Academic:

1. Degree Offered –UG, PG, PhD
   Title of degree: M.V.Sc., Ph.D
   Duration: 02 Years, 03 Years
   Eligibility Criteria: B.V.Sc. & A.H.
2. Academic Regulations:
   UG , PG, PhD (VCI, ICAR, IV, V Dean's and Corrigendum) – PDF Copies

3. Course offered :: UG, PG , PhD - Semester / Year wise

   - List of UG Courses (B.V.Sc & AH) As per latest MSVE Guidelines) , B.Tech. (D.T.) and B.F.Sc as per ICAR – V Deans Committee – 2016.

Sr No	Course No.	Title	Credit	Course offered in the Year
1	VPT	Veterinary Pharmacology Toxicology	4+1	III year

   - List of PG Courses (MVSc) and M.Tech. (Dairy Technology)

M.V.Sc.

Sr No	Course No .	Title	Credit	Semester
1	VPT-501	Concepts of Pharmacology, Drug Design and Development	2 + 0 = 2	I
2	VPT-502	Autonomic and Autacoid Pharmacology	2 + 1 = 3	I
3	VPT-503	CNS Pharmacology	2 + 1 = 3	I
4	VPT-504	Digestive and Respiratory Pharmacology	2 + 1 = 3	I
5	VPT-507	Chemotherapy	2 + 1 = 3	I
6	VPT-505	Cardiovascular and Urinary System Pharmacology	2 + 0 = 2	II
7	VPT-506	Endocrine and Reproductive Pharmacology	2 + 1 = 3	II

8	VPT-508	Toxicology of Xenobiotics	2 + 1 = 3	II
9	VPT-509	Toxinology	2 + 1 = 3	II
10	VPT-510	Pharmacological Techniques	0 + 2 = 2	II
11	VPT-511	Techniques in Toxicology	0 + 2 = 2	II
12	VPT-512	Ethnopharmacology	1 + 1 = 2	II
13	VPT-513	Fundamentals of Pharmacokinetics	1 + 1 = 2	II
14	VPT-591	Masters Seminar	1 + 0 = 1	III
15	VPT-599	Masters Research	0 + 10 = 10	III
16	VPT-599	Masters Research	0 + 20 = 20	IV

Ph.D.

Sr No	Course No .	Title	Credit		Semester	
			Regular	In-service	Regular	In-service
1	VPT-601	Molecular Pharmacology	3+0	3+0	I	I
2	VPT-602	Advances in Autacoid Pharmacology	1+0	1+0	I	I
3	VPT-603	Pharmacology of Herbal Drugs	2+1	2+1	I	I
4	VPT-604	Biotransformation of Xenobiotics	2+0	2+0	I	I
5	VPT-605	Clinical Pharmacology and Pharmacokinetics	2+1	2+1	I	I
6	VPT-606	Pharmacogenomics	2+0	2+0	I	I
7	VPT-607	Immunopharmacology and Immunotoxicology	2+0	2+0	II	II
8	VPT-608	Molecular Toxicology	3+0	3+0	II	II
9	VPT-609	Clinical Toxicology	2+1	2+1	II	II
10	VPT-610	Ecotoxicology	3+0	3+0	II	II

11	VPT-611	Regulatory Toxicology	2+1	2+1	II	II
12	VPT-690	Special Problem	0+1	0+1	III	III
13	VPT-691	Doctoral Seminar I	1+0	1+0	III	III
14	VPT-692	Doctoral Seminar II	1+0	1+0	III	III
15	VPT-699	Doctoral Research	0+15	0+15	III	IV
16	VPT-699	Doctoral Research	0+20	0+15	IV	V
17	VPT-699	Doctoral Research	0+20	0+15	V	VI
18	VPT-699	Doctoral Research	0+20	0+15	VI	VII
19	VPT-699	Doctoral Research	---	0+15	---	VIII

4. Lecture Schedule – UG, PG , PhD - Theory / Practical Schedule – Approved by BoS – Subject wise

UG: - Theory

Sr. No.	**Unit No.**	**Topic to be covered**
1.	Unit 1	Introduction to Veterinary Pharmacology, Historical development of Pharmacology.
2.	Unit 1	Branches of Pharmacology and scope of Pharmacology.
3.	Unit 1	Pharmacological terms and definitions.
4.	Unit 1	Sources and nature of drugs
5.	Unit 1	Drug Discovery & Drug development
6.	Unit 1	Bio Prospecting of Drugs
7.	Unit 1	Principles of drug activity: Pharmacokinetics – Routes of drug Administration.
8.	Unit 1	Absorption of Drugs.
9.	Unit 1	Distribution of Drug.
10.	Unit 1	Biotransformation of drugs & species variation in Biotransformation.
11.	Unit 1	Excretion of drugs.
12.	Unit 1	Pharmacodynamics and concept of drug and receptor, types of receptor.
13.	Unit 1	Dose-response relationship.
14.	Unit 1	Terms related to drug activity and drug interaction.
15.	Unit 1	Factors modifying the drug effect.

16.	Unit 1	Fundamentals of drug-screening. & Drug delivery systems.
17.	Unit 1	Adverse drug reactions.
18.	Unit 1	Introduction to biopharmaceutics gene therapy.
19.	Unit 2	Introduction to Autonomic Nervous System
20.	Unit 2	Autonomic relationship, central integration
21.	Unit 2	Neurohumoral transmission.
22.	Unit 2	Adreno receptors agonists, their SAR.
23.	Unit 2	Adreno receptor antagonists & adrenergic neuron blockers.
24.	Unit 2	Cholinergic receptors agonists & antagonists.
25.	Unit 2	Ganglionic stimulants and blockers.
26.	Unit 2	Autacoids I: Histamine and antihistamine agents.
27.	Unit 2	Autacoids II: 5 – Hydroxytryptamine and its antagonists.
28.	Unit 2	Autacoids III: Prostaglandins, Angiotensin and Bradykinin.
29.	Unit 3	Drugs acting on central nervous system (CNS): Introduction and Classification.
30.	Unit 3	History of general anaesthetics and theories of anaesthesia.
31.	Unit 3	Pharmacology of neurotransmitters of CNS.
32.	Unit 3	Inhalant anaesthetics I: Ether, Halothane, and Nitrous Oxide.
33.	Unit 3	Inhalant anaesthetics II: Enflurane, Isoflurane, Methoxyflurane, Cyclopropane Sevoflurance & recent development.
34.	Unit 3	Intravenous Anaesthesia – Barbiturates its Classification and SAR.
35.	Unit 3	Barbiturates- Pharmacological Action and Uses.
36.	Unit 3	Dissociative anaesthetics – Ketamine, Phencyclidine etc.
37.	Unit 3	Hypnotics and sedatives.
38.	Unit 3	Tranquilizers.
39.	Unit 3	Psychotropic drugs – classification and mechanism.
40.	Unit 3	Anticonvulsants: Phentobarbitone sodium, Phenytoin sodium, Primidone, etc.
41.	Unit 3	Analgesics: Opiod analgesics, Morphine and derivatives.
42.	Unit 3	Non- narcotic analgesics, salicylates, Para-aminophenol derivatives Pyrazolone derivatives.
43.	Unit 3	Non-steroidal anti-inflammatory drugs (NSAID), COX-I and COX-II Inhibitor.
44.	Unit 3	Analeptics & CNS stimulants.
45.	Unit 3	Drugs acting on somatic nervous system: Local anaesthetics.
46.	Unit 3	Central muscle relaxants.
47.	Unit 3	Peripheral muscle relaxants.

48.	Unit 3	Euthanasia.
49.	Unit 4	Drugs acting on digestive system: Stomachic, antacids, antiulcer and Prokinetics.
50.	Unit 4	Drugs acting on digestive system: emetics, antiemetic, purgatives andantidiarrhoeals.
51.	Unit 4	Drugs acting on digestive system: Carminatives, Antizymotics, Cholerectics &Cholagogues.
52.	Unit 4	Rumen pharmacology, Metabolic diseases of ruminal & its treatment
53.	Unit 4	Drugs acting on Cardiovascular system: cardiac glycosides,
54.	Unit 4	Antiarrhythmic drugs- quinidine, procainamide, calcium channel blockers.
55.	Unit 4	Pharmacology of Vasodilators.
56.	Unit 4	Antihypertensive drugs
57.	Unit 4	Coagulants, anticoagulants (local and systemic) and Haematinics.
58.	Unit 4	Drugs acting on respiratory system: Expectorants, antitussives and respiratory stimulants.
59.	Unit 4	Bronchodilators and mucolytics.
60.	Unit 4	Drugs acting on urogenital system: Diuretics, their classification and mechanisms of action.
61.	Unit 4	Urinary alkalizers and acidifiers.
62.	Unit 4	Fluid therapy
63.	Unit 4	Ecbolics and tocolytics.
64.	Unit 4	Drugs acting on skin and mucous membranes: Emollients, demulcents and counter irritants.
65.	Unit 4	Immuno modulators & Bioenhancers.
66.	Unit 4	Pharmacotherapeutics of Pituitary Hormones – I
67.	Unit 4	Pharmacotherapeutics of Gonadal Hormones
68.	Unit 4	Pharmacotherapeutics of adrenal Hormones
69.	Unit 4	Pharmacotherapeutics of Pancreatic Hormones – II
70.	Unit 4	Drug used for abuse in Veterinary field
71.	Unit 5	Introduction to Chemotherapy, Classification
72.	Unit 5	General principles in antibacterial chemotherapy (definition of antibiotic, MBC, MIC and classification of antibiotic with examples etc.)
73.	Unit 5	Antibacterial resistance
74.	Unit 5	Rational use of Chemotherapeutic agents.
75.	Unit 5	Sulphonamides, mechanism of action, spectrum, clinical uses, toxicity, dose and route of administration and their combination with diaminopyrimidines
76.	Unit 5	Other antimicrobial compounds like Sulfones, Nitrofurans, Nalidixic acid.

77.	Unit 5	Quinolones and Fluoroquinolones (structure, mechanism, spectrum, clinical uses, toxicity, dose and route of administration.
78.	Unit 5	Penicillin – Penicillin, synthetic penicillin, beta lactamase inhibitors.
79.	Unit 5	Combination of Penicillin with other drugs.
80.	Unit 5	Cephalosporin and Cephamycins.
81.	Unit 5	Aminoglycoside –I: Gentamicin, Streptomycin.
82.	Unit 5	Aminoglycoside –II: Neomycin, Kanamycin, Amikacin etc.
83.	Unit 5	Tetracycline and tetracycline derivatives.
84.	Unit 5	Amphenicols (Chloramphenicol, thiamphenicol, florphenicol).
85.	Unit 5	Macrolide antibiotics.
86.	Unit 5	Lincosamides.
87.	Unit 5	Polypeptides (Polymixins, Bacitracin)
88.	Unit 5	Glycopeptide antibiotics.
89.	Unit 5	Miscellaneous agents: Novobiocin, virginiamycin, tiamulin.
90.	Unit 5	Antitubercular drugs.
91.	Unit 5	Antifungal agents: Topical and systemic agents.
92.	Unit 5	Antifungal agent: antibiotics
93.	Unit 5	Anthelmintics: introduction, classification, ideal Anthelmintics.
94.	Unit 5	Anthelmintic Resistance.
95.	Unit 5	Mechanism of action of Anthelmintics, Antinematodal drugs.
96.	Unit 5	Anticestodal and antitrematodal drugs and broad-specrum Anthelmintics.
97.	Unit 5	Antiprotozoan drugs I – for Trypanosomiasis, Babesiosis and Anaplasmosis.
98.	Unit 5	Antiprotozoan drugs II – Giardiasis, Trichomoniasis and Amoebiasis.
99.	Unit 5	Anticoccidial drugs- general principles, classification, and mechanism of action and dosage of Anticoccidial drugs.
100.	Unit 5	Ectoparasiticides I
101.	Unit 5	Antiviral drugs.
102.	Unit 5	Anticancer drugs.
103.	Unit 5	Antiseptics and disinfectants –I.
104.	Unit 5	Antiseptics and disinfectants –II.
105.	Unit 5	Growth promoters.
106.	Unit 5	Pharmacology of indigenous medicinal plants: Scientific name, common name, active principles, pharmacological

		actions and therapeutic uses of Ginger, Ocmium, Neem, Piper longum, Withania, Leptadenia, Tinospora, Embilica.
107.	Unit 5	Pharmacology of indigenous medicinal plants: Scientific name, common name, active principles, pharmacological actions and therapeutic uses of Eucalyptus, Glycerrhiza, Trichospermum, curcuma, Adhantoda, Butea, Aloes, Sena, Rheubarb, Catechu etc.
108.	Unit 6	General Toxicology: Definitions, History of toxicology.
109.	Unit 6	Fundamentals and scope of Toxicology.
110.	Unit 6	Sources and classification of toxicants.
111.	Unit 6	Factors modifying toxicity.
112.	Unit 6	General approaches of diagnosis of poisoning.
113.	Unit 6	General approaches for treatment of poisoning.
114.	Unit 6	Toxicity caused by lead.
115.	Unit 6	Toxicity caused by Arsenic.
116.	Unit 6	Toxicity caused by Mercury.
117.	Unit 6	Toxicity caused by Copper & Molybdenum.
118.	Unit 6	Toxicity caused by Selenium and Selenium accumulating plants.
119.	Unit 6	Toxicity caused by Nitrate and Nitrites.
120.	Unit 6	Toxicity caused by Chlorate, common salt and urea.
121.	Unit 6	Toxicity caused by Phosphorus, Iodine & Fluorine.
122.	Unit 6	Poisonous Plants: Cyanogenetic Plants, Oleander, and Cotton.
123.	Unit 6	Poisonous plants: oxalate producing plants.
124.	Unit 6	Plants causing Thiamine deficiency.
125.	Unit 6	Poisonous plants: Abrus, Ipomoea, Datura, Nux Vomica, Castor, etc..
126.	Unit 6	Plants causing photosensitization and lathyrism.
127.	Unit 6	Toxicity caused by Agrochemicals I: Insecticides - Chlorinated hydrocarbons, Organophosphates.
128.	Unit 6	Toxicity caused by Agrochemicals II: Carbamates, Pyrethroids, newer insecticides.
129.	Unit 6	Toxicity caused by Agrochemicals III: Herbicides.
130.	Unit 6	Toxicity caused by fungicides.
131.	Unit 6	Toxicity caused by rodenticides.
132.	Unit 6	Fungal toxins: Aflatoxins, Rubratoxin, Ochratoxin.
133.	Unit 6	Fungal toxins: Sporidesmin, Citrinin, F – 2 toxin, Trichothecenes, Ergot & Fescue.
134.	Unit 6	Bacterial toxins: Botulinum toxin and tetanus toxin.
135.	Unit 6	Venomous bites and stings: Snake, scorpion, spider.
136.	Unit 6	Venomous bites and stings: bees and wasp, toad and fishes (puffer fish, shellfish).
137.	Unit 6	Toxicity caused by food additives and preservatives.
138.	Unit 6	Drug & drug residual toxicology.

139.	Unit 6	Environmental pollutants: Air and water pollutants, Methane pollution, acid rain, Green house effect.
140.	Unit 6	Concept of radiation hazards.

PRACTICAL SCHEDULE OF VETERINARY PHARMACOLOGY AND TOXICOLOGY

SR. NO.	**UNIT NO.**	**Topic to be covered.**
1.	**Unit 1**	Introduction to Pharmacy and Pharmacy appliances.
2.	**Unit 1**	Concept of good laboratory practices (GLP). Handling and operation of commonly used laboratory instruments.
3.	**Unit 1**	Metrology and Pharmacy calculations.
4.	**Unit 1**	Principles of Compounding, Dispensing & Labelling of Drugs.
5.	**Unit 1**	Incompatibilities.
6.	**Unit 1**	Pharmaceutical processes.
7.	**Unit 1**	Pharmaceutical dosage forms.
8.	**Unit 1**	Routes of Drug administration.
9.	**Unit 1**	Prescription writing.
10.	**Unit 1**	Drug standards and regulations, custody of poisons.
11.	**Unit 1**	Compounding and dispensing of powders and mixtures.
12.	**Unit 1**	Compounding and dispensing of ointments
13.	**Unit 1**	Compounding and dispensing of liquors and tinctures.
14.	**Unit 1**	Compounding and dispensing of emulsions and electuaries.
15.	**Unit 1**	Compounding and dispensing of liniments and lotions.
16.	**Unit 2**	Demonstration adrenergic activity on isolated heart.

17.	**Unit 2**	Demonstration adrenergic / cholinergic activity on rabbit eye.
18.	**Unit 2**	Demonstration of cholinergic / anticholinergic activity on isolated intestine.
19.	**Unit 2**	Demonstration effect of drug on blood pressure (of dog / rat).
20.	**Unit 3**	Demonstration of CNS depressant / stimulant drugs in lab animals.
21.	**Unit 3**	Demonstration of analgesia in lab animals. (Hot plate / tails flick).
22.	**Unit 3**	Demonstration of anticonvulsant activity in laboratory animals.
23.	**Unit 3**	Demonstration of muscle relaxant activity in laboratory animals.
24.	**Unit 3**	Demonstration of local Anaesthetic effect.
25.	**Unit 3**	Drug Reading.
26.	**Unit 4**	Demonstration of various chemotherapeutic agents and their dosage forms, various combinations predicts.
27.	**Unit 4**	Demonstration of antibiotic sensitivity test and its interpretation.
28.	**Unit 4**	Drug Reading.
29.	**Unit 5**	Detection of plant principles.
30.	**Unit 5**	General principles for toxicology analysis.
31.	**Unit 5**	Detection of heavy metals or non – metals.
32.	**Unit 5**	Demonstration of agrochemical toxicity and its antidotes therapy via simulation methods.
33.	**Unit 5**	Demonstration of toxic weeds and plants of local area.
34.	**Unit 5**	Methods of Calculation of median Lethal dose (LD_{50}) or Maximum tolerated dose (MTD).
35.	**Unit 5**	Collection, preservation and dispatch of material for toxicology analysis.

PG Lecture Schedule:-

Course Outline-cum-Lecture Schedule for Master Degree Programme

I. **Course Title : Concepts of Pharmacology, Drug Design and Development**
II. **Course Code : VPT 501**
III. **Credit Hours: 2+0**
IV. **Aim of the course**

To study the basic concepts of drug actions, and drug design and development.

V. **Lecture/ Practical schedule**

Theory:

Lecture No	Name of the topic
1	Scope of pharmacology, nature and sources of drugs and other therapeutic agents
2	Concept of Pharmacology in Therapeutics
3	Scope of pharmacology, nature and sources of drugs and other therapeutic agents
4	Principles of biopharmaceutics and dosage forms of drugs
5	Principles of biopharmaceutics and dosage forms of drugs
6	Routes of Drug Administrations
7	Principles of Pharmacokinetics-Absorption, distribution, metabolism and excretion of drugs
8	Principles of Pharmacokinetics-Absorption, distribution, metabolism and excretion of drugs
9	Principles of Pharmacokinetics-Absorption, distribution, metabolism and excretion of drugs
10	Principles of Pharmacokinetics-Absorption, distribution, metabolism and excretion of drugs
11	Principles of Pharmacokinetics-Absorption, distribution, metabolism and excretion of drugs
12	Application of Pharmacokinetics

13	Principles of drug action, rational, empirical and various other therapeutics
14	Principles of drug action, rational, empirical and various other therapeutics
15	Pharmacodynamics-targets for drug actions (enzymes, ion channels, structural and transporter proteins)
16	Pharmacodynamics-targets for drug actions (enzymes, ion channels, structural and transporter proteins)
17	Pharmacodynamics-targets for drug actions (enzymes, ion channels, structural and transporter proteins)
18	Pharmacodynamics-targets for drug actions (enzymes, ion channels, structural and transporter proteins)
19	Receptor mediated drug action, types of drug receptors, second messengers of drug action and signal transduction
20	Receptor mediated drug action, types of drug receptors, second messengers of drug action and signal transduction
21	Receptor mediated drug action, types of drug receptors, second messengers of

	drug action and signal transduction
22	Receptor mediated drug action, types of drug receptors, second messengers of drug action and signal transduction
23	Regulation and malfunctioning of diseases
24	Quantitation of drug-receptor interactions and elicited effects
25	Quantitation of drug-receptor interactions and elicited effects
26	Drug interactions and adverse drug reactions
27	Drug interactions and adverse drug reactions
28	Drugs design and development, Screening and drug assay
29	Drugs design and development, Screening and drug assay
30	Drugs design and development, Screening and drug assay
31	Clinical drug trials
32	Clinical drug trials
33	Drug safety, drug standards and regulations
34	Drug safety, drug standards and regulations
35	Gene therapy and novel drug delivery systems
36	Gene therapy and novel drug delivery systems

I. Course Title : Autonomic and Autacoid Pharmacology

II. Course Code : VPT 502

III. Credit Hours : 2 + 1

IV. Aim of the course

To study the pharmacological basis of therapeutic uses of autonomic and autacoiddrugs.

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	Introduction to autonomic nervous system (ANS), Anatomical and physiological considerations of autonomic and somatic motor nervous system
2	Introduction to autonomic nervous system (ANS), Anatomical and physiological considerations of autonomic and somatic motor nervous system
3	Introduction to autonomic nervous system (ANS), Anatomical and physiological considerations of autonomic and somatic motor nervous system
4	Neurohumoral transmission
5	Neurohumoral transmission
6	EXceptions to generalization of ANS, Agents modulating peripheral nervous system, non adrenergic-non cholinergic (NANC) transmission
7	EXceptions to generalization of ANS, Agents modulating peripheral nervous system, non adrenergic-non cholinergic (NANC) transmission
8	EXceptions to generalization of ANS, Agents modulating peripheral nervous system, non adrenergic-non cholinergic (NANC) transmission
9	Sympathetic nervous system, adrenergic agonists, antagonists and adrenergic neuron blockers
10	Sympathetic nervous system, adrenergic agonists, antagonists and adrenergic neuron blockers
11	Sympathetic nervous system, adrenergic agonists, antagonists and adrenergic neuron blockers
12	Sympathetic nervous system, adrenergic agonists, antagonists and adrenergic neuron blockers
13	Therapeutic uses of sympathetic drugs and blockers

14	Parasympathetic nervous system, cholinergic agonists, antagonists and cholinergic neuron blockers
15	Parasympathetic nervous system, cholinergic agonists, antagonists and cholinergic neuron blockers
16	Parasympathetic nervous system, cholinergic agonists, antagonists and cholinergic neuron blockers
17	Parasympathetic nervous system, cholinergic agonists, antagonists and cholinergic neuron blockers
18	Therapeutic uses of parasympathetic drugs and blockers
19	Ganglion stimulating and blocking drugs
20	Ganglion stimulating and blocking drugs

21	Neuromuscular blocking drugs
22	Introduction to immunity and inflammation
23	Introduction to immunity and inflammation
24	Immunostimulants, immunosuppressants and tolerogens
25	Histaminergic and antihistaminics
26	Histaminergic and antihistaminics
27	Serotonin and antiserotonin agents
28	Serotonin and antiserotonin agents
29	Kinins as mediators of inflammation
30	Kinins as mediators of inflammation
31	Eicosanoids and platelet activating factor
32	Eicosanoids and platelet activating factor
33	Eicosanoids and platelet activating factor
34	Angiotensins and other putative autacoids
35	Angiotensins and other putative autacoids
36	Angiotensins and inhibitors of renin-angiotensin system

V. Lecture/ Practical schedule

Practical:

Practical No	Name of the topic
1	Demonstration of adrenergic activity on isolated heart
2	Demonstration of cholinergic activity on isolated intestine
3	Demonstration of adrenergic / cholinergic activity on rabbit eye
4	Demonstration of adrenergic / antiadrenergic activity on blood pressure
5	Effect of drugs on guinea pig tracheal chain preparation
6	Demonstration of effects of drugs on isolated guinea pig ileum
7	Effects of drugs on rabbit jejunum
8	Demonstration of adrenergic activity on isolated rat uterus
9	Demonstration of cholinergic drugs on isolated abdominal muscle
10	Demonstration of the effect of drugs on ECG
11	Effects of autonomic drugs on blood pressure, ECG, etc.
12	Effects of autonomic drugs on blood pressure, ECG, etc.
13	Effect of autacoids on different systems-Isolated Intestine
14	Effect of autacoids on different systems-Isolated Intestine
15	Effect of autacoids on different systems-Isolated Lungs
16	Effect of autacoids on different systems-Isolated Lungs
17	Effect of autacoids on different systems-Isolated Uterus
18	Effect of autacoids on different systems-Isolated Uterus

I. Course Title : CNS Pharmacology

II. Course Code : VPT 503

III. Credit Hours : 2 +1

IV. Aim of the course:

To study the pharmacology of drugs acting on central nervous system (CNS)Lecture/ Practical schedule:

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	Introduction to CNS – Physiological and anatomical considerations
2	Drugs action on CNS
3	Drugs action on CNS
4	Central neurotransmitters
5	Central neurotransmitters
6	General anaesthesia – History, theories and stages of general anaesthesia
7	General anaesthesia – History, theories and stages of general anaesthesia
8	General anaesthesia – History, theories and stages of general anaesthesia
9	Adjuvants to general anaesthetics
10	Inhalant general anaesthetics
11	Inhalant general anaesthetics
12	Inhalant general anaesthetics
13	Injectable general anaesthetics
14	Injectable general anaesthetics
15	Injectable general anaesthetics
16	Local anaesthetics
17	Local anaesthetics
18	Hypnotics and sedatives
19	Hypnotics and sedatives
20	Hypnotics and sedatives
21	Psychotropic drugs and drugs modifying abnormal behavior of animals
22	Psychotropic drugs and drugs modifying abnormal behavior of animals
23	Anticonvulsants
24	Anticonvulsants
25	Opioid agonists (analgesics) and antagonists
26	Opioid agonists (analgesics) and antagonists
27	Opioid agonists (analgesics) and antagonists
28	Non steroidal anti-inflammatory drugs (NSAIDs)
29	Non steroidal anti-inflammatory drugs (NSAIDs)

30	Non steroidal anti-inflammatory drugs (NSAIDs)
31	CNS stimulants
32	Central muscle relaXants
33	Drugs of abuse
34	Drugs of abuse
35	Currents topics/ Discussion on library assignments
36	Currents topics/ Discussion on library assignments

V. Lecture/ Practical schedule

Practical:

Practical No	Name of the topic
1	Study on general anaesthetics – gaseous & liquid anesthesia
2	Study on general anaesthetics – gaseous & liquid anesthesia
3	Study on local anaesthetics
4	Study on local anaesthetics
5	Study on sedatives and hypnotics
6	Study on sedatives and hypnotics
7	Study on anticonvulsants
8	Study on anticonvulsants
9	Study on antipyretics
10	Study on analgesics
11	Study on analgesics
12	Study on anti-inflammatory drugs
13	Study on anti-inflammatory drugs
14	Study on psychotropic drugs
15	Study on psychotropic drugs
16	Study on CNS stimulants
17	Study on central muscle relaxants
18	Study on central muscle relaxants

I. Course Title : Digestive and Respiratory Pharmacology

II. Course Code : VPT 504

III. Credit Hours : 2 + 1

IV. Aim of the course:

To study the pharmacological aspects of drugs acting on digestive andrespiratory systems.

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	Drugs acting on Digestive System-General consideration
2	Drugs affecting salivary secretions – Sialics and antisialics
3	Drugs affecting gastric secretion – Stomachics, histamine and gastrin analogues
4	Gastric antisecretory and antiulcer drugs – H_2-receptor antagonists and proton pump inhibitors
5	Gastric antisecretory and antiulcer drugs – H_2-receptor antagonists and proton pump inhibitors
6	Antacids
7	Emetics
8	Antiemetics
9	Carminatives and antizymotics
10	Appetizers and digestants
11	Appetizers and digestants
12	Appetizers and digestants
13	Pro-kinetics
14	Pro-kinetics
15	Cathartics
16	Cathartics
17	Antidiarrhoeic drugs
18	Antidiarrhoeic drugs
19	Antidiarrhoeic drugs
20	Hepatoprotectants
21	Choleretics & Cholagogues
22	Rumen Pharmacology
23	Rumen Pharmacology
24	Rumen Pharmacology
25	Metabolic Diseases of Ruminants & its Treatments
26	Metabolic Diseases of Ruminants & its Treatments
27	Drugs Acting on Respiratory System
28	Antitussives
29	Expectorants
30	Analeptics
31	Analeptics

32	Bronchodilators and other drugs acting on respiratory system
33	Bronchodilators and other drugs acting on respiratory system
34	Gastro-esophageal reflux disease.
35	Current topics/ Discussion on digestive systems
36	Current topics/ Discussion on respiratory.

V. Lecture/ Practical schedule

Practical:

Practical No	Name of the topic
1	Demonstration of anti-ulcer agents
2	Demonstration of anti-ulcer agents
3	Demonstration of effect of anti-Secretory agents
4	Demonstration of effect of anti-Secretory agents
5	Demonstration of effect of drugs on Intestinal motility
6	Measurement of intragastric pressure in rats
7	In vitro evaluation of antacid of test Compounds
8	Evaluation of antidiarrhoeal effect of Drugs
9	Demonstration of effect of anti-emetic Drugs
10	Demonstration of spasmolytic activity in isolated guinea pig lung strips
11	Demonstration of spasmolytic activity in isolated guinea pig lung strips
12	Demonstration of bronchial Hyperreactivity
13	Demonstration of spasmolytic activity in isolated trachea of g. Pig
14	Demonstration of spasmolytic activity in isolated trachea of g. Pig
15	Demonstration of effects of respiratory Depressants in conscious rats
16	Demonstration of effects of respiratory Depressants in conscious rats
17	Antitussive activity after irritant Inhalation in guinea pigs
18	Demonstration of cough induced by Mechanical stimulation

I. **Course Title : Cardiovascular and Urinary System Pharmacology**

II. **Course Code : VPT 505**

III. **Credit Hours : 2 + 0**

IV. **Aim of the course**

To study the pharmacological aspects of drugs acting on CVS and kidneys.

V. **Lecture/ Practical schedule Theory:**

Lecture No	Name of the topic
1	General considerations to cardiovascular system
2	General considerations to cardiovascular system
3	Myocardial stimulants – Cardiac glycosides and other myocardial stimulants
4	Myocardial stimulants – Cardiac glycosides and other myocardial stimulants
5	Myocardial stimulants – Cardiac glycosides and other myocardial stimulants
6	Anti-arrhythmic drugs
7	Anti-arrhythmic drugs
8	Anti-arrhythmic drugs
9	Vasodilators and antianginal drugs
10	Vasodilators and antianginal drugs
11	Antihypertensive agents
12	Antihyperlipidemic and anti-hypotensive drugs
13	Haemostatics and coagulants
14	Haemostatics and coagulants
15	Anti-coagulants
16	Anti-coagulants
17	Fibrinolytic and anti-platelet drugs
18	Heamtaopoietic drugs
19	Heamtaopoietic drugs
20	Blood components and blood substitutes
21	Plasma expanders
22	Drugs used in treatment of shock
23	Drugs used in treatment of shock
24	Antihyperlipoproteinemics
25	Physiological basis of renal pharmacology
26	Physiological basis of renal pharmacology
27	Diuretics
28	Diuretics and antidiuretics
29	Urinary acidifier and alkalyzers
30	Drugs affecting fluid, electrolyte and acid-base balance
31	Drugs affecting fluid, electrolyte and acid-base balance
32	Drugs affecting urinary pH and tubular transport

33	Drugs affecting urinary pH and tubular transport
34	Urinary antiseptics, uricoseric and anti-gout drugs
35	Current topics/ Disccusion on library assignments
36	Current topics/ Disccusion on library assignments

I. **Course Title : Endocrine and Reproductive Pharmacology**

II. **Course Code : VPT 506**

III. **Credit Hours : 2 + 1**

IV. **Aim of the course**

To study the pharmacology of drugs affecting endocrine functions.

V. **Lecture/ Practical schedule Theory:**

Lecture No	Name of the topic
1	General considerations to Endocrine and reproductive systems
2	General considerations to Endocrine and reproductive systems
3	Pharmacology of drugs affecting endocrine functions of hypoteleamus
4	Pharmacology of drugs affecting endocrine functions of Pituitary gland
5	Pharmacology of drugs affecting endocrine functions of Pituitary gland
6	Pharmacology of drugs affecting endocrine functions of Pituitary gland
7	Pharmacology of drugs affecting endocrine functions of thyroid gland
8	Pharmacology of drugs affecting endocrine functions of thyroid gland
9	Pharmacology of drugs affecting endocrine functions of adrenals
10	Pharmacology of drugs affecting endocrine functions of adrenals
11	Pharmacology of drugs affecting endocrine functions of adrenals
12	Pharmacology of drugs affecting endocrine functions of the Pancreas
13	Pharmacology of drugs affecting endocrine functions of the Pancreas
14	Physiological basis of calcium and phosphorus homeostasis
15	Physiological basis of calcium and phosphorus homeostasis
16	Hormonal regulation of calcium and phosphorus homeostasis.
17	Hormonal regulation of calcium and phosphorus homeostasis
18	Pharmacology of drugs affecting male reproductive organs,
19	Pharmacology of drugs affecting male reproductive organs,
20	Drugs affecting spermatogenesis
21	Drugs affecting spermatogenesis and erectile dysfunctions
22	Pharmacology of drugs affecting female reproductive organs
23	Pharmacology of drugs affecting female reproductive organs
24	Drugs affecting ovulation
25	Drugs affecting ovulation
26	Drugs affecting oestrus
27	Drugs affecting conception
28	Drugs affecting conception
29	Drugs affecting gestation
30	Drugs affecting gestation

31	Drugs affecting lactation
32	Drugs affecting lactation
33	Oxytocis and other drugs affecting uterus
34	Current topics/ Disccusion on library assignments
35	Current topics/ Disccusion on library assignments
36	Current topics/ Disccusion on library assignments

V. Lecture/ Practical schedule

Practical:

Practical No	Name of the topic
1	Demonstration of Adrenalectomy in Rats
2	Study on Glucocorticoid Activity
3	Transactivation assay for glucocorticoids
4	Biological assay of PMSG in immature female rats
5	Receptor binding assay for LH
6	Assay of long-acting thyroid stimulating factor (LATS) in mice
7	Determination of Oxytocin activity using Isolated uterus
8	Effect of Oxytocin on Chicken blood pressure
9	Estimation of oxytocin using Milk ejection in the lactating rabbit or rat
10	Oxytocin receptor determination
11	Inhibition of gonadotropin secretion in intact animals
12	Inhibition of ovulation and luteinization
13	Radioimmunoassay of rat prolactin
14	Estimation of the effect of prolactin by using the Pigeon crop method
15	Evaluation of effects of prolactin on Lactation in rabbits
16	Bioassay of Vasopressin
17	Bioassay of Acth
18	Bioassay of D-Tubocurarine

I. Course Title : Chemotherapy

II. Course Code : VPT 507

III. Credit Hours : 2 + 1

IV. Aim of the course

To study the recent advances in chemotherapeutic agents with relevance to their molecular mechanisms and therapeutic aspects.

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	General considerations of chemotherapy
2	Classification of antimicrobial agents, General principles of antibacterial therapy
3	Combinations of antimicrobial agents-guidelines and indications
4	Bacterial resistance and Cross resistance
5	Guidelines for successful antimicrobial therapy and Adverse reactions to antimicrobial agents
6	Sulfonamides classification, SAR, mechanism of action and antimicrobial spectrum
7	Sulfonamides and Potentiated Sulphonamides -Clinical use and adverse effects
8	Beta-Lactam antibiotics- properties, SAR and mechanism of action
9	Penicillins classification, antimicrobial spectrum and adverse effects
10	Narrow spectrum, broad spectrum and extended spectrum penicillins and their clinical use
11	Cephalosporins-classification and clinical use
12	Cephalosporins - Newer agentsand their antimicrobial spectrum and clinical use
13	Beta-lactamase inhibitors
14	Aminoglycosides –properties, classification and mechanism of action
15	Aminoglycosides and Aminocyclitols- antimicrobial spectrum, resistance, clinical use and adverse effects
16	Chloramphenicol and Thiamphenicol- mechanism of action, antimicrobial spectrum, resistance, clinical use and adverse effects
17	Tetracyclines- mechanism of action, antimicrobial spectrum, resistance, clinical use and adverse effects
18	Tetracyclines Long acting - properties, pharmacokinetics, clinical use and adverse effects
19	Macrolide and licosamides antibiotics - properties, classification, antimicrobial spectrum and mechanism of action
20	Macrolides and licosamides- clinical use and adverse effects
21	Quinolones – properties, classification, antimicrobial spectrum and mechanism of action
22	Quinolones – clinical use and adverse effects
23	Anti- tubercular drugs- mechanism of action, antimicrobial spectrum,

	resistance, clinical use and adverse effects
24	Other antimicrobials of therapeutic importance
25	Antifungal agents- properties, classification
26	Antifungal agents-Topical and systemic drugs, clinical use and adverse effects
27	Antiviral agents- properties, classification
28	Antiviral agents- clinical use and adverse effects
29	Anticancer agents – General principles, properties, classification and mechanism
30	Anticancer agents – clinical use and adverse effects
31	Anthelmintics – General principles, properties and classification
32	Anthelmintics –Antinematodal, Anticestodal drugs
33	Anthelmintics –Antitrematodal drugs, Ectoparasiticides
34	Antiprotozoan Drugs- General principles, properties and classification
35	Antiprotozoan Drugs- clinical use in small and large animals and adverse effects
36	Anticoccidial drugs

VI. Lecture/ Practical schedule Practical:

Practical No	Name of the topic
1	General methods for assay of chemotherapeutic agents-Disc diffusion method
2	General methods for assay of chemotherapeutic agents-Disc diffusion method
3	General methods for assay of chemotherapeutic agents-Tube dilution method and Test for bactericidal activity
4	General methods for assay of chemotherapeutic agents-Tube dilution method and Test for bactericidal activity
5	Estimation of sulfonamides in biological fluids
6	Estimation of sulfonamides in biological fluids
7	Estimation of penicillins and cephalosporins in biological fluids
8	Estimation of penicillins and cephalosporins in biological fluids
9	Estimation of penicillins and cephalosporins in biological fluids
10	Estimation of penicillins and cephalosporins in biological fluids
11	Estimation of oxytetracyclines in biological fluids
12	Estimation of oxytetracyclines in biological fluids
13	Estimation of trimethoprim in biological fluids
14	Estimation of trimethoprim in biological fluids
15	Estimation of nitrofurans in biological fluids
16	Estimation of trimethoprim in biological fluids
17	Estimation of nitrofurans in biological fluids

18	Estimation of nitrofurans in biological fluids

I. Course Title : Toxicology of Xenobiotics

II. Course Code : VPT-508

III. Credit Hours : 2 + 1

IV. Aim of the course

To study the molecular basis of poisoning and antidotal therapy in animals.

V. Lecture/ Practical schedule

Lecture No	Name of the topic
1	Introduction, definitions and fields of toxicology
2	History and scope of toxicology
3	Sources and classification of toxicants
4	General modes of action of poisons
5	Detoxification of poisons
6	Detoxification of poisons
7	Principles and fundamentals of toxicology
8	Principles and fundamentals of toxicology
9	Principles and fundamentals of toxicology
10	Factors affecting toxicity
11	Diagnosis of poisoning
12	Diagnosis of poisoning
13	Treatment and management of poisonings
14	Treatment and management of poisonings
15	Toxicology of metals – Arsenic
16	Toxicology of metals –mercury
17	Toxicology of metals –lead
18	Toxicology of metals –copper and molybdenum,
19	Toxicology of metals –cadmium and iron
20	Toxicology of agrochemicals – Insecticides
21	Toxicology of agrochemicals – herbicides
22	Toxicology of agrochemicals – fungicides
23	Toxicology of agrochemicals – rodenticides
24	Toxicology of agrochemicals – rodenticides
25	Toxicology of solvents and vapours
26	Toxicology of solvents and vapours
27	Feed additives – Growth and performance enhancers, non-protein nitrogen compounds, common salt
28	Feed additives – Growth and performance enhancers, non-protein nitrogen compounds, common salt
29	Radiations and radioactive chemicals

30	Radiations and radioactive chemicals
31	Genetic and developmental toxicology
32	Genetic and developmental toxicology
33	Regulatory and forensic toxicology
34	Regulatory and forensic toxicology
35	Current topics/ Discussion of library assignments
36	Current topics/ Discussion of library assignments

VI. Lecture/ Practical schedule Practical:

Practical No	Name of the topic
1	Collection of Material for Toxicological Investigation
2	Identification and detection of common poison.
3	Extraction and separation of samples of poison from toxicological specimen
4	Dispatch and Processing of Samples for Toxicological Investigation
5	Demonstration of organophosphate toxicity and its antidotal treatment in laboratory animals.
6	Demonstration of organochlorine toxicity and its antidotal treatment in laboratory animals.
7	Demonstration of nitrate/ nitrites toxicity and its antidotal treatment in laboratory animals
8	Spot test for detection of heavy metals
9	Immunotoxicity study of xenobiotics/ toxicants in rats.
10	Genotoxicity testing for xenobiotics by Micronuclei assay in rodents
11	Genotoxicity testing of xenobiotics by chromosomal aberrations test in rodents
12	Genotoxicity testing of xenobiotics by comet assay in rodents
13	Acute Dermal (Irritation/Corrosion) toxicity test in rabbit
14	Eye Irritation/Corrosion test in rabbit.
15	Acute Oral Toxicity - Fixed Dose Procedure.
16	Sub-acute toxicity study: Repeated Dose 28-day Oral Toxicity Study in Rodents

17	Sub-acute toxicity study: Repeated Dose 28-day dermal Toxicity Study in Rodents
18	chronic toxicity study

I. Course Title : Toxinology

II. Course Code : VPT 509

III. Credit Hours : 2 + 1

IV. Aim of the course

To impart knowledge of molecular basis of toxicity induced by toxins of plants, microbes and animals origin.

V. Lecture schedule

Theory:

L. No	Name of the topic
1	Introduction to plant toxicology, toxins, venoms, mycotoxins, bacterial toxins and phytotoxins etc.
2	Classification and identification of chemical constituents of poisonous plants
3	Classification of Toxins (Phytotoxins, Microbial toxins)
4	Phytotoxins their sources and effects
5	Phytotoxins their sources and effects
6	Study of toxicity of Nitrate/nitrite containing plants : sources, mechanism of toxicity, clinical findings, diagnosis, treatment and control
7	Study of toxicity of Nitrate/nitrite containing plants : sources, mechanism of toxicity, clinical findings, diagnosis, treatment and control
8	Study of toxicity of cyanide containing plants : sources, mechanism of toxicity, clinical findings, diagnosis, treatment and control
9	Study of toxicity of cyanide containing plants : sources, mechanism of toxicity, clinical findings, diagnosis, treatment and control
10	Study of plants containing lectins and cardiac glycosides
11	Photosensitization – I : mechanism of toxicity, clinical signs and treatment
12	Photosensitization – II : mechanism of toxicity, clinical signs and treatment
13	Bracken fern poisoning – Clinical signs, diagnosis and treatment
14	Toxicity of plants containing oxalate – sources, Mechanism of toxicity
15	Toxicity of plants containing oxalate –clinical signs, diagnosis and treatment.
16	Poisoning due to *Strychnos nux-vomica*, *Ricinus communis* and *Nerium oleander* – Mechanism of toxicity, clinical signs, diagnosis and treatment
17	Poisoning due to *Strychnos nux-vomica*, *Ricinus communis* and *Nerium oleander* – Mechanism of toxicity, clinical signs, diagnosis and treatment
18	Study of plants producing lathyrism.
19	Toxicity due to *Dhatura alba*, *Abrus precatorius*, *Ipomoea carnea* – Mechanism of toxicity, clinical signs, diagnosis and treatment
20	Toxicity due to *Dhatura alba*, *Abrus precatorius*, *Ipomoea carnea* – Mechanism of toxicity, clinical signs, diagnosis and treatment
21	Mycotoxins – Hepatotoxins (sporidesmin, aflatoxins and rubratoxins): mechanism of toxicity, symptoms and treatment

22	Mycotoxins – Hepatotoxins (sporidesmin, aflatoxins and rubratoxins): mechanism of toxicity, symptoms and treatment
23	Nephrotoxins (ochratoxin, citrinin) : clinical signs and treatment
24	Neurotoxins (penitren A and Patulin) : clinical signs and treatment
25	Ergot alkaloids, estrogenism and Trichothecene toxins: clinical signs and treatment
26	Classification of Bacterial toxins : Endotoxins and Exotoxins
27	Bacterial toxins – Diphtheria toxins, Botulinum toxin, Cholera toxin, tetanus toxin, E.coli., Enterotoxin, Endotoxin
28	Bacterial toxins – Diphtheria toxins, Botulinum toxin, Cholera toxin, tetanus toxin, E.coli., Enterotoxin, Endotoxin
29	Bacterial toxins – Diphtheria toxins, Botulinum toxin, Cholera toxin, tetanus toxin, E.coli., Enterotoxin, Endotoxin
30	Snake: types, classification and identification of Poisonous Snakes
31	Toxicity of snake venom – Mechanism of toxicity, clinical signs and treatment
32	Toxicity of snake venom – Mechanism of toxicity, clinical signs and treatment
33	Toxicity due to scorpion – Mechanism of toxicity, clinical signs and treatment
34	Toxicity due to spider and insect stings and toad poisoning – Mechanism of toxicity, clinical signs and treatment
35	Toxicity due to spider and insect stings and toad poisoning – Mechanism of toxicity, clinical signs and treatment
36	Current topics/ Discussion of library assignments

Practical schedule:

P. No	Name of the topic
1	Detection of alkaloids in toxic plants
2	Detection of glycosides in toxic plants
3	Detection of cyanides in toxic plants
4	Detection of nitrate/ nitrite in toxic plants
5	Detection of tannins in toxic plants
6	Detection of saponins in toxic plants
7	Detection of resins in toxic plants
8	Detection of oxalates in toxic plants
9	Extraction and separation of Phytotoxins
10	Phytochemical analysis of toxic plant extracts
11	Phytochemical analysis of toxic plant extracts
12	Detection of mycotoxins in the samples of feed/ fodder and animal tissue
13	Detection of mycotoxins in the samples of feed/ fodder and animal tissue
14	Identification of toxic weeds and plants of the local area
15	Identification of toxic weeds and plants of the state area

16	Identification of toxic weeds and plants of the state area
17	Collection and dispatch of material for analysis in poisoning cases.
18	Toxicants and antidotal therapy

Course Title : Pharmacological Techniques

I. Course Code : VPT 510

II. Credit Hours : 0 + 2

III. Aim of the course

To impart the knowledge of various pharmacological techniques and screeningmethods of drugs.

IV. Lecture/ Practical schedulePractical:

P. No	Name of the topic
01	Principles of drug
02	Bioassay.Typs of bioassay, bioassay techniques
03	Bioassay.Typs of bioassay, bioassay techniques
04	Bioassay.Typs of bioassay, bioassay techniques
05	Setting up of an isolated tissue preparation and an intact preparation
06	Setting up of an isolated tissue preparation and an intact preparation
07	Study of dose response relationship
08	Study of dose response relationship
09	Suprmaximal effect by cumulative dose response study
10	Study on isolated organ assembly
11	Study on isolated organ assembly
12	Study on isolated organ assembly
13	Intact frog heart perfusion
14	Recording of blood pressure in animals
15	Recording of blood pressure in animals
16	Recording of ECG in animals
17	Screening Programme of drugs: General and multidimensional
18	Screening Programme of drugs: General and multidimensional
19	Gross observational methods in Screening procedures
20	Gross observational methods in Screening procedures
21	Calculation of EC50, potency ratio, PDv, PDx PD values

22	Calculation of ED50,TD50 and LD50
23	Screening of hypnotic activity
24	Study of analgesic, antipyretic and anti-inflammatory activity in laboratory animals
25	Study of analgesic, antipyretic and anti-inflammatory activity in laboratory animals
26	Study of general and local anaesthesia in experimental animals
27	Study of anticonvulsant and muscle relaxant effect of drugs
28	Study of anticonvulsant and muscle relaxant effect of drugs
29	Study of antiarrythmic and antihypertensive action of test compound
30	Study of antiarrythmic and antihypertensive action of test compound
31	Study of Hypotensive action of test drugs
32	Study of Hypotensive action of test drugs
33	Study of hypoglycemic effect of drugs in rat/rabbits
34	Study of antihyperglycemic and anticholinesteric acivity
35	Test of pyrogen using rabbit
36	Guidelines for safety studies of drugs

I. Course Title : Techniques in Toxicology

I. Course Code : VPT 511

II. Credit Hours : 0 + 2

III. Aim of the course:

To understand the animal toxicity tests and assessment of various toxicants using specific tests.

IV. Lecture/ Practical

Practical:

Practical No	Name of the topic
1	Guidelines for conducting toxicity studies- OECD, WHO, EPA
2	Cell Culture Techniques for Toxicity Assessment
3	Animal Models in Toxicology
4	In vivo Metabolism Studies:
5	In Vitro Metabolism Studies
6	Immunotoxicity Testing- cytokine assay
7	Immunotoxicity Testing- Lymphocyte proliferation assay
8	Animal Toxicity Test- Acute Toxicity
9	Liquid Chromatography-Mass Spectrometry (LC-MS) Analysis toxicological samples
10	Animal toxicity tests- subacute toxicity
11	Animal toxicity tests - chronic toxicity
12	Specific toxicity test for neurotoxicity
13	Specific toxicity test for immunotoxicity
14	Specific toxicity test for developmental toxicity
15	Specific toxicity test for behavioral toxicity
16	Genotoxicity and Mutagenicity Testing
17	Ames Test: Detect mutagenic potential using bacterial cultures.
18	Micronucleus Assay: Assess chromosomal damage in mammalian cells.
19	Comet Assay: Evaluate DNA damage in individual cells.
20	Specific toxicity test for reproductive toxicity
21	Specific toxicity test for inhalation toxicity
22	Study-specific toxicity test for carcinogenicity
23	Animal toxicological tests to study metabolism
24	Animal toxicological tests for synergism
25	Animal toxicological tests for the study of antagonisms
26	Good laboratory practices in toxicology
27	Evaluation of the impact of toxic substances on ecosystems.
28	Biomarker Analysis in Toxicology
29	Assays for marker enzymes: AchE, GPx, SOD, Catalase
30	Toxicokinetics and Pharmacokinetics:

31	Analysis of toxicants in biological material
32	Biochemical analysis of suspected toxicity specimens
33	Toxicology in Drug Development
34	Hematological evaluation of toxicological samples
35	Environmental Toxicology and Monitoring Techniques
36	Recent techniques in toxicological analysis

I. Course Title : Ethnopharmacology

II. Course Code : VPT 512

III. Credit Hours : 1 + 1

IV. Aim of the course

To impart the knowledge and importance of traditional Indian medicine.

V. Lecture/ Practical scheduleTheory:

Lecture No	Name of the topic
1	History, traditional remedies and regional knowledge in disease cure.
2	Alternate systems of medicine in animals
3	Plant drugs with proven pharmacological and therapeutic efficacy
4	Scope of ethnopharmacology
5	Classification and Identification of Medicinal plants
6	Different Phytoconstituents, Classification and Pharmacological profile.
7	Indigenous drugs used as antimicrobials
8	Indigenous drugs used as analgesics
9	Indigenous drugs used in CNS disorders
10	Indigenous drugs used in Renal and Urinary tract disorders
11	Indigenous drugs used in eye, ear and skin disorders
12	Therapeutic and adverse effects of potential herbal drugs
13	Therapeutic and adverse effects of potential herbal drugs
14	Current topics/ Discussion of library assignments
15	Current topics/ Discussion of library assignments
16	Standardization and clinical validation of bioactive molecules from plant sources.
17	Herbs used as galactagogues, carminatives, antiseptics, antidiarrhoeals, anthelmintics, agents etc
18	Herbs used as Immuno-stimulants, antimicrobials, bioenhancers, analgesics, anti-inflammatory agents,

VI. Lecture/ Practical schedule Practical:

Practical No	Name of the topic
1	Identification of medicinal plants
2	Selection of Raw Materials - selection of plants (based on ethnopharmacological, chemotaxonomic, geographical, or compound structural bases, environmental factors, and parts of plant selected for extraction.
3	Collection, Identification Authentication of Plant Materials - preservation of herbarium samples, authentication and identification of plant samples
4	Drying of plant Materials by using suitable methods - air drying, microwave heating, oven drying, freeze drying
5	Selection of solvents – selection of solvent for extraction on the basis of solvent power (selectivity), boiling temperature, reactivity, viscosity, safety, cost, vapor pressure, and recovery; classification of the Solvents (polar solvents, semi-polar solvents, non-polar solvents)
6	Methods of Extraction - Maceration, Digestion, Remaceration, Infusion and Decoction.
7	Classification, identification and chemical constituents of medicinal plants
8	Preparation of plant extracts in various solvents using different techniques
9	Ethnopharmacological survey
10	Methods of extraction for extracting specific phytoconstituent such as, alkaloids.
11	Methods of extraction for extracting specific phytoconstituent such as, alkaloids, carotenoids.
12	Methods of extraction for extracting specific phytoconstituent such as, fats and waxes
13	Methods of extraction for extracting specific phytoconstituent such as, glycosides and phenolic compounds, proteins, polysaccharides
14	Evaluation of pharmacological activities of extracts used in animals (Analgesic activity)
15	Evaluation of pharmacological activities of extracts using in animals (Muscle Relaxant activity)
16	Visit to medicinal plant garden.
17	Herbal Medicine Regulation and Ethics
18	Herbal Formulation Development

I. Course Title : Fundamentals of Pharmacokinetics

II. Course Code : VPT 513

III. Credit Hours : 1 + 1

IV. Aim of the course

To study the disposition of drugs and dosage regimen.

V. Lecture/ Practical

Theory:

Lecture No	Name of the topic
1	Dosage forms of drugs
2	Routes of drug administration
3	Transfer of drugs across biological membranes
4	Absorption of drugs
5	Distribution of drugs
6	Biotransformation of drugs
7	Biotransformation of drugs
8	Excretion of drugs
9	Principles of pharmacokinetics
10	Principles of pharmacokinetics
11	Various Pharmacokinetics models
12	Important pharmacokinetic parameters
13	Dosage regiment
14	*In-vitro* plasma protein binding of drugs
15	PK-PD modelling and Time kill kinetics
16	PK-PD modelling and Time kill kinetics
17	CYP enzymes and their analysis in drug disposition
18	Pharmacokinetic differences in drug metabolism of ruminants and monogastric animals

VI. Lecture/ Practical schedule Practical:

Practical No	Name of the topic
1	Various methods of drug assay
2	Various methods of drug assay
3	Microbiological assay for antimicrobial drugs
4	Microbiological assay for antimicrobial drugs
5	HPLC techniques
6	HPLC techniques
7	HPLC techniques
8	HPLC techniques
9	Bioavailability of drugs
10	Pharmacokinetics in animal disease models
11	Pharmacokinetics in animal disease models
12	*In-vitro* plasma protein binding of drugs
13	Determination of different pharmacokinetic parameters
14	Determination of different pharmacokinetic parameters
15	Analysis of pharmacokinetic data
16	Analysis of pharmacokinetic data
17	PK-PD modeling and Time kill kinetics
18	PK-PD modeling and Time kill kinetics

Ph.D Lecture Schedule:-

Course Outline-cum-Lecture Schedule for Doctoral Degree Programme

I. Course Title : Molecular Pharmacology

II. Course Code: VPT 601

III. Credit Hours: 3 + 0

IV. Aim of the course

To understand the identification and characterization of receptors and drug receptorsinteractions and underlying mechanisms of drug receptor interactions and its effects.

V. Lecture/ Practical schedule Theory:

Lecture No	Name of the topic
1	Introduction of Drugs & Its Physicochemical Properties
2	Concept of receptors and forces involved in binding of drugs to receptors
3	Concept of receptors and forces involved in binding of drugs to receptors
4	Structure Activity relationship

5	Dose Response relationship
6	Specificity and Selectivity of Drug Molecule
7	Methods of identification, isolation and characterization of receptors.
8	Methods of identification, isolation and characterization of receptors.
9	Methods of identification, isolation and characterization of receptors.
10	Quantitative aspects and theories of drug-receptor interactions
11	Quantitative aspects and theories of drug-receptor interactions
12	Signal transduction mechanisms: transducers, effectors and second messengers
13	Signal transduction mechanisms: transducers, effectors and second messengers
14	Signal transduction mechanisms: transducers, effectors and second messengers
15	Classification and structures of receptors – Receptor conformation and configuration – Iono-receptors
16	Classification and structures of receptors – Receptor conformation and configuration – Iono-receptors
17	G-protein coupled receptors
18	G-protein coupled receptors
19	Enzymatic receptors
20	Enzymatic receptors
21	Steroid receptors
22	Steroid receptors
23	Molecular mechanisms of drug actions
24	Molecular mechanisms of drug actions
25	Structures, types and functions of membrane ion channels.
26	Structures, types and functions of membrane ion channels.
27	Structures, types and functions of membrane ion channels.
28	Receptors for physiological regulatory molecules
29	Receptors for physiological regulatory molecules
30	Receptors as pharmaceutical targets.
31	Receptors as pharmaceutical targets.
32	Hepatic and extra-hepatic metabolism of drugs
33	Hepatic and extra-hepatic metabolism of drugs

34	Hepatic and extra-hepatic metabolism of drugs
35	Role of cytochrome P450 isozymes in drug metabolism
36	Role of cytochrome P450 isozymes in drug metabolism
37	Metabolic enzyme induction and inhibition
38	Metabolic enzyme induction and inhibition
39	Factors affecting drug metabolism
40	Factors affecting drug metabolism
41	Mechanism of bioactivation and cytotoxicity – Electrophilic metabolites, free radicals and reactive oxygen species
42	Mechanism of bioactivation and cytotoxicity – Electrophilic metabolites, free radicals and reactive oxygen species
43	Mechanism of bioactivation and cytotoxicity – Electrophilic metabolites, free radicals and reactive oxygen species
44	Drug induced mechanism of cell death – Necrosis and apoptosis
45	Drug induced mechanism of cell death – Necrosis and apoptosis
46	Cytoprotective mechanisms against bioactive substances – Role of glutathione and other protectants
47	Cytoprotective mechanisms against bioactive substances – Role of glutathione and other protectants
48	Calcium homeostasis within the cells
49	Calcium homeostasis within the cells
50	Pharmacology of mitogen-activated protein (MAP) kinases/ extracellular signal-regulated kinases (ERK) and small G proteins
51	Pharmacology of mitogen-activated protein (MAP) kinases/ extracellular signal-regulated kinases (ERK) and small G proteins
52	Pharmacology of mitogen-activated protein (MAP) kinases/ extracellular signal-regulated kinases (ERK) and small G proteins
53	Recent Concept and Development in Molecular Pharmacology
54	Recent Concept and Development in Molecular Pharmacology

I. Course Title : Advances in Autacoid Pharmacology

II. Course Code : VPT 602

III. Credit Hours : 1 + 0

IV. Aim of the course

To study the pharmacodynamics and clinical implications of autacoids.

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	Histamine and antihistamines
2	Histamine and antihistamines
3	Serotonin and its antagonists
4	Serotonin and its antagonists
5	Kinins
6	Kinins
7	Angiotensins and inhibitors of renin-angiotensin system
8	Angiotensins and inhibitors of renin-angiotensin system
9	Lipid-derived autacoids-prostaglandins and leukotrienes
10	Lipid-derived autacoids-prostaglandins and leukotrienes
11	Drug modifying Eicosanoids cascade
12	Platelet activating factor
13	Platelet activating factor
14	Cytokines and other autacoids
15	Cytokines and other autacoids
16	Neurohumoral transmission – purine nucleotides, peptides, amino acids and nitric oxide
17	Neurohumoral transmission – purine nucleotides, peptides, amino acids and nitric oxide
18	Recent Advances in Autacoid Pharmacology

I. Course Title : Pharmacology of Herbal Drugs
II. Course Code : VPT 603
III. Credit Hours : 2 + 1
IV. Aim of the course

To study the pharmacological, therapeutic and toxicological aspects of potential medicinalplants.

V. Lecture/ Practical schedule

Theory:

Practical No	Name of the topic
1	Introduction to indigenous pharmacology – History, definitions and scope
2	Basic requirements and classification of indigenous drugs
3	Basic requirements and classification of indigenous drugs
4	Collection and preparations of indigenous drugs
5	Methods of Extractions
6	Methods of Extractions
7	Purification of drugs by heat processes – Distillation, evaporation, sublimations,
8	Purification of drugs by heat processes – Distillation, evaporation, sublimations,
9	Filtration and clarification
10	Plant drugs with proven pharmacological and therapeutic efficacy
11	Indigenous drugs used in treatment of various gastrointestinal ailments
12	Indigenous drugs used in treatment of various gastrointestinal ailments
13	Indigenous drugs used as antimicrobials
14	Indigenous drugs used as analgesics
15	Indigenous drugs used in cardiovascular disorders
16	Indigenous drugs used in cardiovascular disorders
17	Indigenous drugs used in CNS disorders
18	Indigenous drugs used in CNS disorders
19	Indigenous drugs used in Respiratory ailments
20	Indigenous drugs used in Respiratory ailments
21	Indigenous drugs used in behavioral disorders
22	Indigenous drugs used in Renal and Urinary tract disorders
23	Indigenous drugs used in Renal and Urinary tract disorders
24	Indigenous drugs used in eye, ear and skin disorders
25	Indigenous drugs used in eye, ear and skin disorders
26	Indigenous drugs used in eye, ear and skin disorders
27	Indigenous drugs used in reproductive disorders

28	Indigenous drugs used in reproductive disorders
29	Therapeutic and adverse effects of potential herbal drugs
30	Therapeutic and adverse effects of potential herbal drugs
31	Alternate systems of medicine in animals – Homeopathy
32	Alternate systems of medicine in animals – Ayurvedic concepts
33	Alternate systems of medicine in animals – Ayurvedic concepts
34	Alternate systems of medicine in animals – Folklore medicine
35	Alternate systems of medicine in animals – Unani medicine
36	Discussion on few review articles on herbal drugs from journals

VI. Lecture/ Practical schedule

Practical:

Practical No	**Name of the topic**
1	Extraction and isolation of plant material for separation of different phytochemical by different extraction procedures
2	Extraction and isolation of plant material for separation of different phytochemical by different extraction procedures
3	Methods of Purification of biological active fraction by TLC
4	Methods of Purification of biological active fraction by TLC
5	Methods of Purification of biological active fraction by HPLC
6	Methods of Purification of biological active fraction by HPLC
7	Pharmacological screening of isolated active molecules on Intact lab Animal : Effect of isolated active molecules on Central Nervous System
8	Pharmacological screening of isolated active molecules on Intact lab Animal Demonstration of analgesic activity of isolated active molecules in lab animals
9	Pharmacological screening of isolated active molecules on Intact lab Animal Demonstration of muscle relaxant activity of isolated active molecules in lab animals
10	Pharmacological screening of isolated active molecules on Intact lab Animal: Effect of isolated active molecules on rabbit eye.
11	Pharmacological screening of isolated active molecules on Intact lab Animal : Effect of isolated active molecules on Blood Pressure
12	Pharmacological screening of isolated active molecules on Intact lab Animal : Effect of isolated active molecules on Blood Pressure
13	Pharmacological screening of isolated active molecules on isolated Tissue: Effect of isolated active molecules on isolated Heart.

14	Pharmacological screening of isolated active molecules on isolated Tissue: Effect of isolated active molecules on isolated Heart.
15	Pharmacological screening of isolated active molecules on isolated Tissue: Effect of isolated active molecules on isolated intestine
16	Pharmacological screening of isolated active molecules on isolated Tissue: Effect of isolated active molecules on isolated intestine
17	Safety Evaluation of Herbal Extract
18	Safety Evaluation of Herbal Extract

I. Course Title : Biotransformation of Xenobiotics
II. Course Code : VPT 604
III. Credit Hours : 2 + 0
IV. Aim of the course

To study the molecular mechanisms of biotransformation of xenobiotics.

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	Introduction, importance of drug metabolism. Mechanisms and processes of drug biotransformation
2	Synthetic and non-synthetic pathways of drug metabolism. Phase reactions- oxidative, reductive, and hydrolytic reactions
3	Phase II reactions- conjugation (glucuronidation, sulfation, methylation, acetylation), conjugation with glutathione, aminoacids and thiosulfates
4	Oxidation- molecular details, cytochrome P 450 system. Types of CYP enzymes with special reference to CYP 3A4, 1A2, 2D6, 2E1
5	Important drugs metabolized by different CYP isoforms- molecular mechanisms involved
6	Nuclear receptor mediated transcriptional regulation of cytochrome P 450 system- Nuclear receptors and their ligands
7	7-ethoxy-resorufin O-deethylation (EROD) and 7-methoxyresorufin O-demethylation (MROD) as markers of Cytochrome P450 1 activities in hepatic microsomes
8	Activity of liver enzymes during the acute and chronic phases of diseases- role ofTotal bilirubin, Aspartate transaminase (AST), AST/ ALT ratio, Alkaline phosphatase (ALP), Gamma glutamyl transpeptidase (GGT)
9	Use S9 liver fraction from animals for the prediction of *in vivo* drug metabolism, Chemical inhibition assays of S9 fraction
10	Xenobiotic response systems- AhR (aryl hydrocarbon receptor), ER (estrogen receptor), PPAR (peroxisome proliferator-activated receptor)
11	Response systems - VDR (Vitamin-D-Receptor), FXR(farsenoid-X-receptor), HNF4

	(hepatocyte nuclear factor), Nrf2-Keap1.
12	Concept of orphan nuclear receptors in different phases of metabolism
13	Role of Pregnane-X-Receptor (PXR), Constitutive-Androstane- Receptor (CAR),Liver-X-Receptor (LXR) in metabolism of commonly used drugs. Cross-talk in metabolism pathways
14	Role of genetically modified animals in drug metabolism studies
15	Specific studies on PXR, CAR, LXR involving gene knockout mice, transgenic mice.
	Cholesterol and bile acid homeostasis. Search for new response elements
16	Reduction reactions- molecular details with specific reaction examples of drugs undergoing reduction: of hydrogenation, decarboxylation, amination
17	Hydrolysis- molecular details with specific reaction examples of drugs undergoing hydrolysis with enzymes like esterases, peptidases, and amidases
18	Glucuronidation- mechanism, sites, general influencing factors
19	Glucuronidation affected drugs – metabolism of morphine, oxazepamcarbamazepine, acetaminophen, testosterone, zidovudine), inhibitors and inducers of glucuronidation (barbiturates, ibuprofen, etc.
20	Sulfation-Tyrosine sulfation (function, Regulation, Posttranslational modification)
21	Acetylation- Ultrastructural Aspects of the Heterogeneous Acetylation
22	Phase II Biotransformation Reactions-Glutathione-S-Transferase, Glutathione S-conjugates as prodrugs to target drug-resistant tumors
23	Phase III – further modification and excretion- detoxification of endogenous reactive metabolites such as peroxides and reactive aldehydes, sites
24	Membrane transport – permeability barriers and detoxification, receptor mediated transcytosis, role of the solute carrier (SLC) and the ATP-binding Cassette (ABC) transporters; implications in drug resistance
25	Drug metabolism in organs other than liver- role of kidney, intestine and placenta
26	Drug metabolism in fetus and new born.
27	*In-vitro* and *in-vivo* studies in drug metabolism; metabolic schemes of selected drugs
28	Factors influencing drug metabolism: Steriochemical, Physicochemical and biological factors
29	Strain difference in biotransformation, sex, age, environment factors, Genetic

	factors (pharmacogenetics) heritable factors recognized by use of drugs
30	Pathological states- Effect of liver dysfunction on the metabolism of drugs; effect on dosage regimens
31	Effect of renal dysfunction on the metabolism of different drugs
32	Chemical, biological, genetic and environmental factors. Species variations affecting drug biotransformation mechanisms
33	Biotechnology involved in drug metabolism studies- Electrophoretic Mobility Shift Assay (EMSA), northern, western/ southern blotting, PCR, real-time PCR
34	Preparation and Analysis of Total RNA Extracted from Hepatocytes for metabolism studies. Sulfation assay using P32, Site-directed Mutagenesis, etc
35	Methods to determine glutathione in liver and blood. Importance of Gamma-glutaylcysteine (GGC) as the immediate precursor to GSH
36	Cell lines as tools for drug metabolism studies. Predicting *in-vivo* drug metabolismfron *in-vitro* studies, Cultured hepatocytes (cryopreserved or fresh) for induction and down-regulation studies

I. Course Title : Clinical Pharmacology and Pharmacokinetics

II. Course Code : VPT 605

III. Credit Hours : 2 + 1

IV. Aim of the course

To study the efficacy and disposition of drugs in clinical conditions.

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	Introduction and general principles of pharmacokinetics including absorption, distribution, metabolism and excretion
2	Introduction and general principles of pharmacokinetics including absorption, distribution, metabolism and excretion
3	Introduction and general principles of pharmacokinetics including absorption, distribution, metabolism and excretion
4	Graphical plotting and interpretation of kinetic data
5	Graphical plotting and interpretation of kinetic data
6	Calculation of pharmacokinetic constants
7	Calculation of pharmacokinetic constants
8	Pharmacokinetic models and their application
9	Pharmacokinetic models and their application
10	Pharmacokinetic models and their application
11	Determination of pharmacokinetic parameters and their significance
12	Determination of pharmacokinetic parameters and their significance
13	Determination of pharmacokinetic parameters and their significance
14	Computation of dosage regimen
15	Computation of dosage regimen
16	Plasma protein binding of drugs
17	Plasma protein binding of drugs
18	Erythrocyte penetration of drugs
19	Erythrocyte penetration of drugs
20	Factors modifying pharmacokinetics of drugs
21	Factors modifying pharmacokinetics of drugs
22	Pharmacokinetics of drugs in diseased models
23	Pharmacokinetics of drugs in diseased models
24	Pharmacokinetics of drugs in diseased models
25	Urinary excretion of drugs
26	Kinetics following single and multiple doses
27	Kinetics following single and multiple doses
28	Non-compartmental pharmacokinetic modelling

29	Non-compartmental pharmacokinetic modelling
30	Non-compartmental pharmacokinetic modelling
31	Application of pharmacokinetics in clinical practice
32	Application of pharmacokinetics in clinical practice
33	Drug therapy in neonate and geriatric animals
34	Drug therapy in neonate and geriatric animals
35	Current topics/ Discussion on library assignments
36	Current topics/ Discussion on library assignments

VI. Lecture/ Practical schedule

Practical:

Practical No	**Name of the topic**
1	Estimation of drugs by chemical and microbiological assays
2	Estimation of drugs by chemical and microbiological assays
3	Estimation of drugs by chemical and microbiological assays
4	Graphical representation of plasma levels of drugs
5	Graphical representation of plasma levels of drugs
6	Determination of pharmacokinetic models
7	Determination of pharmacokinetic models
8	Calculation of kinetic constants and parameters
9	Calculation of kinetic constants and parameters
10	Calculation of dosage regimen
11	Renal clearance studies of drugs
12	*In-vitro* experiments on plasma protein binding
13	*In-vitro* experiments on plasma protein binding
14	Calculation of constants of plasma protein binding
15	*In-vitro* erythrocytic penetration of drugs
16	Pharmacokinetic parameters and adjustment of dosage regimen in diseased conditions
17	Pharmacokinetic parameters and adjustment of dosage regimen in diseased conditions
18	Pharmacokinetic parameters and adjustment of dosage regimen in diseased conditions

I. Course Title : Pharmacogenomics
II. Course Code : VPT 606
III. Credit Hours : 2 + 0
IV. Aim of the course

To study the concepts of genomics in drug development.

Theory:

Lecture No	Name of the topic
1	Introduction- basic pharmacogenomic nomenclature and principle
2	Pharmacogenomics and bioinformatics: past, present and future, species variations affecting drug responses
3	Pharmacogenomics and bioinformatics: past, present and future, species variations affecting drug responses
4	Optimized drug development- Pharmacogenomics impacts on pharmacokinetics and pharmacodynamics
5	Increased and decreased responsiveness to drug effects/ toxicities and novel drug effects- prediction through databases
6	Personalized medicine using genotyping technologies- Optimized drug therapy
7	Challenges of Pharmacogenomic Testing- access, feasibility, cost
8	Challenges of Pharmacogenomic Testing- access, feasibility, cost
9	Genetic basis of disease – Impact of genetic variations on drug metabolism
10	Ethical applications, social and economic implications
11	Genetic polymorphism- Relevance to a drug, Relevance to a disease, Types ofnomenclature- Star Nomenclature, Genotype Nomenclature, Haplotype Nomenclature
12	Genetic polymorphism types-Single nucleotide polymorphism (SNP), Variable number tandem repeat, Gene deletion, Copy number variant
13	Single Nucleotide Polymorphism (SNP)- Synonymous polymorphism, Non-synonymous polymorphism, Variable Number Tandem Repeat: UGT1A1
14	Single Nucleotide Polymorphism (SNP)- Synonymous polymorphism, Non-synonymous polymorphism, Variable Number Tandem Repeat: UGT1A1
15	Gene Deletions and Copy Number Variants- Ultra-rapid metabolizers, Extensive

	metabolizers, Intermediate metabolizers, Poor metabolizers
16	Potential Roles for Healthcare Professionals- Implications for Clinical Practice
17	Pharmacogenomic Resources- Centers for Disease Control and Prevention (CDC), Food and Drug Administration (FDA),
18	Gene therapy: gene transfer technology, viral vectors, natural delivery strategies.
19	Gene therapy: gene transfer technology, viral vectors, natural delivery strategies
20	Transient and Stable Transfection, Transfection Methods- Lipid-mediated method
21	Calcium-phosphate mediated method of transfection, diethylaminoethyloethyl- dextran mediated method of transfection
22	Electroporation- Steps of the electroporation transfection, Biolistics(Gene gun/ microparticle bombardment), Laser transfection
23	Drugs and gene therapy of inherited diseases- approaches , cell types, vectors
24	Genetic inactivation strategies- key concepts. RNA interference(RNAi), Chemical modification on siRNA
25	Engineered nucleases- zinc finger nucleases (ZFNs), transcription activator likeeffector nucleases (TALENs), clustered regularly interspaced short palindromic repeat associated (CRISPR associated) system
26	DNA repair- Sources of damage –Nuclear versus mitochondrial, Senescence andapoptosis. Mechanisms- Direct reversal, Single-strand damage, Double-strand breaks, Translesion synthesis, Medicine and DNA repair modulation
27	DNA repair- Sources of damage –Nuclear versus mitochondrial, Senescence andapoptosis. Mechanisms- Direct reversal, Single-strand damage, Double-strand breaks, Translesion synthesis, Medicine and DNA repair modulation
28	Cancer gene therapy- Immunotherapy, Oncolytic virotherapy- history, current clinical trials, future directions
29	Cancer gene therapy- Immunotherapy, Oncolytic virotherapy- history, current clinical trials, future directions
30	Boosting the immune response, Gene therapies to make cancer treatments effective
31	Pro drug gene therapy, Blocking processes that protect cancer cells, Using altered viruses

32	Role of bioinformatics in pharmacogenomic- Bioinformatics and drug discovery, Barriers to bioinformatics progress in drug design process
33	Pharmacogenomics in drug discovery and development- Personalized/ effective medication.
34	Reviving orphan drug, Barriers to pharmacogenomics progress in drug designing and development.
35	Clinical applications of bioinformatics, genomics, and pharmacogenomics, Relationships and exchange of information with other resources
36	Time dependent inhibition of genes involved in cytochrome P450 (CYP450) enzymes (single point, IC 50 shift)

I. Course Title : Immunopharmacology and Immunotoxicology

II. Course Code : VPT 607

III. Credit Hours : 2 + 0

IV. Aim of the course

To study the pharmacological intervention of immune functions.

V. Lecture/ Practical scheduleTheory:

Lecture No	Name of the topic
1	Introduction to immunology
2	General aspect of Immune system
3	General aspect of Immune system
4	General aspect of Immune system
5	Cellular components of immune system
6	Cellular components of immune system
7	Interaction of Immune system with nervous and endocrine system
8	Chemical mediators of immune system
9	General principles of immunopharmacology
10	Immunomodulators and their use in animals
11	Immunomodulators and their use in animals
12	Immunostimulants and their role in animal health and diseases
13	Immunostimulants and their role in animal health and diseases
14	Immunosuppressants, and tolerogens – clinical applications
15	Immunosuppressants, and tolerogens – clinical applications
16	Immunological basis of drug allergy and drug tolerance
17	Immunological basis of drug allergy and drug tolerance
18	Neuroendocrine immune interactions
19	Neuroendocrine immune interactions
20	Iimmunotoxic effects of environmental and other pollutants
21	Iimmunotoxic effects of environmental and other pollutants
22	Iimmunotoxic effects of environmental and other pollutants
23	Molecular mechanisms of immunotoxicity
24	Molecular mechanisms of immunotoxicity
25	Immunomodulatory effect of xenobiotics
26	Immunomodulatory effect of xenobiotics
27	Implications of immune alterations in health and disease
28	Implications of immune alterations in health and disease
29	Immune defiencies, autoimmune response to xenobiotics
30	Immune defiencies, autoimmune response to xenobiotics
31	Immunoregulants and their therapeutic applications in asthma, arthritis, cancer, dermatology and organ transplant etc
32	Immunoregulants and their therapeutic applications in asthma, arthritis,

	cancer, dermatology and organ transplant etc
33	Other immunological drugs
34	Other immunological drugs
35	Current discussions and assignments
36	Current discussions and assignments

Course Title : Molecular Toxicology

II. Course Code : VPT 608

III. Credit Hours : 3+0

IV. Aim of the course

To understand the mechanisms and targets of cellular/ molecular toxicity.

V. Lecture/ Practical schedule.Theory:

Lecture No	Name of the topic
01	Cellular, subcellular and molecular targets and mechanism of toxicity
02	Cellular, subcellular and molecular targets and mechanism of toxicity
03	Concept of receptors and forces involved in binding of xenobiotics to receptors
04	Concept of receptors and forces involved in binding of xenobiotics to receptors
05	Concept of receptors and forces involved in binding of xenobiotics to receptors
06	Endocrinal disruption by chemicals
07	Quantitative aspects and theories of xenobiotic-receptor interactions
08	Quantitative aspects and theories of xenobiotic-receptor interactions
09	Quantitative aspects and theories of xenobiotic-receptor interactions
10	Signal transduction mechanisms: transducers, effectors and second Messengers
11	Signal transduction mechanisms: transducers, effectors and second Messengers
12	G-protein coupled receptors
13	G-protein coupled receptors
14	Enzymatic receptors
15	Enzymatic receptors
16	Steroid receptors
17	Steroid receptors
18	Biotransformation

19	Biotransformation
20	Biophysics of toxicants
21	Biophysics of toxicants
22	Hepatic and extra-hepatic metabolism of xenobiotics
23	Hepatic and extra-hepatic metabolism of xenobiotics
24	Hepatic and extra-hepatic metabolism of xenobiotics
25	Metabolic enzyme induction and inhibition
26	Metabolic enzyme induction and inhibition
27	Metabolic enzyme induction and inhibition
28	Mechanism of bioactivation and cytotoxicity – Electrophilic metabolites, free radicals and reactive oxygen species
29	Mechanism of bioactivation and cytotoxicity – Electrophilic metabolites, free radicals and reactive oxygen species
30	Mechanism of bioactivation and cytotoxicity – Electrophilic metabolites, free radicals and reactive oxygen species
31	DNA damage
32	DNA damage
33	Molecular mechanisms of target organ directed toxicity of xenobiotics- brain, hematopoietic system, GIT, liver, lungs, kidneys, reproductive system, skin, etc.
34	Molecular mechanisms of target organ directed toxicity of xenobiotics- brain, hematopoietic system, GIT, liver, lungs, kidneys, reproductive system, skin, etc.

35	Molecular mechanisms of target organ directed toxicity of xenobiotics- brain, hematopoietic system, GIT, liver, lungs, kidneys, reproductive system, skin, etc.
36	Molecular mechanisms of target organ directed toxicity of xenobiotics- brain, hematopoietic system, GIT, liver, lungs, kidneys, reproductive system, skin, etc.
37	Cellular dysfunctions and their consequences
38	Cellular dysfunctions and their consequences
39	Mechanism of cell death in toxicity
40	Mechanism of cell death in toxicity
41	Repair and disrepair of toxic damage
42	Repair and disrepair of toxic damage
43	Xenobiotic induced mechanism of cell death – Necrosis and apoptosis 3
44	Xenobiotic induced mechanism of cell death – Necrosis and apoptosis 3
45	Xenobiotic induced mechanism of cell death – Necrosis and apoptosis 3
46	Risk Assessment
47	Risk Assessment
48	Mechanism involved in carcinogenesis, mutagenesis, teratogenesis
49	Mechanism involved in carcinogenesis, mutagenesis, teratogenesis
50	Radiation toxicity
51	Radiation toxicity
52	Recent advances in molecular toxicology
53	Current topics/ Discussion of library assignments
54	Current topics/ Discussion of library assignments

I. Course Title : Clinical Toxicology

II. Course Code : VPT 609

III.Credit Hours : 2 + 1

IV. Aim of the course

To study the concepts of clinical toxicology.

Theory:

Lecture No	Name of the topic
1	Introduction, history, definition and scope of clinical toxicology
2	Veterolegal consideration in poisoning
3	Importance and processes of forensic toxicology
4	Toxicological investigations
5	Management and antidotal therapy of poisonings
6	Toxicity of metals – Arsenic, lead, mercury, selenium, molybdenum, and other Metals
7	Toxicity of metals – Arsenic, lead, mercury, selenium, molybdenum, and other Metals
8	Toxicity of metals – Arsenic, lead, mercury, selenium, molybdenum, and other Metals
9	Toxicity of non-metals – Fluoride, nitrite/ nitrate, sodium chloride, phosphorus
10	Toxicity of non-metals – Fluoride, nitrite/ nitrate, sodium chloride, phosphorus
11	Toxicity of non-metals – Fluoride, nitrite/ nitrate, sodium chloride, phosphorus
12	Toxicity of insecticides – Chlorinated hydrocarbons, organophosphates, carbamates, pyrethroids, and botanical and newer insecticides
13	Toxicity of insecticides – Chlorinated hydrocarbons, organophosphates, carbamates, pyrethroids, and botanical and newer insecticides
14	Toxicity of insecticides – Chlorinated hydrocarbons, organophosphates, carbamates, pyrethroids, and botanical and newer insecticides
15	Toxicity of fumigants
16	Toxicity of herbicides
17	Drug Overdose and toxicity
18	Toxicity of fungicides
19	Toxicity of rodenticides
20	Toxicity of rodenticides
21	Toxicity of fertilizers

22	Toxicity of fertilizers
23	Toxicity of solvents and vapours
24	Toxic plants – Plants causing cyanide poisoning, photosensitization, thiamine deficiency and oxalate poisoning
25	Toxic plants – Plants causing cyanide poisoning, photosensitization, thiamine deficiency and oxalate poisoning
26	Toxic plants – Plants causing cyanide poisoning, photosensitization, thiamine deficiency and oxalate poisoning
27	Mycotoxins
28	Mycotoxins
29	Venomous stings and bites – Snake, scorpion, spider, bees and wasps
30	Venomous stings and bites – Snake, scorpion, spider, bees and wasps
31	Toxicity of therapeutic agents
32	Toxicity of therapeutic agents
33	GLP in toxicological evaluation
34	Different hepatotoxins
35	Different Nephrotoxins
36	Poisons affecting Nervous system

VI. Lecture/ Practical schedulePractical:

Practical No	**Name of the topic**
1	Collection, Preservation and Dispatch of toxicological samples
2	Extraction, separation, and detection of various poisons in suspected materials
3	Different Techniques Used in Diagnosis of Poisoning
4	Use of blood and tissue biomarker enzymes in assessment of toxicity, viz., acetylcholinesterase, carboxylesterase, etc.
5	Use of blood and tissue biomarker enzymes in assessment of toxicity, viz., acetylcholinesterase, carboxylesterase, etc.
6	Different techniques of toxicological diagnosis.
7	Demonstration of poisoning and their antidotal treatment
8	Demonstration of poisoning and their antidotal treatment
9	Veterolegal Aspects of Poisoning Cases
10	Evaluation of antioxidant profile of intoxicated animals
11	Emergency procedures in toxicity cases.
12	Analysis of poisons in biological samples
13	Analysis of poisons in biological samples
14	Use of biomarkers in the assessment of toxicity
15	Good laboratory practices evaluation

16	Identification and collection of poisonous plants
17	Detection of HCN Poisoning
18	Detection of Heavy metal poisoning- spot tests

I. Course Title : Ecotoxicology

II. Course Code : VPT 610

III. Credit Hours : 3 + 0

IV. Aim of the course:

To impart knowledge regarding eco-toxicology for the Conservation of healthy eco-system.

V. Lecture/ Practical

Schedule I. Theory:

Lecture No	Name of the topic
1	Introduction and basic principles of Eco-toxicology
2	Introduction and basic principles of Eco-toxicology
3	Sources of Environmental contamination-I (Inorganic)
4	Sources of Environmental contamination-II (Organic)
5	Sources of Environmental contamination-II (Organic)
6	Sources of Environmental contamination-II (Radiations)
7	Effects of Pollutants on Eco-health-Uptake
8	Effects of Pollutants on Eco-health- Biotransformation, and Detoxification
9	Effects of Pollutants on Eco-health- Elimination, and Accumulation
10	Fate of chemicals in the environment and target species
11	Fate of chemicals in the environment and target species
12	General aspects of hazards associated with Air and water pollutants
13	General aspects of hazards associated with Air and water pollutants
14	Radiation and its hazards
15	Radiation and its hazards
16	Toxicity of pesticides in relation to environmental contamination
17	Toxicity of pesticides in relation to environmental contamination
18	Toxicity of pesticides in relation to environmental contamination
19	Toxicity of metals related to Agriculture
20	Toxicity of metals related to Agriculture
21	Toxicity of metals related to Agriculture
22	Nano-particle Toxicology
23	Nano-particle Toxicology
24	Ecological emergencies
25	Ecological emergencies
26	Residues of Agrochemicals in Food and Ecosystem
27	Residues of agrochemicals in food and Ecosystem
28	Marine and wildlife as monitors of Environmental Quality
29	Marine and wildlife as monitors of Environmental Quality
30	Marine and wildlife as monitors of Environmental Quality
31	Bioaccumulation and biomagnifications of toxicants
32	Bioaccumulation from Food and Trophic Transfer
33	Factors Influencing Bioaccumulation
34	Forensic and Regulatory toxicology as related to agrochemicals
35	Forensic and regulatory toxicology as related to agrochemicals

36	Forensic and regulatory toxicology as related to agrochemicals
37	Hazards of toxicants in domestic and wildlife
38	Hazards of toxicants in domestic and wildlife
39	Hazards of toxicants in domestic and wildlife
40	Biomarkers of monitoring the impact of environmental pollutants
41	Biomarkers of monitoring the impact of environmental pollutants
42	Molecular effects and Biomarkers
43	Environmental hazard and risk identification from mixture of chemicals
44	Environmental hazard and risk identification from mixture of chemicals
45	Environmental hazard and risk identification from mixture of chemicals
46	Contamination control measures
47	Contamination control measures
48	Contamination control measures
49	Approaches to rehabilitating damaged ecosystems
50	Approaches to rehabilitating damaged ecosystems
51	Approaches to rehabilitating damaged ecosystems
52	Ethical, moral, and professional issues in toxicology
53	Ethical, moral, and professional issues in toxicology
54	Modern Environmental Laws and Regulations

I. Course Title : Regulatory Toxicology

II. Course Code : VPT 611

III. Credit Hours : 2 + 1

IV. Aim of the course:

To study acts and regulations and risk assessment regarding the use of drugs, chemicals,and cosmetics.

V. Lecture/ Practical schedule

Theory:

Lecture No	Name of the topic
1	Introduction to Toxicology; scope and industrial application
2	Drug and development in modern industry
3	Regulatory toxicology and Pre-clinical pharmaceutical testing services-linkage
4	Regulatory toxicology and Pre-clinical pharmaceutical testing services-linkage
5	Principles of Hazard Identification and Risk Assessment
6	Principles of Hazard Identification and Risk Assessment
7	Different guidelines for safety assessments
8	Methods of Toxic Dose Estimation
9	Methods of Toxic Dose Estimation
10	Risk assessment and Post marking surveillance
11	Risk assessment and Post marking surveillance
12	Procedure for Acute Toxicity Study
13	Procedure for sub-acute toxicity study
14	Procedure for Chronic Toxicity Study
15	Toxicity test guidelines and different routes
16	Toxicity test guidelines and different routes
17	Guidelines for Herbal Safety Risk Assessment Evaluation
18	Guidelines for Herbal Safety Risk Assessment Evaluation
19	Working principle of FDA and Indian legislation
20	Schedules of drugs and classification of industrial chemicals
21	Schedules of drugs and classification of industrial chemicals
22	Approaches to hazard identification-carcinogenicity
23	Approaches to hazard identification-carcinogenicity
24	Modern concept tolerance: classification, evaluation
25	Modern concept tolerance: classification, evaluation
26	Dose-response assessment LOEL, LOAEL and AOEL, NOEL, NOAEL, ADI, etc.
27	Dose-response assessment LOEL, LOAEL and AOEL, NOEL, NOAEL, ADI, etc.

28	Dose-response assessment LOEL, LOAEL and AOEL, NOEL, NOAEL, ADI, etc.
29	Guidelines for registration of medicines
30	Specific aspects of drug registration legislation abroad
31	Central Drugs Standard Control Organization – CDSCO, India
32	Central Drugs Standard Control Organization – CDSCO, India
33	Concept of GLP India and abroad;
34	Concept of GLP India and abroad;
35	Role of GLP in Toxicological Evaluation
36	Role of GLP in Toxicological Evaluation

Practical:

Practical No	Name of the topic
1	Introduction to Good laboratory practices in toxicology
2	Introduction to Good laboratory practices in toxicology
3	Screening procedures in Regulatory Toxicology (In-vitro)
4	Screening procedures in Regulatory Toxicology (in-vivo)
5	Screening procedures in Regulatory Toxicology (in-silico)
6	Evaluation of Acceptable daily intake (ADI)
7	Evaluation of Acceptable daily intake (ADI)
8	Determination of No-Observable Effect Level (NOEL) and NOAEL
9	Determination of No-Observable Effect Level (NOEL) and NOAEL
10	Determination of Low-observable effect level (LOEL) and LOAEL
11	Determination of Low-observable effect level (LOEL) and LOAEL
12	Determination of AOEL (Dermal)
13	Determination of AOEL (Inhalation)
14	Determination of AOEL (Ophthalmic)
15	Mandatory toxicity testing protocols (Ames test- carcinogenicity)
16	Mandatory toxicity testing protocols (Mouse lymphoma assay)
17	Mandatory toxicity testing protocols (Invitro micronucleus assay)
18	Mandatory toxicity testing protocols (Neutral red uptake assay)