“KAR BHALA HOGA BHALA”

KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR

(Established vide Gujarat State Government Act 21 of 2007 and approved by UGC (ref F.9-18/2008(cpp-1) March 19, 2009)

ACADEMIC REGULATIONS & SYLLABUS

BACHELOR OF PHARMACY

EFFECTIVE FROM JUNE-2017

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION & RESEARCH

GH-6, SECTOR-23, KADI CAMPUS, GANDHINAGAR-382023.

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PRINCIPAL **H.O.D.**

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KADI SARVA VISHWAVIDYALAYA
K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH
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BACHELOR OF PHARMACY SYLLABUS

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SEMESTER-I

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP101T	Human Anatomy and Physiology I– Theory	3	-	1	4	-
BP102T	Pharmaceutical Analysis I – Theory	3	-	1	4	-
BP103T	Pharmaceutics I – Theory	3	-	1	4	-
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3		1	4	-
BP105T	Communication skills – Theory *	2	-	-	2	-
BP106RBT	Remedial Biology/	2	-	-	2	–
BP106RMT	Remedial Mathematics – Theory*			-		
BP107P	Human Anatomy and Physiology I– Practical	-	4	-	-	2
BP108P	Pharmaceutical Analysis I – Practical	-	4	-	-	2
BP109P	Pharmaceutics I – Practical	-	4	-	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	-	4	-	-	2
BP111P	Communication skills – Practical*	-	2	-	-	1
BP112RBP	Remedial Biology – Practical*	-	2	-	-	1
Total		**32/34$/36#**		**4**	**27/29$/30#**	

#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course.

$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course.

* Non-University Examination (NUE)

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SEMESTER-II

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP201T	Human Anatomy and Physiology II – Theory	3	-	1	4	-
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	-	1	4	-
BP203T	Biochemistry – Theory	3	-	1	4	-
BP204T	Pathophysiology – Theory	3	-	1	4	-
BP205T	Computer Applications in Pharmacy – Theory *	3	-	-	3	-
BP206T	Environmental sciences – Theory *	3	-	-	3	-
BP207P	Human Anatomy and Physiology II –Practical	-	4	-	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	-	4	-	-	2
BP209P	Biochemistry – Practical	-	4	-	-	2
BP210P	Computer Applications in Pharmacy – Practical*	-	2	-	-	1
Total		32		4	29	

*Non-University Examination (NUE)

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SEMESTER-III

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	-	1	4	-
BP302T	Physical Pharmaceutics I – Theory	3	-	1	4	-
BP303T	Pharmaceutical Microbiology – Theory	3	-	1	4	-
BP304T	Pharmaceutical Engineering – Theory	3	-	1	4	-
BP305P	Pharmaceutical Organic Chemistry II – Practical	-	4	-	-	2
BP306P	Physical Pharmaceutics I – Practical	-	4	-	-	2
BP307P	Pharmaceutical Microbiology – Practical	-	4	-	-	2
BP308P	Pharmaceutical Engineering – Practical	-	4	-	-	2
Total		28		4	24	

KADI SARVA VISHWAVIDYALAYA

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SEMESTER-IV

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	-	1	4	-
BP402T	Medicinal Chemistry I – Theory	3	-	1	4	-
BP403T	Physical Pharmaceutics II – Theory	3	-	1	4	-
BP404T	Pharmacology I – Theory	3	-	1	4	-
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	-	1	4	-
BP406P	Medicinal Chemistry I – Practical	-	4	-	-	2
BP407P	Physical Pharmaceutics II – Practical	-	4	-	-	2
BP408P	Pharmacology I – Practical	-	4	-	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	-	4	-	-	2
Total		31		5	28	

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SEMESTER-V

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP501T	Medicinal Chemistry II – Theory	3	-	1	4	-
BP502T	Industrial Pharmacy I– Theory	3	-	1	4	-
BP503T	Pharmacology II – Theory	3	-	1	4	-
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	-	1	4	-
BP505T	Pharmaceutical Jurisprudence – Theory	3	-	1	4	-
BP506P	Industrial Pharmacy I – Practical	-	4	-	-	2
BP507P	Pharmacology II – Practical	-	4	-	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	-	4	-	-	2
Total		27		5	26	

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SEMESTER-VI

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP601T	Medicinal Chemistry III – Theory	3	-	1	4	-
BP602T	Pharmacology III – Theory	3	-	1	4	-
BP603T	Herbal Drug Technology – Theory	3	-	1	4	-
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	-	1	4	-
BP605T	Pharmaceutical Biotechnology – Theory	3	-	1	4	-
BP606T	Quality Assurance –Theory	3	-	1	4	-
BP607P	Medicinal Chemistry III – Practical	-	4	-	-	2
BP608P	Pharmacology III – Practical	-	4	-	-	2
BP609P	Herbal Drug Technology – Practical	-	4	-	-	2
Total		30		6	30	

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SEMESTER-VII

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP701T	Instrumental Methods of Analysis – Theory	3	-	1	4	-
BP702T	Industrial Pharmacy II – Theory	3	-	1	4	-
BP703T	Pharmacy Practice – Theory	3	-	1	4	-
BP704T	Novel Drug Delivery System – Theory	3	-	1	4	-
BP705P	Instrumental Methods of Analysis – Practical	-	4	-	-	2
BP706PS	Practice School*	-	12	-	-	6
Total		28		4	24	

***** Non-University Examination (NUE)

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SEMESTER-VIII

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP801T	Biostatistics and Research Methodology - Theory	3	-	1	4	-
BP802T	Social and Preventive Pharmacy - Theory	3	-	1	4	-
BP803ET	Pharma Marketing Management - Theory	3+3	-	1+1	4+4	-
BP804ET	Pharmaceutical Regulatory Science - Theory		-			-
BP805ET	Pharmacovigilance - Theory		-			-
BP806ET	Quality Control and Standardization of Herbals - Theory		-			-
BP807ET	Computer Aided Drug Design - Theory		-			-
BP808ET	Cell and Molecular Biology - Theory		-			-
BP809ET	Cosmetic Science - Theory		-			-
BP810ET	Pharmacological Screening Methods - Theory		-			-
BP811ET	Advanced Instrumentation Techniques - Theory		-			-
BP812ET	Dietary Supplements and Nutraceuticals - Theory		-			-
BP813ET	Pharmaceutical Product Development - Theory		-			-
BP814PW	Project Work	-	12	-	-	6
Total		24		4	22	

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SEMESTER-I

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP101T	Human Anatomy and Physiology I– Theory	3	--	25	--	75	--	100
BP102T	Pharmaceutical Analysis I – Theory	3	--	25	--	75	--	100
BP103T	Pharmaceutics I – Theory	3	--	25	--	75	--	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	--	25	--	75	--	100
BP105T	Communication skills – Theory *	1.5	--	15	--	35	--	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory*	1.5	--	15	--	35	--	50
BP107P	Human Anatomy and Physiology I– Practical	--	4	--	15	--	35	50
BP108P	Pharmaceutical Analysis I – Practical	--	4	--	15	--	35	50
BP109P	Pharmaceutics I – Practical	--	4	--	15	--	35	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	--	4	--	15	--	35	50
BP111P	Communication skills – Practical*	--	2	--	10	--	15	25
BP112RBP	Remedial Biology – Practical*	--	2	--	10	--	15	25
Total		31.5/33[$]/35[#]		185/200[$]/210		490/525[$]/540[#]		675/725[$]/750[#]

[#]Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course**.**

[$]Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course**.**

* Non-University Examination (NUE)

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SEMESTER-II

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP201T	Human Anatomy and Physiology II – Theory	3	--	25	--	75	--	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	--	25	--	75	--	100
BP203T	Biochemistry – Theory	3	--	25	--	75	--	100
BP204T	Pathophysiology – Theory	3	--	25	--	75	--	100
BP205T	Computer Applications in Pharmacy – Theory *	2	--	25	--	50	--	75
BP206T	Environmental sciences – Theory *	2	--	25	--	50	--	75
BP207P	Human Anatomy and Physiology II –Practical	--	4	--	15	--	35	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	--	4	--	15	--	35	50
BP209P	Biochemistry – Practical	--	4	--	15	--	35	50
BP210P	Computer Applications in Pharmacy – Practical*	--	2	--	10	--	15	25
Total		30		205		520		725

*Non-University Examination (NUE)

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SEMESTER-III

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	--	25	--	75	--	100
BP302T	Physical Pharmaceutics I – Theory	3	--	25	--	75	--	100
BP303T	Pharmaceutical Microbiology – Theory	3	--	25	--	75	--	100
BP304T	Pharmaceutical Engineering – Theory	3	--	25	--	75	--	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	--	4	--	15	--	35	50
BP306P	Physical Pharmaceutics I – Practical	--	4	--	15	--	35	50
BP307P	Pharmaceutical Microbiology – Practical	--	4	--	15	--	35	50
BP308P	Pharmaceutical Engineering – Practical	--	4	--	15	--	35	50
Total		28		160		440		600

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SEMESTER-IV

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	--	25	--	75	--	100
BP402T	Medicinal Chemistry I – Theory	3	--	25	--	75	--	100
BP403T	Physical Pharmaceutics II – Theory	3	--	25	--	75	--	100
BP404T	Pharmacology I – Theory	3	--	25	--	75	--	100
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	--	25	--	75	--	100
BP406P	Medicinal Chemistry I – Practical	--	4	--	15	--	35	50
BP407P	Physical Pharmaceutics II – Practical	--	4	--	15	--	35	50
BP408P	Pharmacology I – Practical	--	4	--	15	--	35	50
BP409P	Pharmacognosy and Phytochemistry I – Practical	--	4	--	15	--	35	50
Total		31		185		515		700

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SEMESTER-V

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP501T	Medicinal Chemistry II – Theory	3	--	25	--	75	--	100
BP502T	Industrial Pharmacy I– Theory	3	--	25	--	75	--	100
BP503T	Pharmacology II – Theory	3	--	25	--	75	--	100
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	--	25	--	75	--	100
BP505T	Pharmaceutical Jurisprudence – Theory	3	--	25	--	75	--	100
BP506P	Industrial Pharmacy I – Practical	--	4	--	15	--	35	50
BP507P	Pharmacology II – Practical	--	4	--	15	--	35	50
BP508P	Pharmacognosy and Phytochemistry II – Practical	--	4	--	15	--	35	50
Total		27		170		480		650

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SEMESTER-VI

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP601T	Medicinal Chemistry III – Theory	3	--	25	--	75	--	100
BP602T	Pharmacology III – Theory	3	--	25	--	75	--	100
BP603T	Herbal Drug Technology – Theory	3	--	25	--	75	--	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	--	25	--	75	--	100
BP605T	Pharmaceutical Biotechnology – Theory	3	--	25	--	75	--	100
BP606T	Quality Assurance –Theory	3	--	25	--	75	--	100
BP607P	Medicinal chemistry III – Practical	--	4	--	15	--	35	50
BP608P	Pharmacology III – Practical	--	4	--	15	--	35	50
BP609P	Herbal Drug Technology – Practical	--	4	--	15	--	35	50
Total		30		195		555		750

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SEMESTER-VII

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP701T	Instrumental Methods of Analysis – Theory	3	--	25	--	75	--	100
BP702T	Industrial Pharmacy II – Theory	3	--	25	--	75	--	100
BP703T	Pharmacy Practice – Theory	3	--	25	--	75	--	100
BP704T	Novel Drug Delivery System – Theory	3	--	25	--	75	--	100
BP705P	Instrumental Methods of Analysis – Practical	--	4	--	15	--	35	50
BP706PS	Practice School*	5	--	--	25	--	125	150
Total		21		140		460		600

***** The subject experts at college level shall conduct examinations

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SEMESTER-VIII

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP801T	Biostatistics and Research Methodology - Theory	3	--	25	--	75	--	100
BP802T	Social and Preventive Pharmacy - Theory	3	--	25	--	75	--	100
BP803ET	Pharma Marketing Management - Theory	3+3	--	25+25	--	75+75	--	100+100
BP804ET	Pharmaceutical Regulatory Science - Theory		--		--		--	
BP805ET	Pharmacovigilance - Theory		--		--		--	
BP806ET	Quality Control and Standardization of Herbals - Theory		--		--		--	
BP807ET	Computer Aided Drug Design - Theory		--		--		--	
BP808ET	Cell and Molecular Biology - Theory		--		--		--	
BP809ET	Cosmetic Science - Theory		--		--		--	
BP810ET	Pharmacological Screening Methods – Theory		--		--		--	
BP811ET	Advanced Instrumentation Techniques - Theory		--		--		--	
BP812ET	Dietary Supplements and Nutraceuticals - Theory		--		--		--	
BP813ET	Pharmaceutical Product Development - Theory		--		--		--	
BP814PW	Project Work	--	4	--	--	--	150	150
Total		16		100		450		550

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SEMESTER-I

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP101T	Human Anatomy and Physiology I - Theory	3	-	1	4	-
BP102T	Pharmaceutical Analysis I - Theory	3	-	1	4	-
BP103T	Pharmaceutics I - Theory	3	-	1	4	-
BP104T	Pharmaceutical Inorganic Chemistry - Theory	3		1	4	-
BP105T	Communication skills - Theory *	2	-	-	2	-
BP106RBT	Remedial Biology/	2	-	-	2	-
BP106RMT	Remedial Mathematics - Theory*			-		
BP107P	Human Anatomy and Physiology I - Practical	-	4	-	-	2
BP108P	Pharmaceutical Analysis I - Practical	-	4	-	-	2
BP109P	Pharmaceutics I - Practical	-	4	-	-	2
BP110P	Pharmaceutical Inorganic Chemistry - Practical	-	4	-	-	2
BP111P	Communication Skills - Practical*	-	2	-	-	1
BP112RBP	Remedial Biology - Practical*	-	2	-	-	1
Total		**32/34$/36#**		**4**	**27/29$/30#**	

#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course.

$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course.

* Non-University Examination (NUE)

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SEMESTER-I

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP101T	Human Anatomy and Physiology I – Theory	3	--	25	--	75	--	100
BP102T	Pharmaceutical Analysis I – Theory	3	--	25	--	75	--	100
BP103T	Pharmaceutics I – Theory	3	--	25	--	75	--	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	--	25	--	75	--	100
BP105T	Communication Skills – Theory *	1.5	--	15	--	35	--	50
BP106RBT BP106RM	Remedial Biology/ Mathematics – Theory*	1.5	--	15	--	35	--	50
BP107P	Human Anatomy and Physiology I – Practical	--	4	--	15	--	35	50
BP108P	Pharmaceutical Analysis I – Practical	--	4	--	15	--	35	50
BP109P	Pharmaceutics I – Practical	--	4	--	15	--	35	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	--	4	--	15	--	35	50
BP111P	Communication Skills – Practical*	--	2	--	10	--	15	25
BP112RBP	Remedial Biology – Practical*	--	2	--	10	--	15	25
Total		31.5/33$^{\$}$/35$^{\#}$		185/200$^{\$}$/210$^{\#}$		490/525$^{\$}$/540$^{\#}$		675/725$^{\$}$

$^{\#}$Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course**.**

$^{\$}$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course**.**

* Non-University Examination (NUE)

SUBJECT : **HUMAN ANATOMY AND PHYSIOLOGY - I THEORY**
SUBJECT CODE : **BP101T**
SCOPE This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.
OBJECTIVES Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Draw and label the internal structure of cell, arrangement of tissues, important organs and body systems.
2. Narrate the functions of important organs and their sub-parts.
3. Provide the basis for physiological variations
4. Quantify the various components of blood and able to diagnose any abnormalities based on variations in the blood components.
5. Identify the important bones, body organs in the models.
6. Able to measure the radial pulse, Blood pressure and body temperature
7. Take ECG tracings and describe the significance of each wave.
8. Explain the cause, transmission, prevention and management of common communicable diseases.
9. Define various terminologies used in health.
10. Narrate various macro and micro-nutrients and provide their importance in maintenance of health.
11. Demonstrate the various first-aid techniques used in emergencies.
12. Narrate the various contraceptive methods, their merits and demerits.

PREREQUISITES: The student should have basic knowledge of biology, physics and chemistry of HSC level.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP101T	Human Anatomy and Physiology I - Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	• **Introduction to human body** Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. • **Cellular level of organization** Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway	10

	activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine • **Tissue level of organization** Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	
2	• **Integumentary system** Structure and functions of skin • **Skeletal system** Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction • **Joints** Structural and functional classification, types of joints movements and its articulation	10
3	• **Body fluids and blood** Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system. • **Lymphatic system** Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system	10
4	• **Peripheral nervous system:** Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. • **Special senses** Structure and functions of eye, ear, nose and tongue and their disorders.	8
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 heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.	7

SUBJECT : HUMAN ANATOMY AND PHYSIOLOGY I – PRACTICAL
SUBJECT CODE : **BP107P**

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP107P	Human Anatomy and Physiology I - Practical	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1.	Study of compound microscope.
2.	Microscopic study of epithelial and connective tissue
3.	Microscopic study of muscular and nervous tissue
4.	Identification of axial bones
5.	Identification of appendicular bones
6.	Introduction to hemocytometry.
7.	Enumeration of white blood cell (WBC) count
8.	Enumeration of total red blood corpuscles (RBC) count
9.	Determination of bleeding time
10.	Determination of clotting time
11.	Estimation of hemoglobin content
12.	Determination of blood group.
13.	Determination of erythrocyte sedimentation rate (ESR).
14.	Determination of heart rate and pulse rate.
15.	Recording of blood pressure.

BOOKS RECOMMENDED

1.	Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brother's medical publishers, New Delhi.
2.	Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
3.	Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
4.	Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, USA.
5.	Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6.	Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7.	Textbook of Practical Physiology by C. L. Ghai, Jaypee brother's medical publishers, New Delhi.
8.	Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.
Reference Books (Latest Editions)	
9.	Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
10.	Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11.	Human Physiology (Vol 1 and 2) by Dr. C.C. Chatterjee, Academic Publishers Kolkata

SUBJECT : PHARMACEUTICAL ANALYSIS I - THEORY
SUBJECT CODE : BP102T
SCOPE : This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs
OBJECTIVES Upon completion of the course, student shall be able to understand:

- Understand the principles of volumetric and electro chemical analysis
- Carry out various volumetric and electrochemical titrations
- Develop analytical skills

LEARNING OUTCOMES: At the end of the course the student will be able to:
1. Correctly sample the drug for testing
2. Carry out calculations involved in basic statistics.
3. Narrate the principles of methods and instruments used in assay of various drugs and chemicals.
4. Conduct assays of some drugs using these methods and instruments.

PREREQUISITES: Basic knowledge of physics, chemistry and pharmaceutical calculations taught in earlier semesters

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP102T	Pharmaceutical Analysis I - Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	• **Pharmaceutical analysis**- Definition and scope I. Different techniques of analysis II. Methods of expressing concentration iii) Primary and secondary standards. III. Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate. **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
	• **Acid base titration**: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves • **Non-aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10
2	• **Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. • **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. • **Gravimetry:** Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. • Basic Principles, methods and application of diazotization titration.	10
	Redox titrations	8

	(a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate	
3	**Electrochemical methods of analysis** • **Conductometry**- Introduction, Conductivity cell, Conductometric titrations, applications. • **Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. • **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications	7

SUBJECT : PHARMACEUTICAL ANALYSIS I - PRACTICAL
SUBJECT CODE : BP108P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP108P	Pharmaceutical Analysis I - Practical	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS

SR.NO	PRACTICAL
I Limit Test of the following	
1.	Chloride
2.	Sulphate
3.	Iron
4.	Arsenic
II Preparation and standardization of	
5.	Sodium hydroxide
6.	Sulphuric acid
7.	Sodium thiosulfate
8.	Potassium permanganate
9.	Ceric ammonium sulphate
III Assay of the following compounds along with Standardization of Titrant	
10.	Ammonium chloride by acid base titration
11.	Ferrous sulphate by Cerimetry
12.	Copper sulphate by Iodometry
13.	Calcium gluconate by Complexometry
14.	Hydrogen peroxide by Permanganometry (6) Sodium benzoate by non-aqueous titration (7) Sodium Chloride by precipitation titration
IV Determination of Normality by electro-analytical methods	
15.	Conductometric titration of strong acid against strong base
16.	Conductometric titration of strong acid and weak acid against strong base
17.	Potentiometric titration of strong acid against strong base

SR.NO	NAME OF BOOK/REFERENCE
1.	A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2.	A.I. Vogel, Text Book of Quantitative Inorganic analysis
3.	P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4.	Bentley and Driver's Textbook of Pharmaceutical Chemistry
5.	John H. Kennedy, Analytical chemistry principles
6.	Indian Pharmacopoeia.

SUBJECT : **PHARMACEUTICS I - THEORY**
SUBJECT CODE : **BP103T**
SCOPE : This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.
OBJECTIVES Upon completion of the course, student shall be able to understand:

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

LEARNING OUTCOMES: At the end of the course the student will be able to:

- Narrate various dosage forms, routes of administration and their merits and demerits
- Describe importance of environmental factors on drug manufacturing.
- Explain some unit processes used in industry.
- Describe the importance of certain physical properties of drugs and excipients and their utilization in drug manufacturing

PREREQUISITES: The student knowledgeable of basic physics and chemistry can take this course well.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP103T	Pharmaceutics I - Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**Historical background and development of profession of pharmacy:** • History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, • Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. • Different dosage forms, • Routes of administration and their comparisons, • Environment control in Pharmaceutical industry and its importance, • Importance of air, water, Humidity, Temperature in drug manufacturing giving some examples, • Introduction to various processes in Pharmaceutical manufacturing units • Prescription: Definition, Parts of prescription, handling of Prescription and • Errors in prescription. • Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	10
2	**Pharmaceutical calculations: Weights and measures** – • Imperial & Metric system, • Calculations involving percentage solutions, allegation, proof spirit and isotonic solutions based on freezing point and molecular weight.	10
	Powders:	

	• Definition, classification, advantages and disadvantages, • Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, • Eutectic mixtures. Geometric dilutions.	
	Liquid dosage forms: • Advantages and disadvantages of liquid dosage forms. • Excipients used in formulation of liquid dosage forms. • Solubility enhancement techniques	
3	**Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.	10
	Biphasic liquids: • Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. • Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	
4	**Suppositories:** Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	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

SUBJECT : PHARMACEUTICS I – PRACTICAL
SUBJECT CODE : BP109P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP109P	Pharmaceutics I - Practical	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS

SR.NO	PRACTICAL
1.	To prepare the list of market products as per physical form.
2.	To prepare the list of market products as per route of administration.
3.	To collect the data of environment requirements of various sections of Pharmaceutical industry.
4.	1. Conversion tables. 2. Household measures and conversions 3. Apothecary system units' conversions
5.	Syrups (a) Syrup IP'66 (b) Compound syrup of Ferrous Phosphate BPC'68
6.	Elixirs (a) Piperazine citrate elixir (b) Paracetamol pediatric elixir
7.	Linctus (a) Terpin Hydrate Linctus IP'66 (b) Iodine Throat Paint (Mandle's Paint)
8.	Solutions (a) Strong solution of ammonium acetate (b) Cresol with soap solution (c) Lugol's solution
9.	Suspensions (a) Calamine lotion (b) Magnesium Hydroxide mixture (c) Aluminium Hydroxide gel
10.	Emulsions (a) Turpentine Liniment (b) Liquid paraffin emulsion
11.	Powders and Granules (a) ORS powder (WHO) (b) Effervescent granules (c) Dusting powder (d) Divided powders
12.	Suppositories a) Glycero gelatin suppository b) Coca butter suppository c) Zinc oxide suppository
13.	Semisolids a) Sulphur ointment b) Non staining iodine ointment with methyl salicylate

	c) Carbopol gel
14.	Gargle Mouthwashes a) Iodine gargle b) Chlorhexidine mouthwash

Sr. NO	NAME OF BOOK/REFERENCE
1.	H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2.	M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
3.	Carter S. J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
4.	Indian pharmacopoeia.
5.	British pharmacopoeia.
6.	Lachmann Theory and Practice of Industrial Pharmacy, Lea& Febiger Publisher, The University of Michigan.
7.	Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8.	Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9.	E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10.	Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11.	Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12.	Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

SUBJECT : PHARMACEUTICAL INORGANIC CHEMISTRY - THEORY
SUBJECT CODE : BP104T
SCOPE : This subject deal with the monographs of inorganic drugs and pharmaceuticals.
OBJECTIVES Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Describe the method of preparation, assay principle for testing purity, official methods to measure the quality and medicinal uses of important inorganic compounds.
2. Refer the Pharmacopeia (monographs and appendices) for the drugs they study.
3. Prepare some standard reagents used in testing purity and quality of inorganic compounds.
4. Conduct limit tests for heavy metals, iron, arsenic, lead, chloride, sulphates as per pharmacopeia.
5. Conduct quantitative tests to identify inorganic mixtures

PREREQUISITES: The student should be knowledgeable of the basic chemistry learnt till HSC level.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP104T	Pharmaceutical Inorganic Chemistry - Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**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
	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	**Gastrointestinal agents** Acidifiers: Ammonium chloride* and Dil. HCl **Antacid**: Ideal properties of antacids, combinations of antacids, Sodium	10
	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	
3	**Miscellaneous compounds**	8

	Expectorants: Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Sodium potassium tartarate. **Haematinics**: Ferrous sulphate*, Ferrous gluconate **Poison and Antidote**: Sodium thiosulphate*, Activated charcoal, Sodium nitrite[333] **Astringents**: Zinc Sulphate, Potash Alum	
	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α, β, γ-radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.	7

SUBJECT : PHARMACEUTICAL INORGANIC CHEMISTRY - PRACTICAL
SUBJECT CODE : BP110P
SCOPE : This subject deal with the monographs of inorganic drugs and pharmaceuticals.
OBJECTIVES Upon completion of the course, student shall be able to understand:

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

PREREQUISITES: The student should be knowledgeable of the basic chemistry learnt till HSC level.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP110P	Pharmaceutical Inorganic Chemistry - Practical	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS

SR.NO	PRACTICAL
1.	Limit tests for following ions
2.	Limit test for Chlorides and Sulphates
3.	Modified limit test for Chlorides and Sulphates
4.	Limit test for Iron
5.	Limit test for Heavy metals
6.	Limit test for Lead
7.	Limit test for Arsenic
II Identification Test: Magnesium hydroxide, Ferrous sulphate, Sodium bicarbonate, Calcium gluconate, Copper sulphate	
III Test for purity	
8.	Swelling power of Bentonite
9.	Neutralizing capacity of aluminum hydroxide gel
10.	Determination of potassium iodate and iodine in potassium Iodide
IV Preparation of inorganic pharmaceuticals	
11.	Boric acid Potash Alum Ferrous sulphate

SR.NO	NAME OF BOOK/REFERENCE
1.	A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2.	A. I. Vogel, Text Book of Quantitative Inorganic analysis
3.	P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4.	M.L Schroff, Inorganic Pharmaceutical Chemistry
5.	Bentley and Driver's Textbook of Pharmaceutical Chemistry
6.	Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7.	Indian Pharmacopoeia

SUBJECT : **COMMUNICATION SKILLS – THEORY***
SUBJECT CODE : **BP105T**
SCOPE : This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:
The student should be able to communicate well both verbally and in written form at various levels such as at interviews, group discussion, letter writing, writing proposals etc.

PREREQUISITES: Basic English

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP105T	Communication skills – Theory*	2	-	2	2	15	--	35*	--	50

***NON-UNIVERSITY EXAM**

Course content:

CH.NO	PARTICULARS	30 HRS
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
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
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	7

	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	
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
5	❖ Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion	4

SUBJECT : COMMUNICATION SKILLS – PRACTICAL*
SUBJECT CODE : BP111P
PREREQUISITES : Basic English
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP111P	Communication Skills – Practical*	-	2	2	1	--	10	--	15*	25

***NON-UNIVERSITY EXAM**

LIST OF PRACTICALS

SR.NO	PRACTICAL
The following learning modules are to be conducted using words worth® English language lab software	
1	**Basic communication covering the following topics** Meeting People Asking Questions Making Friends What did you do? Do's and Dont's.
2	**Pronunciations covering the following topics** Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds).
3	**Advanced Learning** Listening Comprehension / Direct and Indirect Speech, Figures of Speech, Effective Communication, Writing Skills Effective Writing, Interview Handling Skills, E-Mail etiquette, Presentation Skills.

SR.NO	NAME OF BOOK/REFERENCE
1.	Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2.	Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011
3.	Organizational Behaviour, Stephen. P. Robbins, 1stEdition, Pearson, 2013
4.	Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5.	The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6.	Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7.	Communication skills for professionals, Konarnira, 2nd Edition, New arrivals – PHI, 2011
8.	Personality development and soft skills, Barun K Mitra, 1st Edition, Oxford Press, 2011
9.	Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India Pvt. Ltd, 2011
10.	Soft skills and professional communication, Francis Peters SJ, 1st Edition, Mc Graw Hill Education, 2011
11.	Effective communication, John Adair, 4thEdition, Pan Mac Millan, 2009
12.	Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

SUBJECT : **REMEDIAL MATHEMATICS - THEORY***
SUBJECT CODE : **BP106RMT**
SCOPE : This is an introductory course in mathematics. This subject deal with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.
OBJECTIVES Upon completion of the course, student shall be able to understand:

1. Know the theory and their application in Pharmacy
2. Solve the different types of problems by applying theory
3. Appreciate the important application of mathematics in Pharmacy

LEARNING OUTCOMES: At the end of the course the student will be able to:

1) Carry out routine calculations involved in pharmacy profession.
2) Draw and understand different graphs

PREREQUISITES: Basic knowledge of arithmetic, physics and chemistry.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP106RMT	Remedial Mathematics - Theory*	2	-	2	2	15	--	35	--	50

***NON-UNIVERSITY EXAM**

Course content:

CH.NO	PARTICULARS	30 HRS
1	**Partial fraction** Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics	6
	Logarithms Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.	
	Function: Real Valued function, Classification of real valued functions,	
	• **Limits and continuity** : Introduction , Limit of a function, Definition of limit of a function ($\in$ - δ definition) , $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$,	
2	**Matrices and Determinant:** • Introduction matrices, • Types of matrices, • Operation on matrices, • Transpose of a matrix, • Matrix Multiplication, • Determinants, Properties of determinants, Product of determinants, • Minors and co-Factors, • Adjoint or adjugate of a square matrix, • Singular and non-singular matrices, • Inverse of a matrix,	6

	• Solution of system of linear of equations using matrix method, • Cramer's rule, • Characteristic equation and roots of a square matrix, • Cayley–Hamilton theorem, • Application of Matrices in solving Pharmacokinetic equations	
3	**Calculus** • Differentiation: Introductions, • Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, • Derivative of the sum or difference of two functions, • Derivative of the product of two functions (product formula), • Derivative of the quotient of two functions (Quotient formula) – Without Proof, Derivative of xn w. r. tx, where n is any rational number, • Derivative of ex, Derivative of loge x , Derivative of ax, Derivative of trigonometric functions from first principles (without Proof), • Successive Differentiation, • Conditions for a function to be a maximum or a minimum at a point. Application	6
4	**Analytical Geometry:** • Introduction: Signs of the Coordinates, Distance formula, • Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line • Integration: • Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, • Method of Partial fractions, Integration by parts, definite integrals, application	6
5	**Differential Equations:** • Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, • Linear Differential equations, • Exact equations, Application in solving Pharmacokinetic equations **Laplace Transform:** • Introduction, Definition, • Properties of Laplace transform, • Laplace Transforms of elementary functions, • Inverse Laplace transforms, • Laplace transform of derivatives, • Application to solve Linear differential equations, • Application in solving Chemical kinetics and Pharmacokinetics equations	6

SR.NO	NAME OF BOOK/REFERENCE
1	Differential Calculus by Shanthinarayan
2	Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3	Integral Calculus by Shanthinarayan
4	Higher Engineering Mathematics by Dr. B. S. Grewal

SUBJECT : REMEDIAL BIOLOGY – THEORY*
SUBJECT CODE : BP106RBT
SCOPE To learn and understand the components of living world, structure and functional system of plant and animal kingdom.
OBJECTIVES Upon completion of the course, student shall be able to understand:

- Know the Classification and Salient Features of Five Kingdoms of Life
- Understand the Basic Components of Anatomy & Physiology of Plant
- Know Understand the Basic Components of Anatomy & Physiology Animal with Special Reference to Human

PREREQUISITES:
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP106RBT	Remedial Biology - Theory*	2	-	2	2	15	--	35	--	50

***NON-UNIVERSITY EXAM**

Course content:

CH.NO	PARTICULARS	30 HRS
1	**Living world:** • Definition and characters of living organisms • Diversity in the living world • Binomial nomenclature • Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus, • Morphology of Flowering plants • Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. • General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones	7
2	**Body fluids and circulation** • Composition of blood, blood groups, coagulation of blood • Composition and functions of lymph • Human circulatory system • Structure of human heart and blood vessels • Cardiac cycle, cardiac output and ECG **Digestion and Absorption** • Human alimentary canal and digestive glands • Role of digestive enzymes • Digestion, absorption and assimilation of digested food **Breathing and respiration** • Human respiratory system • Mechanism of breathing and its regulation • Exchange of gases, transport of gases and regulation of respiration • Respiratory volumes	7
3	**Excretory products and their elimination** • Modes of excretion • Human excretory system- structure and function	7

	• Urine formation • Rennin angiotensin system **Neural control and coordination** • Definition and classification of nervous system • Structure of a neuron • Generation and conduction of nerve impulse • Structure of brain and spinal cord • Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata **Chemical coordination and regulation** • Endocrine glands and their secretions • Functions of hormones secreted by endocrine glands **Human reproduction** • Parts of female reproductive system • Parts of male reproductive system • Spermatogenesis and Oogenesis • Menstrual cycle	
4	**Plants and mineral nutrition:** • Essential mineral, macro and micronutrients • Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation • Photosynthesis • Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.	5
5	**Plant respiration**: Respiration, glycolysis, fermentation (anaerobic). **Plant growth and development** • Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators • Cell - The unit of life • Structure and functions of cell and cell organelles. Cell division • Tissues • Definition, types of tissues, location and functions.	4

SUBJECT : REMEDIAL BIOLOGY – PRACTICAL*
SUBJECT CODE : BP112RBP
PREREQUISITES:
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP112RBP	Remedial Biology – Practical*	-	2	2	1	--	10	--	15	25

***NON-UNIVERSITY EXAM**

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1.	Introduction to experiments in biology a) Study of Microscope b) Section cutting techniques c) Mounting and staining d) Permanent slide preparation
2.	Study of cell and its inclusions
3.	Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4.	Detailed study of frog by using computer models
5.	Microscopic study and identification of tissues pertinent to Stem, Root, Leaf, seed, fruit and flower
6.	Identification of bones
7.	Determination of blood group
8.	Determination of blood pressure
9.	Determination of tidal volume

SR.NO	NAME OF BOOK/REFERENCE
1	Practical human anatomy and physiology. by S. R. Kale and R. R. Kale.
2	A Manual of pharmaceutical biology practical by S. B. Gokhale, C. K. Kokate and S. P. Shriwastava.
4	Biology practical manual according to National core curriculum. Biology forum of Karnataka. Prof. M. J. H. Shafi
Text Books	
(a)	Text book of Biology by S. B. Gokhale
(b)	A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.
Reference Books	
(a)	A Text book of Biology by B.V. Sreenivasa Naidu
(b)	A Text book of Biology by Naidu and Murthy c. Botany for Degree Students By A.C. Dutta.
(c)	Outlines of Zoology by M. Ekambaranatha Ayyer and T. N. Ananthakrishnan.
(d)	A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

KADI SARVA VISHWA VIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

Effective from Session JUNE 2017

SEMESTER-II

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	HRS OF TEACHING		TUTORIAL	CREDIT	
		T	P		T	P
BP201T	Human Anatomy and Physiology II - Theory	3	-	1	4	-
BP202T	Pharmaceutical Organic Chemistry I - Theory	3	-	1	4	-
BP203T	Biochemistry - Theory	3	-	1	4	-
BP204T	Pathophysiology - Theory	3	-	1	4	-
BP205T	Computer Applications in Pharmacy - Theory *	3	-	-	3	-
BP206T	Environmental Sciences - Theory *	3	-	-	3	-
BP207P	Human Anatomy and Physiology II - Practical	-	4	-	-	2
BP208P	Pharmaceutical Organic Chemistry I - Practical	-	4	-	-	2
BP209P	Biochemistry - Practical	-	4	-	-	2
BP210P	Computer Applications in Pharmacy - Practical*	-	2	-	-	1
Total		32		4	29	

*Non-University Examination (NUE)

SEMESTER-II

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL
		T	P	T		P		
BP201T	Human Anatomy and Physiology II - Theory	3	--	25	--	75	--	100
BP202T	Pharmaceutical Organic Chemistry I - Theory	3	--	25	--	75	--	100
BP203T	Biochemistry - Theory	3	--	25	--	75	--	100
BP204T	Pathophysiology - Theory	3	--	25	--	75	--	100
BP205T	Computer Applications in Pharmacy - Theory *	2	--	25	--	50	--	75
BP206T	Environmental Sciences - Theory *	2	--	25	--	50	--	75
BP207P	Human Anatomy and Physiology II - Practical	--	4	--	15	--	35	50
BP208P	Pharmaceutical Organic Chemistry I - Practical	--	4	--	15	--	35	50
BP209P	Biochemistry - Practical	--	4	--	15	--	35	50
BP210P	Computer Applications in Pharmacy - Practical*	--	2	--	10	--	15	25
Total		30		205		520		725

*Non-University Examination (NUE)

SUBJECT : HUMAN ANATOMY AND PHYSIOLOGY - II - THEORY
SUBJECT CODE : BP201T
SCOPE This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the hematological tests like blood cell counts, hemoglobin estimation, bleeding/clotting time etc., and 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.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Recognize and understand anatomical and physiological terminology
2. Apply the concept of homeostasis to human physiological activity.
3. Know major organic and inorganic chemicals as they relate to the human body.
4. Describe cellular structure and cellular activity.
5. Discuss anatomical and physiological features of the integumentary, skeletal, Muscular, nervous and sensory systems.
6. Evaluate select pathological conditions as they relate to normal functioning of the above-named systems.
7. General features of biochemical and cellular physiology, as well as neuronal Integration of various body processes

PREREQUISITES: General Biology and General chemistry.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP201T	Human Anatomy and Physiology II – Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
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
2	**Digestive system** 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.	06

	Energetics Formation and role of ATP, Creatinine Phosphate and BMR.	
3	**Respiratory 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. **Urinary system** Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.	10
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
5	**Reproductive system** Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition **Introduction to genetics** Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	09

SUBJECT : HUMAN ANATOMY AND PHYSIOLOGY - II - PRACTICAL
SUBJECT CODE : BP207P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP207P	Human Anatomy and Physiology II – Practical	-	4	4	2	--	15	--	35	50

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

LIST OF PRACTICALS

1.	To study the integumentary and special senses using specimen, models, etc.,
2.	To study the nervous system using specimen, models, etc.,
3.	To study the endocrine system using specimen, models, etc
4.	To demonstrate the general neurological examination
5.	To demonstrate the function of olfactory nerve
6.	To examine the different types of taste.
7.	To demonstrate the visual acuity
8.	To demonstrate the reflex activity
9.	Recording of body temperature
10.	To demonstrate positive and negative feedback mechanism.
11.	Determination of tidal volume and vital capacity.
12.	Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13.	Recording of basal mass index.
14.	Study of family planning devices and pregnancy diagnosis test.
15.	Demonstration of total blood count by cell analyzer
16.	Permanent slides of vital organs and gonads.

NAME OF BOOK/REFERENCE

1.	Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2.	Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3.	Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, River view, MI USA
4.	Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
5.	Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6.	Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7.	Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8.	Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.
9.	Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
10.	Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11.	Human Physiology (Vol. 1 and 2) by Dr. C. C. Chatterjee, Academic Publishers Kolkata.

SUBJECT : PHARMACEUTICAL ORGANIC CHEMISTRY – I THEORY
SUBJECT CODE : BP202T
SCOPE : The subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions**.**
OBJECTIVES : Upon completion of the course, student shall be able to

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Define and explain different types of chemical bonds.
2. Name the organic compounds according to IUPAC nomenclature system.
3. Narrate physical and chemical properties of different compounds representing different functional group
4. To understand reactivity of various functional groups.
5. Synthesis some organic compounds.
6. Identify unknown organic compounds by conducting different physical and chemical tests.

PREREQUISITES: Basic organic chemistry learnt at HSC level
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP202T	Pharmaceutical Organic Chemistry - I Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences.		
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 isomerism in organic compounds	7
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. E_1 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
3	**Alkyl halides*** SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.	10

	SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions Structure and uses of ethyl chloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. **Alcohols***- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol.	
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, Vanillin, Cinnamaldehyde.	10
5	**Carboxylic acids*** Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester. Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid. **Aliphatic amines*** - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	8

SUBJECT : PHARMACEUTICAL ORGANIC CHEMISTRY - I - PRACTICAL
SUBJECT CODE : BP208P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP208P	Pharmaceutical Organic Chemistry - I - Practical	-	4	4	2	--	15	--	35	50

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

A	Systematic qualitative analysis of unknown organic compounds like
1.	Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
2.	Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
3.	Solubility test
4.	Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
5.	Melting point/Boiling point of organic compounds
6.	Identification of the unknown compound from the literature using melting point/ boiling point.
7.	Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
8.	Minimum 5 unknown organic compounds to be analyzed systematically.
B	Preparation of suitable solid derivatives from organic compounds
C	Construction of molecular models

BOOKS RECOMMENDED (LATEST EDITIONS)

1	Organic Chemistry by Morrison and Boyd
2	Organic Chemistry by I. L. Finar, Volume-I
3	Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4	Organic Chemistry by P. L. Soni
5	Practical Organic Chemistry by Mann and Saunders
6	Vogel's text book of Practical Organic Chemistry
7	Advanced Practical organic chemistry by N. K. Vishnoi.
8	Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9	Reaction and reaction mechanism by Ahluwaliah /Chatwal.

SUBJECT : **BIOCHEMISTRY THEORY**
SUBJECT CODE : **BP203T**
SCOPE : The subject deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

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

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

LEARNING OUTCOMES:

1. Describe the structure and functions of various biochemicals
2. Describe the various biochemical pathways occurring within the human body.
3. Describe the basic principles of enzymology.
4. Classify the different enzymes.

PREREQUISITES: Physics, chemistry, human anatomy physiology

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP203T	Biochemistry – Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**Biomolecules** Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.	8
	Bioenergetics • Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. • Energy rich compounds; classification; biological significances of ATP and cyclic AMP	
2	**Carbohydrate metabolism** • Glycolysis – Pathway, energetics and significance • Citric acid cycle- Pathway, energetics and significance • HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency • Glycogen metabolism Pathways and glycogen storage diseases (GSD) • Gluconeogenesis- Pathway and its significance • Hormonal regulation of blood glucose level and Diabetes mellitus	10
	Biological oxidation • Electron transport chain (ETC) and its mechanism. • Oxidative phosphorylation & its mechanism and substrate Phosphorylation.	

	• Inhibitors ETC and oxidative phosphorylation/Uncouplers	
3	**Lipid metabolism** • β-Oxidation of saturated fatty acid (Palmitic acid) • Formation and utilization of ketone bodies; ketoacidosis • De novo synthesis of fatty acids (Palmitic acid) • Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D • Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity. **Amino acid metabolism** • General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders. • Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alkaptonuria, tyrosinemia) • Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline • Catabolism of heme; hyperbilirubinemia and jaundice	10
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
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	7

SUBJECT : BIOCHEMISTRY PRACTICAL
SUBJECT CODE : BP209P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP209P	Biochemistry Practical	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS

1	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2	Identification tests for Proteins (albumin and Casein)
3	Quantitative analysis of reducing sugars (DNSA method) and Proteins I. (Biuret method)
4	Qualitative analysis of urine for abnormal constituents
5	Determination of blood creatinine
6	Determination of blood sugar
7	Determination of serum total cholesterol
8	Preparation of buffer solution and measurement of pH
9	Study of enzymatic hydrolysis of starch
10	Determination of Salivary amylase activity
11	Study the effect of Temperature on Salivary amylase activity.
12	Study the effect of substrate concentration on salivary amylase activity.

RECOMMENDED BOOKS (LATEST EDITIONS)

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayana and U. Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

SUBJECT : **PATHOPHYSIOLOGY THEORY**
SUBJECT CODE : **BP204T**
SCOPE : Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.
OBJECTIVES : Upon completion of the course, student shall be able to-

1. Describe the etiology and pathogenesis and complications of the selected disease states;
2. Name the signs and symptoms of the diseases; and
3. Mention the complications of the diseases.
4. Target mechanisms for drug acting on particular disease/disorder.

PREREQUISITES: Biology of HSC level

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP204T	Pathophysiology– Theory	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
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	10
	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	
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
3	**Hematological Diseases:** Iron deficiency, megaloblastic anemia (Vit. B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease. **Gastrointestinal system:** Peptic Ulcer	10

4	• Inflammatory bowel diseases, jaundice, hepatitis (A, B, C, D, E, F) alcoholic liver disease. • **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout • **Principles of cancer:** classification, etiology and pathogenesis of cancer	8
5	• **Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections • **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhea	7

RECOMMENDED BOOKS (LATEST EDITIONS)

1.	Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2	Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3	Laurence B, Bruce C, Bjorn K.; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4	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;
5	William and Wilkins, Baltimore;1991 [1990 printing].
6	Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston; Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7	Guyton A, John. E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8	Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9	V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10	Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

SUBJECT **: COMPUTER APPLICATIONS IN PHARMACY – THEORY***
SUBJECT CODE : **BP205T**
SCOPE **:** This subject deal with the introduction Database, Database Management system, computer application in clinical studies and use of databases.
OBJECTIVES Upon completion of the course, student shall be able to

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1) Prepare documents in MS-Word
2) Preparing data tables in MS-Excel
3) Do calculation in MS-Excel of the data collected from various experiments using simple operations and formulas.
4) Draw Graphs in MS-Excel

PREREQUISITES: Basic computer operations

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP205T	Computer Applications in Pharmacy – Theory*	3	-	3	3	25	--	50	--	75

Course content:

CH.NO.	PARTICULARS	30 HRS
1	❖ **Number system**: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc., binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division ❖ **Concept of Information Systems and Software**: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	6
2	❖ **Web technologies**: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products ❖ Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	6
3	❖ **Application of computers in Pharmacy** – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring ❖ **Diagnostic System**, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	6
4	❖ **Bioinformatics**: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	6
5	❖ **Computers as data analysis in Preclinical development**: Chromatographic dada analysis(CDS), Laboratory Information Management System (LIMS) and Text Information Management System (TIMS)	6

SUBJECT **: COMPUTER APPLICATIONS IN PHARMACY – PRACTICAL***
SUBJECT CODE : **BP210P**
SCOPE **:** This subject deal with the introduction Database, Database Management system, computer application in clinical studies and use of databases.
OBJECTIVES Upon completion of the course, student shall be able to

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1) Prepare documents in MS-Word
2) Preparing data tables in MS-Excel
3) Do calculation in MS-Excel of the data collected from various experiments using simple operations and formulas.
4) Draw Graphs in MS-Excel

PREREQUISITES: Basic computer operations.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP210P	Computer Applications in Pharmacy – Practical*	-	2	2	1	--	10	--	15	25

Course content:

SR.NO	PRACTICAL
1	Design a questionnaire using a word processing package to gather information about a disease.
2	Create a HTML web page to show personal information.
3	Retrieve the information of a drug and its adverse effects using online tools
4	Creating mailing labels Using Label Wizard, generating label in MS WORD
5	Create a database in MS Access to store the patient information with the required fields Using access
6	Design a form in MS Access to view, add, delete and modify the patient record in the database
7	Generating report and printing the report from patient database
8	Creating invoice table using – MS Access
9	Drug information storage and retrieval using MS Access
10	Creating and working with queries in MS Access
11	Exporting Tables, Queries, Forms and Reports to web pages
12	Exporting Tables, Queries, Forms and Reports to XML pages

BOOKS RECOMMENDED:

SR.NO	NAME OF BOOK/REFERENCE
1	Computer Application in Pharmacy – William E. Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2	Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3	Bioinformatics (Concept, Skills and Applications) – S. C. Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4	Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N. Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

SUBJECT : **ENVIRONMENTAL SCIENCES – THEORY***
SUBJECT CODE : **BP206T**
SCOPE : Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Know about safety hazards
2. Environmental control
3. Good practices about saving environment

PREREQUISITES: NONE

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP206T	Environmental sciences – Theory *	3	-	3	3	25	--	50	--	75

Course content:

CH.NO	PARTICULARS	30 HRS
1	The Multidisciplinary nature of environmental studies • Natural Resources • Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: • Role of an individual in conservation of natural resources.	10
2	Ecosystems • Concept of an ecosystem. • Structure and function of an ecosystem. • Introduction, types, characteristic features, structure and function of the ecosystems: • Forest ecosystem; Grassland ecosystem; • Desert ecosystem; • Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	10
3	Environmental Pollution: Air pollution; Water pollution; Soil pollution	10

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Y.K. Sing, Environmental Science, New Age International Pvt., Publishers, Bangalore
2	Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4	Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5	Clark R.S., Marine Pollution, Clanderson Press Oxford
6	Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7	De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8	Down of Earth, Centre for Science and Environment

KADI SARVA VISHWAVIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

Effective from Session JUNE 2017

SEMESTER-III

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	-	1	4	-
BP302T	Physical Pharmaceutics I – Theory	3	-	1	4	-
BP303T	Pharmaceutical Microbiology – Theory	3	-	1	4	-
BP304T	Pharmaceutical Engineering – Theory	3	-	1	4	-
BP305P	Pharmaceutical Organic Chemistry II – Practical	-	4	-	-	2
BP306P	Physical Pharmaceutics I – Practical	-	4	-	-	2
BP307P	Pharmaceutical Microbiology – Practical	-	4	-	-	2
BP308P	Pharmaceutical Engineering – Practical	-	4	-	-	2
Total		28		4	24	

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K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

Effective from Session JUNE 2017

SEMESTER-III

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	--	25	--	75	--	100
BP302T	Physical Pharmaceutics I – Theory	3	--	25	--	75	--	100
BP303T	Pharmaceutical Microbiology – Theory	3	--	25	--	75	--	100
BP304T	Pharmaceutical Engineering – Theory	3	--	25	--	75	--	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	--	4	--	15	--	35	50
BP306P	Physical Pharmaceutics I – Practical	--	4	--	15	--	35	50
BP307P	Pharmaceutical Microbiology – Practical	--	4	--	15	--	35	50
BP308P	Pharmaceutical Engineering – Practical	--	4	--	15	--	35	50
Total		28		160		440		600

SUBJECT : PHARMACEUTICAL ORGANIC CHEMISTRY II - THEORY
SUBJECT CODE : BP301T
SCOPE : This subject deal with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are
also included in the syllabus.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Application of Heterocyclic chemistry in drug discovery.
2. Write chemical reactions depicting synthesis and chemical properties of these organic compounds.
3. Synthesis of heterocyclic compounds.
4. Identify unknown organic compounds by conducting different physical and chemical tests and its derivatization.

PREREQUISITES: Basic organic chemistry learnt at H. Sc. level and organic chemistry learnt in previous semester

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP301T	PHARMACEUTICAL ORGANIC CHEMISTRY II - THEORY	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences		
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, halogenation- reactivity, 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
2	❖ **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols ❖ **Aromatic Amines*** - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts ❖ **Aromatic Acids*** –Acidity, effect of substituents on acidity and important reactions of benzoic acid.	10
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

4	❖ **Polynuclear hydrocarbons**: • Synthesis, reactions • Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives	8
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	7

SUBJECT : PHARMACEUTICAL ORGANIC CHEMISTRY II - PRACTICAL
SUBJECT CODE : BP305P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP305P	PHARMACEUTICAL ORGANIC CHEMISTRY II-PRACTICAL	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	**Experiments involving laboratory techniques**
	Recrystallization
	Steam distillation
2	**Determination of following oil values (including standardization of reagents)**
	Acid value
	Saponification value
	Iodine value
3	**Preparation of compounds**
a	Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol/Aniline by acylation reaction.
b	2,4,6-Tribromo aniline/Para bromo-acetanilide from Aniline/Acetanilide by halogenation (Bromination) reaction.
c	5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
d	Benzoic acid from Benzyl chloride by oxidation reaction.
e	Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
f	1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
g	Benzil from Benzoin by oxidation reaction.
h	Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
i	Cinnammic acid from Benzaldehyde by Perkin reaction
j	P-Iodo benzoic acid from P-amino benzoic acid

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Organic Chemistry by Morrison and Boyd
2	Organic Chemistry by I.L. Finar , Volume-I
3	Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4	Organic Chemistry by P. L. Soni
5	Practical Organic Chemistry by Mann and Saunders.
6	Vogel's text book of Practical Organic Chemistry
7	Advanced Practical organic chemistry by N. K. Vishnoi.
8	Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

SUBJECT : **PHYSICAL PHARMACEUTICS I -THEORY**
SUBJECT CODE : **BP302T**
SCOPE : The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.
OBJECTIVES **:** Upon completion of the course, student shall be able to understand:

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 and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain the properties
2. Measure this properties
3. Alter the properties using different techniques to achieve desired result

PREREQUISITES: An introduction to metrology and pharmaceutical calculations; the prescription and those legal considerations concerning this document; and an introduction to pharmaceutical dosage forms

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP302T	**PHYSICAL PHARMACEUTICS I**	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
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 solution temperature and applications. • Distribution law, its limitations and applications	10
2	States of Matter and properties of matter: • 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.	10

	• Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	
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, solubilization, detergency, • Adsorption at solid interface.	10
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
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

SUBJECT : PHYSICAL PHARMACEUTICS I -PRACTICAL
SUBJECT CODE : BP306P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP306P	PHYSICAL PHARMACEUTICS – I	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Determination the solubility of drug at room temperature
2	Determination of pKa value by Half Neutralization/ Henderson Hassel Balch equation.
3	Determination of Partition co- efficient of benzoic acid in benzene and water
4	Determination of Partition co- efficient of Iodine in CCl4 and water
5	Determination of % composition of NaCl in a solution using phenol-water system by CST method
6	Determination of surface tension of given liquids by drop count and drop weight method
7	Determination of HLB number of a surfactant by saponification method
8	Determination of Freundlich and Langmuir constants using activated char coal
9	Determination of critical micellar concentration of surfactants
10	Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method
12	Determination the solubility of drug at room temperature

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Physical Pharmacy by Alfred Martin
2	Experimental Pharmaceutics by Eugene, Parott.
3	Tutorial Pharmacy by Cooper and Gunn.
4	Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5	Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to Marcel Dekker Inc.
6	Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekker Inc.
7	Physical Pharmaceutics by Ramasamy C and Manavalan R.
8	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9	Physical Pharmaceutics by C.V.S. Subramanyam
10	Test book of Physical Pharmacy, by Gaurav Jain & Roop K. Khar Physical Pharmacy by Alfred Martin

SUBJECT : PHARMACEUTICAL MICROBIOLOGY - THEORY
SUBJECT CODE : BP303T
SCOPE : Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc.
OBJECTIVES : Upon completion of the course, student shall be able to understand:

1. Understand methods of identification, cultivation and preservation of various microorganisms
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 applications in pharmaceutical industries.

LEARNING OUTCOMES:

- Understand how microorganisms survive where they do, how they are related, and how they interact with us.
- Have a solid grasp of the scope of the microbial world and its role in human disease
- How to control bacterial growth- use of chemical and physical agents to control microbe propagation How to provide a microbe-free environment for the health professional
- Understand the rationale behind the use of chemicals to control bacterial propagation (anti-microbial agents)
- How microorganisms relate with us causing disease
- Summarize mechanisms of animal defenses to infection, including primary defenses, innate immunity, and acquired immunity.
- How microbes harm us by causing Pathogenesis
- Learn the most important disease-causing organisms: Bacteria, viruses, protozoans and worms. Classification and characteristics
- The laboratory work will help acquire basic bacteriological skills so as to successfully use them.

PREREQUISITES: Basic principles of Biology and Chemistry

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP303T	PHARMACEUTICAL MICROBIOLOGY	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	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 • 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 contrast microscopy, dark field microscopy and electron microscopy	10
2	Identification of bacteria • Staining techniques (simple, Gram's &Acid-fast staining) and biochemical tests (IMViC).	10

	Sterilization : • 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.	
3	Fungi and Viruses.: • Study of morphology, classification, reproduction/replication and cultivation Disinfectants: • Classification and mode of action • Factors influencing disinfection, antiseptics and their evaluation. Preservatives: • 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
4	Aseptic area: • Designing of aseptic area, • Laminar flow equipments; • Study of different sources of contamination in an aseptic area and methods of prevention, • Clean area classification. Microbiological Assay. • Principles and methods of different assay. • Methods for standardization of antibiotics, vitamins and amino acids. • Assessment of a new antibiotic.	8
5	Spoilage and contamination: • 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. Cell culture methods: • 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.	7

SUBJECT : PHARMACEUTICAL MICROBIOLOGY -PRACTICAL
SUBJECT CODE : BP307P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP307P	PHARMACEUTICAL MICROBIOLOGY	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2	Sterilization of glassware, preparation and sterilization of media.
3	Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4	Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5	solation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6	Microbiological assay of antibiotics by cup plate method and other methods
7	Motility determination by Hanging drop method.
8	Sterility testing of pharmaceuticals.
9	Bacteriological analysis of water
10	Biochemical test.

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2	Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3	Pelzar, Chan Krieg, Microbiology, Tata McGraw Hill edn.
4	Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5	Rose: Industrial Microbiology.
6	Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7	Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution. Peppler: Microbial Technology.
8	I.P., B.P., U.S.P.- latest editions.
9	Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
10	Edward: Fundamentals of Microbiology.
11	N. K. Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
12	Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

SUBJECT : **PHARMACEUTICAL ENGINEERING - THEORY**
SUBJECT CODE : **BP304T.**
SCOPE : This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.
OBJECTIVES Upon completion of the course, student shall be able to understand:

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in 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.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain the fundamental principles lying behind these processes.
2. Explain the construction, principles, applications, merits and demerits of all equipments used in industry to carry out these processes.
3. Troubleshoot the problems underlying these processes.

PREREQUISITES: Basics of Physics, Chemistry and fundamentals of pharmaceutics learnt in past semesters.

TEACHING AND EVALUATION SCHEME

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP304T	PHARMACEUTICAL ENGINEERING	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**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 : o Hammer mill, o Ball mill, o Fluid energy mill, o Edge runner mill & o End runner mill. **Size Separation:** • Objectives, • Applications & mechanism of size separation, • Official standards of powders, sieves, • Size separation Principles,	10

	• Construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.	
2	**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
3	**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,	10

	• Planetary mixers, • Propellers, Turbines, Paddles & Silverson Emulsifier,	
4	**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 • Seitz 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
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 nonmetals, • Basic of material handling systems.	7

SUBJECT : PHARMACEUTICAL ENGINEERING - PRACTICAL
SUBJECT CODE : BP308P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP308P	PHARMACEUTICAL ENGINEERING	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

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

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2	Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3	Unit operation of chemical engineering – Mc-cabe Smith, Latest edition.
4	Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5	Remington practice of pharmacy- Martin, Latest edition.
6	Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7	Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8	Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

KADI SARVA VISHWAVIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

Effective from Session JUNE 2017

SEMESTER-IV

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	-	1	4	-
BP402T	Medicinal Chemistry I – Theory	3	-	1	4	-
BP403T	Physical Pharmaceutics II – Theory	3	-	1	4	-
BP404T	Pharmacology I – Theory	3	-	1	4	-
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	-	1	4	-
BP406P	Medicinal Chemistry I – Practical	-	4	-	-	2
BP407P	Physical Pharmaceutics II – Practical	-	4	-	-	2
BP408P	Pharmacology I – Practical	-	4	-	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	-	4	-	-	2
Total		31		5	28	

KADI SARVA VISHWAVIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

Effective from Session JUNE 2017

SEMESTER-IV

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	--	25	--	75	--	100
BP402T	Medicinal Chemistry I – Theory	3	--	25	--	75	--	100
BP403T	Physical Pharmaceutics II – Theory	3	--	25	--	75	--	100
BP404T	Pharmacology I – Theory	3	--	25	--	75	--	100
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	--	25	--	75	--	100
BP406P	Medicinal Chemistry I – Practical	--	4	--	15	--	35	50
BP407P	Physical Pharmaceutics II – Practical	--	4	--	15	--	35	50
BP408P	Pharmacology I – Practical	--	4	--	15	--	35	50
BP409P	Pharmacognosy and Phytochemistry I – Practical	--	4	--	15	--	35	50
Total		31		185		515		700

*Non-University Examination (NUE)

SUBJECT : PHARMACEUTICAL ORGANIC CHEMISTRY III - THEORY
SUBJECT CODE : BP401T
SCOPE : This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.
OBJECTIVES : Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:
1. Application of Heterocyclic chemistry in drug discovery.
2. Write chemical reactions depicting synthesis and chemical properties of these organic compounds.
3. Synthesis of heterocyclic compounds.
4. Identify unknown organic compounds by conducting different physical and chemical tests and its derivatization.

PREREQUISITES: Basic organic chemistry learnt at HSC level and organic chemistry learnt in previous semester

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP401T	PHARMACEUTICAL ORGANIC CHEMISTRY - III	3	-	3	4	25	--	75	--	100

Course content:

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

CH.NO	PARTICULARS	45 HRS
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
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 stereo selective reactions	10
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

4	**Synthesis, reactions and medicinal** uses of following compounds/derivatives: • Pyrazole, Imidazole, Oxazole and Thiazole. • Pyridine, Quinoline, Isoquinoline, Acridine and Indole. • Basicity of pyridine • Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives	8
5	**Reactions of synthetic importance** • Metal hydride reduction (NaBH4 and LiAlH4), • Clemmensen reduction, • Birch reduction, • Wolff Kishner reduction. • Oppenauer-oxidation and Dakin reaction. • Beckmanns rearrangement and Schmidt rearrangement. • Claisen-Schmidt condensation	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Organic chemistry by I.L. Finar, Volume-I & II.
2	A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3	Heterocyclic Chemistry by Raj K. Bansal
4	Organic Chemistry by Morrison and Boyd
5	Heterocyclic Chemistry by T.L. Gilchrist

SUBJECT : MEDICINAL CHEMISTRY I - THEORY
SUBJECT CODE : BP402T
SCOPE . This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.
OBJECTIVES : Upon completion of the course the student shall be able to

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Draw correct chemical structure of drugs
2. Give scientific name of drugs
3. Narrate physicochemical properties and Structure activity relationship.
4. Cary out synthesis of certain drugs.

PREREQUISITES: Knowledge of Pharmacology and Organic Chemistry
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP402T	MEDICINAL CHEMISTRY – I	3	-	3	4	25	--	75	--	100

Course content:
Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

CH.NO	PARTICULARS	45 HRS
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
2	**Drugs acting on Autonomic Nervous System** • **Adrenergic Neurotransmitters:** Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.	10
	• **Sympathomimetic agents:** o SAR of Sympathomimetic agents o Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, o Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. o Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. o Agents with mixed mechanism: Ephedrine, Metaraminol.	
	• **Adrenergic Antagonists:**	

	○ Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. ○ Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	
3	**Cholinergic neurotransmitters:** • Biosynthesis and catabolism of acetylcholine. • Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. **Parasympathomimetic agents**: ○ SAR of Parasympathomimetic agents Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine. ○ Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion **Cholinesterase reactivator**: ○ Pralidoxime chloride. **Cholinergic Blocking agents**: ○ SAR of cholinolytic agents ○ Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*. **Synthetic cholinergic blocking agents**: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.	10
4	**Drugs acting on Central Nervous System** **A.** Sedatives and Hypnotics: • Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem • Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital • Miscelleneous: Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde. **B.** Antipsychotics • Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, 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. **C.** Anticonvulsants: • SAR of Anticonvulsants, mechanism of anticonvulsant action	8

	• Barbiturates: Phenobarbitone, Methabarbital. Hydantoins: Phenytoin*, Mephenytoin, Ethotoin Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam • Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate	
5	**Drugs acting on Central Nervous System** General anesthetics: • Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. • Ultra-short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium. • Dissociative anesthetics: Ketamine hydrochloride.*	7
	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.	

SUBJECT : MEDICINAL CHEMISTRY I - PRACTICAL
SUBJECT CODE : BP406P
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP406P	MEDICINAL CHEMISTRY – I	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	**Preparation of drugs/ intermediates**
	1. 1,3-pyrazole
	2. 1,3-oxazole
	3. Benzimidazole
	4. Benztriazole
	5. 2,3- diphenyl quinoxaline
	6. Benzocaine
	7. Phenytoin
	8. Phenothiazine
	9. Barbiturate
2	**Assay of drugs**
	1. Chlorpromazine
	2. Phenobarbitone
	3. Atropine
	4. Ibuprofen
	5. Aspirin
	6. Furosemide
3	**Determination of Partition coefficient for any two drugs**

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2	Foye's Principles of Medicinal Chemistry.
3	Burger's Medicinal Chemistry, Vol I to IV.
4	Introduction to principles of drug design- Smith and Williams.
5	Remington's Pharmaceutical Sciences.
6	Martindale's extra pharmacopoeia
7	Organic Chemistry by I.L. Finar, Vol. II.
8	The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9	Indian Pharmacopoeia.
10	Text book of practical organic chemistry- A.I. Vogel.

SUBJECT : **PHYSICAL PHARMACEUTICS II - THEORY**
SUBJECT CODE : **BP403T**
SCOPE : The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.
OBJECTIVES : Upon completion of the course, student shall be able to understand:

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.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain the physicochemical properties of pharmaceutical solids.
2. Measure this properties
3. Alter the properties using different techniques to achieve desired result

PREREQUISITES: An introduction to metrology and pharmaceutical calculations; the prescription and those legal considerations concerning this document; and an introduction to pharmaceutical dosage forms

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP403T	PHYSICAL PHARMACEUTICS - II	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
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
2	**Rheology**: Newtonian systems, • Law of flow, • Kinematic viscosity, • Effect of temperature, Non-Newtonian systems: • Pseudo plastic, dilatant, plastic, thixotropy, thixotropy in formulation, • Determination of viscosity, capillary, falling sphere, rotational viscometers • Deformation of solids: plastic and elastic deformation, Heckel equation, stress, Strain, Elastic Modulus	10
3	**Coarse dispersion**: • Suspension	10

	○ Interfacial properties of suspended particles, ○ Settling in suspensions, ○ Formulation of flocculated and deflocculated suspensions. • Emulsions ○ Theories of emulsification, ○ Micro emulsion and multiple emulsions; ○ stability of emulsions, preservation of emulsions, ○ Rheological properties of emulsions and emulsion formulation by hlb method.	
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
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

SUBJECT : PHYSICAL PHARMACEUTICS II - PRACTICAL
SUBJECT CODE : BP407P
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP407P	PHYSICAL PHARMACEUTICS – II	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Determination of particle size, particle size distribution using sieving method
2	Determination of particle size, particle size distribution using Microscopic method
3	Determination of bulk density, true density and porosity
4	Determine the angle of repose and influence of lubricant on angle of repose
5	Determination of viscosity of liquid using Ostwald's viscometer
6	Determination sedimentation volume with effect of different suspending agent
7	Determination sedimentation volume with effect of different concentration of single suspending agent
8	Determination of viscosity of semisolid by using Brookfield viscometer
9	Determination of reaction rate constant first order.
10	Determination of reaction rate constant second order
11	Accelerated stability studies
12	Determination of particle size, particle size distribution using sieving method

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Physical Pharmacy by Alfred Martin, Sixth edition
2	Experimental pharmaceutics by Eugene, Parott.
3	Tutorial pharmacy by Cooper and Gunn.
4	Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5	Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekker Inc.
6	Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekker Inc.

SUBJECT : **PHARMACOLOGY I - THEORY**
SUBJECT CODE : **BP404T**
SCOPE : The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.
OBJECTIVES **:** Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Define and explain the various terminologies pertaining to the subject.
2. Explain the basic principles of Pharmacokinetics and pharmacodynamics
3. Narrate the principles involved in measurement of drug effects
4. Classify the drugs according to pharmacological classes
5. Explain the mechanism of action, pharmacodynamics and pharmacokinetic effects of drugs, adverse effects, contraindications and therapeutic application of various classes of drugs.
6. Conduct some simple in vitro and in vivo experiments to demonstrate the pharmacological actions of the drugs.

PREREQUISITES: Knowledge of Human Anatomy Physiology, Health Education, Biochemistry and basic physics and chemistry.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP404T	PHARMACOLOGY - I	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**General Pharmacology** • Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, o 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- o Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination	8
2	**General Pharmacology** • Pharmacodynamics- o Principles and mechanisms of drug action. o Receptor theories and classification of receptors, o Regulation of receptors.	12

	○ 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. • Adverse drug reactions. • Drug interactions (pharmacokinetic and pharmacodynamics) • Drug discovery and clinical evaluation of new drugs ○ Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.	
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). e. Local anesthetic agents. • Drugs used in myasthenia gravis and glaucoma	10
4	**Pharmacology of drugs acting on central nervous system** • Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. • General anesthetics and pre-anesthetics. • Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics • Alcohols and disulfiram	8
5	• **Pharmacology of drugs acting on central nervous system**. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. • Drugs used in Parkinson's disease and Alzheimer's disease. c. CNS stimulants and nootropics. • Opioid analgesics and antagonists • Drug addiction, drug abuse, tolerance and dependence.	7

SUBJECT : PHARMACOLOGY I - PRACTICAL
SUBJECT CODE : BP408P
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP408P	PHARMACOLOGY - I	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

S2R.NO	PRACTICAL
1	Introduction to experimental pharmacology.
2	Commonly used instruments in experimental pharmacology.
3	Study of common laboratory animals.
4	Maintenance of laboratory animals as per CPCSEA guidelines.
5	Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6	Study of different routes of drugs administration in mice/rats.
7	Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8	Effect of drugs on ciliary motility of frog esophagus
9	Effect of drugs on rabbit eye.
10	Effects of skeletal muscle relaxants using Rota-rod apparatus.
11	Effect of drugs on locomotor activity using actophotometer.
12	Anticonvulsant effect of drugs by MES and PTZ method.
13	Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14	Study of anxiolytic activity of drugs using rats/mice.
15	Study of local anesthetics by different methods
Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos	

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4	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
5	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6	K. D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8	Modern Pharmacology with clinical Applications, by Charles R. Craig& Robert,
9	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan, K.D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

SUBJECT : PHARMACOGNOSY AND PHYTOCHEMISTRY I - THEORY
SUBJECT CODE : BP405T.
SCOPE : The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.
OBJECTIVES : Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain structure and function of plant tissues.
2. Describe and demonstrate the morphological characters of different parts of plants.
3. Describe taxonomical characters of plants belonging to some important plant families.
4. Classify plant derived drugs
5. Demonstrate different tests used for quality control of herbal drugs.

PREREQUISITES: Biology

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP405T	PHARMACOGNOSY AND PHYTOCHEMISTRY - I	3	-	3	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**Introduction to Pharmacognosy:** • Definition, history, scope and development of Pharmacognosy • Sources of Drugs – Plants, Animals, Marine & Tissue culture • 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 • 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, Leaf constants, Camera Lucida And Diagrams of Microscopic Objects To Scale With Camera Lucida.	10
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

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
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
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, Serrati peptidase, 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

SUBJECT : PHARMACOGNOSY AND PHYTOCHEMISTRY I - PRACTICAL
SUBJECT CODE : BP409P
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP409P	PHARMACOGNOSY AND PHYTOCHEMISTRY – I	-	4	4	2	--	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Analysis of crude drugs by chemical tests: (i)Tragacanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2	Determination of stomatal number and index
3	Determination of vein islet number, vein islet termination and palisade ratio.
4	Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5	Determination of Fiber length and width
6	Determination of number of starch grains by Lycopodium spore method
7	Determination of Ash value
8	Determination of Extractive values of crude drugs
9	Determination of moisture content of crude drugs
10	Determination of swelling index and foaming

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	W. C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
3	Tyler, V. E., Brady, L. R. and Robbers, J. E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
4	Text Book of Pharmacognosy by T.E. Wallis
5	Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
6	Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
7	Herbal drug industry by R. D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.
8	Essentials of Pharmacognosy, Dr. S. H. Ansari, IInd edition, Birla publications, New Delhi, 2007
9	Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhale

KADI SARVA VISHWA VIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

Effective from Session JUNE 2017

SEMESTER-V

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P	T	T	P
BP501T	Medicinal Chemistry II – Theory	3	-	1	4	-
BP502T	Industrial Pharmacy I – Theory	3	-	1	4	-
BP503T	Pharmacology II – Theory	3	-	1	4	-
BP504T	Pharmacognosy and Phytochemistry II – Theory	3	-	1	4	-
BP505T	Pharmaceutical Jurisprudence – Theory	3	-	1	4	-
BP506P	Industrial Pharmacy I – Practical	-	4	-	-	2
BP507P	Pharmacology II – Practical	-	4	-	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	-	4	-	-	2
	TOTAL	**27**		**5**	**26**	

SEMESTER-V

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP501T	Medicinal Chemistry II – Theory	3	--	25	--	75	--	100
BP502T	Industrial Pharmacy I – Theory	3	--	25	--	75	--	100
BP503T	Pharmacology II – Theory	3	--	25	--	75	--	100
BP504T	Pharmacognosy and Phytochemistry II – Theory	3	--	25	--	75	--	100
BP505T	Pharmaceutical Jurisprudence – Theory	3	--	25	--	75	--	100
BP506P	Industrial Pharmacy I – Practical	--	4	--	15	--	35	50
BP507P	Pharmacology II – Practical	--	4	--	15	--	35	50
BP508P	Pharmacognosy and Phytochemistry II – Practical	--	4	--	15	--	35	50
TOTAL		**27**		**170**		**480**		**650**

SUBJECT **: MEDICINAL CHEMISTRY II - THEORY**
SUBJECT CODE **: BP501T**
SCOPE : This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Understand reaction mechanism with examples.
2. Help in design and synthesis of new medicinal compounds.
3. Correlate with role of various parameters on activity.
4. Understand industrial perspective on drug design

PREREQUISITES:

1. Basic knowledge of stereochemistry and heterocyclic chemistry.
2. Fundamental of organic chemistry.
3. IUPAC nomenclature of organic compounds.
4. Basic principle of medicinal chemistry

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP501T	Medicinal Chemistry II - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)		
1	❖ **Antihistaminic agents:** Histamine, receptors and their distribution in the human body • **H1–antagonists**: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelennamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenindamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetirizine, Cromolyn sodium, • **H2-antagonists**: Cimetidine*, Famotidine, Ranitidine. • **Gastric Proton pump inhibitors**: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole	10
	❖ **Anti-neoplastic agents:** • **Alkylating agents**: Mechlorethamine*, 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.	
2	❖ **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: Chlorothiazide*, 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 monocolpate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.	10
3	❖ **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, Cholesteramine and Colestipol ❖ **Coagulant & Anticoagulants**: Menadione, Acetomenadione, Warfarin*, Anisidine, clopidogrel ❖ **Drugs used in Congestive Heart Failure**: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.	10
4	❖ **Drugs acting on Endocrine system** Nomenclature, Stereochemistry and metabolism of steroids • **Sex hormones**: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol. • **Drugs for erectile dysfunction**: Sildenafil, Tadalafil. • **Oral contraceptives**: Mifepristone, Norgestril, Levonorgestrol • **Corticosteroids**: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone • **Thyroid and antithyroid drugs**: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.	8
5	❖ **Antidiabetic agents:** • Insulin and its preparations: Sulfonyl ureas: 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.	7

	• **Amino Benzoic acid derivatives**: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate. • **Lidocaine/Anilide derivatives**: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. • **Miscellaneous**: Phenacaine, Diperodon, Dibucaine.*	

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2	Foye's Principles of Medicinal Chemistry.
3	Burger's Medicinal Chemistry, Vol I to IV.
4	Introduction to principles of drug design- Smith and Williams.
5	Remington's Pharmaceutical Sciences.
6	Martindale's extra pharmacopoeia.
7	Organic Chemistry by I.L. Finar, Vol. II.
8	The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.
9	Indian Pharmacopoeia.
10	Text book of practical organic chemistry- A.I.Vogel

SUBJECT : **INDUSTRIAL PHARMACY I - THEORY**
SUBJECT CODE : **BP502T**
SCOPE : Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.
OBJECTIVES Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain the technology involved in manufacturing of various dosage forms.
2. Develop the dosage forms at laboratory scale
3. Evaluate the quality of these drug formulations using various tests.

PREREQUISITES: Pharmaceutical unit operations

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	P	TUT	TOTAL		Theory	Practical	Theory	Practical	
BP502T	Industrial Pharmacy I - Theory	3	-	1	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	❖ **Preformulation Studies**: • Introduction to Preformulation, goals and objectives, study of physicochemical characteristics of drug substances. • Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism • Chemical Properties: Hydrolysis, oxidation, reduction, racemization, 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.	7
2	❖ **Tablets:** • Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. • Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. • 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
3	❖ **Capsules:** • 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	8

	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	
4	❖ **Parenteral Products:** • Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity • Production procedure, production facilities and controls, aseptic processing • Formulation of injections, sterile powders, large volume parenterals and lyophilized products. • 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
5	❖ **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

SUBJECT : INDUSTRIAL PHARMACY I - PRACTICAL
SUBJECT CODE : BP506P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP506P	Industrial Pharmacy I - Practical	-	4	4	2	-	15	-	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Preformulation studies on paracetamol/aspirin/or any other drug
2	Preparation and evaluation of Paracetamol tablets
3	Preparation and evaluation of Aspirin tablets
4	Coating of tablets- film coating of tables/granules
5	Preparation and evaluation of Tetracycline capsules
6	Preparation of Calcium Gluconate injection
7	Preparation of Ascorbic Acid injection
8	Quality control test of (as per IP) marketed tablets and capsules
9	Preparation of Eye drops/ and Eye ointments
10	Preparation of Creams (cold / vanishing cream)
11	Evaluation of Glass containers (as per IP)

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
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
5	Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6	Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7	Pharmaceutics- The science of dosage form design by M. E. Aulton, Churchill Livingstone, Latest edition
8	Introduction to Pharmaceutical Dosage Forms by H. C. Ansel, Lea & Febiger, Philadelphia, 5thedition, 2005
9	Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

SUBJECT **: PHARMACOLOGY II - THEORY**
SUBJECT CODE **: BP503T**
SCOPE . This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Narrate the principles involved in measurement of drug effects
2. Classify the drugs according to pharmacological classes
3. Explain the mechanism of action, pharmacodynamics and pharmacokinetic effects of drugs, adverse effects, contraindications and therapeutic application of various classes of drugs.
4. Conduct some simple in vivo experiments to demonstrate the pharmacological actions of the drugs.

PREREQUISITES:

Knowledge of Human Anatomy Physiology, Health Education, Biochemistry and basic physics and chemistry. Fundamentals of pharmacology learnt in previous semesters.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP503T	Pharmacology II - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **Pharmacology of drugs acting on cardiovascular system** a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic drugs.	10
2	❖ **Pharmacology of drugs acting on cardiovascular system** a. Drug used in the therapy of shock. b. Hematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders 2. Pharmacology of drugs acting on urinary system a. Diuretics b. Anti-diuretics.	10
3	❖ **Autacoids and related drugs** a. Introduction to autacoids and classification b. Histamine, 5-HT and their antagonists. c. Prostaglandins, Thromboxanes and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. d. Non-steroidal anti-inflammatory agents f. Anti-gout drugs e. Antirheumatic drugs	10

4	❖ **Pharmacology of drugs acting on endocrine system** a. Basic concepts in endocrine pharmacology. b. Anterior Pituitary hormones- analogues and their inhibitors. c. Thyroid hormones- analogues and their inhibitors. c. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. d. Insulin, Oral Hypoglycemic agents and glucagon. e. ACTH and corticosteroids.	8
5	❖ **Pharmacology of drugs acting on endocrine system** a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus. ❖ **Bioassay** a. Principles and applications of bioassay. b. Types of bioassay c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT	7

SUBJECT : PHARMACOLOGY II - PRACTICAL
SUBJECT CODE : BP507P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP507P	Pharmacology II - Practical	-	4	4	2	-	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Introduction to in-vitro pharmacology and physiological salt solutions.
2	Effect of drugs on isolated frog heart.
3	Effect of drugs on blood pressure and heart rate of dog.
4	Study of diuretic activity of drugs using rats/mice.
5	DRC of acetylcholine using frog rectus abdominis muscle.
6	Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7	Bioassay of histamine using guinea pig ileum by matching method.
8	Bioassay of oxytocin using rat uterine horn by interpolation method.
9	Bioassay of serotonin using rat fundus strip by three point bioassay.
10	Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11	Determination of PA2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12	Determination of PD2 value using guinea pig ileum.
13	Effect of spasmogens and spasmolytics using rabbit jejunum.
14	Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15	Analgesic activity of drug using central and peripheral methods
Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos	

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
3	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4	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.
5	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
6	K. D. Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8	Modern Pharmacology with clinical Applications, by Charles R. Craig& Robert.
9	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

SUBJECT : **PHARMACOGNOSY AND PHYTOCHEMISTRY II - THEORY**
SUBJECT CODE : **BP504T**
SCOPE : The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

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

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 carryout isolation and identification of phytoconstituents

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Describe the metabolic pathways involved in formation of various secondary metabolites
2. Classify secondary metabolites based on their chemical structures
3. Understand and implement the procedures for isolation of secondary metabolites from their natural sources
4. Explain the commercial uses of important phytoconstituents

PREREQUISITES:

- Basic knowledge about secondary plant metabolites
- Basic knowledge of organic chemistry and pathology

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP504T	**Pharmacognosy and Phytochemistry II - Theory**	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
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
2	❖ **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

3	❖ **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	6
4	❖ **Industrial production, estimation and utilization** of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine	10
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.	8

SUBJECT : PHARMACOGNOSY AND PHYTOCHEMISTRY II - PRACTICAL
SUBJECT CODE : BP508P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP508P	Pharmacognosy and Phytochemistry II - Practical	-	4	4	2	-	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2	Exercise involving isolation & detection of active principles a. Caffeine - from tea dust. b. Diosgenin from Dioscorea c. Atropine from Belladonna d. Sennosides from Senna
3	Separation of sugars by Paper chromatography
4	TLC of herbal extract
5	Distillation of volatile oils and detection of phytoconstituents by TLC
6	Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2	Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3	Textbook of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4	Herbal drug industry by R.D. Choudhary (1996), Ist Ed^{n}, Eastern Publisher, New Delhi.
5	Essentials of Pharmacognosy, Dr. S. H. Ansari, IInd edition, Birla publications, New Delhi, 2007
6	Herbal Cosmetics by H. Pande, Asia Pacific Business press, Inc, New Delhi.
7	A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8	R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9	Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10	The formulation and preparation of cosmetic, fragrances and flavours.
11	Remington's Pharmaceutical sciences.
12	Textbook of Biotechnology by Vyas and Dixit.
13	Text Book of Biotechnology by R.C. Dubey.

SUBJECT : PHARMACEUTICAL JURISPRUDENCE - THEORY
SUBJECT CODE : BP505T
SCOPE : This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.
OBJECTIVES Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:
1. Basic principles, purpose and dimensions of the laws
2. Important inclusions and exclusions of the laws
3. Important rules and regulations and procedures made to execute the laws
4. Important penalties for breaking these laws.

PREREQUISITES: none

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP505T	Pharmaceutical Jurisprudence - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
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
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
3	❖ **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**:	10

	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	
4	❖ **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	8
	❖ **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)	
5	❖ **Pharmaceutical Legislations** – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee=	7
	❖ **Code of Pharmaceutical ethics** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath	
	❖ **Medical Termination of Pregnancy Act**	
	❖ **Right to Information Act**	
	❖ **Introduction to Intellectual Property Rights (IPR)**	

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Forensic Pharmacy by B. Suresh
2	Textbook of Forensic Pharmacy by B.M. Mithal
3	Hand book of drug law-by M.L. Mehra
4	A textbook of Forensic Pharmacy by N.K. Jain
5	Drugs and Cosmetics Act/Rules by Govt. of India publications.
6	Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7	Narcotic drugs and psychotropic substances act by Govt. of India publications
8	Drugs and Magic Remedies act by Govt. of India publication
9	Bare Acts of the said laws published by Government. Reference books (Theory)

KADI SARVA VISHWA VIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

Effective from Session JUNE 2017

SEMESTER-VI

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P		T	P
BP601T	Medicinal Chemistry III – Theory	3	-	1	4	-
BP602T	Pharmacology III – Theory	3	-	1	4	-
BP603T	Herbal Drug Technology – Theory	3	-	1	4	-
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	-	1	4	-
BP605T	Pharmaceutical Biotechnology – Theory	3	-	1	4	-
BP606T	Quality Assurance – Theory	3	-	1	4	-
BP607P	Medicinal Chemistry III – Practical	-	4	-	-	2
BP608P	Pharmacology III – Practical	-	4	-	-	2
BP609P	Herbal Drug Technology – Practical	-	4	-	-	2
Total		30		6	30	

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP601T	Medicinal Chemistry III – Theory	3	--	25	--	75	--	100
BP602T	Pharmacology III – Theory	3	--	25	--	75	--	100
BP603T	Herbal Drug Technology – Theory	3	--	25	--	75	--	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	--	25	--	75	--	100
BP605T	Pharmaceutical Biotechnology – Theory	3	--	25	--	75	--	100
BP606T	Quality Assurance – Theory	3	--	25	--	75	--	100
BP607P	Medicinal Chemistry III – Practical	--	4	--	15	--	35	50
BP608P	Pharmacology III – Practical	--	4	--	15	--	35	50
BP609P	Herbal Drug Technology – Practical	--	4	--	15	--	35	50
Total		30		195		555		750

SUBJECT : **MEDICINAL CHEMISTRY III - THEORY**
SUBJECT CODE : **BP601T**
SCOPE : This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

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

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.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1.Understand about Lead identification and QSAR
2. Know about Rational and traditional approaches of drug identification for drug discovery
3.Students are able to know how CADD methods and bioinformatics tools offer significant benefits for drug discovery programs.

PREREQUISITES:

1. Drug design software
2. Molecular modeling and docking program
3. Basic Computer Knowledge

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP601T	Medicinal Chemistry III - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
	Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted by (*)	
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
2	❖ **Antibiotics** Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. • Macrolide: Erythromycin Clarithromycin, Azithromycin.	10

	• 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.	
3	❖ **Anti-tubercular Agents** • Synthetic anti tubercular agents: Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* • Anti-tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine, Streptomycin, 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
4	❖ **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*.	8
5	❖ **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 phase and solution phase synthesis.	7

SUBJECT : MEDICINAL CHEMISTRY III - PRACTICAL
SUBJECT CODE : BP607P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP607P	Medicinal Chemistry III - Practical	-	4	4	2	-	15	-	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	**Preparation of drugs and intermediates**
	1. Sulphanilamide
	2. 7-Hydroxy, 4-methyl coumarin
	3. Chlorobutanol
	4. Triphenyl imidazole
	5. Tolbutamide
	6. Hexamine
2	**Assay of drugs**
	1. Isonicotinic acid hydrazide
	2. Chloroquine
	3. Metronidazole
	4. Dapsone
	5. Chlorpheniramine maleate
	6. Benzyl penicillin
3	Preparation of medicinally important compounds or intermediates by Microwave irradiation technique
4	Drawing structures and reactions using chem draw®
5	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)

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1.	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2.	Foye's Principles of Medicinal Chemistry.
3.	Burger's Medicinal Chemistry, Vol I to IV.
4.	Introduction to principles of drug design- Smith and Williams.
5.	Remington's Pharmaceutical Sciences.
6.	Martindale's extra pharmacopoeia.
7.	Organic Chemistry by I.L. Finar, Vol. II.
8.	The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9.	Indian Pharmacopoeia.
10.	Textbook of practical organic chemistry- A.I.Vogel.

SUBJECT : **PHARMACOLOGY III - THEORY**
SUBJECT CODE : **BP602T**
SCOPE : This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and Chrono pharmacology.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Narrate the principles involved in measurement of drug effects
2. Classify the drugs according to pharmacological classes
3. Explain the mechanism of action, pharmacodynamics and pharmacokinetic effects of drugs, adverse effects, contraindications and therapeutic application of various classes of drugs.
4. Conduct some simple in vivo experiments to demonstrate the pharmacological actions of the drugs.

PREREQUISITES:

Knowledge of Human Anatomy Physiology, Health Education, Biochemistry and basic physics and chemistry. Fundamentals of pharmacology learnt in previous semesters

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP602T	Pharmacology III - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **Pharmacology of drugs acting on Respiratory system** a. Anti -asthmatic drugs b. Drugs used in the management of COPD c. Expectorants and antitussives d. Nasal decongestants e. Respiratory stimulants ❖ **Pharmacology of drugs acting on the Gastrointestinal Tract** a. Antiulcer agents. b. Drugs for constipation and diarrhoea. c. Appetite stimulants and suppressants. d. Digestants and carminatives. e. Emetics and anti-emetics.	10
2	❖ **Chemotherapy** a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides	10
3	❖ **Chemotherapy** a. Antitubercular agents b. Antileprotic agents c. Antifungal agents d. Antiviral drugs e. Anthelmintics f. Antimalarial drugs g. Antiamoebic agents,	10

4	❖ **Chemotherapy** • Urinary tract infections and sexually transmitted diseases. • Chemotherapy of malignancy. ❖ **Immunopharmacology** a. Immunostimulants b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars	8
5	❖ **Principles of toxicology** a. Definition and basic knowledge of acute, subacute and chronic toxicity. b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity c. General principles of treatment of poisoning d. Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning. ❖ **Chronopharmacology** a. Definition of rhythm and cycles. b. Biological clock and their significance leading to chronotherapy.	7

SUBJECT : PHARMACOLOGY III - PRACTICAL
SUBJECT CODE : BP608P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP608P	Pharmacology III - Practical	-	4	4	2	-	15	--	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Dose calculation in pharmacological experiments
2	Antiallergic activity by mast cell stabilization assay
3	Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4	Study of effect of drugs on gastrointestinal motility
5	Effect of agonist and antagonists on guinea pig ileum
6	Estimation of serum biochemical parameters by using semi- autoanalyzer
7	Effect of saline purgative on frog intestine
8	Insulin hypoglycemic effect in rabbit
9	Test for pyrogens (rabbit method)
10	Determination of acute oral toxicity (LD50) of a drug from a given data
11	Determination of acute skin irritation / corrosion of a test substance
12	Determination of acute eye irritation / corrosion of a test substance
13	Calculation of pharmacokinetic parameters from a given data
14	Biostatistics methods in experimental pharmacology(student's t test, ANOVA)
15	Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

*Experiments are demonstrated by simulated experiments/videos

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,
	Churchil Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc
	Graw-Hill
3	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4	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
5	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6	K.D. Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical
	Publishers (P) Ltd, New Delhi.
7	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
	Modern Pharmacology with clinical Applications, by Charles R. Craig& Robert,
8	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan,
10	N. Udupa and P.D. Gupta, Concepts in Chronopharmacology.

SUBJECT **: HERBAL DRUG TECHNOLOGY - THEORY**
SUBJECT CODE **: BP603T**
SCOPE : This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

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

1. Understand raw material as source of herbal drugs from cultivation to herbal drug product
2. Know the who and ich guidelines for evaluation of herbal drugs
3. Know the herbal cosmetics, natural sweeteners, nutraceuticals
4. Appreciate patenting of herbal drugs, GMP .

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain basic principles of Indian systems of medicine
2. Prepare and evaluate herbal formulations as per WHO and ICH guidelines
3. Explain the health benefits of nutraceuticals in various ailments
4. Identify the interaction of selected herbs with foods and drugs
5. Discuss the significance of natural substances as pharmaceutical excipients
6. Judge the patentability of a herbal product
7. Explain the regulations related to GMP of herbal drug products

PREREQUISITES: Basic knowledge of pharmaceutical formulations

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP603T	Herbal Drug Technology - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **Herbs as raw materials**	11
	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.	
2	❖ **Nutraceuticals**	7
	• 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: Alfa-alfa, 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.	
3	❖ **Herbal Cosmetics**	10
	• 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	
4	❖ **Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs**	10
	• 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.	
5	❖ **General Introduction to Herbal Industry**	7
	• Herbal drugs industry: Present scope and future prospects.	
	• A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.	
	• **Schedule T – Good Manufacturing Practice of Indian systems of medicine**	
	• Components of GMP (Schedule – T) and its objectives	
	• Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.	

SUBJECT : HERBAL DRUG TECHNOLOGY - PRACTICAL
SUBJECT CODE : BP609P

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP609P	Herbal Drug Technology - Practical	-	4	4	2	-	15	-	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	To perform preliminary phytochemical screening of crude drugs.
2	Determination of the alcohol content of Asava and Arista
3	Evaluation of excipients of natural origin
4	Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5	Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopeial requirements.
6	Monograph analysis of herbal drugs from recent Pharmacopoeias
7	Determination of Aldehyde content
8	Determination of Phenol content
9	Determination of total alkaloids

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Textbook of Pharmacognosy by Trease & Evans.
2	Textbook of Pharmacognosy by Tyler, Brady & Robber.
3	Pharmacognosy by Kokate, Purohit and Gokhale
4	Essential of Pharmacognosy by Dr. S.H. Ansari
5	Pharmacognosy & Phytochemistry by V.D. Rangari
6	Pharmacopeial standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of
8	Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

SUBJECT : **BIOPHARMACEUTICS AND PHARMACOKINETICS - THEORY**
SUBJECT CODE : **BP604T**
SCOPE : This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arised therein.
OBJECTIVES Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Predict effective drug concentration at given time.
2. Design the required dose of drug.
3. Design multiple dosing for the therapy.

PREREQUISITES: Mathematical calculations.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP604T	Biopharmaceutics and Pharmacokinetics - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **Introduction to Biopharmaceutics** • **Absorption**; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, • **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs	10
2	• **Elimination**: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs • **Bioavailability and Bioequivalence**: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, • In-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.	10
3	❖ **Pharmacokinetics:** a. Definition and introduction to Pharmacokinetics, b. Compartment models, Non compartment models, physiological models, One compartment open model. (a) Intravenous Injection (Bolus) (b) Intravenous infusion and (c) Extra vascular administrations. c. Pharmacokinetics parameters - KE , $t_{1/2}$,V_d, AUC, Ka, Clt and CLR- definitions methods of eliminations, understanding of their significance and application	10
4	❖ **Multicompartment models**:	8

	d. Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.	
5	❖ **Nonlinear Pharmacokinetics**: a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2	Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3	Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew
4	B.C.YU 4th edition, Prentice-Hall International edition USA
5	Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B. Jaiswal, Vallabh Prakashan Pitampura, Delhi
6	Pharmacokinetics: By Milo Glbaldi Donald, R. Marcel Dekker Inc.
7	Handbook of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
8	Biopharmaceutics; By Swarbrick
9	Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10	Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
11	Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12	Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvania

SUBJECT : **PHARMACEUTICAL BIOTECHNOLOGY - THEORY**
SUBJECT CODE : **BP605T**
SCOPE : Biotechnology has a long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises lot more. It is basically a research-based subject.
OBJECTIVES Upon completion of the course, student shall be able to understand:
Understanding the importance of Immobilized enzymes in Pharmaceutical

1. Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Describe the basic principles underlying the technology used for production of drugs using biotechnology.
2. Describe the methods used in the production of various vaccines, antibiotics and other biological products.

PREREQUISITES: General biology, Anatomy, Physiology, biochemistry
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP605T	Pharmaceutical Biotechnology - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
1	a. Brief **introduction** to Biotechnology with reference to Pharmaceutical Sciences. b. Enzyme Biotechnology- Methods of enzyme immobilization and applications. c. Biosensors- Working and applications of biosensors in Pharmaceutical Industries. d. Brief introduction to Protein Engineering. e. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. f. Basic principles of genetic engineering.	10
2	a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of r DNA technology and genetic engineering in the production of: 1. Interferon 2. Vaccines- hepatitis- B 3. Hormones-Insulin. d) Brief introduction to PCR	10
3	❖ **Types of immunity**- • Humoral immunity, cellular immunity • Structure of Immunoglobulins • Structure and Function of MHC • Hypersensitivity reactions, Immune stimulation and Immune suppressions.	10

	• 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 Substitutes	
4	❖ **Immuno-blotting techniques-** • ELISA, Western blotting, Southern blotting. b) 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.	8
5	❖ **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 Substitutes.	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
2	RA Goldshy et. al. Kuby Immunology.
3	J.W. Goding: Monoclonal Antibodies.
4	J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5	Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6	S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7	Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

SUBJECT **: QUALITY ASSURANCE - THEORY**
SUBJECT CODE **: BP606T**
SCOPE : This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.
OBJECTIVES Upon completion of the course, student shall be able to understand:

- 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

LEARNING OUTCOMES: At the end of the course the student will be able to:

- Carry out analytical method validation
- Calibration and validation of various instruments
- Role of quality control and quality assurance in pharmaceutical industry
- Importance of Good laboratory practice

PREREQUISITES: Basic knowledge of Quality assurance and Quality control

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP606T	Quality Assurance - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **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
2	❖ **Organization and personnel**: • Personnel responsibilities, training, hygiene and personal records. • **Premises**: Design, construction and plant layout, maintenance, sanitation, • Environmental control, utilities and maintenance of sterile areas, control of contamination. • **Equipments and raw materials**: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.	10
3	❖ **Quality Control**: • Quality control test for containers, rubber closures and secondary packing materials. • **Good Laboratory Practices**: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities	10
4	❖ **Complaints:**	8

	• Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. • **Document maintenance in pharmaceutical industry**: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.	
5	❖ **Calibration and Validation**: • Introduction, definition and general principles of calibration, • Qualification and validation, importance and scope of validation, types of validation, validation master plan. • Calibration of pH meter, • Qualification of UV-Visible spectrophotometer, • General principles of Analytical method Validation. • **Warehousing**: Good warehousing practice, materials management	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Quality Assurance Guide by organization of Pharmaceutical Products of India.
2	Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3	Quality Assurance of Pharmaceuticals- A compendium of Guide-lines and Related materials Vol I WHO Publications.
4	A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5	How to Practice GMP's – P P Sharma.
6	ISO 9000 and Total Quality Management – Sadhank G Ghosh
7	The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8	Good laboratory Practices – Marcel Dekker Series
9	ICH guidelines, ISO 9000 and 14000 guidelines

KADI SARVA VISHWAVIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

SEMESTER-VII

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUT	CREDIT	
		T	P		T	P
BP701T	Instrumental Methods of Analysis – Theory	3	-	1	4	-
BP702T	Industrial Pharmacy II – Theory	3	-	1	4	-
BP703T	Pharmacy Practice – Theory	3	-	1	4	-
BP704T	Novel Drug Delivery System – Theory	3	-	1	4	-
BP705P	Instrumental Methods of Analysis – Practical	-	4	-	-	2
BP706PS	Practice School*	-	12	-	-	6
Total		28		4	24	

***** Non-University Examination (NUE)

SEMESTER-VII
SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP701T	Instrumental Methods of Analysis – Theory	3	--	25	--	75	--	100
BP702T	Industrial Pharmacy II – Theory	3	--	25	--	75	--	100
BP703T	Pharmacy Practice – Theory	3	--	25	--	75	--	100
BP704T	Novel Drug Delivery System – Theory	3	--	25	--	75	--	100
BP705P	Instrumental Methods of Analysis – Practical	--	4	--	15	--	35	50
BP706PS	Practice School*	5	--	--	25	--	125	150
Total		21		140		460		600

***** The subject experts at college level shall conduct examinations

SUBJECT : **INSTRUMENTAL METHODS OF ANALYSIS - THEORY**
SUBJECT CODE : **BP701T**
SCOPE : This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Understand the basic difference between various spectroscopic methods.
2. Should be having knowledge regarding basic principal of working as well as various components of instruments used in different methods.
3. Should be able to understand basics of various chromatography methods and instrumentation.

PREREQUISITES:

1. Knowledge of basic chemistry and terminologies.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP701T	Instrumental Methods of Analysis - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45HRS
1	**UV Visible spectroscopy** • Electronic Transitions, • Chromophores, • Auxochromes, • Spectral Shifts, • Solvent Effect on Absorption Spectra, • Beer and Lambert's Law, • Derivation and Deviations. ❖ Instrumentation – • Sources of Radiation, • Wavelength Selectors, • Sample Cells, • Detectors- Photo Tube, • Photomultiplier Tube, • Photo Voltaic Cell, • Silicon Photodiode. ❖ Applications - Spectrophotometric titrations, Single component and multi component analysis	10
	Fluorimetry: • Theory, • Concepts of Singlet, • Doublet and Triplet Electronic States, • Internal and External Conversions, • Factors Affecting Fluorescence, Quenching,	

	• Instrumentation and applications	
2	❖ **IR spectroscopy** • Introduction, • Fundamental Modes of Vibrations in Poly Atomic Molecules, • Sample Handling, • Factors Affecting Vibrations • Instrumentation - Sources of Radiation, Wavelength Selectors, Detectors - Golay Cell, Bolometer, Thermocouple, Thermister, Pyroelectric Detector and Applications ❖ **Flame Photometry-** • Principle, Interferences, • Instrumentation and Applications ❖ **Atomic absorption spectroscopy-** • Principle, • Interferences, • Instrumentation and Applications ❖ **Nepheloturbidometry-** Principle, instrumentation and applications	10
3	**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
4	**Gas chromatography –** • Introduction, • Theory, • Instrumentation, • Derivatization, • Temperature Programming, • Advantages,	8

	• Disadvantages And • Applications **High performance liquid chromatography (HPLC)-** • Introduction, • Theory, • Instrumentation, • Advantages And • Applications.	
5	**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

SUBJECT : INSTRUMENTAL METHODS OF ANALYSIS - PRACTICAL
SUBJECT CODE : BP705P
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)			CREDITS	EVALUATION SCHEME				TOTAL MARKS
						INTERNAL		EXTERNAL		
		T	P	TOTAL		Theory	Practical	Theory	Practical	
BP705P	*Instrumental Methods of Analysis -Practical*	-	4	4	2	-	15	-	35	50

LIST OF PRACTICALS:

SR.NO	PRACTICAL
1	Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2	Estimation of dextrose by colorimetry
3	Estimation of sulfanilamide by colorimetry
4	Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5	Assay of paracetamol by UV- Spectrophotometry
6	Estimation of quinine sulfate by fluorimetry
7	Study of quenching of fluorescence
8	Determination of sodium by flame photometry
9	Determination of potassium by flame photometry
10	Determination of chlorides and sulphates by nephelo turbidometry
11	Separation of amino acids by paper chromatography
12	Separation of sugars by thin layer chromatography
13	Separation of plant pigments by column chromatography
14	Demonstration experiment on HPLC
15	Demonstration experiment on Gas Chromatography

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Instrumental Methods of Chemical Analysis by B.K Sharma
2	Organic spectroscopy by Y.R Sharma
3	Textbook of Pharmaceutical Analysis by Kenneth A. Connors
4	Vogel's Textbook of Quantitative Chemical Analysis by A.I. Vogel
5	Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6	Organic Chemistry by I. L. Finar
7	Organic spectroscopy by William Kemp
8	Quantitative Analysis of Drugs by D. C. Garrett
9	Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10	Spectrophotometric identification of Organic Compounds by Silverstein

SUBJECT : **INDUSTRIAL PHARMACY II - THEORY**
SUBJECT CODE : **BP702T.**
SCOPE : This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market
OBJECTIVES Upon completion of the course, student shall be able to:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain the technology involved in manufacturing of various dosage forms.
2. Develop the dosage forms at laboratory scale
3. Evaluate the quality of these drug formulations using various tests.

PREREQUISITES: Pharmaceutical unit operations

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP702T	Industrial Pharmacy II - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**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
2	**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
3	**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
4	**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	8
5	**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.	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http://en.wikipedia.org/wiki/Regulatory_Affairs.
2	International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php
3	Douglas J Pisano and David S. Mantus. Textbook of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4	Regulatory Affairs brought by learning plus, Inc. available at http.//www.cgmp.com/ra.htm.

SUBJECT : PHARMACY PRACTICE - THEORY
SUBJECT CODE : BP703T
SCOPE : In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

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

1. List and outline various drug distribution methods in a hospital
2. Describe and summarize the pharmacy stores management
3. Design approaches for inventory control
4. Monitor drug therapy of patient through medication chart review and clinical review
5. Record and interpret medication history
6. Interview and counsel the patients
7. Implement patient counseling in community set up
8. Identify drug related problems
9. Detect and assess adverse drug reactions (ADRs)
10. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
11. Recognize pharmaceutical care services
12. Outline the concept of rational drug therapy and distinguish between rational and irrational use of drugs

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Create lay out of ideal hospital
2. Compose and construct Drug Formulary for hospital considering various factors
3. Set up drug distribution channel in hospital
4. Propose and set up Adverse Drug Reaction monitoring in the hospital
5. Recommend patient counselling set up and plan

PREREQUISITES: NONE

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	P	TUT	TOTAL		Theory	Practical	Theory	Practical	
BP703T	Pharmacy Practice - Theory	3	-	1	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	**a) Hospital and it's organization** Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non-clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions. **b) Hospital pharmacy and its organization** Definition, functions of hospital pharmacy, Organization, structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists. **c) Adverse drug reaction** Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.	10

	d) Community Pharmacy Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.	
2	**a) Drug distribution system in a hospital** Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs. **b) Hospital formulary** Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary. **c) Therapeutic drug monitoring** Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring. **d) Medication adherence** Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence. **e) Patient medication history interview** Need for the patient medication history interview, medication interview forms. **f) Community pharmacy management** Financial, materials, staff, and infrastructure requirements.	10
3	**a) Pharmacy and therapeutic committee** Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation. b) **Drug information services** Drug and Poison information Centre, Sources of drug information, Computerized services, and storage and retrieval of information. **c) Patient counseling** Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist **d) Education and training program in the hospital** Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education. **e) Prescribed medication order and communication skills** Prescribed medication order- interpretation and legal requirements, And Communication skills- communication with prescribers and patients.	10
4	**a) Budget preparation and implementation** Budget preparation and implementation **b) Clinical Pharmacy** Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. **c) Over the counter (OTC) sales** Introduction and sale of over the counter and Rational use of common over the counter medications.	8
5	**a) Drug store management and inventory control** Organization of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement	7

	and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure b) **Investigational use of drugs** Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. **c) Interpretation of Clinical Laboratory Tests** Blood chemistry, hematology, and urinalysis	

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Merchant S.H. and Dr. J. S. Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2	Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1st ed. Chennai: Orient Longman Private Limited; 2004.
3	William E. Hassan. Hospital pharmacy, 5th ed. Philadelphia: Lea & Febiger;1986.
4	Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications; 2008.
5	Scott LT. Basic skills in interpreting laboratory data, 4th ed. American Society of Health System Pharmacists Inc; 2009.
6	Parmar N.S. Health Education and Community Pharmacy, 18th ed. India: CBS Publishers & Distributers; 2008.
Journals:	
1	Therapeutic drug monitoring. ISSN: 0163-4356
2	Journal of pharmacy practice. ISSN: 0974-8326
3	American journal of health system pharmacy. ISSN: 1535-2900 (online)
4	Pharmacy times (Monthly magazine)

SUBJECT : **NOVEL DRUG DELIVERY SYSTEMS - THEORY**
SUBJECT CODE : **BP704T**
SCOPE : This subject is designed to impart basic knowledge on the area of novel drug delivery systems.
OBJECTIVES Upon completion of the course, student shall be able:

1. 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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Choose correct DDS for given drug candidate with suitable route of administration.
2. Justify the rationale for DDS.
3. Know proper characterization methods for each DDS.

PREREQUISITES: Physical Pharmaceutics.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	P	TUT	TOTAL		Theory	Practical	Theory	Practical	
BP704T	Novel Drug Delivery Systems - Theory	3	-	1	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	❖ **Controlled drug delivery systems**: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design-controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations ❖ **Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.	10
2	❖ **Microencapsulation**: Definition, advantages and disadvantages, microspheres/microcapsules, micro particles, methods of microencapsulation, applications ❖ **Mucosal Drug Delivery system**: Introduction, Principles of bio adhesion / mucoadhesion, concepts, advantages and disadvantages, trans mucosal permeability and formulation considerations of buccal delivery systems ❖ **Implantable Drug Delivery Systems**: Introduction, advantages and disadvantages, concept of implants and osmotic pump	10
3	❖ **Transdermal Drug Delivery Systems**: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches ❖ **Gastro retentive drug delivery systems**: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastro adhesive systems and their applications ❖ **Naso-pulmonary drug delivery system**: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers	10
4	❖ **Targeted drug Delivery**: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications	8
5	❖ **Ocular Drug Delivery Systems**: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and occuserts ❖ **Intrauterine Drug Delivery Systems**: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2	Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3	Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4	N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5	S. P. Vyas and R.K. Khar, Controlled Drug Delivery-concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.
Journals	
1	Indian Journal of Pharmaceutical Sciences (IPA)
2	Indian Drugs (IDMA)
3	Journal of Controlled Release (Elsevier Sciences)
4	Drug Development and Industrial Pharmacy (Marcel & Decker)
5	International Journal of Pharmaceutics (Elsevier Sciences)

SUBJECT : **PRACTICE SCHOOL**
SUBJECT CODE : **BP706PS**
SCOPE : The subject is designed to give field exposure to each student along with the skill development for special practical and projects. The interactive sessions for field training shall acquaint the students with skills necessary in addition to theoretical knowledge.

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

1. Apply theoretical knowledge to practical field.
2. Develop practical skills for new techniques.
3. National and international regulatory requirements for rug products.
4. Understand functioning of CRO and Medical stores.

COURSE OUTCOME: At the end of course, the student will be able to:

1. Identify and list the regulatory requirements for setting up a medical store, a CRO and a Hospital.
2. Identify and list the national and international regulatory requirements for drug product registration.
3. Prepare documents for different pharmaceutical operations.
4. Recognize and describe the leadership and entreprenural skills to start a business.
5. Apply the pharmaceutical knowledge in counseling of patients regarding use of conventional and new DDS.
6. Distinguish between the roles of a community pharmacist and a hospital pharmacist.
7. Evaluate the current state of retail and hospital health care based on their observations.
8. Summarize their observations in form of a report.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP706PS	**Practice School***	--	--	12	12	6	-	25	-	125	150

- NON-UNIVERSITY EXAMINATIONS

KADI SARVA VISHWAVIDYALAYA

K. B. INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

BACHELOR OF PHARMACY SYLLABUS

SEMESTER-VIII

SCHEME OF TEACHING

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		TUTORIAL	CREDIT	
		T	P	T	T	P
BP801T	Biostatistics and Research Methodology- Theory	3	-	1	4	-
BP802T	Social and Preventive Pharmacy - Theory	3	-	1	4	-
BP803ET	Pharma Marketing Management - Theory	3+3	-	1+1	4+4	-
BP804ET	Pharmaceutical Regulatory Science - Theory		-			-
BP805ET	Pharmacovigilance - Theory		-			-
BP806ET	Quality Control and Standardization of Herbals - Theory		-			-
BP807ET	Computer Aided Drug Design - Theory		-			-
BP808ET	Cell and Molecular Biology - Theory		-			-
BP809ET	Cosmetic Science - Theory		-			-
BP810ET	Pharmacological Screening Methods – Theory		-			-
BP811ET	Advanced Instrumentation Techniques - Theory		-			-
BP812ET	Dietary Supplements and Nutraceuticals – Theory		-			-
BP813ET	Pharmaceutical Product Development – Theory		-			-
BP814PW	Project Work	-	12	-	-	6
Total		24		4	22	

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS				TOTAL MARKS
				Institute level evaluation		University level evaluation		
		T	P	T	P	T	P	
BP801T	Biostatistics and Research Methodology – Theory	3	--	25	--	75	--	100
BP802T	Social and Preventive Pharmacy – Theory	3	--	25	--	75	--	100
BP803ET	Pharma Marketing Management – Theory	3+3	--	25+25	--	75+75	--	100+100
BP804ET	Pharmaceutical Regulatory Science – Theory		--		--		--	
BP805ET	Pharmacovigilance – Theory		--		--		--	
BP806ET	Quality Control and Standardization of Herbals – Theory		--		--		--	
BP807ET	Computer Aided Drug Design – Theory		--		--		--	
BP808ET	Cell and Molecular Biology – Theory		--		--		--	
BP809ET	Cosmetic Science – Theory		--		--		--	
BP810ET	Pharmacological Screening Methods – Theory		--		--		--	
BP811ET	Advanced Instrumentation Techniques – Theory		--		--		--	
BP812ET	Dietary Supplements and Nutraceuticals – Theory		--		--		--	
BP813ET	Pharmaceutical Product Development - Theory		--		--		--	
BP814PW	Project Work	--	4	--	--	--	150	150
Total		16		100		450		550

SUBJECT : **BIOSTATISTICS AND RESEARCH METHODOLOGY - THEORY**
SUBJECT CODE : **BP801T**
SCOPE : To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.
OBJECTIVES Upon completion of the course, student shall be able to understand:
Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)

- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Explain the basic principles of statistics.
2. Carry out data analysis using different statistical tools pertaining to data variability, probability and correlation.
3. Carry out correct sampling for collecting data.

PREREQUISITES: Basic arithmetics

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP801T	Biostatistics and Research Methodology - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	❖ **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
2	❖ **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
3	❖ **Non-Parametric tests**: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test ❖ **Introduction to Research**:	10

	Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism **Graph**s: 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.	
4	❖ **Blocking and confounding system** for Two-level factorials Regression modeling: Hypothesis testing in Simple and Multiple regression models, **Introduction to Practical components** of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach	8
5	❖ **Design and Analysis of experiments:** Factorial Design: Definition, 22, 23design. Advantage of factorial design Response Surface methodology: Central composite design, Historical design, Optimization Techniques	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. New York.
2	Fundamental of Statistics – Himalaya Publishing House- S. C. Guptha
3	Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
4	Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

SUBJECT : **SOCIAL AND PREVENTIVE PHARMACY - THEORY**
SUBJECT CODE : **BP802T**
SCOPE : The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.
OBJECTIVES : Upon completion of the course, student shall be able to

1. Outline the contagious endemic disease that can cause national health emergencies
2. Manage and prevent the epidemic infectious diseases
3. Have a critical way of thinking based on current healthcare development.
4. Evaluate alternative ways of solving problems related to health and pharmaceutical issues

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Enlist infectious epidemic disease and their preventive measures
2. Set up and manage primary healthcare centre in rural and urban areas
3. Support the national and global health programmes
4. Create the policies for irradiation of childhood infections
5. Plan the balanced diet for nutrition

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP802T	Social and Preventive Pharmacy - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45 HRS
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
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
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
4	❖ **National health intervention programme for mother and child**,	8

	• 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	
5	❖ **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.	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2	Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3	Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4	Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5	Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6	Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad
Recommended Journals:	
1	Research in Social and Administrative Pharmacy, Elsevier, Ireland

SUBJECT : PHARMA MARKETING MANAGEMENT - THEORY
SUBJECT CODE : BP803ET
SCOPE : The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.
OBJECTIVES Upon completion of the course, student shall be able to:
The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Describe the concept of pharmaceutical marketing.
2. Enumerate the concept of product management in pharmaceutical industry
3. Discuss the various components of promotion of pharmaceutical products
4. Explain the different pharmaceutical marketing channels
5. Discuss the role and responsibility of professional sales representative
6. Discuss the roles and responsibilities of pricing authorities in India
7. Discuss the emerging concepts of marketing
8. Discuss the role market research

PREREQUISITES: NIL
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP803ET	Pharma Marketing Management - Theory	3	1	-	4	4	25	-	75	-	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	❖ **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	❖ **Product decision:** Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.	8
3	❖ **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.	7
4	❖ **Pharmaceutical marketing channels:** Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management. ❖ **Professional sales representative (PSR):** Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.	10

5	❖ **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; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.	10

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2	Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata MC Graw Hill, New Delhi.
3	Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4	Arun Kumar and N Meenakshi: Marketing Management, Vikas Publishing, India
5	Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6	Ramaswamy, U.S & Nanakamari, S: Marketing Management: Global Perspective, Indian Context, Macmilan India, New Delhi.
7	Shanker, Ravi: Service Marketing, Excell Books, New Delhi.
8	Subba Rao Changanti, Pharmaceutical Marketing in India (GIF –Excel series) Excel Publications.

SUBJECT : PHARMACEUTICAL REGULATORY SCIENCE - THEORY
SUBJECT CODE : BP804ET
SCOPE : This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.
OBJECTIVES Upon completion of the course, student shall be able to:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

- To understand types of Documentation in pharmaceutical industry required for.
- To understand detail knowledge of all the GLP and GMP related records as per the requirement of the industry by adopting Good Documentation Practice.
- To implement Good Regulatory Practices in the Healthcare and related Industries and the student will be prepared to be able to conduct audits and inspections.
- To understand the contents and requirements for filling INDA, NDA and ANDA in accordance with current guidelines of different approving authorities globally.

PREREQUISITES: NIL
TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
B804ET	Pharmaceutical Regulatory Science - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
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
2	❖ **Regulatory Approval Process** 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. Regulatory authorities and agencies Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)	10
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
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
5	❖ **Regulatory Concepts**	7

	Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book	

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2	The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informa Health care Publishers.
3	New Drug Approval Process: Accelerating Global Registrations by Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
4	Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5	FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6	Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143.
7	Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8	Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9	Drugs: From Discovery to Approval, Second Edition by Rick Ng

SUBJECT : PHARMACOVIGILANCE - THEORY
SUBJECT CODE : BP805ET
SCOPE : 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. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Search, compile, analyse and evaluate reports about adverse drug reactions in scientific literature and databases.
2. Explain the importance of pharmacogenomics for individual variation in adverse drug reactions.
3. Analyse methods for pharmacovigilance.
4. Analyse and assess warnings, risk management and risk communication about adverse drug reactions.
5. Analyse and assess the effects and safety of drugs.
6. Give an account for pharmacovigilance from a regulatory perspective.
7. Write scientific and popular text in proper English.

PREREQUISITES: Clinical Pharmacy Principles

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP805ET	Pharmacovigilance - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS

1	❖ **Introduction to Pharmacovigilance** • History and development of Pharmacovigilance • Importance of safety monitoring of Medicine • WHO international drug monitoring programme • Pharmacovigilance Program of India (PvPI) ❖ **Introduction to adverse drug reactions** • 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 ❖ **Basic terminologies used in pharmacovigilance** • Terminologies of adverse medication related events • Regulatory terminologies	10
2	❖ **Drug and disease classification** • Anatomical, therapeutic and chemical classification of drugs • International classification of diseases • Daily defined doses • International Non-proprietary Names for drugs ❖ **Drug dictionaries and coding in pharmacovigilance** • WHO adverse reaction terminologies • MedDRA and Standardized MedDRA queries • WHO drug dictionary • Eudravigilance medicinal product dictionary ❖ **Information resources in pharmacovigilance** • Basic drug information resources • Specialized resources for ADRs ❖ **Establishing pharmacovigilance programme** • Establishing in a hospital • Establishment & operation of drug safety department in industry • Contract Research Organizations (CROs) • Establishing a national programme	10
3	❖ **Vaccine safety surveillance** • Vaccine Pharmacovigilance • Vaccination failure • Adverse events following immunization ❖ **Pharmacovigilance methods** • Passive surveillance – Spontaneous reports and case series • Stimulated reporting • Active surveillance – Sentinel sites, drug event monitoring and registries • Comparative observational studies – Cross sectional study, case control study and cohort study • Targeted clinical investigations ❖ **Communication in pharmacovigilance** • Effective communication in Pharmacovigilance • Communication in Drug Safety Crisis management • Communicating with Regulatory Agencies, Business Partners, Healthcare facilities &Media	10
4	❖ **Safety data generation** • Pre-clinical phase • Clinical phase • Post approval phase (PMS) ❖ **ICH Guidelines for Pharmacovigilance** • Organization and objectives of ICH, • Expedited reporting • Individual case safety reports • Periodic safety update reports	8

	• Post approval expedited reporting • Pharmacovigilance planning • Good clinical practice in pharmacovigilance studies	
5	❖ **Pharmacogenomics of adverse drug reactions** • Genetics related ADR with example focusing PK parameters. ❖ **Drug safety evaluation in special population** • Paediatrics, Pregnancy and lactation, Geriatrics ❖ **CIOMS** • CIOMS Working Groups, CIOMS Form ❖ **CDSCO (India) and Pharmacovigilance** • D&C Act and Schedule Y • Differences in Indian and global pharmacovigilance requirements	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2	Practical Drug Safety from A to Z by Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3	Mann's Pharmacovigilance: Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4	Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5	An Introduction to Pharmacovigilance: Patrick Waller, Wiley Publishers.
6	Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert, Jones & Bartlett Publishers.
7	Textbook of Pharmacoepidemiology edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy, Wiley Publishers.
8	A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills: G. Parthasarathi, Karin Nyfort Hansen, Milap C. Nahata
9	National Formulary of India
10	Textbook of Medicine by Yashpal Munjal
11	Textbook of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
12	http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
13	http://www.ich.org/
14	http://www.cioms.ch/
15	http://cdsco.nic.in/
16	http://www.who.int/vaccine_safety/en/
17	http://www.ipc.gov.in/PvPI/pvhome.html168

SUBJECT : QUALITY CONTROL AND STANDARDIZATION OF HERBALS - THEORY
SUBJECT CODE: BP806ET.

SCOPE : In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

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

1. Know WHO Guidelines for Quality Control of Herbal Drugs
2. Know Quality Assurance in Herbal Drug Industry
3. Know the Regulatory Approval Process and Their Registration in Indian and International Markets
4. Appreciate EU and ICH guidelines for quality control of herbal drugs.

LEARNING OUTCOMES: At the end of the course the student will be able to:

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- It provides the opportunities to understand the guidelines for evaluation and standardization of herbs and herbal drugs
- Appreciate the importance of standardization and quality control of herbal drugs and products.
- Understand the importance of authentic drugs, adulterants and substitutes.
- Understand the process of registration of herbal drugs for marketing approval & export.
- Appreciate the role of biomarkers in standardization of herbal products.
- Standardisation of herbs and herbal formulations using modern analytical techniques such as HPTLC and HPLC.

PREREQUISITES: NIL

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP806ET	Quality Control and Standardization of Herbals -Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45 HRS
1	❖ **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
2	❖ **Quality assurance in herbal drug industry**: • 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
3	❖ EU and ICH guidelines for quality control of herbal drugs. ❖ Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines	10
4	❖ **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
5	❖ **Regulatory requirements for herbal medicines**. • WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems • Comparison of various Herbal Pharmacopoeias.	7

	• Role of chemical and biological markers in standardization of herbal products	

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Pharmacognosy by Trease and Evans
2	Pharmacognosy by Kokate, Purohit and Gokhale
3	Rangari, V.D., Textbook of Pharmacognosy and Phytochemistry Vol. I, Carrier Pub., 2006.
4	Agrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5	EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7	Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8	WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9	WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
10	WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11	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.
12	WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

SUBJECT : COMPUTER AIDED DRUG DESIGN - THEORY
SUBJECT CODE : BP807ET
SCOPE : This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.
OBJECTIVES Upon completion of the course, student shall be able to understand:

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

- The role of drug design in drug discovery process and different approaches of drug design.
- Students should be updated with knowledge of steps involved in Design and discovery of lead molecules for research work.
- The design of new drug molecules using molecular modeling software which is innovative and focus in new running era.
- Different types of strategies which are important to develop new drug like molecules.
- The student shall be able to understand the concept of QSAR and docking

PREREQUISITES:

- Student should have Basic knowledge of different physicochemical parameters of QSAR and its approaches.
- Student should have computer knowledge for using molecular modeling software.
- Student should be updated with current new molecules research.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
B807ET	Computer Aided Drug Design - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **Introduction to Drug Discovery and Development** • Stages of drug discovery and development • Lead discovery and Analog Based Drug Design • 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. • Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies	10
2	❖ **Quantitative Structure Activity Relationship (QSAR)** • SAR versus QSAR, • History and development of QSAR, • Types of physicochemical parameters, • Experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Taft's steric constant.	10

	• Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.	
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
4	❖ **Informatics & Methods in drug design:** Introduction to Bioinformatics, Chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.	8
5	❖ **Molecular Modeling:** Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Robert GCK, ed., "Drug Action at the Molecular Level" University Park Press Baltimore.
2	Martin YC. "Quantitative Drug Design" Dekker, New York.
3	Delgado JN, Remers WA eds "Wilson & Gisvolds's Textbook of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York
4	Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
5	Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
6	Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley& Sons, New York.
7	Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8	Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
9	Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.

SUBJECT : CELL AND MOLECULAR BIOLOGY - THEORY
SUBJECT CODE : BP808ET
SCOPE : Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function. This is done both on a microscopic and molecular level. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges.

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

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

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Understand and utilize the scientific vocabulary used in communicating information in cell and molecular biology
2. Understand and apply general concepts of cell and molecular biology to relevant, specific problems
3. Describe and discuss the properties and biological significance of the major classes of molecules found in living organisms and the relationship between molecular structure and biological function
4. Represent and illustrate the structural organization of genes and the control of gene expression
5. Conceptualize and describe protein structure, folding and sorting
6. Explain the structure of membranes and intracellular compartments and relate these to function.
7. Summarize the processes of energy transduction in cells and explain their significance.
8. Relate how cell movement and cell-cell communication occur and discuss mechanisms of signal transduction
9. Outline the processes that control eukaryotic cell cycle and cell death.
10. Link the rapid advances in cell and molecular biology to a better understanding of diseases, including cancer.

PREREQUISITES: NIL

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP808ET	Cell and Molecular Biology - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **Cell and Molecular Biology:** • Definitions theory and basics and Applications. • Cell and Molecular Biology: History and Summation. • Properties of cells and cell membrane. • Prokaryotic versus Eukaryotic • Cellular Reproduction • Chemical Foundations – an Introduction and Reactions (Types)	10
2	❖ **DNA and the Flow of Molecular Information** • DNA Functioning • DNA and RNA • Types of RNA	10

	• Transcription and Translation	
3	❖ **Proteins:** • Defined and Amino Acids • Protein Structure • Regularities in Protein Pathways • Cellular Processes • Positive Control and significance of Protein Synthesis	10
4	❖ **Science of Genetics** • Transgenic and Genomic Analysis • Cell Cycle analysis • Mitosis and Meiosis • Cellular Activities and Checkpoints	8
5	❖ **Cell Signals: Introduction** • Receptors for Cell Signals • Signaling Pathways: Overview • Mis regulation of Signaling Pathways • Protein-Kinases: Functioning	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2	Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3	Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edition.
4	Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5	Rose: Industrial Microbiology.
6	Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7	Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8	Peppler: Microbial Technology.
9	Edward: Fundamentals of Microbiology.
10	N.K. Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi.
11	Bergey's Manual of systematic bacteriology, Williams and Wilkins- A Waverly company.
12	B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
13	RA Goldshy et. al.: Kuby Immunology.

SUBJECT : COSMETIC SCIENCE - THEORY
SUBJECT CODE : BP809ET
SCOPE : Provide knowledge on cosmetics, and related sciences, cosmeceuticals (cosmetics with skin, hair and oral care benefits) and personal care and hygiene products. Provide multidisciplinary scientific knowledge to gain expertise in the field and to respond the industry challenges effectively. Provide with knowledge on marketing approaches on studying consumer need, need gaps, managing competition and global markets. Develop your potential to have a career in this fast-growing industry in the area of product development & research, regulatory, quality assurance and manufacturing or pursue academic research in the area or to become an entrepreneur in the field.

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

1. This course is designed to provide foundation knowledge of cosmetic principles to address the needs of cosmetic industry.
2. Provide practical skills in the area of biology, formulation science and analytical techniques required to scientifically design and develop products.

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Key ingredients used in cosmetics and cosmeceuticals.
2. Key building blocks for various formulations.
3. Various key ingredients and basic science to develop cosmetics and
4. cosmeceuticals
5. Scientific knowledge to develop cosmetics and with desired Safety, stability, and efficacy.

PREREQUISITES:

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP809ET	Cosmetic Science - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **Classification of cosmetic and cosmeceutical products** • Definition of cosmetics as per Indian and EU regulations, • Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs ❖ **Cosmetic excipients**: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application ❖ **Skin:** Basic structure and function of skin. ❖ **Hair:** Basic structure of hair. Hair growth cycle. ❖ **Oral Cavity**: Common problem associated with teeth and gums.	10
2	❖ **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. ❖ **Principles of formulation and building blocks of Hair care products:** • Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. • Hair oils. • Chemistry and formulation of Para-phylene diamine-based hair dye. ❖ **Principles of formulation and building blocks of oral care products**: • Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.	10
3	❖ **Sun protection**, • Classification of Sunscreens and SPF.	10

	❖ **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.	
4	❖ **Principles of Cosmetic Evaluation**: • Principles of Sebumeter, Corneometer. • Measurement of TEWL, • Skin Color, • Hair tensile strength, • Hair combing properties • Soaps, and syndet bars. • Evolution and skin benefits.	8
5	• 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

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2	Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3	Textbook of Cosmeticology by Sanju Nanda & Roop K. Khar, Tata Publishers.

SUBJECT : PHARMACOLOGICAL SCREENING METHODS - THEORY
SUBJECT CODE : BP810ET
SCOPE : This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.
OBJECTIVES Upon completion of the course, student shall be able to understand:

1. Appreciate the applications of various commonly used laboratory animals.
2. Appreciate and demonstrate the various screening methods used in preclinical Research
3. Appreciate and demonstrate the importance of biostatistics and research methodology
4. Design and execute a research hypothesis independently

LEARNING OUTCOMES: At the end of the course the student will be able to:

1. Implement CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals.
2. Understand dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups
3. Classify and explain the pre-clinical screening models for ANS activity, sympathomimetics sympatholytic, parasympathomimetics, Parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local Anaesthetics
4. Understand the pre-clinical screening models for CVS activity- antihypertensives, diuretics, antiarrhythmic, anti-dyslepidemic, anti-aggregatory, coagulants, and anticoagulants

PREREQUISITES: Basic pharmacology

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP810ET	Pharmacological Screening Methods - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **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.	08
2	❖ **Preclinical 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, c. **Preclinical screening models**: for CNS activity- analgesic, antipyretic, anti-inflammatory, general Anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, Alzheimer's disease	10
3	❖ **Preclinical screening models**: For ANS activity, sympathomimetics, sympatholytics, Parasympathomimetics, Parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anesthetics.	10
4	❖ **Preclinical screening models:** For CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslipidemic, anti-aggregatory, coagulants, and anticoagulants ❖ Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.	12

5	❖ **Research methodology and Biostatistics** 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

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Fundamentals of experimental Pharmacology- by M. N. Ghosh
2	Handbook of Experimental Pharmacology-S. K. Kulakarni
3	CPCSEA guidelines for laboratory animal facility.
4	Drug discovery and Evaluation by Vogel H.G.
5	Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6	Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

SUBJECT : ADVANCED INSTRUMENTATION TECHNIQUES - THEORY
SUBJECT CODE : BP811ET
SCOPE : This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

- Understand the advanced instruments used and its applications in drug analysis
- Understand the chromatographic separation and analysis of drugs.
- Understand the calibration of various analytical instruments
- know analysis of drugs using various analytical instruments.

LEARNING OUTCOMES: At the end of the course the student will be able to:

- Understand the advanced instruments used and its applications in drug analysis
- Understand the chromatographic separation and analysis of drugs.
- Understand the calibration of various analytical instruments
- Know analysis of drugs using various analytical instruments.

PREREQUISITES:

- Basic knowledge of different principals of different spectroscopic methods.
- Basic knowledge of different components of instruments and their function.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP811ET	Advanced Instrumentation Techniques - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ **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
2	❖ **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
3	❖ **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
4	❖ **Radio immune assay**: Importance, various components, Principle, different methods, Limitation and Applications of Radio immunoassay ❖ **Extraction techniques**: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction	8
5	❖ **Hyphenated techniques**-LC-MS/MS, GC-MS/MS, HPTLC-MS.	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Instrumental Methods of Chemical Analysis by B.K Sharma
2	Organic spectroscopy by Y.R Sharma
3	Textbook of Pharmaceutical Analysis by Kenneth A. Connors
4	Vogel's Textbook of Quantitative Chemical Analysis by A.I. Vogel
5	Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6	Organic Chemistry by I. L. Finar
7	Organic spectroscopy by William Kemp
8	Quantitative Analysis of Drugs by D. C. Garrett
9	Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10	Spectrophotometric identification of Organic Compounds by Silverstein

SUBJECT : DIETARY SUPPLEMENTS AND NUTRACEUTICALS - THEORY
SUBJECT CODE : BP812ET
SCOPE : This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population
OBJECTIVES Upon completion of the course, student shall be able to:

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 the application.
4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

LEARNING OUTCOMES: At the end of the course the student will be able to:

- Explain the classification and applications of dietary supplements to maintain healthy life.
- Appreciate the role of nutraceuticals in prevention of certain diseases.
- Know and enumerate the uses of phytochemicals as nutraceuticals.
- Know the components in dietary supplements and their role in the health of normal individual.
- General aspects, Market, growth, scope and types of products available in the market.
- Know the concept of free radicals & their role in human ailments.
- Appreciate the role of endogenous antioxidants & health benefits of synthetic antioxidants.
- Understand the need of supplements by the different group of people to maintain healthy life.
- Understand the outcome of deficiencies in dietary supplements.
- Appreciate the components in dietary supplements and the application.
- Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

PREREQUISITES: NIL

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP812ET	Dietary Supplements and Nutraceuticals - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc. ❖ Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community. ❖ 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
2	❖ Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following a. Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin b. Sulfides: Diallyl sulfides, Allyl trisulfide. c. Polyphenolics: Resveratol d. Flavonoids- Rutin, Naringin, Quercetin, Anthocyanidins, catechins, Flavones e. Prebiotics / Probiotics.: Fructo-oligosaccharides, Lactobacillum f. Phyto-estrogens: Isoflavones, daidzein, Geebustin, lignans g. Tocopherols h. Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.	15

3	a) 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. b) Dietary fibres and complex carbohydrates as functional food ingredients.	7
4	a) 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. b) Antioxidants: Endogenous antioxidants – enzymatic and non-enzymatic antioxidant defense, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione, Vitamin C, Vitamin E, α- Lipoic acid, melatonin c) Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole. d) Functional foods for chronic disease prevention	10
5	a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.	6

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Dietetics by Sri Lakshmi
2	Role of dietary fibres and nutraceuticals in preventing diseases by K.T Agusti and P. Faizal: BS Publication.
3	Advanced Nutritional Therapies by Cooper. K.A., (1996).
4	The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5	Prescription for Nutritional Healing by James F. Balch and Phyllis A. Balch 2nd Edn., Avery Publishing Group, NY (1997).
6	G. Gibson and C. Williams Editors 2000 Functional foods Wood head Publ. Co. London.
7	Goldberg, I. Functional Foods. 1994. Chapman and Hall, New York.
8	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.
9	Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10	Shils, ME, Olson, JA, Shike, M. 1994 Modern Nutrition in Health and Disease. Eighth edition. Lea and Febiger

SUBJECT : PHARMACEUTICAL PRODUCT DEVELOPMENT - THEORY
SUBJECT CODE : BP813ET
SCOPE : Developing a dosage form is an art but it also includes the basic science, without which it is not possible to create the presently available dosage form. The student here learns the basic principles governing the development of dosage forms. Also, he/she learns the factors affecting the efficacy, utilization and stability of these dosage forms.

OBJECTIVES:

1. To learn the various factors which must be considered while developing the dosage form.
2. To apply these basic understandings for development of formulations.

LEARNING OUTCOMES: The student should be able to:

1. Describe the basic principles of biopharmaceutics.
2. Explain the various factors encompassing formulation of dosage forms
3. Demonstrate the techniques for studying the effect of various excipients.
4. Conduct the stability studies for drug formulations

PREREQUISITES: Physical pharmaceutics

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP813ET	Pharmaceutical Product Development - Theory	3	1	-	4	4	25	--	75	--	100

Course content:

CH.NO	PARTICULARS	45HRS
1	❖ Introduction to pharmaceutical product development, objectives, regulations related to Preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms	10
2	❖ An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Solvents and solubilizers ii. Cyclodextrins and their applications iii. Non - ionic surfactants and their applications iv. Polyethylene glycols and sorbitols v. Suspending and emulsifying agents vi. Semi solid excipients	10
3	❖ An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Tablet and capsule excipients ii. Directly compressible vehicles iii. Coat materials iv. Excipients in parenteral and aerosols products v. Excipients for formulation of NDDS Selection and application of excipients in pharmaceutical formulations with specific industrial applications	10
4	❖ 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

5	❖ Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.	7

BOOKS RECOMMENDED

SR.NO	NAME OF BOOK/REFERENCE
1	Pharmaceutical Statistics Practical and Clinical Applications by Stanford Bolton, Charles Bon; Marcel Dekker Inc.
2	Encyclopedia of Pharmaceutical Technology, edited by James swarbrick, Third Edition, Informa Healthcare publishers.
3	Pharmaceutical Dosage Forms, Tablets, Volume II, edited by Herbert A. Lieberman And Leon Lachman; Marcel Dekker, Inc.
4	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.
5	Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, edited by Patrick J. Sinko, BI Publications Pvt. Ltd.
6	Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyas and R. K. Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012.
7	Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V. Allen Jr., Nicholas B. Popovich, Howard C. Ansel, 9th Ed. 40
8	Aulton's Pharmaceutics – The Design and Manufacture of Medicines, Michael E. Aulton,3rd Ed.
9	Remington – The Science and Practice of Pharmacy, 20th Ed.
10	Pharmaceutical Dosage Forms – Tablets Vol 1 to 3, A. Liberman, Leon Lachman and Joseph B. Schwartz
11	Pharmaceutical Dosage Forms – Disperse Systems Vol 1 to 3, H.A. Liberman, Martin, M.R and Gilbert S. Banker.
12	Pharmaceutical Dosage Forms – Parenteral Medication Vol 1 & 2, Kenneth E. Avis and H.A. Liberman.
13	Advanced Review Articles related to the topics.

SUBJECT : **PROJECT WORK**
SUBJECT CODE : **BP814PW**
SCOPE : The subject is designed to bridge the gap between theoretical knowledge and its implementation in pharmaceutical practice. It reflects actual need of professional environment. The designed project work will tangentially touch the contents of elective theory subjects and will provide scope to apply concepts to executing the project.

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

1. Problem solving capabilities and enables them to think clearly in their future career.
2. Able to work in a team to involve in interdisciplinary research projects.
3. Manage information, develop technical reports and make presentations
4. Build, manage and lead a team to successfully complete a project and communicate across teams and organizations to achieve professional objectives
5. Work under various constraints to meet project targets
6. Adopt to the chosen profession by continuously upgrading his/her knowledge and understanding through life-long learning philosophy

LEARNING OUTCOME: At the end of course, the student will be able to:

1. Work in team and undertake a project in the area of Pharmacy
2. Develop their oratory and leadership skills.
3. Apply appropriate research methodology, simulating research environment while formulating a project
4. Define project specifications with strategic planning.
5. Learn statistical techniques and problem-solving skills while managing the project.
6. Present, exhibit and document the project work and generate a project report.

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME (HRS)				CREDITS	EVALUATION SCHEME				TOTAL MARKS
							INTERNAL		EXTERNAL		
		T	TUT	P	TOTAL		Theory	Practical	Theory	Practical	
BP814PW	**Project Work**	-	-	12	12	6	-	-	-	150	150

EXAM NO _____

KADI SARVA VISHWAVIDYALAYA

SEMESTER END EXAMINATION (MONTH-YEAR)

B. PHARM SEM - (NEW)

(SUBJECT CODE) SUBJECT NAME

DATE: **TIME: 3 HRS** **MARKS: 75**

NOTE: 1) Attempt ALL the Questions from each section.
2) Tie both the Sections Separately.

SECTION-I **[40]**

Q.1	Answer the following questions (MCQs/fill in blanks/Objective/ T/F) one Marks each	[10]
Q.2	LONG Answer the following	[10]
	OR//	
Q.2	LONG Answer the following	[10]
Q.3	Short Answer the following [ANY FOUR]	[20]
	1)	
	2)	
	3)	
	4)	
	5)	

SECTION-II **[35]**

Q.4	Answer the following questions (MCQs/fill in blanks/Objective/ T/F) marks each	[10]
Q.5	LONG Answer the following	[10]
	OR//	
Q.5	LONG Answer the following	[10]
Q.6	Short Answer the following [ANY THREE]	[15]
	1)	
	2)	
	3)	
	4)	

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