Himachal Pradesh Technical University, Hamirpur (H.P.)

CURRICULUM (PCI)

BACHELOR OF PHARMCY

(B.PHARMACY)

1st TO 8th SEMESTER

Dean
H.P. Technical University
Hamirpur - 177001

Teaching and Evaluation Scheme

SEMESTER- I (B. Pharmacy)

S. N.	Category	Paper Code	Subject	L	T	P/D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	PC	BP101 T	Human Anatomy and Physiology I– Theory	3	1	-	4	15	10	25	75	100
2	PC	BP102 T	BP102T Pharmaceutical Analysis I – Theory	3	1	-	4	15	10	25	75	100
3	PC	BP103 T	BP103T Pharmaceutics I – Theory	3	1	-	4	15	10	25	75	100
4	PC	BP104 T	Pharmaceutical Inorganic Chemistry – Theory	3	1	-	4	15	10	25	75	100
5	MC	BP105 T	BP105T Communication skills – Theory *	2	-	-	2	10	5	15	35	50
6	MC	BP106 RBT BP106 RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	-	2	10	5	15	35	50
		Labs:										
1	PC	BP107 P	Human Anatomy and Physiology – Practical	-	-	4	2	10	5	15	35	50
2	P C	BP108 P	BP108P Pharmaceutical Analysis I – Practical	-	-	4	2	10	5	15	35	50
3	P C	BP109 P	BP109P Pharmaceutics I – Practical	-	-	4	2	10	5	15	35	50
4	PC	BP110 P	Pharmaceutical Inorganic Chemistry – Practical	-	-	4	2	10	5	15	35	50
	MC	BP111 P	Communication skills – Practical*	-	-	2	1	5	5	10	15	25
	MC	BP112 RBP	Remedial Biology – Practical*	-	-	2	1	5	5	10	15	25
Total				**16**	**4**	**18/20**	**29/30**					**675/725 $/ 750#**
	Total work Load=27 Hrs.						**Total Credit = 27/29$/30#**					

Dean
H.P. Technical University
Hamirpur - 177001

#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)

Legend:

L	Lecture	ESE	End Semester Examination
T	Tutorial	PC	Program Core Courses
P	Practical	FC	Foundation Courses
CT	Class Test	HS	Humanities and social science
TA	Teacher's Assessment	MC	Mandatory Course

SEMESTER – II (B. Pharmacy)

S. N.	Category	Paper Code	Subject	L	T	P/ D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	MC	BP201 T	Human Anatomy and Physiology II – Theory	3	1	-	4	15	10	25	75	100
2	PC	BP202 T	Pharmaceutical Organic Chemistry I – Theory	3	1	-	4	15	10	25	75	100
3	PC	BP203 T	Biochemistry – Theory	3	1	-	4	15	10	25	75	100
4	PC	BP204 T	Pathophysiology – Theory	3	1	-	4	15	10	25	75	100
5	PC	BP205 T	Computer Applications in Pharmacy – Theory *	3	-	-	3	15	10	25	75	100
6	FC	BP206 T	Environmental sciences – Theory *	3	-	-	3	15	10	25	75	100
		Labs:										
1	PC	BP207 P	Human Anatomy and Physiology II – Practical		-	4	2	10	5	15	35	50
2	PC	BP208 P	Pharmaceutical Organic Chemistry I– Practical		--	4	2	10	5	15	35	50
3	PC	BP209 P	Biochemistry – Practical		-	4	2	10	5	15	35	50
4	PC	BP210 P	Computer Applications in Pharmacy – Practical*		-	2	1	5	5	10	15	25
Total				**18**	**0**	**14**	**29**					**725**
Total Work Load 32 Hrs.				**Total Credit 29**								

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

Legend:

L	Lecture	ESE	End Semester Examination
T	Tutorial	PC	Program Core Courses
P	Practical	FC	Foundation Courses
CT	Class Test	HS	Humanities and social science
TA	Teacher's Assessment	MC	Mandatory Course

Dean
H.P. Technical University
Hamirpur - 177001

SEMESTER- III (B. Pharmacy)

S. N.	Category	Paper Code	Subject	L	T	P/ D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	PC	BP301 T	Pharmaceutical Organic Chemistry II – Theory	3	1		4	15	10	25	75	100
2	PC	BP302 T	Physical Pharmaceutics I – Theory	3	1		4	15	10	25	75	100
3	PC	BP303 T	Pharmaceutical Microbiology – Theory	3	1		4	15	10	25	75	100
4	PC	BP304 T	Pharmaceutical Engineering – Theory	3	1		4	15	10	25	75	100
		Labs:										
1	PC	BP305 P	Pharmaceutical Organic Chemistry II – Practical			4	2	10	5	15	35	50
2	PC	BP306 P	Physical Pharmaceutics I – Practical			4	2	10	5	15	35	50
3	PC	BP307 P	Pharmaceutical Microbiology – Practical			4	2	10	5	15	35	50
4	PC	BP 308P	Pharmaceutical Engineering –Practical			4	2	10	5	15	35	50
Total				**12**	**4**	**16**	**24**					**600**
	Total Work Load=32 Hrs.					**Total Credit 24**						

Legend:

L	Lecture	ESE	End Semester Examination
T	Tutorial	PC	Program Core Courses
P	Practical	FC	Foundation Courses
CT	Class Test	HS	Humanities and social science
TA	Teacher's Assessment	MC	Mandatory Course

Dean
H.P. Technical University
Hamirpur - 177001

SEMESTER- IV (B. Pharmacy)

S. N.	Category	Paper Code	Subject	L	T	P/D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	FC	BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1		4	15	10	25	75	100
2	PC	BP402T	Medicinal Chemistry I – Theory	3	1		4	15	10	25	75	100
3	PC	BP403T	Physical Pharmaceutics II – Theory	3	1		4	15	10	25	75	100
4	PC	BP404T	Pharmacology I – Theory	3	1		4	15	10	25	75	100
5	PC	BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1		4	15	10	25	75	100
		Labs:										
1	CC	BP406P	Medicinal Chemistry I – Practical			4	2	10	5	15	35	50
2	PC	BP407P	Physical Pharmaceutics II– Practical			4	2	10	5	15	35	50
3	PC	BP408P	Pharmacology I – Practical			4	2	10	5	15	35	50
4	PC	BP409P	Pharmacognosy and Phytochemistry I – Practical			4	2	10	5	15	35	50
Total				**15**	**5**	**16**	**28**					**700**
	Total Working = 36 Hrs.						**Total Credit =28**					

Legend:

L	Lecture	ESE	End Semester Examination
T	Tutorial	PC	Program Core Courses
P	Practical	FC	Foundation Courses
CT	Class Test	HS	Humanities and social science
TA	Teacher's Assessment	MC	Mandatory Course

Dean
H.P. Technical University
Hamirpur - 177001

SEMESTER- V (B. Pharmacy)

S. N.	Category	Paper Code	Subject	L	T	P/ D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	PC	BP 501T	Medicinal Chemistry II – Theory	3	1	-	4	15	10	25	75	100
2	PC	BP 502T	Industrial PharmacyI– Theory	3	1	-	4	15	10	25	75	100
3	PC	BP 503T	Pharmacology II – Theory	3	1	-	4	15	10	25	75	100
4	PC	BP 504T	Pharmacognosy and Phytochemistry II– Theory	3	1	-	4	15	10	25	75	100
5	PC	BP 505T	Pharmaceutical Jurisprudence – Theory	3	1	-	4	15	10	25	75	100
Labs:												
1	PC	BP 506P	Industrial PharmacyI – Practical	-	-	4	2	10	5	15	35	50
2	PC	BP 507P	Pharmacology II – Practical	-	-	4	2	10	5	15	35	50
3	PC	BP 508P	Pharmacognosy and Phytochemistry II – Practical	-	-	4	2	10	5	15	35	50
	Total			**15**	**5**	**12**	**26**					**650**
	Total Work Load=32 Hrs.						**Total Credit 26**					

Legend:

L	Lecture	ESE	End Semester Examination
T	Tutorial	PC	Program Core Courses
P	Practical	FC	Foundation Courses
CT	Class Test	HS	Humanities and social science
TA	Teacher's Assessment	MC	Mandatory Course

Dean
H.P. Technical University
Hamirpur - 177001

SEMESTER- VI (B. Pharmacy)

S. N.		Paper Code	Subject	L	T	P/ D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	PC	BP 601T	Medicinal Chemistry III – Theory	3	1	-	4	15	10	25	75	100
2	PC	BP 602T	Pharmacology III – Theory	3	1	-	4	15	10	25	75	100
3	PC	BP 603T	Herbal Drug Technology – Theory	3	1	-	4	15	10	25	75	100
4	PC	BP 604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	-	4	15	10	25	75	100
5	PC	BP 605T	Pharmaceutical Biotechnology – Theory	3	1	-	4	15	10	25	75	100
6	PC	BP 606T	Quality Assurance – Theory	3	1	-	4	15	10	25	75	100
		Labs:										
1	PC	BP 607P	Medicinal chemistry III – Practical	-	-	4	2	10	5	15	35	50
2	PC	BP 608P	Pharmacology III – Practical	-	-	4	2	10	5	15	35	50
3	PC	BP 609P	Herbal Drug Technology – Practical	-	-	4	2	10	5	15	35	50
	Total			**18**	**6**	**12**	**30**					**750**
	Total Work Load=36 Hrs.						**Total Credit 30**					

Note

Legend:

L	Lecture	ESE	End Semester Examination
T	Tutorial	PC	Program Core Courses
P	Practical	FC	Foundation Courses
CT	Class Test	HS	Humanities and social science
TA	Teacher's Assessment	MC	Mandatory Course

Dean
H.P. Technical University
Hamirpur - 177001

SEMESTER- VII (B. Pharmacy)

S. N.	Category	Paper Code	Subject	L	T	P/ D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	PC	BP 701T	Instrumental Methods of Analysis – Theory	3	1	-	4	15	10	25	75	100
2	PC	BP 702T	Industrial PharmacyII – Theory	3	1	-	4	15	10	25	75	100
3	PC	BP 703T	Pharmacy Practice – Theory	3	1	-	4	15	10	25	75	100
4	PC	BP704 T	Novel Drug Delivery System – Theory	3	1	-	4	15	10	25	75	100
		Labs:										
1	PC	BP 705P	Instrumental Methods of Analysis – Practical			4	2	10	5	15	35	50
2	PC	BP 706P	Practice School*			12	6	20	30	50	50	100
Total				**12**	**4**	**16**	**24**					**600**
	Total Work Load=32 Hrs.						**Total Credit 24**					

***** Non University Examination (NUE)

Dean
H.P. Technical University
Hamirpur - 177001

SEMESTER- VIII (B. Pharmacy)

S. N.	Category	Paper Code	Subject	L	T	P/ D	Credits	Evaluation Scheme				
								Internal Assessment			ESE	Subject Total
								CT	TA	Total		
	Theory:											
1	PC	BP 801T	Biostatistics and Research Methodology	3	1	-	4	15	10	25	75	100
2	PC	BP 802T	Social and Preventive Pharmacy	3	1	-	4	15	10	25	75	100
3	PC	BP 803ET	Pharma Marketing Management	3 +3 =6	1 + 1 = 2	-	4+4=8	15	10	25	75	100
4	PC	BP 804ET	Pharmaceutical Regulatory Science					15	10	25	75	100
5	PC	BP 805ET	Pharmacovigilance					15	10	25	75	100
6	PC	BP 806ET	Quality Control and Standardization of Herbals					15	10	25	75	100
7	PC	BP 807ET	Computer Aided Drug Design					15	10	25	75	100
8	PC	BP 808ET	Cell and Molecular Biology					15	10	25	75	100
9	PC	BP 809ET	Cosmetic Science					15	10	25	75	100
10	PC	BP 810ET	Experimental Pharmacology					15	10	25	75	100
11	PC	BP 811ET	Advanced Instrumentation Techniques					15	10	25	75	100
12	PC	BP 812ET	Dietary Supplements and Nutraceuticals					15	10	25	75	100
		Labs:										
1	PC	BP 813 PW	Project Work	-	-	12	6	-	-	-	150	150
Total				**12**	**4**	**12**	**22**					**550**
	Total Work Load=28						**Total Credit 22**					

Legend:

L	Lecture	ESE	End Semester Examination
T	Tutorial	PC	Program Core Courses
P	Practical	FC	Foundation Courses

Dean
H.P. Technical University
Hamirpur - 177001

CT	Class Test	HS	Humanities and social science
TA	Teacher's Assessment	MC	Mandatory Course

SEMESTER WISE CREDIT DISTRIBUTION

Semester	Credit Points
I	**27/29$/30#**
II	29
III	26
IV	28
V	26
VI	26
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**209/211$/212#**

* The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

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

#Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology course.

Dean
H.P. Technical University
Hamirpur - 177001

BP101T: HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

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 this course the student should be able to

- 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

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**Introduction to human body:** Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. **Cellular level of organization:** Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine. **Tissue level of organization:** Classification of tissues, structure, location and	10

	functions of epithelial, muscular and nervous and connective tissues.	
II	**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**
III	**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**
IV	**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.	**08**
V	**Cardiovascular system:** Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.	**07**

BP107P: HUMAN ANATOMY AND PHYSIOLOGY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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**.**

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.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother‘s medical publishers, New Delhi.
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)

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

BP102T: PHARMACEUTICAL ANALYSIS (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This course deals with the fundamentals of analytical chemistry and principles ofelectrochemical analysis of drugs

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

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- develop analytical skills

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**(a) Pharmaceutical analysis-** Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate,sulphuric acid, potassium permanganate and ceric ammonium sulphate **(b)Errors:** Sources of errors, types of errors, methods of minimizing errors,accuracy, precision and significant figures **(c)** Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.	**10**
II	**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**

III	**Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. **Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. Basic Principles,methods and application of diazotisation titration.	**10**
IV	**Redox titrations** (a)) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications)Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration withpotassium iodate	**08**
V	**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	**07**

Dean
H.P. Technical University
Hamirpur - 177001

BP108P: PHARMACEUTICAL ANALYSIS (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	4 hours

I **Limit Test of the following**

(1) Chloride(2) Sulphate(3) Iron(4) Arsenic

II **Preparation and standardization of**

(1) Sodium hydroxide(2) Sulphuric acid

(3) Sodium thiosulfate(4) Potassium permanganate

(5) Ceric ammonium sulphate

III **Assay of the following compounds along with Standardization of Titrant**

(1) Ammonium chloride by acid base titration

(2) Ferrous sulphate by Cerimetry

(3) Copper sulphate by Iodometry

(4) Calcium gluconate by complexometry

(5) Hydrogen peroxide by Permanganometry

(6) Sodium benzoate by non-aqueous titration

(7) Sodium Chloride by precipitation titration

IV **Determination of Normality by electro-analytical methods**

(1) Conductometric titration of strong acid against strong base

(2) Conductometric titration of strong acid and weak acid against strong base

(3) Potentiometric titration of strong acid against strong base

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, StahlonePress 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.

BP103T: PHARMACEUTICS- I (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This course is designed to impart a fundamental knowledge on the preparatorypharmacy with arts and science of preparing the different conventional dosage forms.

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

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

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. **Dosage forms:** Introduction to dosage forms, classification and definitions **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription. **Posology:** Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	10
II	**Pharmaceutical calculations**: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent,	10

	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	
III	**Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments andLotions. **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.	**08**
IV	**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.	**08**
V	**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	**07**

BP109P: PHARMACEUTICSI (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	4 hours

1 . Syrups: a) Syrup IP‘66

b) Compound syrup of Ferrous Phosphate BPC‘68

2. Elixirs: a) Piperazine citrate elixir

b) Paracetamol pediatric elixir

3.Linctus a) Terpin Hydrate Linctus IP‘66

4. Solutionsa)Iodine Throat Paint (Mandles Paint)

b) Strong solution of ammonium acetate

c) Cresol with soap solution

d) Lugol‘s solution

5. Suspensionsa) Calamine lotion

b) Magnesium Hydroxide mixture

c) Aluminimum Hydroxide gel

6. Emulsions a) Turpentine Liniment

b) Liquid paraffin emulsion

7. Powders and Granulesa) ORS powder (WHO)

b) Effervescent granules

c) Dusting powder

d)Divided powders

8. Suppositoriesa) Glycero gelatin suppository

b) Coca butter suppository

c) Zinc Oxide suppository

9. Semisolidsa) Sulphur ointment

b) Non staining-iodine ointment with methyl salicylate

c) Carbopal gel

10. Gargles and Mouthwashesa) Iodine gargleb) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, LippincottWilliams andWalkins, New Delhi.
2. Carter S.J., Cooper and Gunn‘s-Dispensing for Pharmaceutical Students, CBS publishers,New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone,Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, TheUniversity of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, LippincottWilliams, 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 andSuspensions, Marcel Dekker, INC, New York.

Dean
H.P. Technical University
Hamirpur - 177001

BP104T: PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of course student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganicdrugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

COURSE CONTENT

General methods of preparation, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes

UNIT	CONTENT	No. ofHrs.
I	**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	10
II	**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

III	**Gastrointestinal agents** **Acidifiers:** Ammonium chloride* and Dil. HCl **Antacid:** Ideal properties of antacids, combinations of antacids, SodiumBicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture **Cathartics:** Magnesium sulphate, Sodium orthophosphate, Kaolin andBentonite **Antimicrobials**: Mechanism, classification, Potassium permanganate, Boricacid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	**10**
IV	**General methods of preparation**, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes **Miscellaneous compounds** **Expectorants:** Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Sodium potassium tartarate **Haematinics:** Ferrous sulphate*, Ferrous gluconate **Poison and Antidote:** Sodium thiosulphate*, Activated charcoal, Sodiumnitrite **Astringents**: Zinc Sulphate, Potash Alum	**08**
V	**Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions & pharmaceutical application of radioactive substances.	**07**

BP110P: PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	4 hours

I. **Limit tests for following ions**

a. Limit test for Chlorides and Sulphates
b. Modified limit test for Chlorides and Sulphates
c. Limit test for Iron
d. Limit test for Heavymetals
e. Limit test for Lead
f. Limit test for Arsenic

II. **Identification test for Magnesium** hydroxide, Ferrous sulphate, Sodium bicarbonate, Calcium gluconate, Copper sulphate

III. **Test for purity**

a. Swelling power of Bentonite
b. Neutralizing capacity of aluminum hydroxide gel
c. Determination of potassium iodate and iodine in potassium Iodide

IV. **Preparation of inorganic pharmaceuticals**

a. Boric acid
b. Potash alum
c. Ferrous sulphate

Recommended Books (Latest Editions)

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

BP105T: COMMUNICATION SKILLS (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
2	0	0	2	15	35	50	1.5 hours

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

Objectives:

Upon completion of the course the student shall be able to

- Understand the behavioral needs for a Pharmacist to function effectively in theareas of pharmaceutical operation
- Communicate effectively (Verbal and Non Verbal)
- Effectivelymanage the team as a team player
- Develop interview skills
- Develop Leadership qualities and essentials

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**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	07
II	**Elements of Communication:** Introduction, Face to Face Communication - Tone	07

	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	
III	**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations **Effective Written Communication:** Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion‘ Required, Shades of Meaning, Formal Communication **Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	**07**
IV	**Interview Skills:** Purpose of an interview, Do‘s and Dont‘s of an interview **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring YourPresentation, Delivering Your Presentation, Techniques of Delivery	**05**
V	**Group Discussion:** Introduction, Communication skills in group discussion, Do‘s and Dont‘s of group discussion	**04**

BP111P: COMMUNICATION SKILLS (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	2	1	10	15	25	2 hours

Thefollowing learning modules are to be conducted using wordsworth® English languagelab software

Basic communication covering the following topics

Meeting People, Asking Questions, Making Friends, What did you do?, Do‘s and Dont‘s

Pronunciations covering the following topics

Pronunciation (Consonant Sounds), Pronunciation and Nouns, Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech, Figures of Speech, Effective Communication, Writing Skills, Effective Writing, Interview Handling Skills, E-Mail etiquette Presentation Skills.

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition,Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, GopalaSwamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Greenhall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals –PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, 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, 1stEdition, Mc GrawHill 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

BP 106 RBT. REMEDIAL BIOLOGY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
2	0	0	2	15	35	50	1.5 hours

Scope: To learn and understand the components of living world, structure and functionalsystem of plant and animal kingdom.

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

- 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 withspecial reference to human

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**Living world:** Definition and characters of living organisms; Diversity in the living world; Binomial nomenclature ; Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus. **Morphology of Flowering plants:** Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones.	07
II	**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	07

	respiration ; Respiratory volumes	
III	**Excretory products and their elimination:** Modes of excretion; Human excretory system- structure and function; Urine formation; Rennin angiotensin system **Neural control and coordination:** Definition and classification of nervous system; Structure of a neuron; Generation and conduction of nerve impulse; Structure of brain and spinal cord; Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata. **Chemical coordination and regulation:** Endocrine glands and their secretions; Functions of hormones secreted by endocrine glands **Human reproduction:** Parts of female reproductive system; Parts of male reproductive system; Spermatogenesis and Oogenesis; Menstrual cycle	**07**
IV	**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.	**05**
V	**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.	**04**

BP112 RBP. REMEDIAL BIOLOGY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	2	1	10	15	25	2 hours

1. Introduction to experiments in biology
   a) Study of Microscopeb) Section cutting techniquesc) 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

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.

d.Outlines of Zoology byM. Ekambaranatha ayyer and T. N. Ananthakrishnan.

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

f. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.

g. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate andS.P.Shriwastava.

h.Biology practical manual according to National core curriculum .Biology forum ofKarnataka. Prof .M.J.H.Shafi

BP 106RMT. REMEDIAL MATHEMATICS (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
2	0	0	2	15	35	50	1.5 Hours

Scope: This is an introductory course in mathematics. This subject deals with theintroduction to Partial fraction, Logarithm, matrices and Determinant, Analyticalgeometry, Calculus, differential equation and Laplace transform.

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

- Know the theory and their application in Pharmacy
- Solve the different types of problems by applying theory
- Appreciate the important application of mathematics in Pharmacy

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**Partial fraction** Introduction, Polynomial, Rational fractions, Proper and Improper fractions,Partial fraction , Resolving into Partial fraction, Application of PartialFraction in Chemical Kinetics and Pharmacokinetics **Logarithms** Introduction, Definition, Theorems/Properties of logarithms, Commonlogarithms, Characteristic and Mantissa, worked examples, application oflogarithm 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) , $\lim_{x\to a}\frac{x^n - a^n}{x-a} = na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta} = 1$,	06
II	**Matrices and Determinant:** Introduction matrices, Types of matrices, Operation on matrices,Transpose of a matrix, Matrix Multiplication, Determinants, Properties ofdeterminants , Product	06

Dean
H.P. Technical University
Hamirpur - 177001

	of determinants, Minors and co-Factors, Adjointor adjugate of a square matrix , Singular and non-singular matrices,Inverse of a matrix, Solution of system of linear of equations using matrixmethod, Cramer‘s rule, Characteristic equation and roots of a squarematrix, Cayley–Hamilton theorem,Applicationof Matrices in solvingPharmacokinetic equations.	
III	**Calculus** **Differentiation** : Introductions, Derivative of a function, Derivative of aconstant, Derivative of a product of a constant and a function , Derivativeof the sum or difference of two functions, Derivative of the product of twofunctions (product formula), Derivative of the quotient of two functions(Quotient formula) – **Without Proof**, Derivative of *xn w.r.t*x,where *n* is anyrational number, Derivative of *ex*,, Derivative of loge *x* , Derivative of*ax*,Derivative of trigonometric functions from first principles **(withoutProof)**, Successive Differentiation, Conditions for a function to be amaximum or a minimum at a point. Application	**06**
IV	**Analytical Geometry** **Introduction:** Signs of the Coordinates, Distance formula,**Straight Line** : Slope or gradient of a straight line, Conditions forparallelism and perpendicularity of two lines, Slope of a line joining twopoints, Slope – intercept form of a straight line. **Integration:**Introduction, Definition, Standard formulae, Rules of integration , Method ofsubstitution, Method of Partial fractions, Integration by parts, definiteintegrals, application	**06**
V	**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 Chemicalkinetics and Pharmacokinetics equations	**06**

Recommended Books (Latest Edition)

1. Differential Calculus by Shanthinarayan

2. Pharmaceutical Mathematics with application to Pharmacy by PanchaksharappaGowda D.H.

3. Integral Calculus by Shanthinarayan

4. Higher Engineering Mathematics by Dr.B.S.Grewal

2ND SEMESTER

BP 201T: HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart fundamental knowledge on the structure andfunctions of the various systems of the human body. It also helps in understanding bothhomeostatic mechanisms. The subject provides the basic knowledge required tounderstand the various disciplines of pharmacy.

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

- 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 hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**Nervous system:** Organization of nervous system, neuron, neuroglia, classification andproperties of nerve fibre, electrophysiology, action potential,nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain andcerebrospinal fluid.structure and functions of brain (cerebrum, brainstem, cerebellum), spinal cord (gross structure, functions of afferentand efferent nerve tracts,reflex activity)	10

Dean
H.P. Technical University
Hamirpur - 177001

II	**Digestive system:** Anatomy of GI Tract with special reference to anatomy and functions of stomach,(Acid production in the stomach, regulation of acid production throughparasympathetic nervous system, pepsin role in protein digestion) small intestineand large intestine, anatomy and functions of salivary glands, pancreas and liver,movements of GIT, digestion and absorption of nutrients and disorders of GIT. **Energetics:** Formation and role of ATP, Creatinine Phosphate and BMR.	**10**
III	**Respiratory system:** Anatomy of respiratory system with special reference to anatomy of lungs,mechanism of respiration, regulation of respirationLung 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 andnephrons, functions of kidney and urinary tract, physiology of urine formation,micturition reflex and role of kidneys in acid base balance, role of RAS in kidneyand disorders of kidney.	**10**
IV	**Endocrine system** Classification of hormones, mechanism of hormone action, structureand functions of pituitary gland, thyroid gland, parathyroid gland,adrenalgland, pancreas, pineal gland, thymus and their disorders.	**10**
V	**Reproductive system** Anatomy of male and female reproductive system, Functions of male and femalereproductive 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**

BP 207 P: HUMAN ANATOMY AND PHYSIOLOGY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	2	1	10	15	25	4 hours

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

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 reproductivesystems with the help of models, charts and specimens.
13. Recording of basal mass index .
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypeebrothers medical publishers, New Delhi.

2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, ChurchillLivingstone, New York
3.Physiological basis of Medical Practice-Best and Tailor. Williams & WilkinsCo,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH,U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers,New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, NewDelhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma,Jaypee brother‘s medical publishers, New Delhi.

Reference Books:

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

BP202T: PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject deals with classification and nomenclature of simple organiccompounds, structural isomerism, intermediates forming in reactions, important physicalproperties, reactions and methods of preparation of these compounds. The syllabus alsoemphasizes on mechanisms and orientation of reactions.

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

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be ExplainedTo emphasize on definition, types, classification, principles/mechanisms, applications, examplesand differences

UNIT	CONTENT	No. ofHrs.
I	**Classification, nomenclature and isomerism:** Classification of Organic Compounds, Common and IUPAC systems of nomenclature of organic compounds(up to 10 Carbons open chain and carbocyclic compounds). Structural isomerisms in organic compounds	07
II	**Alkanes*, Alkenes* and Conjugated dienes*:** SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.Stabilities of alkenes, SP2 hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement ofcarbocations, Saytzeffs orientation and evidences. E1 verses E2	10

	reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff'sorientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical additionreactions of conjugated dienes, allylic rearrangement	
III	**Alkyl halides*:** SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry andrearrangement of carbocations.SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions. Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene,dichloromethane, tetrachloromethane and iodoform. **Alcohols*-** Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol,chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol	**10**
IV	**Carbonyl compounds* (Aldehydes and ketones):** Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation,Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkincondensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone,Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.	**10**
V	**Carboxylic acids*:** Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitativetests for carboxylic acids ,amide and ester. Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalicacid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate andAcetyl salicylic acid **Aliphatic amines* -** Basicity, effect of substituent on Basicity. Qualitative test, Structure anduses of Ethanolamine, Ethylenediamine, Amphetamine	**08**

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	4 hours

Systematic qualitative analysis of unknown organic compounds

1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturationand unsaturation, etc.
2. Detection of elements like Nitrogen, Sulphur and Halogen byLassaigne‘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 andAnilides.
5. Melting point/Boiling point of organic compounds
6. Identification of the unknown compound from the literature usingmelting point/ boiling point.
7. Preparation of the derivatives and confirmation of the unknowncompound bymelting point/ boiling point.
8. Minimum 5 unknown organic compounds to be analyzed systematically.
9. Preparation of suitable solid derivatives from organic compounds
10. Construction of molecular models

Recommended Books (Latest Editions)

1. Organic Chemistry byMorrison 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 byMann 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.

BP203 T. BIOCHEMISTRY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: Biochemistry deals with complete understanding of the molecular levels of thechemical process associated with living cells. The scope of the subject is providingbiochemical facts and the principles to understand metabolism of nutrient molecules inphysiological and pathological conditions. It is also emphasizing on genetic organizationof mammalian genome and hetero & autocatalytic functions of DNA.

Objectives: Upon completion of course student shell able to

- Understand the catalytic role of enzymes, importance of enzyme inhibitors indesign of new drugs, therapeutic and diagnostic applications of enzymes.
- Understand the metabolism of nutrient molecules in physiological andpathological conditions.
- Understand the genetic organization of mammalian genome and functions ofDNA in the synthesis of RNAs and proteins.

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**Biomolecules:** Introduction, classification, chemical nature and biological role ofcarbohydrate, lipids, nucleic acids, amino acids and proteins. **Bioenergetics:** Concept of free energy, endergonic and exergonic reaction, Relationshipbetween free energy, enthalpy and entropy; Redox potential.Energy rich compounds; classification; biological significances of ATPand cyclic AMP	08
II	**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	10

	Hormonal regulation of blood glucose level and Diabetes mellitus **Biological oxidation:** Electron transport chain (ETC) and its mechanism.Oxidative phosphorylation & its mechanism and substratephosphorylation. Inhibitors ETC and oxidative phosphorylation/Uncouplerslevel	
III	**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 intobile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis,fatty liver and obesity. **Amino acid metabolism:** General reactions of amino acid metabolism: Transamination,deamination & decarboxylation, urea cycle and its disorders Catabolism of phenylalanine and tyrosine and their metabolic disorders(Phenyketonuria, Albinism, alkeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin,dopamine, noradrenaline, adrenaline, Catabolism of heme; hyperbilirubinemia and jaundice	**10**
IV	**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**
V	**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, allostericenzymes regulation, Therapeutic and diagnostic applications of enzymes and isoenzymes, Coenzymes –Structure and biochemical functions	**07**

BP 209 P. BIOCHEMISTRY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	2 hours

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

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. Satyanarayan 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.

BP 204T.PATHOPHYSIOLOGY (THEORY)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: Pathophysiology is the study of causes of diseases and reactions of the body tosuch disease producing causes.This course is designed to impart a thorough knowledge ofthe relevant aspects of pathology of various conditions with reference to itspharmacological applications, and understanding of basic pathophysiologicalmechanisms. Hence it will not only help to study the syllabus of pathology, but also toget baseline knowledge required to practice medicine safely, confidently, rationally andeffectively.

Objectives: Upon completion of the subject student shall be able to –

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

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**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 cellularaccumulation, Calcification, Enzyme leakage and Cell Death Acidosis&Alkalosis,Electrolyte imbalance **Basic mechanism involved in the process of inflammation and repair:** Introduction, Clinical signs of inflammation, Different types of Inflammation,Mechanism, of Inflammation – Alteration in vascular permeability and blood flow, migration ofWBC's,Mediators of inflammation,Basic principles of wound healing in theskin,Pathophysiology of Atherosclerosis.	10
II	**Cardiovascular System:** Hypertension, congestive heart failure, ischemic heart	10

	disease (angina,myocardialinfarction, atherosclerosis and arteriosclerosis) **Respiratory system:** Asthma, Chronic obstructive airways diseases. **Renal system:**Acute and chronic renal failure .	
III	**Haematological Diseases:** Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia,thalasemia, hereditary acquired anemia, hemophilia **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones **Nervous system:** Epilepsy, Parkinson‘s disease, stroke, psychiatric disorders:depression, schizophrenia and Alzheimer‘s disease. **Gastrointestinal system:** Peptic Ulcer	**10**
IV	Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liverdisease. **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout **Principles of cancer:** classification, etiology and pathogenesis of cancer **Diseases of bones and joints:**Rheumatoid Arthritis, Osteoporosis,Gout **Principles of Cancer:** Classification, etiology and pathogenesis of Cancer	**08**
V	**Infectious diseases:**Meningitis,Typhoid, Leprosy, Tuberculosis, Urinary tract infections **Sexually transmitted diseases:**AIDS, Syphilis, Gonorrhea	**07**

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis ofDisease; South Asia edition; India; Elsevier; 2014.
2. HarshMohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman‘s The Pharmacological Basis ofTherapeutics; 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 Practiceof Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.

7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB SaundersCompany; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey;Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-HillMedical; 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.

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	0	0	3	25	75	100	3 hours

Scope: This subject deals with the introduction Database, Database Management system,computer application in clinical studies and use of databases.

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

- know the various types of application of computers in pharmacy
- know the various types of databases
- know the various applications of databases in pharmacy

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	**Number system**: Binary number system, Decimal number system, Octalnumber system, Hexadecimal number systems, conversion decimal tobinary, binary to decimal, octal to binary etc, binary addition, binarysubtraction – One's complement ,Two's complement method, binarymultiplication, binary division **Concept of Information Systems and Software : I**nformation gathering,requirement and feasibility analysis, data flow diagrams, processspecifications, input/output design, process life cycle, planning andmanaging the project	06
II	**Web technologies**:Introduction to HTML, XML,CSS andProgramming languages, introduction to web servers and ServerProducts, Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	06
III	**Application of computers in Pharmacy** – Drug information storage andretrieval, Pharmacokinetics, Mathematical model in Drug design, Hospitaland 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,	06

	Patient Monitoring System,Pharma Information System	
IV	**Bioinformatics:** Introduction, Objective of Bioinformatics, BioinformaticsDatabases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	**06**
V	**Computers as data analysis in Preclinical development**: Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS)	**06**

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	2	1	10	15	25	2 hours

1. Design a questionnaire using a word processing package to gather informationabout a particular disease.
2. Create a HTML web page to show personal information.
3 Retrieve the information of a drug and its adverse effects using online tools 4
Creating mailing labels Using Label Wizard , generating label in MS WORD
5 Create a database in MS Access to store the patient information with the requiredfields Using access
6. Design a form in MS Access to view, add, delete and modify the patient record inthe 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

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600South 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 andDistributors, 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

Dean
H.P. Technical University
Hamirpur - 177001

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	0	0	3	25	75	100	3 hours

Scope: Environmental Sciences is the scientific study of the environmental system andthe status of its inherent or induced changes on organisms. It includes not only the studyof physical and biological characters of the environment but also the social and culturalfactors and the impact of man on environment.

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

- Create the awareness about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the environment.
- Motivate learner to participate in environment protection and environmentimprovement.
- Acquire skills to help the concerned individuals in identifying and solvingenvironmental problems.
- Strive to attain harmony with Nature.

COURSE CONTENT

UNIT	CONTENT	No. ofHrs.
I	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
II	Ecosystems : Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features, structure and function ofthe ecosystems: Forest ecosystem; Grassland ecosystem; Desert	10

	ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans,estuaries)	
III	Environmental Pollution: Air pollution; Water pollution; Soil pollution	**10**

Recommended Books (Latest edition):

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 Pu blishing 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

Dean
H.P. Technical University
Hamirpur - 177001

3rd SEMESTER

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject deals with general methods of preparation and reactions of someorganic compounds. Reactivity of organic compounds are also studied here. The syllabusemphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils arealso included in the syllabus.

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

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be ExplainedTo emphasize on definition, types, classification, principles/mechanisms, applications, examplesand differences

UNIT	CONTENT	No. of Hrs.
I	**Benzene and its derivatives:** **A.** Analytical, synthetic and other evidences in the derivation of structureof benzene, Orbital picture, resonance in benzene, aromaticcharacters, Huckel‘s rule **B.** Reactions of benzene - nitration, sulphonation, halogenations reactivity,Friedelcrafts alkylation- reactivity, limitations,Friedelcrafts acylation. **C.** Substituents, effect of substituents on reactivity and orientation ofmono substituted benzene compounds towards electrophilicsubstitution reaction **D.** Structure and uses of DDT, Saccharin, BHC and Chloramine	10
II	**Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitativetests, Structure and uses of phenol, cresols, resorcinol, naphthols	10

Dean
H.P. Technical University
Hamirpur - 177001

	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 andimportant reactions of benzoic acid.	
III	**Fats and Oils** a. Fatty acids – reactions. b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Dryingoils. c. Analytical constants – Acid value, Saponification value, Ester value,Iodine value, Acetyl value, Reichert Meissl (RM) value – significance andprinciple involved in their determination.	**10**
IV	**Polynuclear hydrocarbons:** a. Synthesis, reactions, structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene,Diphenylmethane, Triphenylmethane and their derivatives	**08**
V	**Cyclo alkanes***Stabilities – Baeyer‘s strain theory, limitation of Baeyer‘s strain theory,Coulson and Moffitt‘s modification, Sachse Mohr‘s theory (Theory ofstrainless rings), reactions of cyclopropane and cyclobutane only	**07**

Dean
H.P. Technical University
Hamirpur - 177001

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

I Experiments involving laboratory techniques

a) Recrystallization b) Steam distillation

II Determination of following oil values (including standardization of reagents)

a) Acid value b) Saponification value c) Iodine value

III **Preparation of compounds**

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

Recommended Books (Latest Editions)

1. Organic Chemistry byMorrison 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 byMann 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.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: The course deals with the various physica and physicochemical properties, andprinciples involved in dosage forms/formulations. Theory and practicalcomponents of the subject help the student to get a better insight into variousareas of formulation research and development, and stability studies ofpharmaceutical dosage forms.

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

- Understand various physicochemical properties of drug molecules in thedesigning the dosage forms
- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Demonstrate use of physicochemical properties in the formulationdevelopment and evaluation of dosage forms.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Solubility of drugs:** Solubility expressions, mechanisms of solute solvent interactions,ideal solubility parameters, solvation & association, quantitative approach to the factorsinfluencing solubility of drugs, diffusion principles in biological systems. Solubilityof gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions)Raoult‘s law, real solutions. Partiallymiscible liquids, Critical solution temperature andapplications. Distribution law, its limitations and applications	10
II	**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, solidcrystalline,amorphous & polymorphism.	10

	Physicochemical properties of drug molecules: Refractive index, optical rotation,dielectric constant, dipole moment, dissociation constant, determinations and applications	
III	**Surface and interfacial phenomenon:** Liquid interface, surface & interfacial tensions,surface free energy, measurement of surface & interfacial tensions, spreading coefficient,adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation,detergency, adsorption at solid interface.	**08**
IV	**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	**08**
V	**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.	**07**

Dean
H.P. Technical University
Hamirpur - 177001

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalchequation.
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 byCST method
6. Determination of surface tension of given liquids by drop count and drop weightmethod
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-Caffeinecomplex by solubilitymethod
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycinecomplex by pH titration method

Recommended Books: (Latest Editions)

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 to3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Dispersesystems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. LaboratoryManual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: Study of all categories of microorganisims especially for the production of alcholantibiotics, vaccines, vitamins enzymes etc..

Objectives: Upon completion of the subject student shall be able to;

- Understand methods of identification, cultivation and preservation ofvarious microorganisms
- To understand the importance and implementation of sterlization inpharmaceutical processing and industry
- Learn sterility testing of pharmaceutical products.
- Carried out microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceuticalindustries.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	Introduction, history of microbiology, its branches, scope and itsimportance. Introduction to Prokaryotes and Eukaryotes, Study of ultra-structure and morphological classification of bacteria,nutritional requirements, raw materials used for culture media and physicalparameters for growth, growth curve, isolation and preservation methodsfor pure cultures, cultivation of anaerobes, quantitative measurement ofbacterial growth (total & viable count).Study of different types of phase constrast microscopy, dark fieldmicroscopy and electron microscopy.	10
II	Identification of bacteria using staining techniques (simple, Gram‘s &Acidfast staining) and biochemical tests (IMViC).Study of principle, procedure, merits, demerits and applications of physical,chemical gaseous,radiation and mechanical method of sterilization.Evaluation of the efficiency of sterilization methods.Equipments employed in large scale sterilization.Sterility indicators.	10

III	Study of morphology, classification, reproduction/replication andcultivation of Fungi and Viruses.Classification and mode of action of disinfectantsFactors influencing disinfection, antiseptics and their evaluation. Forbacteriostatic and bactericidal actionsEvaluation of bactericidal & Bacteriostatic.Sterility testing of products (solids, liquids, ophthalmic and other sterileproducts) according to IP, BP and USP.	**10**
IV	Designing of aseptic area, laminar flow equipments; study of differentsources of contamination in an aseptic area and methods of prevention,clean area classification.Principles and methods of different microbiological assay. Methods forstandardization of antibiotics, vitamins and amino acids.Assessment of a new antibiotic.	**08**
V	Types of spoilage, factors affecting the microbial spoilage ofpharmaceutical products, sources and types of microbial contaminants,assessment of microbial contamination and spoilage.Preservation of pharmaceutical products using antimicrobial agents,evaluation of microbial stability of formulations.Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.	**07**

BP 307P. PHARMACEUTICAL MICROBIOLOGY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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 withpractical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and othertechniques.
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.

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientificpublications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors,Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
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. 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

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This course is designed to impart a fundamental knowledge on the art and scienceof various unit operations used in pharmaceutical industry.

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

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimumuse of resources.
- To appreciate the various preventive methods used for corrosion control inPharmaceutical industries.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Flow of fluids:** Types of manometers, Reynolds number and its significance,Bernoulli's theorem and its applications, Energy losses, Orifice meter,Venturimeter, Pitot tube and Rotometer. **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction,factors affecting size reduction, principles, construction, working, uses, merits anddemerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & endrunner mill. **Size Separation:** Objectives, applications & mechanism of size separation,official standards of powders, sieves, size separation Principles, construction,working, uses, merits and demerits of Sieve shaker, cyclone separator, Airseparator, Bag filter & elutriation tank.	10

Dean
H.P. Technical University
Hamirpur - 177001

II	**Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier'slaw, 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 tubeevaporator, climbing film evaporator, forced circulation evaporator, multipleeffect evaporator& Economy of multiple effect evaporator. **Distillation:** Basic Principles and methodology of simple distillation,flashdistillation, fractional distillation, distillation under reduced pressure, steamdistillation & molecular distillation	**10**
III	**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 spraydryer, fluidized bed dryer, vacuum dryer, freeze dryer. **Mixing:** Objectives, applications & factors affecting mixing, Difference betweensolid and liquid mixing, mechanism of solid mixing, liquids mixing andsemisolids mixing. Principles, Construction, Working, uses, Merits and Demeritsof Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer,planetarymixers, Propellers, Turbines, Paddles & Silverson Emulsifier	**08**
IV	**Filtration:** Objectives, applications, Theories & Factors influencing filtration,filter aids, filter medias. Principle, Construction, Working, Uses, Merits anddemerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter &Cartridge filter, membrane filters and Seidtz filter. **Centrifugation:** Objectives, principle & applications of Centrifugation,principles, construction, working, uses, merits and demerits of Perforated basketcentrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & supercentrifuge.	**08**
V	**Materials of pharmaceutical plant construction, Corrosion and itsprevention:** Factors affecting during materials selected for Pharmaceutical plantconstruction, Theories of corrosion, types of corrosion and there prevention.Ferrous and nonferrous metals, inorganic and organic non metals, basic ofmaterial handling systems.	**07**

Dean
H.P. Technical University
Hamirpur - 177001

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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 ofDew point method.
7. Description of Construction working and application of PharmaceuticalMachinery 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 arithmeticandlogarithmic probability plots.
9. Size reduction: To verify the laws of size reduction using ball mill anddetermining Kicks, Rittinger‘s, Bond‘s coefficients, power requirement andcritical speed of Ball Mill.
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryerand such othermajor equipment.
11. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentrationand 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 ConeBlender.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latestedition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latestedition.
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.

4th SEMESTER

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject imparts knowledge on stereo-chemical aspects of organic compoundsand organic reactions, important named reactions, chemistry of important hetero cycliccompounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives: At the end of the course, the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemicalreactions
- know the medicinal uses and other applications of organic compounds

Course Content:

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

UNIT	CONTENT	No. of Hrs.
I	**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 ofnomenclature of optical isomers, Reactions of chiral molecules, Racemic modification and resolution of racemic mixture.Asymmetric synthesis: partial and absolute	10
II	**Geometrical isomerism:** Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems), Methods of determination of configuration of geometrical isomers.Conformational isomerism in Ethane, n-Butane and Cyclohexane.Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.Stereospecific and stereoselective reactions	10
III	**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

IV	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	**08**
V	**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	**07**

Recommended Books (Latest Editions)

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 byMorrison and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist

BP402T. MEDICINAL CHEMISTRY – I (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart fundamental knowledge on the structure,chemistry and therapeutic value of drugs. The subject emphasizes on structure activityrelationships of drugs, importance of physicochemical properties and metabolism ofdrugs. The syllabus also emphasizes on chemical synthesis of important drugs under eachclass.

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

- understand the chemistry of drugs with respect to their pharmacological activity
- understand the drug metabolic pathways, adverse effect and therapeutic value ofdrugs
- know the Structural Activity Relationship (SAR) of different class of drugs
- write the chemical synthesis of some drugs

Course Content:

Note: Study of the development of the following classes of drugs, Classification, mechanism ofaction, uses of drugs mentioned in the course, Structure activity relationship of selectiveclass of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Medicinal Chemistry** **History and development of medicinal chemistry** **Physicochemical properties in relation to biological action** Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Proteinbinding, 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

II	**Drugs acting on Autonomic Nervous System** **Adrenergic Neurotransmitters:** Biosynthesis and catabolism of catecholamine.Adrenergic receptors (Alpha & Beta) and their distribution. **Sympathomimetic agents: SAR of Sympathomimetic agents** Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline,Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine,Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol. **Adrenergic Antagonists:** **Alpha adrenergic blockers:** Tolazoline*, Phentolamine,Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. **Beta adrenergic blockers:** SAR of beta blockers, Propranolol*,Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol,Labetolol, Carvedilol.	**10**
III	**Cholinergic neurotransmitters:** Biosynthesis and catabolism of acetylcholine.Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. **Parasympathomimetic agents: SAR of Parasympathomimetic agents** **Direct acting agents:** Acetylcholine, Carbachol*, Bethanechol,Methacholine, Pilocarpine. **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):** Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride,Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophateiodide, Parathione, Malathion. **Cholinesterase reactivator:** Pralidoxime chloride. **Cholinergic Blocking agents: SAR of cholinolytic agents** **Solanaceous alkaloids and analogues:** Atropine sulphate, Hyoscyaminesulphate, Scopolamine hydrobromide, Homatropine hydrobromide,Ipratropium bromide*. **Synthetic cholinergic blocking agents:** Tropicamide,	**10**

	Cyclopentolatehydrochloride, Clidinium bromide, Dicyclomine hydrochloride*,Glycopyrrolate, Methantheline bromide, Propantheline bromide,Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride,Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide,Ethopropazine hydrochloride.	
IV	**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*, Triflupromazine, Thioridazinehydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate,Trifluoperazine hydrochloride. **Ring Analogues of Phenothiazeines:** Chlorprothixene, Thiothixene,Loxapine succinate, Clozapine. **Fluro buterophenones:** Haloperidol, Droperidol, Risperidone. **Beta amino ketones:** Molindone hydrochloride.**Benzamides:** Sulpieride. **C. Anticonvulsants:** SAR of Anticonvulsants**,** mechanism of anticonvulsant Action. **Barbiturates**: Phenobarbitone, Methabarbital. **Hydantoins:**Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:**Trimethadione, Paramethadione **Succinimides:**Phensuximide, Methsuximide, Ethosuximide* **Urea andmonoacylureas**: Phenacemide, Carbamazepine***Benzodiazepines**: Clonazepam **Miscellaneous:** Primidone, Valproic acid , Gabapentin, Felbamate	**08**
V	**Drugs acting on Central Nervous System**	**07**

	General anesthetics: **Inhalation anesthetics:** Halothane*, Methoxyflurane, Enflurane,Sevoflurane, Isoflurane, Desflurane. **Ultra short acting barbitutrates:** Methohexital sodium*, Thiamylalsodium, Thiopental sodium.**Dissociative anesthetics:** Ketamine hydrochloride.* **Narcotic and non-narcotic analgesics** **Morphine and related drugs:** SAR of Morphine analogues, Morphinesulphate, 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.	

BP406P. MEDICINAL CHEMISTRY – I (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

I Preparation of drugs/ intermediates

a)1,3-pyrazole b) 1,3-oxazole c) Benzimidazole d) Benztriazole

e) 2,3- diphenyl quinoxaline f) Benzocaine g) Phenytoin h) Phenothiazine

i) Barbiturate

II Assay of drugs: Chlorpromazine, Phenobarbitone, Atropine, Ibuprofen, Aspirin, Furosemide

III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

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.

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: The course deals with the various physica and physicochemical properties, andprinciples involved in dosage forms/formulations. Theory and practicalcomponents of the subject help the student to get a better insight into variousareas of formulation research and development, and stability studies ofpharmaceutical dosage forms.

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

- Understand various physicochemical properties of drug molecules in thedesigning the dosage forms
- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Demonstrate use of physicochemical properties in the formulationdevelopment and evaluation of dosage forms.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Colloidal dispersions:** Classification of dispersed systems & their generalcharacteristics, 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	07
II	**Rheology:** Newtonian systems, law of flow, kinematic viscosity, effect of temperature,non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy informulation, determination of viscosity, capillary, falling Sphere, rotational viscometers. **Deformation of solids:** Plastic and elastic deformation, Heckel equation, Stress, Strain,Elastic Modulus	10

III	**Coarse dispersion:** Suspension, interfacial properties of suspended particles, settling insuspensions, formulation of flocculated and deflocculated suspensions. Emulsions andtheories of emulsification, microemulsion and multiple emulsions; Stability of emulsions,preservation of emulsions, rheological properties of emulsions and emulsionformulation by HLB method.	**10**
IV	**Micromeretics:** Particle size and distribution, mean particle size, number and weightdistribution, particle number, methods for determining particle size by differentmethods, counting and separation method, particle shape, specific surface, methods fordetermining surface area, permeability, adsorption, derived properties of powders,porosity, packing arrangement, densities, bulkiness & flow properties.	**10**
V	**Drug stability:** Reaction kinetics: zero, pseudo-zero, first & second order, units of basicrate constants, determination of reaction order. Physical and chemical factors influencingthe 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**

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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 ofsingle 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

Recommended Books: (Latest Editions)

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 Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1,2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

BP 404 T. PHARMACOLOGY-I (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: The main purpose of the subject is to understand what drugs do to the livingorganisms and how their effects can be applied to therapeutics. The subject covers theinformation about the drugs like, mechanism of action, physiological and biochemicaleffects (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 this course the student should be able to

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

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**General Pharmacology** **Introduction to Pharmacology**- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), sparereceptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.**Pharmacokinetics-** Membrane transport, absorption, distribution, metabolism andexcretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination	08

II	**General Pharmacology** **Pharmacodynamics**- Principles and mechanisms of drug action. Receptor theoriesand classification of receptors, regulation of receptors. drug receptors interactionssignal transduction mechanisms, G-protein–coupled receptors, ion channel receptor,transmembrane enzyme linked receptors, transmembrane JAK-STAT bindingreceptor and receptors that regulate transcription factors, dose responserelationship, therapeutic index, combined effects of drugs and factors modifyingdrug action. Adverse drug reactions, Drug interactions (pharmacokinetic and pharmacodynamic), Drug discovery and clinical evaluation of new drugs -Drug discovery phase,preclinical evaluation phase, clinical trial phase, phases of clinical trials andpharmacovigilance.	**12**
III	**Pharmacology of drugs acting on peripheral nervous system** Organization and function of ANS.Neurohumoral transmission,co-transmission and classification of neurotransmitters.Parasympathomimetics,Parasympatholytics, Sympathomimetics, sympatholytics.Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).Local anesthetic agents.Drugs used in myasthenia gravis and glaucoma	**10**
IV	**Pharmacology of drugs acting on central nervous system** Neurohumoral transmission in the C.N.S.special emphasis on importance of variousneurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.General anesthetics and pre-anesthetics**.**Sedatives, hypnotics and centrally acting muscle relaxants. Anti-epileptics, Alcohols and disulfiram	**08**
V	**Pharmacology of drugs acting on central nervous system** Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents,anti-manics and hallucinogens.Drugs used in Parkinsons disease and Alzheimer‘s disease.CNS stimulants and nootropics.Opioid analgesics and antagonists, Drug addiction, drug abuse, tolerance and dependence	**07**

BP 408 P.PHARMACOLOGY-I (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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

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 sleepingtime in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs byMES 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

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale‘sPharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-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 LippincottWilliams &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 MedicalPublishers (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. VallabhPrakashan,

Dean
H.P. Technical University
Hamirpur - 177001

BP 405 T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification ofcrude drugs, their identification and evaluation, phytochemicals present in them and theirmedicinal properties.

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

- know the techniques in the cultivation and production of crude drugs
- know the crude drugs, their uses and chemical nature
- know the evaluation techniques for the herbal drugs
- carry out the microscopic and morphological evaluation of crude drugs

Course Content

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Pharmacognosy:** (a)) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums andmucilages, oleoresins and oleo- gum -resins). **Classification of drugs:** Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and serotaxonomical classification of drugs **Quality control of Drugs of Natural Origin:** Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical,chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants,camera lucida and diagrams of microscopic objects to scale with camera lucida.	08

II	**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**
III	**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	**07**
IV	**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**
V	Study of biological source, chemical nature and uses of drugs of natural origin containingfollowing 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 PharmaceuticalAids and/or Medicines for the following Primarymetabolites: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey **Proteins and Enzymes :** Gelatin, casein, proteolytic enzymes (Papain, bromelain,serratiopeptidase, urokinase, streptokinase, pepsin). **Lipids(Waxes, fats, fixed oils)** : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax **Marine Drugs:** Novel medicinal agents from marine sources	**08**

BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

1. Analysis of crude drugs by chemical tests: **(**i)Tragaccanth (ii) Acacia (iii)Agar (iv)Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piecemicrometer
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

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co.,London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea andFebiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers &Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition,Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, NewDelhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, NewDelhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs byM.A. Iyengar

Dean
H.P. Technical University
Hamirpur - 177001

5th SEMESTER

BP501T. MEDICINAL CHEMISTRY – II (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart fundamental knowledge on the structure,chemistry and therapeutic value of drugs. The subject emphasizes on structure activityrelationships of drugs, importance of physicochemical properties and metabolism ofdrugs. The syllabus also emphasizes on chemical synthesis of important drugs under eachclass.

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

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effect and therapeutic value ofdrugs
- Know the Structural Activity Relationship of different class of drugs
- Study the chemical synthesis of selected drugs

COURSE CONTENT

Note: 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 (*)

UNIT	CONTENT	No. of Hrs.
I	**Antihistaminic agents:** Histamine, receptors and their distribution in thehumanbody. **H1–antagonists:** Diphenhydramine hydrochloride*, Dimenhydrinate,Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizinehydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*,Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate,Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium**H2-**	**10**

	antagonists: Cimetidine*, Famotidine, Ranitidin. **Gastric Proton pump inhibitors:** Omeprazole, Lansoprazole, Rabeprazole,Pantoprazole **Anti-neoplastic agents:** **Alkylating agents:** Meclorethamine*, Cyclophosphamide, Melphalan,Chlorambucil, Busulfan, Thiotepa **Antimetabolites:** Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine **Antibiotics:** Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin **Plant products:** Etoposide, Vinblastin sulphate, Vincristin sulphate **Miscellaneous:** Cisplatin, Mitotane.	
II	**Anti-anginal**: **Vasodilators:** Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbidedinitrite*, Dipyridamole. **Calcium channel blockers:** Verapamil, Bepridil hydrochloride, Diltiazemhydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine. **Diuretics:** Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide,Dichlorphenamide.Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide. Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.Osmotic Diuretics: Mannitol **Anti-hypertensive Agents**: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodiumnitroprusside, Diazoxide,Minoxidil, Reserpine, Hydralazine hydrochloride.	**10**
III	**Anti-arrhythmic Drugs**: Quinidine sulphate, Procainamide hydrochloride,Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride,Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride,	**10**

	Amiodarone, Sotalol. **Anti-hyperlipidemic agents**: Clofibrate, Lovastatin, Cholesteramine andCholestipol **Coagulant & Anticoagulants**: Menadione, Acetomenadione, Warfarin*,Anisindione, clopidogrel **Drugs used in Congestive Heart Failure:** Digoxin, Digitoxin, Nesiritide,Bosentan, Tezosentan.	
IV	**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.	**08**
V	**Antidiabetic agents:** Insulin and its preparations, Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride., Biguanides: Metformin., Thiazolidinediones: Pioglitazone, Rosiglitazone., Meglitinides: Repaglinide, Nateglinide.Glucosidase inhibitors: Acrabose, Voglibose. **Local Anesthetics:** SAR of Local anesthetics **Benzoic Acid derivatives**; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine. **Amino Benzoic acid derivatives**: Benzocaine*, Butamben, Procaine*, Butacaine,Propoxycaine, Tetracaine, Benoxinate. **Lidocaine/Anilide derivatives**: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. **Miscellaneous**: Phenacaine, Diperodon, Dibucaine.*	**07**

Recommended Books (Latest Editions)

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

Dean
H.P. Technical University
Hamirpur - 177001

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.

BP 502 T. Industrial PharmacyI (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: Course enables the student to understand and appreciate the influence ofpharmaceutical additives and various pharmaceutical dosage forms on the performance ofthe drug product.

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

- Know the various pharmaceutical dosage forms and their manufacturingtechniques.
- Know various considerations in development of pharmaceutical dosage forms
- Formulate solid, liquid and semisolid dosage forms and evaluate them for theirquality

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Preformulation Studies:** Introduction to preformulation, goals and objectives, study ofphysicochemical characteristics of drug substances. ***a. Physical properties:*** Physical form (crystal & amorphous), particle size, shape, flowproperties, solubility profile (pKa, pH, partition coefficient), polymorphism ***b. Chemical Properties:*** Hydrolysis, oxidation, reduction, racemisation, polymerization, BCS classification of drugs & its significant, Application of preformulation considerations in the development of solid, liquid oral andparenteral dosage forms and its impact on stability of dosage forms.	07
II	**Tablets:** a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients,Formulation of tablets, granulation methods, compression and processing problems.Equipments and tablet tooling. b. Tablet coating: Types of coating, coating materials, formulation of coatingcomposition, methods of coating, equipment employed and defects in coating. c. Quality control tests: In process and finished product tests	10

Dean
H.P. Technical University
Hamirpur - 177001

	Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia	
III	**Capsules:** a. ***Hard gelatin capsules:*** Introduction, Production of hard gelatin capsule shells. Sizeof capsules, Filling, finishing and special techniques of formulation of hard gelatincapsules, manufacturing defects. In process and final product quality control testsfor capsules. b. ***Soft gelatin capsules:*** Nature of shell and capsule content, size ofcapsules,importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testingof soft gelatin capsules and their applications. **Pellets:** Introduction, formulation requirements, pelletization process, equipments formanufacture of pellets	**08**
IV	**Parenteral Products:** a. Definition, types, advantages and limitations. Preformulation factors and essentialrequirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls,aseptic processing c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials and infusionfluids. Quality control tests of parenteral products. **Ophthalmic Preparations:** Introduction, formulation considerations; formulation of eyedrops, eye ointments and eye lotions; methods of preparation; labeling, containers;evaluation of ophthalmic preparations	**10**
V	**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 aerosolsystems; formulation and manufacture of aerosols; Evaluation of aerosols; Qualitycontrol and stability studies. **Packaging Materials Science:** Materials used for packaging of pharmaceutical	**10**

Dean
H.P. Technical University
Hamirpur - 177001

	products,factors influencing choice of containers, legal and official requirements for containers,stability aspects of packaging materials, quality control tests.	

BP 506 P. INDUSTRIAL PHARMACYI (PRACTICAL)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

1. Preformulation studies on paracetamol/asparin/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. Qulaity control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

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 PharmaceuticalScience (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchilllivingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger,Philadelphia, 5th edition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition,Marcel Dekker Series, Vol 107.

Dean
H.P. Technical University
Hamirpur - 177001

BP503.T. PHARMACOLOGY-II (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects(classification, mechanism of action, therapeutic effects, clinical uses, side effects andcontraindications) of drugs acting on different systems of body and in addition,emphasison the basic concepts of bioassay.

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

- Understand the mechanism of drug action and its relevance in the treatment ofdifferent diseases
- Demonstrate isolation of different organs/tissues from the laboratory animals bysimulated experiments
- Demonstrate the various receptor actions using isolated tissue preparation
- Appreciate correlation of pharmacology with related medical sciences

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Pharmacology of drugs acting on cardio vascular system** a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic drugs.	10
II	**Pharmacology of drugs acting on cardio vascular system** a. Drug used in the therapy of shock. b. Hematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs	10

	d. Plasma volume expanders **Pharmacology of drugs acting on urinary system** a. Diuretics b. Anti-diuretics.	
III	**Autocoids and related drugs** a. Introduction to autacoids and classification b. Histamine, 5-HT and their antagonists. c. Prostaglandins, Thromboxanes and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. e. Non-steroidal anti-inflammatory agents f. Anti-gout drugs g. Antirheumatic drugs	**10**
IV	**Pharmacology of drugs acting on endocrine system** a. Basic concepts in endocrine pharmacology. b. Anterior Pituitary hormones- analogues and their inhibitors. c. Thyroid hormones- analogues and their inhibitors. d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. d. Insulin, Oral Hypoglycemic agents and glucagon. e. ACTH and corticosteroids.	**08**
V	**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, histamineand 5-HT	**07**

Dean
H.P. Technical University
Hamirpur - 177001

BP 507 P. PHARMACOLOGY-II (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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

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 (bySchilds 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-edemamodel.
15. Analgesic activity of drug using central and peripheral methods

Recommended Books (Latest Editions)

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 McGraw-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 PointLippincott 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 MedicalPublishers (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.

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: The main purpose of subject is to impart the students the knowledge of how thesecondary metabolites are produced in the crude drugs, how to isolate and identify andproduce them industrially. Also this subject involves the study of producing the plants andphytochemicals through plant tissue culture, drug interactions and basic principles oftraditional system of medicine

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

- know the modern extraction techniques, characterization and identification of theherbal drugs and phytoconstituents
- understand the preparation and development of herbal formulation.
- understand the herbal drug interactions
- carryout isolation and identification of phytoconstituents

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Metabolic pathways in higher plants and their determination** a) Brief study of basic metabolic pathways and formation of different secondary metabolitesthrough these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	07
II	General introduction, composition, chemistry & chemical classes, biosources, therapeuticuses and commercial applications of followingsecondary metabolites: **Alkaloids:** Vinca, Rauwolfia, Belladonna, Opium, **Phenylpropanoids and Flavonoids:** Lignans, Tea, Ruta **Steroids, Cardiac Glycosides & Triterpenoids**: Liquorice, Dioscorea, Digitalis	14

	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	
III	Isolation, Identification and Analysis of Phytoconstituents a) Terpenoids: Menthol, Citral, Artemisin b) Glycosides: Glycyrhetinic acid & Rutin c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine d) Resins: Podophyllotoxin, Curcumin	**06**
IV	Industrial production, estimation and utilization of the following phytoconstituents:Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine,Taxol, Vincristine and Vinblastine	**10**
V	**Basics of Phytochemistry** Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crudedrugs.	**08**

Dean
H.P. Technical University
Hamirpur - 177001

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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 Belladonnad. Sennosides from Senna

3. Separation of sugars by Paper chromatography

4. TLC of herbal extract

5. Distillation of volatile oils and detection of phytoconstitutents by TLC

6. Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii)Colophony

(iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

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. Text book 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 Edn, Eastern Publisher, NewDelhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, NewDelhi, 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. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This course is designed to impart basic knowledge on importantlegislations related to the profession of pharmacy in India.

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

- The Pharmaceutical legislations and their implications in the development andmarketing of pharmaceuticals.
- Various Indian pharmaceutical Acts and Laws
- The regulatory authorities and agencies governing the manufacture and sale ofpharmaceuticals
- The code of ethics during the pharmaceutical practice

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Drugs and Cosmetics Act, 1940 and its rules 1945:** Objectives, Definitions, Legal definitions of schedules to the Act andRules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import underlicense or permit. Offences and penalties**.** Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs,Manufacture of drugs for test, examination and analysis, manufacture of new drug, loanlicense and repacking license.	10
II	**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	10

Dean
H.P. Technical University
Hamirpur - 177001

	requirements and specimen labels fordrugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugsLaboratory, Drugs Consultative Committee, Government drug analysts, Licensingauthorities, controlling authorities, Drugs Inspectors	
III	**Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; itsconstitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties **Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing,Manufacture In bond and Outside bond, Export of alcoholic preparations,Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations.Offences and Penalties. **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and productionof poppy straw, manufacture, sale and export of opium, Offences and Penalties	**10**
IV	**Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, InstitutionalAnimal Ethics Committee, CPCSEA guidelines for Breeding and Stocking ofAnimals, Performance of Experiments, Transfer and acquisition of animals forexperiment, Records, Power to suspend or revoke registration, Offences and Penalties **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations,Retail price and ceiling price of scheduled formulations, National List of EssentialMedicines (NLEM)	**08**

Dean
H.P. Technical University
Hamirpur - 177001

V	**Pharmaceutical Legislations –** A brief review, Introduction, Study of drugs enquirycommittee, Health survey and development committee, Hathi committee andMudaliar committee **Code of Pharmaceutical ethics** D efinition, 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)**	**07**

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-byM.L. Mehra
4. A text book 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)

6th SEMESTER

BP601T. MEDICINAL CHEMISTRY – III (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart fundamental knowledge on the structure,chemistry and therapeutic value of drugs. The subject emphasis on modern techniques ofrational drug design like quantitative structure activity relationship (QSAR), Prodrugconcept, combinatorial chemistry and Computer aided drug design (CADD). The subjectalso emphasizes on the chemistry, mechanism of action, metabolism, adverse effects,Structure Activity Relationships (SAR), therapeutic uses and synthesis of importantdrugs.

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

- Understand the importance of drug design and different techniques of drugdesign.
- Understand the chemistry of drugs with respect to their biological activity.
- Know the metabolism, adverse effects and therapeutic value of drugs.
- Know the importance of SAR of drugs.

COURSE CONTENT

Note: Study of the development of the following classes of drugs, Classification, mechanismofaction, uses of drugs mentioned in the course, Structure activity relationship of selectiveclass of drugs as specified in the course and synthesis of drugs superscripted by (*)

UNIT	CONTENT	No. of Hrs.
I	**Antibiotics** Historical background, Nomenclature, Stereochemistry, Structure activityrelationship, Chemical degradation classification and important products ofthe following classes. **β-Lactam antibiotics:** Penicillin, Cepholosporins, β- Lactamase inhibitors,Monobactams **Aminoglycosides:** Streptomycin, Neomycin, Kanamycin **Tetracyclines:** Tetracycline,Oxytetracycline, Chlortetracycline,Minocycline,	10

	Doxycycline	
II	**Antibiotics** Historical background, Nomenclature, Stereochemistry, Structure activityrelationship, Chemical degradation classification and important products of the following classes. **Macrolide:** Erythromycin Clarithromycin, Azithromycin. **Miscellaneous:** Chloramphenicol*, Clindamycin. **Prodrugs:** Basic concepts and application of prodrugs design. **Antimalarials:** Etiology of malaria. **Quinolines:** SAR, Quinine sulphate, Chloroquine*, Amodiaquine,Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. **Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil. **Miscellaneous:** Pyrimethamine, Artesunete, Artemether, Atovoquone.	**10**
III	**Anti-tubercular Agents** **Synthetic anti tubercular agents:** Isoniozid*, Ethionamide, Ethambutol,Pyrazinamide, Para amino salicylic acid.* **Anti tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine, Streptomycine, Capreomycin sulphate. **Urinary tract anti-infective agents** **Quinolones:** SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin,Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin,Moxifloxacin **Miscellaneous:** Furazolidine, Nitrofurantoin*, Methanamine. **Antiviral agents:** Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine, trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine,Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir,Ritonavir.	**10**
IV	**Antifungal agents:** **Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin. **Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole,Oxiconazole Tioconozole, Miconazole*, Ketoconazole,	**08**

	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*.	
V	**Introduction to Drug Design** Various approaches used in drug design.Physicochemical parameters used in quantitative structure activityrelationship (QSAR) such as partition coefficient, Hammet‘s electronicparameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. **Combinatorial Chemistry:** Concept and applicationschemistry: solid phase and solution phase synthesisof combinatorial	**07**

BP607P. MEDICINAL CHEMISTRY- III (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

I Preparation of drugs and intermediates

Sulphanilamide, 7-Hydroxy, 4-methyl coumarin, Chlorobutanol, Triphenyl imidazole, Tolbutamide, Hexamine

II Assay of drugs

Isonicotinic acid hydrazide, Chloroquine, Metronidazole, Dapsone, Chlorpheniramine maleate Benzyl penicillin

III Preparation of medicinally important compounds or intermediates byMicrowaveirradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecularweight, Hydrogen bond donors and acceptors for class of drugs course contentusing drug design software Drug likeliness screening (Lipinskies RO5)

Recommended Books (Latest Editions)

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.

BP602 T. PHARMACOLOGY-III (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects(classification, mechanism of action, therapeutic effects, clinical uses, side effects andcontraindications) of drugs acting on respiratory and gastrointestinal system, infectiousdiseases, immuno-pharmacology and in addition,emphasis on the principles oftoxicology and chronopharmacology.

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

- understand the mechanism of drug action and its relevance in the treatment ofdifferent infectious diseases
- comprehend the principles of toxicology and treatment of various poisoningsand
- appreciate correlation of pharmacology with related medical sciences.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**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.	10

	e. Emetics and anti-emetics.	
II	**Chemotherapy** a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides,quinolones and fluoroquinolins, tetracycline and aminoglycosides	**10**
III	**Chemotherapy** a. Antitubercular agents b. Antileprotic agents c. Antifungal agents d. Antiviral drugs e.Anthelmintics f. Antimalarial drugs g. Antiamoebic agents	**10**
IV	**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	**08**
V	**Principles of toxicology** a. Definition and basic knowledge of acute, subacute and chronic toxicity. b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicityand 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.	**07**

Dean
H.P. Technical University
Hamirpur - 177001

BP 608 P. PHARMACOLOGY-III (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

**Experiments are demonstrated by simulated experiments/videos*

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 andNSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi- autoanalyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology(student‘s t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, WilcoxonSigned Rank test)

Recommended Books (Latest Editions)

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 McGraw-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 LippincottWilliams &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 MedicalPublishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisherModern 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. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

BP 603 T. HERBAL DRUG TECHNOLOGY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject gives the student the knowledge of basic understanding of herbal drugindustry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics,natural sweeteners, nutraceutical etc. The subject also emphasizes on Good ManufacturingPractices (GMP), patenting and regulatory issues of herbal drugs.

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

- understand raw material as source of herbal drugs from cultivation to herbal drugproduct
- know the WHO and ICH guidelines for evaluation of herbal drugs
- know the herbal cosmetics, natural sweeteners, nutraceuticals
- appreciate patenting of herbal drugs, GMP .

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Herbs as raw materials** Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation, Source of Herbs, Selection, identification and authentication of herbal materials, Processing of herbal raw material **Biodynamic Agriculture** Good agricultural practices in cultivation of medicinal plants including Organic farming.Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. **Indian Systems of Medicine** a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas,Ghutika,Churna, Lehya and Bhasma.	11

II	**Nutraceuticals** General aspects, Market, growth, scope and types of products available in the market. Healthbenefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritablebowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic,Honey, Amla, Ginseng, Ashwagandha, Spirulina **Herbal-Drug and Herb-Food Interactions:** General introduction to interaction andclassification. Study of following drugs and their possible side effects and interactions:Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.	**07**
III	**Herbal Cosmetics** Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gumscolours, perfumes, protective agents, bleaching agents, antioxidants in products such as skincare, 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 formslike phytosomes	**10**
IV	**Evaluation of Drugs** WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. **Patenting and Regulatory requirements of natural products:** a) Definition of the terms: Patent, IPR, Farmers right, Breeder‘s right, Bioprospecting andBiopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma& Neem. **Regulatory Issues** - Regulations in India (ASU DTAB, ASU DCC), Regulation ofmanufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.	**10**
V	**General Introduction to Herbal Industry**	**07**

Dean
H.P. Technical University
Hamirpur - 177001

	Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal andaromatic plants in India. **Schedule T – GoodManufacturing Practice of Indian systems of medicine** Components of GMP (Schedule – T) and its objectivesInfrastructural requirements, working space, storage area, machinery and equipments,standard operating procedures, health and hygiene, documentation and records.	

Dean
H.P. Technical University
Hamirpur - 177001

BP 609 P. HERBAL DRUG TECHNOLOGY (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

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, mixturesand tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

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. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research inIndian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation ofBotanicals. Business Horizons Publishers, New Delhi, India, 2002.

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart knowledge and skills of Biopharmaceuticsand pharmacokinetics and their applications in pharmaceutical development, design ofdose and dosage regimen and in solving the problems arised therein.

Objectives: Upon completion of the course student shall be ableto:

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

COURSECONTENT

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Biopharmaceutics** **Absorption**; Mechanisms of drug absorption through GIT, factors influencing drugabsorption though GIT, absorption of drug from Non per oral extra-vascular routes, **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volumeof drug distribution, plasma and tissue protein binding of drugs, factors affectingprotein-drug binding. Kinetics of protein binding, Clinical significance of proteinbinding of drugs	10
II	**Elimination:** Drug metabolism and basic understanding metabolic pathways renalexcretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renalroutes of drug excretion of drugs	10

Dean
H.P. Technical University
Hamirpur - 177001

	Bioavailability and Bioequivalence: Definition and Objectives of bioavailability,absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drugdissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods toenhance the dissolution rates and bioavailability of poorly soluble drugs.	
III	**Pharmacokinetics:** Definition and introduction to Pharmacokinetics, Compartmentmodels, Non compartment models, physiological models, One compartment openmodel. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extravascular administrations. Pharmacokinetics parameters - KE ,t1/2,Vd,AUC,Ka, Clt andCLR- definitions methods of eliminations, understanding of their significance andapplication	**10**
IV	***Multicompartment models:*** Two compartment open model. IV bolusKinetics of multiple dosing, steady state drug levels, calculation of loading andmainetnance doses and their significance in clinical settins.	**08**
V	**Nonlinear Pharmacokinetics:** a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example ofdrugs.	**07**

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and AndrewB.C.YU 4th edition,Prentice-Hall Inernational edition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar andSunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: ByMilo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, ByMilo Gibaldi and Laurie Prescott byADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: ByMalcolm Rowland and
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.

Dean
H.P. Technical University
Hamirpur - 177001

10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack,Publishing Company,Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th editionRevised and expanded by Rebort F Notari Marcel Dekker Inn, New York andBasel, 1987.
12. Remington‘s Pharmaceutical Sciences, ByMack Publishing Company,Pennsylvnia

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: Biotechnology has a long promise to revolutionize the biological sciences andtechnology.Scientific application of biotechnology in the field of genetic engineering,medicine and fermentation technologymakes the subject interesting.Biotechnology is leading to new biological revolutions in diagnosis, preventionand cure of diseases, new and cheaper pharmaceutical drugs.Biotechnology has already produced transgenic crops and animals and the futurepromises lot more.It is basically a research-based subject.

Objectives: Upon completion of the subject student shall be able to;

- Understanding the importance of Immobilized enzymes in PharmaceuticalIndustries
- Genetic engineering applications in relation to production of pharmaceuticals
- Importance of Monoclonal antibodies in Industries
- Appreciate the use of microorganisms in fermentation technology

UNIT	CONTENT	No. of Hrs.
I	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
II	a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of r DNA technology and genetic engineering in the production of:i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. d) Brief introduction to PCR	10

III	Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins b) Structure and Function of MHC c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines f) Hybridoma technology- Production, Purification and Applications g) Blood products and Plasma Substituties.	**10**
IV	a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting. b) Genetic organization of Eukaryotes and Prokaryotes c) Microbial genetics including transformation, transduction, conjugation, plasmids andtransposons.d) Introduction to Microbial biotransformation and applications.**e)** Mutation: Types of mutation/mutants.	**08**
V	a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls.c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Griseofulvin, d) Blood Products: Collection, Processing and Storage of whole human blood, driedhuman plasma, plasma Substituties.	**07**

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applicationsof 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 RoyalSociety of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell ScientificPublication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology,2nd edition, Aditya books Ltd., New Delhi

Dean
H.P. Technical University
Hamirpur - 177001

BP606T. PHARMACEUTICAL QUALITY ASSURANCE (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This course deals with the various aspects of quality control and qualityassurance aspects of pharmaceutical industries. It deals with the important aspects likecGMP, QC tests, documentation, quality certifications and regulatory affairs.

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

- understand the cGMP aspects in a pharmaceutical industry
- appreciate the importance of documentation
- understand the scope of quality certifications applicable to pharmaceuticalindustries
- understand the responsibilities of QA & QC departments

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Quality Assurance and Quality Management concepts:** Definition and concept of Qualitycontrol, 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
II	**Organization and personnel:** Personnel responsibilities, training, hygiene and personal records. **Premises:** Design, construction and plant layout, maintenance, sanitation, environmentalcontrol, utilities and maintenance of sterile areas, control of contamination.	10

Dean
H.P. Technical University
Hamirpur - 177001

	Equipments and raw materials: Equipment selection, purchase specifications, maintenance,purchase specifications and maintenance of stores for raw materials.	
III	**Quality Control:** Quality control test for containers, rubber closures and secondary packingmaterials. **Good Laboratory Practices:** General Provisions, Organization and Personnel, Facilities,Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of aNonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities	**10**
IV	**Complaints:** Complaints and evaluation of complaints, Handling of return good, recalling andwaste disposal. **Document maintenance in pharmaceutical industry:** Batch Formula Record, Master FormulaRecord, SOP, Quality audit, Quality Review and Quality documentation, Reports anddocuments, distribution records.	**08**
V	**Calibration and Validation:** Introduction, definition and general principles of calibration,qualification and validation, importance and scope of validation, types of validation, validationmaster plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, Generalprinciples of Analytical method Validation.**Warehousing:** Good warehousing practice, materials management	**07**

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, SandyWeinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Relatedmaterials Vol IWHO Publications.
4. A guide to Total QualityManagement- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP‘s – P P Sharma.
6. ISO 9000 and Total QualityManagement – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysisand Quality specification for Pharmaceutical Substances, Excipients and Dosageforms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

Dean
H.P. Technical University
Hamirpur - 177001

7th SEMESTER

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject deals with the application of instrumental methods in qualitative andquantitative analysis of drugs. This subject is designed to impart a fundamentalknowledge on the principles and instrumentation of spectroscopic and chromatographictechnique. This also emphasizes on theoretical and practical knowledge on modernanalytical instruments that are used for drug testing.

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

- Understand the interaction of matter with electromagnetic radiations and itsapplications in drug analysis
- Understand the chromatographic separation and analysis of drugs.
- Perform quantitative & qualitative analysis of drugs using various analyticalinstruments.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**UV Visible spectroscopy** Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect onabsorption 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 componentanalysis **Fluorimetry** Theory, Concepts of singlet, doublet and triplet electronic states, internal and externalconversions, factors affecting fluorescence, quenching, instrumentation andapplications	10
II	**IR spectroscopy:** Introduction, fundamental modes of vibrations in poly atomic	10

	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	
III	**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, Techniquesof paper, gel, capillary electrophoresis, applications	**10**
IV	**Gas chromatography -** Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications **High performance liquid chromatography (HPLC)-**Introduction, theory, instrumentation, advantages and applications.	**08**
V	**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	**07**

Dean
H.P. Technical University
Hamirpur - 177001

BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
0	0	4	2	15	35	50	3 hours

1 Determination of absorption maxima and effect of solvents on absorptionmaxima 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

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel‘s Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy byWilliam 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

BP 702 T. INDUSTRIAL PHARMACYII (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This course is designed to impart fundamental knowledge on pharmaceuticalproduct development and translation from laboratory to market

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

- Know the process of pilot plant and scale up of pharmaceutical dosage forms
- Understand the process of technology transfer from lab scale to commercial batch
- Know different Laws and Acts that regulate pharmaceutical industry
- Understand the approval process and regulatory requirements for drug products

Course Content:

UNIT	CONTENT	No. of Hrs.
I	**Pilot plant scale up techniques:** General considerations - including significance ofpersonnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPACguidelines, Introduction to platform technology	10
II	**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 andequipments, qualification and validation, quality control, analytical method transfer,Approved regulatory bodies and agencies, Commercialization - practical aspects andproblems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE /SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs,legal issues	10
III	**Regulatory affairs:** Introduction, Historical overview of Regulatory Affairs,	10

Dean
H.P. Technical University
Hamirpur - 177001

	Regulatoryauthorities, Role of Regulatory affairs department, Responsibility of Regulatory AffairsProfessionals **Regulatory requirements for drug approval:** Drug Development Teams, Non-ClinicalDrug Development, Pharmacology, Drug Metabolism and Toxicology, Generalconsiderations of Investigational New Drug (IND) Application, Investigator's Brochure(IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical ResearchProtocols, Biostatistics in Pharmaceutical Product Development, Data Presentation forFDA Submissions, Management of Clinical Studies.	
IV	**Quality management systems:** Quality management & Certifications: Concept ofQuality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Outof Specifications (OOS), Change control, Introduction to ISO 9000 series of qualitysystems standards, ISO 14000, NABL, GLP	**08**
V	**Indian Regulatory Requirements:** Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate ofPharmaceutical Product (COPP), Regulatory requirements and approval procedures forNew Drugs.	**07**

Recommended Books: (Latest Editions)

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

2. International Regulatory Affairs Updates, 2005. available athttp://www.iraup.com/about.php

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

4. Regulatory Affairs brought by learning plus, inc. available athttp.//www.cgmp.com/ra.htm.

Dean
H.P. Technical University
Hamirpur - 177001

BP 703T. PHARMACY PRACTICE (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: In the changing scenario of pharmacy practice in India, for successful practice ofHospital Pharmacy, the students are required to learn various skills like drug distribution,drug information, and therapeutic drug monitoring for improved patient care. Incommunity pharmacy, students will be learning various skills such as dispensing ofdrugs, responding to minor ailments by providing suitable safe medication, patientcounselling for improved patient care in the community set up.

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

- know various drug distribution methods in a hospital
- appreciate the pharmacy stores management and inventory control
- monitor drug therapy of patient through medication chart review and clinicalreview
- obtain medication history interview and counsel the patients
- identify drug related problems
- detect and assess adverse drug reactions
- interpret selected laboratory results (as monitoring parameters in therapeutics) ofspecific disease states
- know pharmaceutical care services
- do patient counseling in community pharmacy;
- appreciate the concept of Rational drug therapy.

UNIT	CONTENT	No. of Hrs.
I	**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 aHospital, and Medical staffs involved in the hospital and their functions. **b) Hospital pharmacy and its organization:** Definition, functions of hospital pharmacy, Organization structure, Location, Layoutand staff requirements, and	10

Dean
H.P. Technical University
Hamirpur - 177001

	Responsibilities and functions of hospital pharmacists. **c) Adverse drug reaction:** Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicityfollowing sudden withdrawal of drugs, Drug interaction- beneficial interactions,adverse interactions, and pharmacokinetic drug interactions, Methods for detectingdrug interactions, spontaneous case reports and record linkage studies, and Adversedrug reaction reporting and management. **d) Community Pharmacy:** Organization and structure of retail and wholesale drug store, types and design, Legalrequirements for establishment and maintenance of a drug store, Dispensing ofproprietary products, maintenance of records of retail and wholesale drug store.	
II	**a) Drug distribution system in a hospital:** Dispensing of drugs to inpatients, types of drug distribution systems, charging policyand labelling, Dispensing of drugs to ambulatory patients, and Dispensing ofcontrolled drugs. **b) Hospital formulary:** Definition, contents of hospital formulary, Differentiation of hospital formulary andDrug list, preparation and revision, and addition and deletion of drug from hospitalformulary. **c) Therapeutic drug monitoring:** Need for Therapeutic Drug Monitoring, Factors to be considered during theTherapeutic DrugMonitoring, 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**
III	**a) Pharmacy and therapeutic committee:** Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stoporder, and emergency drug list preparation.	**10**

Dean
H.P. Technical University
Hamirpur - 177001

	b) Druginformation services: Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information. **c) Patientcounseling:** 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 communitypharmacy, and Role of pharmacist in the interdepartmental communication andcommunity health education. **e) Prescribed medication order and communication skills:** Prescribed medication order- interpretation and legal requirements, andCommunication skills- communication with prescribers and patients.	
IV	**a) Budgetpreparation 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 chartreview, clinical review, pharmacist intervention, Ward round participation, Medicationhistory 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.	**08**
V	**a) Drug store management and inventory control:** Organisation of drug store, types of materials stocked and storage conditions, Purchaseand inventory control: principles, purchase procedure, purchase order, procurementand stocking, Economic order quantity, Reorder quantity level, and Methods used forthe analysis of the drug expenditure **b) Investigational use of drugs:** Description, principles involved, classification, control, identification, role of hospitalpharmacist, advisory committee. **c) Interpretation of Clinical Laboratory Tests:** Blood chemistry, hematology,	**07**

Dean
H.P. Technical University
Hamirpur - 177001

	and urinalysis	

Recommended Books (Latest Edition):

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 ClinicalPharmacy Practice- essential concepts and skills*, 1st ed. Chennai: OrientLongman 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*, 4thed. American Society ofHealth System Pharmacists Inc; 2009.

6. Parmar N.S. *Health Education and Community Pharmacy*, 18th ed. India: CBSPublishers & 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)

Dean
H.P. Technical University
Hamirpur - 177001

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart basic knowledge on the area of novel drugdelivery systems.

Objectives: Upon completion of the course student shall be able

- To understand various approaches for development of novel drug delivery systems.
- To understand the criteria for selection of drugs and polymers for the development ofNovel drug delivery systems, their formulation and evaluation

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Controlled drug delivery systems**: Introduction, terminology/definitions and rationale,advantages, disadvantages, selection of drug candidates.Approaches to design controlledrelease formulations based on diffusion, dissolution and ion exchange principles.Physicochemical and biological properties of drugs relevant to controlled releaseformulations **Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.	10
II	**Microencapsulation:** Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications**Mucosal Drug Delivery system:** Introduction, Principles of bioadhesion /mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability andformulation considerations of buccal delivery systems **Implantable Drug Delivery Systems:**Introduction, advantages and disadvantages,concept of implantsand osmotic pump	10
III	**Transdermal Drug Delivery Systems:** Introduction, Permeation through skin,	10

Dean
H.P. Technical University
Hamirpur - 177001

	factorsaffecting permeation, permeation enhancers, basic components of TDDS, formulationapproaches **Gastroretentive drug delivery systems:** Introduction, advantages, disadvantages,approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesivesystems and their applications **Nasopulmonary drug delivery system:** Introduction to Nasal and Pulmonary routes ofdrug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays,nebulizers	
IV	**Targeted drug Delivery:** Concepts and approaches advantages and disadvantages,introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and theirapplications	**08**
V	**Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods toovercome –Preliminary study, ocular formulations and ocuserts **Intrauterine Drug Delivery Systems:** Introduction, advantages and disadvantages,development of intra uterine devices (IUDs) and applications	**07**

Recommended Books: (Latest Editions)

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 WileyInterscience 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)

8th SEMESTER

BP801T. BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: To understand the applications of Biostatics in Pharmacy. This subject deals withdescriptive statistics, Graphics, Correlation, Regression, logistic regression Probabilitytheory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA,Introduction to Design of Experiments, Phases of Clinical trials and Observational andExperimental studies, SPSS, R and MINITAB statistical software's, analyzing thestatistical data using Excel**.**

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

- Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design ofExperiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems**.**

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**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
II	**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	10

Dean
H.P. Technical University
Hamirpur - 177001

	Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis,sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standarderror of mean (SEM) - Pharmaceutical examples **Parametric test**: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One wayand Two way), Least Significance difference	
III	**Non Parametric tests:** Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallistest, Friedman Test **Introduction to Research:** Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism **Graphs:** Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph **Designing the methodology:** Sample size determination and Power of a study, Reportwriting and presentation of data, Protocol, Cohorts studies, Observational studies,Experimental studies, Designing clinical trial, various phases.	**10**
IV	Blocking and confounding system for Two-level factorials **Regression modeling:** Hypothesis testing in Simple and Multiple regressionmodels **Introduction to Practical components of Industrial and Clinical Trials Problems**:Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R -Online Statistical Software‘s to Industrial and Clinical trial approach	**08**
V	**Design and Analysis of experiments:** **Factorial Design:** Definition, 22, 23design. Advantage of factorial design **Response Surface methodology**: Central composite design, Historical design, Optimization Techniques	**07**

Recommended Books (Latest edition):

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

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

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

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

Dean
H.P. Technical University
Hamirpur - 177001

BP 802T: SOCIAL AND PREVENTIVE PHARMACY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope:

The purpose of this course is to introduce to students a number of health issues and theirchallenges. This course also introduced a number of national health programmes. Theroles of the pharmacist in these contexts are also discussed.

Objectives:

After the successful completion of this course, the student shall be able to:

- Acquire high consciousness/realization of current issuesrelated to health andpharmaceutical problems within the country and worldwide.
- Have a critical way of thinking based on current healthcare development.
- Evaluate alternative ways of solving problems related tohealth andpharmaceutical issues

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Concept of health and disease:** Definition, concepts and evaluation of public health.Understanding the concept of prevention and control of disease, social causes of diseasesand 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 ofurbanization on health and disease, Poverty and health **Hygiene and health:** personal hygiene and health care; avoidable habits	10
II	**Preventive medicine:** General principles of prevention and control of diseases such ascholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chickenguinea, dengue, lymphatic filariasis, pneumonia, hypertension,	10

	diabetes mellitus, cancer,drug addiction-drug substance abuse	
III	**National health programs, its 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, Nationalprogramme for prevention and control of deafness, Universal immunization programme,National programme for control of blindness, Pulse polio programme.	**10**
IV	National health intervention programme for mother and child, National family welfareprogramme, National tobacco control programme, National Malaria Prevention Program,National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program	**08**
V	Community services in rural, urban and school health: Functions of PHC, Improvementin rural sanitation, national urban health mission, Health promotion and education inschool.	**07**

Recommended Books (Latest edition)*:*

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 RoyRabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEEPublications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6thEdition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D,Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEEPublications
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

BP803ET. PHARMA MARKETING MANAGEMENT (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: The pharmaceutical industry not only needs highly qualified researchers, chemists and,technical people, but also requires skilled managers who can take the industry forwardby managing and taking the complex decisions which are imperative for the growth of theindustry. The Knowledge and Know-how of marketing management groom the peoplefor taking a challenging role in Sales and Product management.

Course Objective: The course aims to provide an understanding of marketing conceptsand techniques and their applications in the pharmaceutical industry.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Marketing:** Definition, general concepts and scope of marketing; Distinction between marketing &selling; Marketing environment; Industry and competitive analysis; Analyzing consumerbuying behavior; industrial buying behavior. **Pharmaceutical market:** Quantitative and qualitative aspects; size and composition of the market; demographicdescriptions and socio-psychological characteristics of the consumer; marketsegmentation& targeting.Consumer profile; Motivation and prescribing habits of thephysician; patients' choice of physician and retail pharmacist.Analyzing the Market;Roleof market research.	10
II	**Product decision:** Classification, product line and product mix decisions, product lifecycle,product portfolio analysis; product positioning; New product decisions; Productbranding, packaging and labeling decisions, Product management in pharmaceuticalindustry.	10
III	**Promotion:** Methods, determinants of promotional mix, promotional budget; An	10

Dean
H.P. Technical University
Hamirpur - 177001

	overview of personal selling, advertising, direct mail, journals, sampling, retailing, medicalexhibition, public relations, online promotional techniques for OTC Products.	
IV	**Pharmaceutical marketing channels:** Designing channel, channel members, selecting the appropriate channel, conflict inchannels, physical distribution management: Strategic importance, tasks in physicaldistribution management. **Professional sales representative (PSR):** Duties of PSR, purpose of detailing, selection and training, supervising, norms forcustomer calls, motivating, evaluating, compensation and future prospects of the PSR.	**10**
V	**Pricing:** Meaning, importance, objectives, determinants of price; pricing methods and strategies,issues in price management in pharmaceutical industry. An overview of DPCO(Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority). **Emerging concepts in marketing:** Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing;Global Marketing.	**10**

Recommended Books: (Latest Editions)

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, TataMC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective,IndianContext,Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) ExcelPublications.

Dean
H.P. Technical University
Hamirpur - 177001

BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This course is designed to impart the fundamental knowledge on the regulatoryrequirements for approval of new drugs, and drug products in regulated markets ofIndia & other countries like US, EU, Japan, Australia,UK etc. It prepares the studentsto learn in detail on the regulatory requirements, documentation requirements, andregistration procedures for marketing the drug products.

Objectives: Upon completion of the subject student shall be able to;

- Know about the process of drug discovery and development
- Know the regulatory authorities and agencies governing the manufacture and saleof pharmaceuticals
- Know the regulatory approval process and their registration in Indian andinternational markets

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**New Drug Discovery and development** Stages of drug discovery, Drug development process, pre-clinical studies, non-clinicalactivities, clinical studies, Innovator and generics, Concept of generics, Generic drugproduct development.	10
II	**Regulatory Approval Process** Approval processes and timelines involved in Investigational New Drug (IND), NewDrug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to anapproved NDA / ANDA. **Regulatory authorities and agencies** Overview of regulatory authorities of India, United States, European Union,	10

Dean
H.P. Technical University
Hamirpur - 177001

	Australia,Japan, Canada (Organization structure and types of applications)	
III	**Registration of Indian drug product in overseas market** Procedure for export of pharmaceutical products, Technical documentation, Drug MasterFiles (DMF), Common Technical Document (CTD), electronic Common TechnicalDocument (eCTD), ASEAN Common Technical Document (ACTD)research.	**10**
IV	**Clinical trials** Developing clinical trial protocols, Institutional Review Board / Independent Ethicscommittee - formation and working procedures, Informed consent process andprocedures, GCP obligations of Investigators, sponsors & Monitors, Managing andMonitoring clinical trials, Pharmacovigilance - safetymonitoring in clinical trials	**08**
V	**Regulatory Concepts** Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book,Federal Register, Code of Federal Regulatory, Purple book	**07**

Recommended books (Latest edition):

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 andRobert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Healthcare Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard AGuarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / SandyWeinberg. By John Wiley &Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, andbiologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel andIsader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory ComplianceBy 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

Dean
H.P. Technical University
Hamirpur - 177001

BP 805T: PHARMACOVIGILANCE (Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This paper will provide an opportunity for the student to learn about development ofpharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenarioof Pharmacovigilance, train students on establishing pharmacovigilance programme in anorganization, various methods that can be used to generate safety data and signal detection. Thispaper also develops the skills of classifying drugs, diseases and adverse drug reactions.

Objectives:

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

- Why drug safety monitoring is important?
- History and development of pharmacovigilance
- National and international scenario of pharmacovigilance
- Dictionaries, coding and terminologies used in pharmacovigilance
- Detection of new adverse drug reactions and their assessment
- International standards for classification of diseases and drugs
- Adverse drug reaction reporting systems and communication in pharmacovigilance
- Methods to generate safety data during pre clinical, clinical and post approval phases ofdrugs‘ life cycle
- Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
- Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
- ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
- CIOMS requirements for ADR reporting
- Writing case narratives of adverse events and their quality.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Pharmacovigilance:** History and development of Pharmacovigilance; Importance of safety monitoringof 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**
II	**Drug and disease classification:** Anatomical, therapeutic and chemical classification of drugs; International classification of diseases; Daily defined doses; International Non proprietary Names for drugs **Drug dictionaries and coding in pharmacovigilance:** WHO adverse reaction terminologies; MedDRA and Standardised MedDRA queries; WHO drug dictionary; Eudravigilance medicinal product dictionary **Information resources in pharmacovigilance:** Basic drug information resources; Specialised resources for ADRs **Establishing pharmacovigilance programme:** Establishing in a hospital, Establishment & operation of drug safety department in industry; Contract Research Organisations (CROs); Establishing a national programme	**10**
III	**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 andcohort study; Targeted clinical investigations **Communication in pharmacovigilance:** Effective communication in Pharmacovigilance; Communication in Drug Safety Crisis management;	**10**

	Communicating with Regulatory Agencies, Business Partners, Healthcare facilities &Media	
IV	**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; Post approval expedited reporting; Pharmacovigilance planning; Good clinical practice in pharmacovigilance studies	**08**
V	**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	**07**

Recommended Books (Latest edition):

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 andBartlett 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 Pharmacoepidemiolog 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 NyfortHansen,Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PKManna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
13. http://www.ich.org/

Dean
H.P. Technical University
Hamirpur - 177001

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/pv_home.html

BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS(Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: In this subject the student learns about the various methods and guidelines forevaluation and standardization of herbs and herbal drugs. The subject also provides anopportunity for the student to learn cGMP, GAP and GLP in traditional system ofmedicines.

Objectives: Upon completion of the subject student shall be able to;

- know WHO guidelines for quality control of herbal drugs
- know Quality assurance in herbal drug industry
- know the regulatory approval process and their registration in Indian andinternational markets
- appreciate EU and ICH guidelines for quality control of herbal drugs

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosageforms, WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use	10
II	**Quality assurance in herbal drug industry** of cGMP, GAP, GMP and GLP in traditional system of medicine.WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines. WHO Guidelines on GACP for Medicinal Plants.	10
III	EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines	10
IV	Stability testing of herbal medicines.Application of various chromatographic techniquesin standardization of herbal products.Preparation of documents for new drug application and export registrationGMP requirements and Drugs & Cosmetics Act provisions.	08
V	Regulatory requirements for herbal medicines. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance	07

Dean
H.P. Technical University
Hamirpur - 177001

	systems. Comparison of various Herbal Pharmacopoeias. Role of chemical and biological markers in standardization of herbal products	

Recommended Books: (Latest Editions

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , CarrierPub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional MedicinalProducts,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation ofBotanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality controlprinciples to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials,World HealthOrganization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of HerbalMedicines. WHO Regional Publications, Western Pacific Series No 3, WHORegional 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 HealthOrganization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and AlternativeMedicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World HealthOrganization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) forMedicinal Plants. World Health Organization, Geneva, 2004.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to provide detailed knowledge of rational drug designprocess and various techniques used in rational drug design process.

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

- Design and discovery of lead molecules
- The role of drug design in drug discovery process
- The concept of QSAR and docking
- Various strategies to develop new drug like molecules.
- The design of new drug molecules using molecular modeling software

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**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 onclinical observation. **Analog Based Drug Design:** Bioisosterism, Classification, Bioisostericreplacement. Any three case studies	10
II	**Quantitative Structure Activity Relationship (QSAR):** SAR versus QSAR, History and development of QSAR, Types ofphysicochemical parameters, experimental and theoretical approaches forthe determination of physicochemical parameters such as Partitioncoefficient, Hammet‘s substituent constant and Tafts steric constant.Hansch analysis, Free Wilson analysis, 3D-QSAR approaches likeCOMFA and COMSIA.	10
III	**Molecular Modeling and virtual screening techniques:**	10

Dean
H.P. Technical University
Hamirpur - 177001

	Virtual Screening techniques: Drug likeness screening, Concept ofpharmacophore mapping and pharmacophore based Screening, **Molecular docking**: Rigid docking, flexible docking, manual docking,Docking based screening. *De novo* drug design.	
IV	**Informatics & Methods in drug design:** Introduction to Bioinformatics, chemoinformatics. ADME databases,chemical, biochemical and pharmaceutical databases.	**08**
V	**Molecular Modeling:** Introduction to molecular mechanics and quantummechanics.Energy Minimization methods and Conformational Analysis,global conformational minima determination.	**07**

Recommended Books (Latest Editions)

1. Robert GCK, ed., ―Drug Action at the Molecular Level‖ University Prak Press Baltimore.
2. Martin YC. ―Quantitative Drug Design‖ Dekker, New York.
3. Delgado JN, Remers WA eds ―Wilson & Gisvolds‘s Text Book of OrganicMedicinal & Pharmaceutical Chemistry‖ Lippincott, New York.
4. Foye WO ―Principles of Medicinal chemistry _Lea & Febiger.
5. Koro lkovas A, Burckhalter JH. ―Essentials of Medicinal Chemistry‖ WileyInterscience.
6. Wolf ME, ed ―The Basis of Medicinal Chemistry, Burger‘s Medicinal Chemistry‖JohnWiley& Sons, New York.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford UniversityPress.
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.

BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject)

Dean
H.P. Technical University
Hamirpur - 177001

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: Cell biology is a branch of biology that studies cells – their physiologicalproperties, their structure, the organelles they contain, interactions with theirenvironment, 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-celledorganisms like bacteria and protozoa, as well as the many specialized cells inmulti-cellular organismssuch as humans, plants, and sponges.

Objectives: Upon completion of the subject student shall be able to;

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.
- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.
- Summarize the Cell Cycle

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	a) Cell and Molecular Biology: Definitions theory and basics and Applications. b) Cell and Molecular Biology: History and Summation. c) Properties of cells and cell membrane. d) Prokaryotic versus Eukaryotic e) Cellular Reproduction f) Chemical Foundations – an Introduction and Reactions (Types)	10
II	a) DNA and the Flow of Molecular Information b) DNA Functioning c) DNA and RNA	10

	d) Types of RNA e) Transcription and Translation	
III	a) Proteins: Defined **and** Amino Acids b) Protein Structure c) Regularities in Protein Pathways d) Cellular Processes e) Positive Control and significance of Protein Synthesis	**10**
IV	a) Science of Genetics b) Transgenics and Genomic Analysis c) Cell Cycle analysis d) Mitosis and Meiosis e) Cellular Activities and Checkpoints	**08**
V	a) Cell Signals: Introduction b) Receptors for Cell Signals c) Signaling Pathways: Overview d) Misregulation of Signaling Pathways e) Protein-Kinases: Functioning	**07**

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientificpublications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers &Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
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. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverlycompany

Dean
H.P. Technical University
Hamirpur - 177001

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

13. RA Goldshy et. al., : Kuby Immunology.

BP809ET. COSMETIC SCIENCE(Theory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart the basic knowledge of cosmetic sciences

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

- Appreciate the applications of various commonly used cosmetic excipients.
- Appreciate and demonstrate the various formulation methods used in cosmetic formulations
- Appreciate and demonstrate the importance of analytical methods used in cosmetics.

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	Classification of cosmetic and cosmeceutical products ; Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticalsfrom cosmetics, cosmetics as quasi and OTC drugs. **Cosmetic excipients:** Surfactants, rheologymodifiers, 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
II	**Principles of formulation and building blocks of skin care products:** Face wash,Moisturizing cream, Cold Cream, Vanishing cream and their advantages anddisadvantages.Application of these products in formulation of cosmecuticals.**Antiperspants & deodorants**- Actives & mechanism of action. **Principles of formulation and building blocks of Hair care products:** Conditioning shampoo, Hair conditioner,anti-dandruff shampoo.Hair oils.Chemistry and formulation of Para-phylene diamine based hair dye.Principles of formulation and building blocks of oral care products:Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.	10
III	Sun protection, Classification of Sunscreens and SPF.	10

Dean
H.P. Technical University
Hamirpur - 177001

	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, skincreamand toothpaste**.**	
IV	Principles of Cosmetic Evaluation:Principles of sebumeter, corneometer. Measurementof TEWL, Skin Color, Hair tensile strength, Hair combing propertiesSoaps,and syndet bars. Evolution and skin benfits.	**08**
V	Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding ofthe terms Comedogenic, dermatitis.Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causesCosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat andbody odor. Antiperspirants and Deodorants- Actives and mechanism of action	**07**

References

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

BP810 ET. PHARMACOLOGICAL SCREENINGMETHODS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject is designed to impart the basic knowledge of preclinical studies inexperimental animals including design, conduct and interpretations of results.

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

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in preclinical Research
- Appreciate and demonstrate the importance of biostatistics and researchmethodology
- Design and execute a research hypothesis independently

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**Laboratory Animals:** Study of CPCSEA and OECD guidelines for maintenance, breedingand conduct of experiments on laboratory animals, Common labanimals: Description and applications of different species and strainsof animals. Popular transgenic and mutant animals.Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collectionand euthanasia.	08
II	**Preclinical screening models:** a. Introduction: Dose selection, calculation and conversions,preparation of drug solution/suspensions, grouping of animals andimportance of sham negative and positive control groups.Rationale for selection of animal species and sex for the study. b. **Study of screening animal models for:** Diuretics, nootropics, anti-Parkinson‘s,antiasthmatics **Preclinical screening models:** for CNS activity- analgesic,antipyretic,anti-	10

Dean
H.P. Technical University
Hamirpur - 177001

	inflammatory, general anaesthetics, sedative andhypnotics, antipsychotic, antidepressant, antiepileptic,antiparkinsonism, alzheimer‘s disease	
III	**Preclinical screening models:** for ANS activity, sympathomimetics,sympatholytics, parasympathomimetics, parasympatholytics, skeletalmuscle relaxants, drugs acting on eye, local anaethetics	**10**
IV	**Preclinical screening models:** for CVS activity- antihypertensives,diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory,coagulants, and anticoagulantsPreclinical screening models for other important drugs like antiulcer,antidiabetic, anticancer and antiasthmatics.	**10**
V	**Research methodology and Bio-statistics** Selection of research topic, review of literature, research hypothesisand study designPre-clinical data analysis and interpretation using Students _t‘ testand One-way ANOVA. Graphical representation of data	**07**

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-byM.N.Ghosh
2. Hand book 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 JRichard

BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P	C	Sessional	End Semester Exam	Total	
3	1	0	4	25	75	100	3 hours

Scope: This subject deals with the application of instrumental methods in qualitative andquantitative analysis of drugs. This subject is designed to impart advanced knowledge onthe principles and instrumentation of spectroscopic and chromatographic hyphenatedtechniques. This also emphasizes on theoretical and practical knowledge on modernanalytical instruments that are used for drug testing.

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

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

COURSE CONTENT

UNIT	CONTENT	No. of Hrs.
I	**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 offlight and Quadrupole, instrumentation, applications	10
II	**Thermal Methods of Analysis**: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) **X-Ray Diffraction Methods:** Origin of X-rays, basic aspects of crystals, Xray Crystallography, rotating crystal technique, single crystal diffraction,powder	10

	diffraction, structural elucidation and applications.	
III	**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**
IV	**Radio immune assay:**Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay **Extraction techniques**:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction	**08**
V	**Hyphenated techniques**-LC-MS/MS, GC-MS/MS, HPTLC-MS.	**07**

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel‘s Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy byWilliam 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

Dean
H.P. Technical University
Hamirpur - 177001

BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

No. of hours :3 Tutorial:1 Credit point:4

Scope :

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Objective:

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should 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.

UNIT I 07 hours

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.
b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.
c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

UNIT II 15 hours

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: Reservetrol
d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones
e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum
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.

UNIT III 07 hours

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..

UNIT IV 10 hours

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 nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione
Vitamin C, Vitamin E, α- Lipoic acid, melatonin
Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.
c) Functional foods for chronic disease prevention

UNIT V 06 hours

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.
b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.
c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

References:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BSPunblication.
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* Woodhead 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