements of drug products.
CO4	Understand the Quality management system (QMS) and common measures in Quality.
CO5	Describe the organization and structure of Indian regulatory agencies and their role and responsibilities.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Pilot plant scale up techniques**	Pilot plant scale up techniques: 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	10	1	9.1 9.2 9.5 9.b
2	**Terminology, Technology transfer protocol, Quality risk management**	Technology development and transfer: WHO guidelines for Technology Transfer(TT): 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	10	2	9.b 9.5 9.1
3	**Regulatory affairs**	Regulatory affairs: 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.	10	3	9.5 9.b 9.2
4	**Quality management systems**	Quality management systems: 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	08	4	9.1 9.5 9.b
5	**Indian Regulatory Requirements**	Indian Regulatory Requirements: 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	07	5	9.1 9.2 9.5 9.b

Reference Books:

Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs

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

Regulatory Affairs brought by learning plus, inc. a

e-Learning Source:

http://www.iraup.com/about.php

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	2	2	1	3	2	2	2	2	-	3	2	3	-	-
CO2	3	3	3	2	2	2	3	2	3	1	2	-	3	2	3	-	-
CO3	3	3	3	2	2	3	3	2	2	3	1	-	3	2	2	-	-

CO4	3	3	3	2	2	3	3	2	2	1	1	-	3	3	3	-	-
CO5	3	3	3	3	2	1	3	2	3	1	3	-	3	3	2	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP703T**	**Title of the Course**	**CLINICAL RESEARCH**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. To know various drug distribution methods in a hospital, pharmacy stores and inventory control management 2. To monitor drug therapy of patient through medication chart review and clinical review, obtain medication history interview and counsel the patients, identify drug related problems and adverse drug reactions 3. To know pharmaceutical care services, patient counseling in community pharmacy 4. Appreciate the concept of rational drug therapy.To interpret selected laboratory results of specific disease state							

Course Outcomes	
CO1	Know and understand the Hospital organization and detect and assess adverse drug reactions, reporting and its management.
CO2	Knowledge of various drug distribution methods system in the hospital, and monitor drug therapy of Patient, role pharmacist in medication adherence and community pharmacy management .also know how to obtain medication history interview
CO3	Know and understand guideline of know pharmaceutical care services such therapeutic committee, drug information services, patient counseling, and also able to answer the role of pharmacist in education and training of program., monitor drug therapy of patient through medication chart review and clinical review.
CO4	Able to understand the medication of management, budget preparation and its implementation, and also help in rational use of common over the counter medication
CO5	Able to understand the appreciate pharmacy stores and inventory control management and able to interpret selected laboratory results of specific disease states and controlling of investigational use of drugs.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Hospital and it's organization, Hospital pharmacy and its organization, Hospital pharmacy and its organization, Adverse drug reaction, Community Pharmacy**	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. Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists. 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 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.	10	1	
2	**Drug distribution system in a hospital, Hospital formulary Therapeutic drug monitoring, Medication adherence, Patient medication history interview, Community pharmacy management**	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 Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary. Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring. Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence. Need for the patient medication history interview, medication interview forms. Financial, materials, staff, and infrastructure requirements	10	2	
3	**Pharmacy and therapeutic committee, Drug information services, Patient counseling, Education and training program in the hospital Prescribed medication order and communication skills**	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. Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information. Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist. 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. Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients	10	3	

4	**Budget preparation and implementation, Clinical Pharmacy, Over the counter (OTC) sales**	Budget preparation and implementation, 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. Introduction and sale of over the counter, and Rational use of common over the counter medications.	10	4	
5	**Drug store management and inventory control, Investigational use of drugs, Interpretation of Clinical Laboratory Tests**	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. Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. Blood chemistry, hematology, and urinalysis	10	5	

Reference Books:

Principles of Clinical Research edited by Giovanna di Ignazio Di Giovanna and Haynes.

Clinical Data Management edited by R K Rondels S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.

Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.

e-Learning Source:

https://ilizone.iul.ac.in/course/modedit.php?update=193274&return=0&sr=0

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	2	2	2	1	2	2	2	2	-	2	3	-	-	-
CO2	3	3	3	2	2	2	1		2	2	2	-	2	3	-	-	-
CO3	3	3	3	2	2	2	1	2	3	3	3	-	2	3	-	-	-
CO4	3	2	2	2	2	2	1	2	3	3	3	-	2	3	-	-	-
CO5	3	3	3	2	2	2	3	2	3	3	3	-	2	3	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP704T**	**Title of the Course**	**NOVEL DRUG DELIVERY SYSTEM**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VII		3	1	-	10
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Upon completion of the course student shall be able to understand various approaches for development of novel drug delivery systems. 2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation.							

Course Outcomes	
CO1	Know the criteria for selection of drugs and polymers for the development of novel drug delivery systems and understand various approaches for development of novel drug delivery systems, their formulation and evaluation..
CO2	Know the approaches, technologies and drug carriers used in the process of drug delivery which serves to improve the selectivity, effectiveness, and/or safety of drug administration.
CO3	The students should understand about Transdermal Drug Delivery Systems, Gastro-retentive drug delivery systems and Naso-pulmonary drug delivery system.
CO4	To understand Targeted Drug Delivery including liposomes, niosomes, nanoparticles, monoclonal antibodies.
CO5	To understand Ocular Drug Delivery Systems and Intrauterine Drug Delivery Systems including intra uterine devices (IUDs).

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Controlled drug delivery systems, Polymer**	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 Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.	10	1	9.5 9.b
2	**Microencapsulation, Mucosal Drug Delivery system, Implantable Drug Delivery Systems**	Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems Introduction, advantages and disadvantages, concept of implantsand osmotic pump	10	2	9.1 9.5
3	**Transdermal Drug Delivery Systems, Gastroretentive drug delivery systems, Nasopulmonary drug delivery system**	Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers	10	3	9.5 9.b
4	**Targeted drug Delivery**	Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications	08	4	9.1 9.5
5	**Ocular Drug Delivery Systems, Intrauterine Drug Delivery Systems**	Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications	07	5	9.1 9.5 9.b

Reference Books:

Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.

Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.

Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim

N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).

S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

Journals

Indian Journal of Pharmaceutical Sciences (IPA)

Indian Drugs (IDMA)

Journal of Controlled Release (Elsevier Sciences)

Drug Development and Industrial Pharmacy (Marcel & Decker)

International Journal of Pharmaceutics (Elsevier Sciences)

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e-Learning Source:
https://www.google.co.in/books/edition/Novel_Drug_Delivery_Technologies/TgDQDwAAQBAJ?hl=en&gbpv=1&dq=NOVEL+DRUG+DELIVERY+SYSTEM&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	2	2	2	3	2	1	2	3	3	-	3	2	1	-	-
CO2	3	2	2	2	2	3	2	1	2	3	3	-	3	2	1	-	-
CO3	3	2	2	2	1	1	2	1	2	1	3	-	3	2	1	-	-
CO4	3	1	1	3	1	1	2	1	2	1	3	-	3	2	1	-	-
CO5	3	2	1	3	2	1	2	2	2	1	2	-	3	2	1	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**BP705P**	**Title of the Course**	**INSTRUMENTATION METHOD OF ANALYSIS**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VII	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	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	To study different types of analytical instruments and how to make their correct use of various equipment & take safety measures while working in a analytical chemistry laboratory.
CO2	The students will be able to apply the use of different reference books for different fundamental techniques of analysis
CO3	To perform quantitative & qualitative analysis of drugs using various analytical instruments.
CO4	To understand the chromatographic separation and analysis of drugs.
CO5	To study the interpretation of UV spectra of unknown drugs and also to interpret the various functional group by spectroscopy

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1.	**UV Visible spectroscopy**	Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds	4	1,3,5
2.	**UV Visible spectroscopy**	Estimation of dextrose by colorimetry	4	1,3,5
3.	**UV Visible spectroscopy**	Estimation of sulfanilamide by colorimetry	4	1,2,3
4.	**UV Visible spectroscopy**	Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy	4	1,2,3
5.	**Spectrophotometric titrations**	Assay of paracetamol by UV- Spectrophotometry	4	1,2,3
6.	**Fluorimetry**	Estimation of quinine sulfate by fluorimetry	4	1,2,3
7.	**Fluorimetry**	Study of quenching of fluorescence	4	1,2,3,
8.	**IR spectroscopy:**	Determination of sodium by flame photometry	4	1,2,3
9.	**Flame Photometry**	Determination of potassium by flame photometry	4	1,2,3
10.	**Nepheloturbidometry-**	Determination of chlorides and sulphates by nephelo turbidometry	4	1,2,4
11.	**Chromatography**	Separation of amino acids by paper chromatography	4	1,2,4
12.	**Chromatography**	Separation of sugars by thin layer chromatography	4	1,2,4
13.	**Chromatography**	Separation of plant pigments by column chromatography	4	1,2,4
14.	**High performance liquid chromatography (HPLC)-**	Demonstration experiment on HPLC	4	2,3,4
15.	**Gas chromatography**	Demonstration experiment on Gas Chromatography	4	2,3,4

e-Learning Source:

Instrumental method of analysis: https://www.youtube.com/watch?v=BSlG2oASWNQ

Fluoresence spectroscopy: https://www.youtube.com/watch?v=9MQPp0cwI8g

Assay of paracetamol by UV- Spectrophotometry : https://www.youtube.com/watch?v=IybO3cbsFC0

High performance liquid chromatography (HPLC)- https://www.youtube.com/watch?v=Y7-CuEGfnyI

Gas chromatography https://www.youtube.com/watch?v=ZpPzImDSfqc

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	1	2	3	1	1	1	2	2	1	3	-	3	1	3	-	-
CO2	3	1	2	3	2	1	1	2	2	1	3	-	3	1	3	-	-
CO3	3	1	2	3	1	2	1	2	2	1	3	-	3	2	3	-	-
CO4	3	1	2	3	1	2	1	2	2	1	3	-	3	2	3	-	-
CO5	3	1	2	3	2	1	1	2	2	1	3	-	3	1	3	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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Name & Sign of Program Coordinator	Sign & Seal of HOD

Effective from Session: 2019-20							
Course Code	**BP706PS**	**Title of the Course**	**PRACTICE SCHOOL**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VII	-	-	4	2
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**	--				
Course Objectives	1. Introduction of pharmacy practice. 2. Pharmacy practice will help in understanding practical aspects of the different field. 3. It will also help to accomplish future endeavours as well as employability.						

Course Outcomes	
CO1	Understand the advanced instruments used and their applications in drug analysis.
CO2	Understand the concepts and applications of alternative medicine.
CO3	Learn to execute and utilize softwares of pharmaceutical importance.
CO4	Understand the calibration of various analytical instruments.
CO5	Know analysis of drugs using various analytical instruments.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	**Formulation development**	Current status of Pharmacovigilance in India.	5	3
2.	**Quality control**	Role of Pharmacist in community pharmacy and health services.	5	4
3.	**Quality control**	Quality control of Solid dosage form.	5	5
4.	**Quality control**	Quality control of Liquid dosage form.	5	5
5.	**Quality control**	Quality control of Parenteral preparations.	5	5
6.	**Nutraceuticals**	Herbs as Neutraceuticals and their clinical use.	5	1
7.	**Formulation development**	Medication error and its management.	5	1
8.	**Drug design and process chemistry**	Drug interaction clinical significance.	5	3
9.	**Drug design and process chemistry**	Supply chain management in Drug distribution	5	2
10.	**Alternative medicine**	Alternative medicine in homeopathy.	5	2
11.	**Alternative medicine**	Alternative medicine in Unani.	5	2
12.	**Quality control**	Quality control test for containers, rubbers, closures and packaging materials.	5	5
13.	**Phytomedicine**	Herbal product development and current trends in formulation of herbal pharmaceuticals and newer herbal drug delivery system.	5	1
14.	**Formulation development**	Current status of Pharmacovigilance in India.	5	3
15.	**Quality control**	Role of Pharmacist in community pharmacy and health services.	5	4

e-Learning Source:

https://www.bing.com/search?q=Pharmacognosy+by+Trease+and+Evans.

https://www.bing.com/search?q=Current+Concepts+in+Drug+Design+by+T.+Durai+and+Ananda+Kumar.

https://www.bing.com/search?q=Mukherjee%2C+P.W.+Quality+Control+of+Herbal+Drugs

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	1	1	1	1	-	1	2	2	1	1	2	1	1	2	1	-	-
CO2	-	-	2	3	-	-	2	-	-	-	-	-	2	-	-	-	-
CO3	-	-	1	1	1	-	1	-	-	-	-	-	1	-	-	-	-
CO4	1	-	1	1	-	-	3	1	-	-	1	-	1	1	-	-	-
CO5	-	-	2	1	-	-	1	-	-	-	-	-	2	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP801T**	**Title of the Course**	**BIOSTATISTICS & RESEARCH METHODOLOGY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. To know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment), various statistical techniques to solve statistical problems.							

Course Outcomes	
CO1	Describe the applications of biostatics and measure of central tendency, dispersion and correlation.
CO2	Understand the regression analysis, probability theory and parametric tests.
CO3	Apprehend the designing of methodology for research, observational and experimental studies.
CO4	Know the concept of blocking, confounding and regression analysis and use of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of experiment).
CO5	Choose the appropriate design and analysis of experiments such as factorial design and response surface methodology.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Introduction, Measures of central tendency, Correlation**	**Introduction:** 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	10	1	
2	**Regression, Probability, Parametric test**	**Regression:** Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– 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 **Parametric test**: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference	10	2	
3	**Non Parametric tests, Introduction to Research**	**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 Plot graph **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.	10	3	
4	**Introduction to Practical components of Industrial and Clinical Trials Problems**	Blocking and confounding system for Two-level factorials **Regression modeling:** Hypothesis testing in Simple and Multiple regressionmodels **Introduction to Practical components of Industrial and Clinical Trials Problems**: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach	08	4	
5	**Design and Analysis of experiments:**	**Design and Analysis of experiments:** **Factorial Design:** Definition, 22, 23design. Advantage of factorial design **Response Surface methodology**: Central composite design, Historical design, Optimization Techniques	07	5	

Reference Books:

Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.

Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha

Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,

e-Learning Source:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5122272/

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	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	1	1	3	1	1	2	-	-	-	1	2	-	1	1	1	-	-
CO2	1	1	3	1	1	1	1	-	-	1	2	-	2	1	1	-	-
CO3	1	2	2	1	-	2	1	-	1	1	1	-	1	2	1	-	-
CO4	1	2	3	3	1	2	-	-	-	-	1	-	1	1	1	-	-
CO5	1	2	3	2	-	1	1	-	-	1	2	-	2	2	1	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP802T**	**Title of the Course**	**SOCIAL & PREVENTIVE PHARMACY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide. 2. Have a critical way of thinking based on current healthcare development. 3. Evaluate alternative ways of solving problems related to health and pharmaceutical issues							

Course Outcomes	
CO1	Able to know about disease, health and health education and acquire the knowledge of nutrition and hygiene.
CO2	Acquire knowledge about prevention and control of various diseases.
CO3	Able to understand various national health programs.
CO4	Understand about National health intervention programme.
CO5	Acquire the knowledge of community services, NRHM and NUHM.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**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 the sick. 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, Poverty and health Hygiene and health: personal hygiene and health care; avoidable habits	10	1	
2	**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	10	2	
3	**National health programs**	objectives, functioning and outcome of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy 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.	10	3	
4	**National health intervention programme**	for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program	08	4	
5	**Community services**	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.	07	5	

Reference Books:

Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications

Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications

Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications

Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS

e-Learning Source:

https://drive.google.com/drive/folders/1zqR5sZiU4qngXrPCwXriQEDQHAv7Vy7u?usp=sharing

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	2	3	2	2	2	2	3	1	1	-	2	3	2	-	-
CO2	3	3	3	3	3	3	2	3	2	2	2	-	3	3	2	-	-
CO3	3	3	3	3	2	2	2	2	3	1	1	-	2	2	2	-	-
CO4	3	3	3	2	3	3	2	3	2	2	1	-	3	2	2	-	-
CO5	3	3	2	2	2	3	2	2	2	1	1	-	2	3	2	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP803ET**	**Title of the Course**	**PHARMACEUTI CAL MARKETING MANAGEMENT**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	-
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.							

Course Outcomes	
CO1	Students able to learn about the pharmaceutical marketing.
CO2	Students will acquire the knowledge of product positioning in pharmaceutical marketing
CO3	Student will understand about the different promotional techniques of pharmaceutical product in competitive market.
CO4	Student will understand about the understanding of marketing channel in pharmaceutical marketing industry
CO5	Students will acquire the knowledge and Know-how the pharmaceutical marketing management groom the people for taking a challenging role in Sales and management of pharmaceutical Products

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Marketing, Consumer profile, Role of market research**	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 market: 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.	10	2	
2	**Classification, product line and product mix decisions**	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.	10	2	
3	**Promotion, OTC Products**	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.	10	3	
4	**Pharmaceutical marketing channels**	Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physicaldistribution 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.	08	4	
5	**Pricing: Meaning, importance, objectives**	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	07	5	

Reference Books:

Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi

Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.

Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill

Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India

e-Learning Source:

https://drive.google.com/drive/folders/2grK0cI2fn1vo9g-jgXZKbfDlduySXPT3?usp=sharing

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	2	2	1	2	3	2	2	1	2	3	2	3	-	-
CO2	3	3	3	3	2	2	1	3	2	3	2	2	2	3	2	-	-
CO3	3	3	3	2	2	2	1	2	1	2	2	2	3	2	3	-	-
CO4	3	3	3	2	2	1	2	2	2	3	1	2	3	3	3	-	-
CO5	3	3	3	2	2	1	1	1	3	2	1	2	3	2	2	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP804ET**	**Title of the Course**	**PHARMACEUTI CAL REGULATORY SCIENCE**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Know about the process of drug discovery and development 2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals 3. Know the regulatory approval process and their registration in Indian and international markets							

Course Outcomes	
CO1	Understand the concepts of innovator and generic drugs, drug development process.
CO2	Know the regulatory guidance's and guidelines for filing and approval process, preparation of dossiers and their submission to regulatory agencies in different countries.
CO3	Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals and the submission of global documents in CTD/ eCTD, ASEAN formats.
CO4	Understand the clinical trials requirements for approvals for conducting clinical trials, pharmacovigilance and process of monitoring in clinical trials.
CO5	Knowledge of basic terminology, regulatory guidance's, guidelines, laws and acts.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**New Drug 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.	10	1	16.5 16.10 16.b
2	**Regulatory Approval Process** **Regulatory authorities and agencies**	Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. Overview of regulatory authorities of India, United States, European Union, Australia,Japan, Canada (Organization structure and types of applications)	10	2	16.1 16.5 16.b
3	**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	10	3	16.3 16.b 16.10
4	**Clinical trials**	Developing clinical trial 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.	8	4	16.1 16.3 16.7 16.b
5	**Regulatory Concepts**	Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book	7	5	16.10 16.b

Reference Books:

Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.

The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Healthcare Publishers

New Drug Approval Process: Accelerating Global Registrations By Richard AGuarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190

Guidebook for drug regulatory submissions / SandyWeinberg. By John Wiley & Sons. Inc.

FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.

Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143

Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams

Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene

Drugs: From Discovery to Approval, Second Edition By Rick Ng

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	2	2	2	3	2	1	2	3	3	-	-	-	-	-	-
CO2	3	2	2	2	2	3	2	1	2	3	3	-	-	-	-	-	-
CO3	3	2	2	2	2	3	2	1	2	3	3	-	-	-	-	-	-

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CO4	3	2	2	2	2	3	2	1	2	3	3	-	-	-	-	-	-
CO5	3	2	2	2	2	3	2	1	2	3	3	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP805ET**	**Title of the Course**	**PHARMACOVIGILANCE**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		6	2	-	8
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	**1.** This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. **2.** This paper also develops the skills of classifying drugs, diseases and adverse drug reactions. **3.** ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning , CIOMS requirements for ADR reporting, Writing case narratives of adverse events and their quality.							

Course Outcomes	
CO1	Understand the national as well as international significance of Pharmacovigilance.
CO2	Implement and spread awareness about drug safety.
CO3	Identify, analyze and classify the types of ADRs.
CO4	Able to prepare ADR report as per international guidelines using Standard terminologies.
CO5	Understand preclinical, clinical and post approval phases of a new drug.

UnitNo.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO	SDG Targets
1	**Introduction to Pharmacovigilance, Introduction to adverse drug reactions, Basic terminologies used in pharmacovigilance**	History and development of Pharmacovigilance, Importance of safety monitoring of Medicine, WHO international drug monitoring programme, Pharmacovigilance Program of India(PvPI), Definitions and classification of ADRs, Detection and reporting, Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment, Management of adverse drug reactions, Terminologies of adverse medication related events, Regulatory terminologies	10	1	3.8, 3.b
2	**Drug and disease classification, Drug dictionaries and Coding in pharmacovigilance, Information Resources in Pharmacovigilance, Establishing pharmacovigilance programme**	Anatomical, therapeutic and chemical classification of drugs, International classification of diseases, Daily defined dose, International Non proprietary Names for drugs, WHO adverse reaction terminologies, MedDRA and Standardised MedDRA queries, WHO drug dictionary, Eudravigilance medicinal product dictionary, Basic drug information resources, Specialised resources for ADRs, Establishing in a hospital Establishment & operation of drug safety department in industry, Contract Research Organisations (CROs), Establishing a national programme	10	2	3.8, 3.b
3	**Vaccine safety surveillance, Pharmacovigilance methods, Communication in pharmacovigilance**	Vaccine Pharmacovigilance, Vaccination failure, Adverse events following immunization, 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, Effective communication in Pharmacovigilance, Communication in Drug Safety Crisis management, Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media	10	3	3.8, 3.b
4	**Safety data generation, ICH Guidelines for Pharmacovigilance**	Pre clinical phase, Clinical phase,Post approval phase (PMS), Organization and objectives of ICH, Expedited reporting, Individual case safety reports, Periodic safety update reports,Post approval expedited reporting, Pharmacovigilance planning, Good clinical practice in pharmacovigilance studies	8	4	3.8, 3.b
5	**Pharmacogenomics of adverse drug reactions, Drug safety evaluation in special population, CIOMS, CDSCO (India) and Pharmacovigilance**	Genetics related ADR with example focusing PK parameters. Paediatrics, Pregnancy and lactation, Geriatrics, CIOMS Working Groups, CIOMS Form, D&C Act and Schedule Y, Differences in Indian and global pharmacovigilance requirements	7	5	3.8, 3.b

Reference Books:

Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.

Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.

Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.

Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.

An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.

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

Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,Wiley Publishers

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A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G Parthasarathi, Karin NyfortHansen,Milap C. Nahata
National Formulary of India
Text Book of Medicine by Yashpal Munjal
Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
e-Learning Source:
http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=729
http://www.ich.org/
http://www.cioms.ch/
http://cdsco.nic.in/
http://www.who.int/vaccine_safety/en/
http://www.ipc.gov.in/PvPI/pv_home.html

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	-	1	1	1	2	2	1	1	2	3	3	2	3	-	-	-
CO2	3	2	3	1	1	2	-	3	3	-	2	3	1	2	-	-	-
CO3	3	3	2	3	1	2	-	3	2	-	2	2	3	3	-	-	-
CO4	2	2	3	1	1	2	-	2	3	2	3	3	3	3	-	-	-
CO5	3	3	3	1	1	2	2	3	2	-	3	3	3	2	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP806ET**	**Title of the Course**	**QUALITY CONTROL AND STANDARDIZATION OF HERBALS**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	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	Gain knowledge on biological source, active constituents and uses of crude drugs Understand the techniques of evaluation of crude drugs as per the WHO guidelines
CO2	Understand the basic principles of cultivation, collection and storage of crude drugs Application of the crop improvement concepts involved in techniques for improvement of quality of medicinal plants
CO3	Exploring the tissue culture technique in medicinal plants
CO4	Appreciate the applications of Primary &Secondary metabolites of the plant and explore its medicinal importance based on its chemical class Understand the principles and application of different system of alternative medicine
CO5	Explore novel medicinal agents from different sources of natural origin

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Basic tests for drugs**	Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use	10	1	
2	**Basic tests for drugs**	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 GACP for Medicinal Plants	10	2	
3	**ICH guidelines**	EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines	10	3	
4	**Stability testing of herbal medicines**	Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products. Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions	8	4	
5	**Pharmacovigilance systems**	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	7	5	

Reference Books:

Pharmacognosy by Trease and Evans

Pharmacognosy by Kokate, Purohit and Gokhale

Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub., 2006

Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002

EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products

Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002

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.

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.

WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.

WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.

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

WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

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https://www.google.co.in/books/edition/Intermediate_Organic_Chemistry/2YdxBgAAQBAJ?hl=en&gbpv=1&dq=organic+chemistry&printsec=frontcover

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	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	2	1	1	-	-	-	1	3	3	-	-	-	-	-	-
CO2	3	-	2	2	-	-	1	1	2	2	2	-	-	-	-	-	-
CO3	3	2	2	3	-	3	2	1	2	-	2	-	-	-	-	-	-
CO4	2	-	3	2	1	-	-	1	-	-	2	-	-	-	-	-	-
CO5	3	1	2	-	-	1	-	1	-	2	2	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP807ET**	**Title of the Course**	**COMPUTER AIDED DRUG DESIGN**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Design and discovery of lead molecules 2. The role of drug design in drug discovery process 3. The concept of QSAR and docking 4. Various strategies to develop new drug like molecules. 5. The design of new drug molecules using molecular modeling software							

Course Outcomes	
CO1	Understand the process of Design and discovery of lead molecules
CO2	Appreciate the role of drug design in drug discovery process
CO3	Understand and apply the concept of QSAR and docking
CO4	Apply various strategies to develop new drug like molecules
CO5	Understand the designing of new drug molecules using molecular modeling software
CO6	Appreciate importance of computational methods in drug design and discovery processes

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Introduction to Drug Discovery and Development** **Lead discovery and Analog Based Drug Design** **Analog Based Drug Design**	Stages of drug discovery and development. Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation. Bioisosterism, Classification, Bioisosteric replacement. Any three case studies	10	1	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
2	**Quantitative Structure Activity Relationship (QSAR)**	SAR versus QSAR, History and development of QSAR, Types of 109hysic chemical parameters, experimental and theoretical approaches for the determination of 109hysic chemical 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.	10	2	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
3	**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	10	3	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
4	**Informatics & Methods in drug design**	Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.	8	4	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
5	**Molecular Modeling:**	Introduction to molecular mechanics and quantum mechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination.	7	5	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b

Reference Books:

Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore

Martin YC. "Quantitative Drug Design" Dekker, New York.

Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.

Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.

Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.

Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" JohnWiley& Sons, New York.

Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.

Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston

Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.

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https://www.masterorganicchemistry.com/

https://www.google.co.in/books/edition/Advanced_Practical_Organic_Chemistry_Thi/lpv9D2hin6gC?hl=en&gbpv=1&dq=organic+chemistry&printsec=frontcover

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https://www.google.co.in/books/edition/Intermediate_Organic_Chemistry/2YdxBgAAQBAJ?hl=en&gbpv=1&dq=organic+chemistry&printsec=frontcover

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	3	3	2	2	3	3	2	3	2	-	-	-	-	-	-
CO2	3	2	3	3	2	2	3	3	2	3	2	-	-	-	-	-	-
CO3	3	2	3	3	2	2	3	3	2	3	2	-	-	-	-	-	-
CO4	3	2	3	3	2	2	3	3	2	3	2	-	-	-	-	-	-
CO5	3	2	3	3	2	2	3	3	2	3	2	-	-	-	-	-	-
CO6																	

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP808ET**	**Title of the Course**	**CELL & MOLECULAR BIOLOGY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Summarize cell and molecular biology history. 2. Summarize cellular functioning and composition. 3. Describe the chemical foundations of cell biology. 4. Summarize the DNA properties of cell biology. 5. Describe protein structure and function 6. Describe cellular membrane structure and function 7. Describe basic molecular genetic mechanisms. 8. Summarize the Cell Cycle							

Course Outcomes	
CO1	Understanding the history of cell and molecular biology, cellular functioning and composition and chemical foundations of cell biology.
CO2	Understanding about DNA and RNA and their functioning.
CO3	Students able to Describe protein structure and function, Protein Synthesis
CO4	Know the basic molecular genetic mechanisms.
CO5	Summarize the Cell Cycle including Cell Signals, Receptors for Cell Signals, Signaling Pathways

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Cell and Molecular Biology**	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)	10	1	
2	**DNA and RNA**	a) DNA and the Flow of Molecular Information b) DNA Functioning c) DNA and RNA d) Types of RNA e) Transcription and Translation	10	2	
3	**Proteins**	a) Proteins: Defined **and** Amino Acids b) Protein Structure c) Regularities in Protein Pathways d) Cellular Processes e) Positive Control and significance of Protein Synthesis	10	3	
4	**Genetics**	a) Science of Genetics b) Transgenics and Genomic Analysis c) Cell Cycle analysis d) Mitosis and Meiosis e) Cellular Activities and Checkpoints	8	4	
5	**Cell Signals**	a) Cell Signals: Introduction b) Receptors for Cell Signals c) Signaling Pathways: Overview d) Misregulation of Signaling Pathways e) Protein-Kinases: Functioning	7	5	

Reference Books:

W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.

Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers &Distributors, Delhi.

Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.

Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology

Rose: Industrial Microbiology

Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan

Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution

Peppler: Microbial Technology.

Edward: Fundamentals of Microbiology.

N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi

Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.

RA Goldshy et. al., : Kuby Immunology.

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https://www.google.co.in/books/edition/Intermediate_Organic_Chemistry/2YdxBgAAQBAJ?hl=en&gbpv=1&dq=organic+chemistry&printsec=frontcover

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	1	1	3	1	2	2	1	2	1	1	-	-	-	-	-	-
CO2	3	2	2	3	1	2	2	1	2	1	1	-	-	-	-	-	-
CO3	3	2	2	3	1	2	2	1	2	2	1	-	--	-	-	-	-
CO4	3	1	1	2	1	1	2	1	2	2	1	-	-	-	-	-	-
CO5	3	1	1	3	1	2	2	1	2	1	1	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP809ET**	**Title of the Course**	**COSMETIC SCIENCE**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Key ingredients used in cosmetics and cosmeceuticals 2. Key building blocks of cosmetics for various formulations 3. Scientific principles to develop cosmetics and cosmeceuticals with desired safety							

Course Outcomes	
CO1	Gain information on key ingredients used in cosmetics and cosmeceuticals
CO2	Understand key building blocks of cosmetics for various formulations
CO3	Know the current technologies in the market
CO4	Understand the scientific principles to develop cosmetics and cosmeceuticals with desired safety
CO5	Know the various problems induced due to cosmetics

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Classification, definition, cosmetic, excipients.**	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 excipient: Surfactant, rheology modifiers, humectant, 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.	10	1	9.1 9.5
2	**Principles of formulation and building blocks of skin care products.**	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 cosmeceuticals. Antiperspirants & deodorants: Actives & mechanism of action. Principle of formulation and building block of hair care products: Conditioning shampoo, hair conditioner, antidandruff shampoo, hair oils. Chemistry and formulation of paraphenylenediamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth, teeth whitening, mouthwash.	10	2	9.1 9.5 9.b
3	**Classification of sunscreens and SPF. Role of herbs in cosmetics. Analytical cosmetics.**	**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.**	10	3	9.1 9.5
4	**Principle of cosmetic evaluation**	Principle of cosmetic evaluation: Principle of sebumeter, corneometer. Measurement of TEWL, skin color, hair tensile strength, hair combing properties, soaps, and syndet bars. Evaluation and skin benefits.	8	4	9.1 9.5
5	**Cosmetic problems associated with hair, scalp and skin. Antiperspirants and deodorants.**	Oily and dry skin, causes leading to dry skin, skin moisturisation. 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.	7	5	9.5 9.b

Reference Books:

Harry's Cosmeticology, Wilkinson, Moore. Seventh Edition, George Godwin.

Cosmetics - Formulations, Manufacturing and Quality Control. P.P. Sharma, 4th Edition. Vandana Publications Pvt. Ltd., Delhi.

Text book of cosmelicology by Sanju Nanda & Roop K. Khar. Tata Publishers.

e-Learning Source:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6188460/

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)															
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**

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CO1	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO2	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO3	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO4	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO5	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP810ET**	**Title of the Course**	**EXPERIMENTAL PHARMACOLOGY**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Appreciate the applications of various commonly used laboratory animals 2. Appreciate and demonstrate the various screening methods used in pre clinical research 3. Appreciate and demonstrate the importance of biostatistics and research methodology 4. Design and execute a research hypothesis independently							

Course Outcomes	
CO1	Appreciate the knowledge gained on pre clinical evaluation of drugs and recent experimental techniques in the drug discovery and development.
CO2	Understood the various laboratory animals and their maintenance as per the guidelines and also describe good laboratory practices in maintenance and handling of experimental animals.
CO3	Appraised the regulations and ethical requirement for the usage of experimental animals.
CO4	Learnt and describe the various pre clinical screening methods (in-vitro and in-vivo) involved in the drug discovery process.
CO5	Correlate the pre clinical data to human's clinical data.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Laboratory animals**	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.	8	1	
2	**Introduction: Pre clinical screening models**	Pre clinical screening models: 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, and alzheimer's disease.	10	2	
3	**Pre clinical screening models for ANS activity**	Preclinical screening models for ANS activity: sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics.	8	3	
4	**Pre clinical screening models for CVS activity**	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.	8	4	
5	**Research methodology and bio-statistics**	Research methodology and bio-statistics. 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	5	5	

Reference Books:

Fundamentals of experimental pharmacology by M N Ghosh.

Hand book of experimental pharmacology by S K Kulakarni.

CPCSEA guidelines for laboratory animal facility.

Drug discovery and evaluation by Vogel H G.

Drug screening methods by Suresh Kumar Gupta and S K Gupta.

Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard.

e-Learning Source:

https://cpcsea.nic.in/WriteReadData/userfiles/file/SOP_CPCSEA_inner_page.pdf

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)															
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**

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CO																	
CO1	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO2	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO3	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO4	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO5	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	**BP811ET**	**Title of the Course**	**ADVANCED INSTRUMENTATION TECHNIQUES**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. To understand the advanced instruments used and its applications in drug analysis. 2. To understand the chromatographic separation and analysis of drugs. 3. To understand the calibration of various analytical instruments. 4. To know analysis of drugs using various analytical instruments.							

Course Outcomes	
CO1	Investigate the pharmaceutical substances by NMR spectroscopy and mass spectrometry.
CO2	Analyze the essentials of thermal methods of analysis and X ray diffraction methods.
CO3	Apprehend the calibration and validation of analytical instruments.
CO4	Recognize the fundamentals of radioimmunoassay and extraction techniques.
CO5	Deal with the fundamentals of hyphenated techniques.

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Nuclear magnetic resonance spectroscopy, Mass spectrometry**	Nuclear magnetic resonance spectroscopy: Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, spin - spin coupling, relaxation, instrumentation and applications. Mass spectrometry: Principles, fragmentation, ionization techniques - Electron impact, chemical ionization, MALDI, FAB. Analyzers - Time of flight and quadrupole, instrumentation, applications.	10	1	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
2	**Thermal methods of analysis, X-ray diffraction methods**	Thermal methods of analysis: Principles, instrumentation and applications of thermogravimetric analysis (TGA), Differential thermal analysis (DTA), Differential scanning calorimetry (DSC). X-ray diffraction methods: Origin of X-rays, basic aspects of crystals, X-ray crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.	10	2	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
3	**Calibration and validation as per ICH and USFDA guidelines**	Calibration and validation as per ICH and USFDA guidelines. Calibration of following Instruments: Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame photometer, HPLC and GC.	10	3	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
4	**Radioimmunoassay, Extraction techniques**	Radioimmunoassay: Importance, various components, principle, different methods, limitation and applications of radio immuno assay. Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid - liquid extraction.	8	4	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b
5	**Hyphenated techniques**	Hyphenated techniques - LC-MS/MS, GC-MS/MS, HPTLC-MS.	7	5	4.3,4.4,4.5,4.6,4.7, 4.c, 9.2, 9.4, 9.5, 9.b

Reference Books:

Instrumental methods of chemical analysis by B K Sharma.

Organic spectroscopy by Y R Sharma.

Text book of pharmaceutical analysis by Kenneth A Connors.

Vogel's text book of quantitative chemical analysis by A I Vogel.

Practical pharmaceutical chemistry by A H Beckett and J B Stenlake.

Organic chemistry by I L Finar.

Organic spectroscopy by William Kemp.

Quantitative analysis of drugs by D C Garrett

Quantitative analysis of drugs in pharmaceutical formulations by P D Sethi.

Spectrophotometric identification of organic compounds by Silverstein.

e-Learning Source:

https://www.google.com/search?q=Nuclear+magnetic+resonance+spectroscopy+research+article&sxsrf=ALiCzsaSX1-lUmnGqpxRQbGaI6loXv5xaQ%3A1671859588931&ei=hI2mY7e7OInh4-EPwIC38A0&ved=0ahUKEwi3jaanwpH8AhWJ8DgGHUDADd4Q4dUDCA8&uact=5&oq=Nuclear+magnetic+resonance+spectroscopy+research+article&gs_lcp=Cgxnd3Mtd2l6LXNlcnAQAzIFCAAQogQyBQgAEKIEMgUIABCiBDIFCAAQogQyBQgAEKIEOgoIABBHENYEELADOgcIIxCwAhAnOgoIABCABBCxAxANOgcIABCABBANOgYIABAHEB46BAgjECc6BwgAELEDEEM6CgghEMMEEAoQoAFKBAhBGABKBAhGGABQ7gRY3BFgtRRoAXABeACAAeACiAG4CJIBBTItMy4xmAEAoAEBoAECyAEIwAEB&sclient=gws-wiz-serp

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)

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PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO2	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO3	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO4	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO5	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**BP812ET**	**Title of the Course**	**DIETARY SUPPLEMENTS & NUTRACEUTICALS**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	1. Understand the need of supplements by the different group of people to maintain healthy life. 2. Understand the outcome of deficiencies in dietary supplements. 3. Appreciate the components in dietary supplements and their application. 4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.							

Course Outcomes	
CO1	Define and classify nutraceuticals, functional foods and dietary supplements and role of nutraceuticals in prevention or cure various diseases.
CO2	Describe about source, chemistry and medicinal uses of several natural nutraceuticals.
CO3	Understand free radicals production and its damaging reactions on lipids, proteins, carbohydrates, nucleic acids and study about Dietary fibres and complex carbohydrates.
CO4	Explain the role of free radicals in development of chronic diseases, aging and the role of natural and synthetic antioxidants, functional foods in prevention of chronic diseases.
CO5	Recognize the effects of processing, storage, environmental factors and regulatory aspects for maintaining quality of nutraceuticals..

UnitNo.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**	**SDG Targets**
1	**Definition of functional foods, Public health nutrition**	Definition 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.	7	1	
2	**Phytochemicals as nutraceuticals**	Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following: Carotenoids - α and β Carotene, Lycopene, Xanthophylls, leutin SULFIDES: Diallyl sulfides, Allyl trisulfide. Polyphenolics: Reservetrol Flavonoids - Rutin, Naringin, Quercitin, Anthocyanidins, catechins, Flavones. Prebiotics/Probiotics: Fructo oligosaccharides, Lacto bacillum Phyto estrogens: Isoflavones, daidzein, Geebustin, lignans Tocopherols Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.	15	2	
3	**Introduction to free radicals, Dietary fibre and complex carbohydrates**	Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, carbohydrates, nucleic acids. Dietary fibres and complex carbohydrates as functional food ingredients.	7	3	
4	**Free radicals, Antioxidants, Synthetic antioxidants, Functional foods**	Free radicals in diabetes mellitus, inflammation, ischemic reperfusion injury, cancer, atherosclerosis, free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing. Antioxidants: Endogenous antioxidants - enzymatic and nonenzymatic antioxidant defence, superoxide dismutase, catalase, glutathione peroxidase, glutathione, Vitamin C, Vitamin E, α- Lipoic acid, melatonin. Synthetic antioxidants: Butylated hydroxy toluene, Butylated hydroxy anisole. Functional foods for chronic disease prevention	10	4	
5	**Nutraceutical, Regulatory aspects, Pharmacopoeial specifications**	Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. Regulatory aspects: FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on food safety. Adulteration of foods. Pharmacopoeial specifications for dietary supplements and nutraceuticals.	6	5	

Reference Books:

Dietetics by Sri Lakshmi

Role of dietary fibres and neutraceuticals in preventing diseases by K T Agusti and P Faizal: B S Punblication.

Advanced nutritional therapies by Cooper K. A. (1996).

The food pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).

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Prescription for nutritional healing by James F Balch and Phyllis A Balch 2nd Edn., Avery Publishing Group, NY (1997).
G Gibson and C williams Editors. *2000 Functional foods.* Woodhead Publ.Co.London.
Goldberg I. *Functional Foods*. 1994. Chapman and Hall, New York.
Labuza, T P. 2000 Functional Foods and Dietary Supplements: Safety, good manufacturing practice (GMPs) and shelf life testing in *Essentials of Functional Foods M K Sachmidl and T P Labuza eds. Aspen Press.*
Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger.
e-Learning Source:

	Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO2	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO3	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO4	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-
CO5	3	3	3	1	1	3	3	3	2	3	3	-	-	-	-	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**

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Effective from Session: 2020-21								
Course Code	**BP813ET**	**Title of the Course**	**PHARMACEUTICAL PRODUCT DEVELOPMENT**	**SDG Goals**	**L**	**T**	**P**	**C**
Year	`IV	**Semester**	VIII		3	1	-	4
Pre-Requisite	10+2 (PCM/PCB)	**Co-requisite**						
Course Objective	5. Understand the need of supplements by the different group of people to maintain healthy life. 6. Understand the outcome of deficiencies in dietary supplements. 7. Appreciate the components in dietary supplements and their application. 8. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.							

Course Outcomes	
CO1	Explain pharmaceutical product development and regulations related to preformulation
CO2	Know pharmaceutical excipients – semi solid dosage form
CO3	Discuss about pharmaceutical excipients – solid dosage forms, liquid dosage forms and NDDS
CO4	Improve pharmaceutical product development by Optimization and quality by design (QbD) techniques
CO5	Discuss about Pharmaceutical packaging and their regulatory considerations.

UnitNo.	**Title of the Unit**	**Content of Unit**	**ContactHrs.**	**Mapped CO**	**SDG Targets**
1	**Introduction to pharmaceutical product development and regulations**	Introduction to pharmaceutical product development, objectives, and regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms.	10	1	9.5 9.b
2	**Introduction to pharmaceutical product development for semi solid preparations**	An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories: Solvents and solubilizers. Cyclodextrins and their applications. Non - ionic surfactants and their applications. Polyethylene glycols and sorbitols. Suspending and emulsifying agents. Semi solid excipients.	10	2	9.1 9.5
3	**Introduction to pharmaceutical product development for solid preparations**	An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories: Tablet and capsule excipients. Directly compressible vehicles. Coat materials. Excipients in parenteral and aerosols products. Excipients for formulation of NDDS. Selection and application of excipients for pharmaceutical formulations, with specific industrial applications.	10	3	9.5 9.b
4	**Optimization techniques in pharmaceutical product development & study of QbD**	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.	8	4	9.1 9.5 9.b
5	**Packaging materials & regulatory considerations**	Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.	7	5	9.5 9.b

Reference Books:

Pharmaceutical Statistics Practical and Clinical Applications by Stanford Bolton, Charles Bon; Marcel Dekker Inc., USA.

Encyclopaedia of Pharmaceutical Technology, edited by James Swarbrick, Third Edition, Informa Healthcare publishers.

Pharmaceutical Dosage Forms – Tablets Vol 1 to 3, by A. Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., USA

Pharmaceutical Dosage Forms – Disperse Systems Vol 1 to 3, by H.A. Liberman, Martin, M.R and Gilbert S. Banker, Marcel Dekker Inc., USA.

Pharmaceutical Dosage Forms – Parenteral Medication Vol 1 & 2, by Kenneth E. Avis and H.A. Liebermann, Marcel Dekker Inc., USA.

The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by Roop K Khar, S P Vyas, Farhan J Ahmad, Gaurav K Jain; CBS Publishers and Distributors Pvt. Ltd. 2013.

Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, edited by Patrick J. Sinko, Lippincott Williams & Wilkins, USA.

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.

Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems by Loyd V. Allen, Jr., N.G. Popovich and H. C. Ansel, Lippincott Williams & Wilkins, USA.

Aulton's Pharmaceutics – The Design and Manufacture of Medicines by Michael E. Aulton, 3rd Ed., Churchill Livingstone, UK.

e-Learning Source:

https://www.google.co.in/books/edition/Pharmaceutical_Drug_Product_Development/cinhDwAAQBAJ?hl=en&gbpv=1&dq=PHARMACEUTICAL+PRODUCT+DEVELOPMENT&printsec=frontcover

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CO1	1	-	3	3	3	3	-	-	-	-	-	-	3	3	3	-	-
CO2	1	-	3	2	3	3	-	-	-	-	-	-	3	3	3	-	-
CO3	1	-	3	2	3	3	-	-	-	-	-	-	3	3	3	-	-
CO4	1	-	3	2	3	3	-	-	-	-	-	-	3	3	3	-	-
CO5	1	-	3	3	3	3	-	-	-	-	-	-	3	3	3	-	-

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HOD**