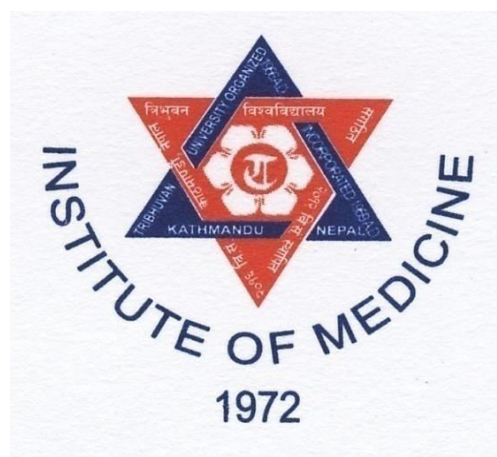


**Curriculum**  
**on**  
**Bachelor in Pharmacy**  
**(B. Pharm)**



*Published by*

**TRIBHUVAN UNIVERSITY**

**INSTITUTE OF MEDICINE**

**NATIONAL CENTRE FOR HEALTH PROFESSIONS EDUCATION**

**Maharajgunj, Kathmandu, Nepal**

**2020 (2076)**

The first year consists of six-theory papers and three practical carrying a total load of 990 Teaching Hours (46) including both theory and practical. In the second year, there are six theory papers and six-practical carrying a total load of 1080 Teaching Hours (48). In the third year, there are seven theory papers and three practical carrying a total load of 900 Teaching Hours (48) and in the fourth year there will be four theory and one practical paper carrying a total load of 450 Teaching Hours (36). The course consists of total of 3420 Teaching Hours (178). Apart from these papers, a 3 months' period is allotted to Dissertation and a 2 months time is allotted to the in-plant training in the fourth year.

### 10. Curriculum structure of Bachelor of Pharmacy

Code No.	Name of the subject	Hrs/ wk	Hrs/ yr	Credit	Marks
<b>FIRST YEAR</b>					
BP 401 A	Anatomy, Physiology & Pathology-Theory	3	90	6	100
BP 402 A	Biochemistry- Theory	3	90	6	100
BP 402 B	Biochemistry-Practical	3	90	2	50
BP 403 A	Pharmaceutical Chemistry-Theory	3	90	6	100
BP 403 B	Pharmaceutical Chemistry-Practical	3	90	2	50
BP 404 A	Medicinal Chemistry I-Theory	3	90	6	100
BP 405 A	Pharmacology I-Theory	3	90	6	100
BP 406 A	Pharmaceutical Microbiology-Theory	3	90	6	100
BP 406 B	Pharmaceutical Microbiology-Practical	3	90	2	50
	<b>Total of First Year</b>	<b>33</b>	<b>990</b>	<b>46</b>	<b>750</b>
<b>SECOND YEAR</b>					
BP 501 A	Pharmaceutics I (Physical Pharmacy)-Theory	3	90	6	100
BP 501 B	Pharmaceutics I (Physical Pharmacy)- Practical	3	90	2	50
BP 502 A	Medicinal Chemistry II-Theory	3	90	6	100
BP 502 B	Medicinal Chemistry II-Practical	3	90	2	50
BP 503 A	Biopharmaceutics and Pharmacokinetics- Theory	3	90	6	100
BP 503 B	Biopharmaceutics and Pharmacokinetics- Practical	3	90	2	50
BP 504 A	Pharmacognosy -Theory	3	90	6	100
BP 504 B	Pharmacognosy –Practical	3	90	2	50
BP 505 A	Pharmacology II-Theory	3	90	6	100
BP 505 B	Pharmacology II-Practical	3	90	2	50

BP 506 A	Pharmaceutical analysis and quality assurance I-Theory	3	90	6	100
BP 506 B	Pharmaceutical analysis and quality assurance I- Practical	3	90	2	50
	<b>Total of Second Year</b>	<b>36</b>	<b>1080</b>	<b>48</b>	<b>900</b>
<b>THIRD YEAR</b>					
BP 601 A	Pharmaceutical Engineering-Theory	3	90	6	100
BP 602 A	Pharmaceutics II (Dosage Forms and Formulation) -Theory	3	90	6	100
BP 602 B	Pharmaceutics II (Dosage Forms and Formulation)–Practical	3	90	2	50
BP 603 A	Pharmaceutical analysis and quality assurance II- Theory	3	90	6	100
BP 603 B	Pharmaceutical analysis and quality assurance II- Practical	3	90	2	50
BP 604 A	Ayurvedic and Herbal Technology-Theory	3	90	6	100
BP 604 B	Ayurvedic and Herbal Technology-Practical	3	90	2	50
BP 605 A	Biostatistics & Research Methodology-Theory	3	90	6	100
BP 606 A	Pharmaceutical Jurisprudence-Theory	3	90	6	100
BP 607 A	Community Pharmacy and First Aid-Theory	3	90	6	100
	<b>Total of Third Year</b>	<b>30</b>	<b>900</b>	<b>48</b>	<b>850</b>
<b>FOURTH YEAR</b>					
BP 701 A	Clinical and Hospital Pharmacy-Theory	3	90	6	100
BP 701 B	Clinical and Hospital Pharmacy-Practical	3	90	2	50
BP 702 A	Pharmaceutical Management-Theory	3	90	6	100
BP 703 A	Pharmaceutics III (Industrial Pharmacy) – Theory	3	90	6	100
BP 704 A	Pharmacotherapeutics-Theory	3	90	6	100
BP 705 DT	Dissertation			6	100
BP 706 IP	In-plant Training in Hospital +Industry (4 weeks each)			4	100
	<b>Total of Fourth Year</b>	<b>15</b>	<b>450</b>	<b>36</b>	<b>650</b>
	<b>Grand Total</b>	<b>114</b>	<b>3420</b>	<b>178</b>	<b>3150</b>

For the dissertation work, each student should develop a thesis topic, which will be carried out under the guidance of teachers. The students should submit a thesis and defend it.

Recognizing the need to develop the ability to translate theory into practice, students are placed for in-plant training in pharmaceutical manufacturing units, hospitals, drug stores as a part of curriculum at the beginning of 4<sup>th</sup> year.

## PHARMACOLOGY I

Subject: Theory	Year: First	Code: BP 405 A
Full Marks: 100	Total Teaching hours: 90	Credit hour: 6

**Course Description:** The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (Pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

### General objectives:

At the end of the course, the student will be able to

- a. Discuss the Classification, pharmacological actions of different categories of drugs
- b. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
- c. Discuss indication, contraindication and adverse effects of different categories of drugs
- d. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- e. Observe the effect of drugs on animals by simulated experiments
- f. Understand the methods in experimental pharmacology, principles of bioassay and be able to correlate drug effects with the action of drugs at the receptors
- g. To be able to identify and monitor adverse drug reactions (ADRs) and appreciate the importance of ADR reporting
- h. Understand pharmacokinetic and pharmacodynamic principles involved in the use of drugs
- i. Discuss new molecules introduced in therapy.

### Specific objectives:

#### Unit 1: General Pharmacology [10 Hrs]

After the completion of the course, students will be able to

- a. Discuss definition and basic terminologies of pharmacology.
- b. Discuss absorption, distribution, metabolism and excretion and various factors influencing them.
- c. Discuss principles and mechanisms of drug action.
- d. Discuss classification of receptors, Signal transduction mechanisms of ligand gated ion channels, G-Protein-coupled receptors, Kinase linked receptors and receptors that regulate transcription factors.
- e. Discuss combined effects of drugs and factors modifying drug action.
- f. Discuss definition and classification of ADRs.

## Unit 2: Pharmacology of Peripheral Nervous System

### A. Pharmacology of Cholinergic drugs [3 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Cholinergic drugs:

- a. **Cholinergic transmission, cholinergic receptors**
- b. **Cholinergic agonists:**
  - **Choline esters:** Acetylcholine, Methacholine, Carbachol, Bethanechol
  - **Alkaloids:** Pilocarpine, Muscarine
- c. **Anticholinesterases:**
  - **Reversible:** Physostigmine, Neostigmine, Pyridostigmine, Rivastigmine, Tacrine
  - **Irreversible:** Carbaryl, Propoxur, Echothiophate, Malathion

### B. Pharmacology of Anticholinergic drugs [3 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Anticholinergic drugs:

- a. **Natural alkaloids:** Atropine, Hyoscine
- b. **Semisynthetic derivatives:** Homatropine, Atropine methonitrate, Hyoscine butyl bromide, Ipratropium bromide, Tiotropium bromide
- c. **Synthetic compounds:**
  - **Mydriatics:** Cyclopentolate, Tropicamide
  - **Antisecretory-antispasmodics:** Propantheline, Oxyphenonium, Clidinium, Isopropamide, Glycopyrrolate, Dicyclomie, Valethamate, Pirenzeoine

### C. Pharmacology of Ganglionic stimulants [1 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Ganglionic stimulants:

- a. **Selective nicotinic agonists:** Nicotine, Varenicline, Bupropion
- b. **Nonselective muscarinic agonists:** Ach, carbachol, Pilocarpine, Anticholine esterase

### D. Pharmacology of Ganglionic blockers [1 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Ganglionic blockers:

- a. **Competitive blockers:** Hexamethonium, Pentolinium, Mecamylamine, Trimethaphan
- b. **Persistent depolarizing blockers:** Nicotine (High dose), Anticholinesterase

### E. Pharmacology of Adrenergic drugs [4 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Adrenergic drugs:

- a. **Adrenergic transmission, adrenergic receptors**
- b. **Pressor agents:** Noradrenaline, Ephedrine, Dopamine, Phenylephrine
- c. **Cardiac stimulants:** Adrenaline, Isoprenaline, Dobutamine
- d. **Bronchodilators:** Isoprenaline, Salbutamol, Terbutaline, Salmeterol
- e. **Nasal decongestants:** Xylometazoline, Oxymetazoline, Naphazoline, Phenylephrine, Pseudoephedrine, Phenylpropanolamine
- f. **CNS stimulants:** Amphetamine, Dexamphetamine
- g. **Anorectics:** Fenfluramine, Dexfenfluramine, Sibutramine
- h. **Uterine relaxants:** Ritodrine, Isoxsuprine, Salbutamol, Terbutaline

### F. Pharmacology of $\alpha$ adrenergic blocking drugs [4 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of  $\alpha$  adrenergic blocking drugs

1. **Nonequilibrium type-** Phenoxybenzamine.
2. **Equilibrium type (competitive)**
  - a. **Nonselective**
    - Ergot alkaloids—Ergotamine, Ergotoxine
    - Hydrogenated ergot alkaloids—Dihydroergotamine (DHE), Dihydroergotoxine
    - Imidazoline—Phentolamine
    - Miscellaneous—Chlorpromazine
  - b.  $\alpha_1$  selective—Prazosin, Terazosin, Doxazosin, Alfuzosin, Tamsulosin
  - c.  $\alpha_2$  selective—Yohimbine

### G. Pharmacology of $\beta$ adrenergic blocking drugs [1 Hr]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of  $\beta$  adrenergic blocking drugs

- a. **Nonselective ( $\beta_1$  and  $\beta_2$ )**
  - Without intrinsic sympathomimetic activity: Propranolol, Sotalol, Timolol.
  - With intrinsic sympathomimetic activity: Pindolol
  - With additional  $\alpha$  blocking property: Labetalol, Carvedilol
- b. **Cardioselective ( $\beta_1$ ):** Metoprolol, Atenolol, Acebutolol, Bisoprolol, Esmolol

## H. Pharmacological action of Drugs for glaucoma [1 Hr]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Drugs for glaucoma

- $\beta$ -adrenergic blockers: Timolol, Betaxolol, Levobunolol
- $\alpha$ -adrenergic agonists: Dipivefrine, Apraclonidine, Brimonidine.
- Prostaglandin analogues: Latanoprost, Travoprost, Bimatoprost.
- Miotics: Pilocarpine
- Carbonic anhydrase inhibitors: Acetazolamide
- Osmotic diuretics: Mannitol, Glycerol (Glycerine)

## Unit 3: Pharmacology of Central Nervous System

After the completion of the course, students will be able to

### A. General Anaesthetics [4 Hrs]

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of General Anaesthetics.

#### 1. Inhalational

- Gas: Nitrous oxide
- Volatile liquids: Halothane, Isoflurane, Desflurane, Sevoflurane

#### 2. Intravenous

- Fast acting drugs: Thiopentone, Methohexitone, Propofol
- Slower acting drugs: Benzodiazepines: Diazepam, Lorazepam, Midazolam
- Dissociative anaesthetic: Ketamine, Opioid analgesic: Fentanyl

### B. Sedative-Hypnotics [3 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Sedative-Hypnotics

- **Barbiturates:** Phenobarbitone, Pentobarbitone, Thiopentone, Methohexitone
- **Benzodiazepines:** Diazepam, Chlordiazepoxide, Lorazepam, Alprazolam, Clobazepam, Temazepam, Triazolam, Flurazepam,
- **Newer agents:** Zopiclone, Zolpidem, Zaleplon

## Unit 4: Pharmacology of Central Nervous System

### A. Pharmacology of Antiepileptic Drugs: [3 Hrs]

After the completion of the course, students will be to Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antiepileptic Drugs

- a. **Barbiturate:** Phenobarbitone
- b. **Deoxybarbiturate:** Primidone
- c. **Hydantoin:** Phenytoin, Fosphenytoin
- d. **Iminostilbene:** Carbamazepine
- e. **Succinimide:** Ethosuximide
- f. **Aliphatic carboxylic acid:** Valproate sodium, Divalproex
- g. **Benzodiazepines:** Diazepam, Clonazepam, Clobazepam, Lorazepam
- h. **Phenyltriazine:** Lamotrigine
- i. **Cyclic GABA analogues:** Gabapentin, Pregabalin
- j. **Newer agents:** Topiramate, Zonisamide, Vigabatrin, Tiagabine, Lacosamide

### B. Pharmacology of Antiparkinsonian drugs [4 Hrs]

After the completion of the course, students will be able to Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antiparkinsonian drugs

- a. **Dopamine precursor:** Levodopa
- b. **Peripheral decarboxylase inhibitors:** Carbidopa, Benserazide
- c. **Dopaminergic agonists:** Bromocriptine, Ropinirole, Pramipexole
- d. **COMT Inhibitors:** Tolcapone, Entecapone
- e. **MAO-B Inhibitors:** Selegiline, Rasagiline
- f. **NMDA receptor agonist:** Amantadine
- g. **Central anticholinergics:** Trihexyphenidyl, Procyclidine, Biperiden
- h. **Antihistaminics:** Orphenadrine, Promethazine

### C. Pharmacology of Antipsychotic drugs [2 Hrs]

After the completion of the course, students will be able to Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antipsychotic drugs:

- a. **Phenothiazines:** Chlorpromazine, Triflupromazine, Thioridazine, Trifluoperazine, Fluphenazine
- b. **Butyrophenones:** Haloperidol, Trifluoperidol, Penfluridol
- c. **Thioxanthine:** Flupenthixol
- d. **Other heterocyclic compounds:** Pimozide, Loxapine
- e. **Atypical antipsychotics:** Clozapine, Olanzapine, Risperidone, Aripiprazole.



#### **D. Pharmacology of Antidepressant drugs [3 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antidepressant drugs

- **MAO inhibitors:** Moclobemide
- **SSRIs:** Fluvoxamine, Fluoxetine, Paroxetine, Sertraline, Citalopram, Escitalopram.
- **Tricyclic antidepressants:** Amitriptyline, Imipramine, Trimipramine, Doxepine, Clomipramine, Nortriptyline, Desipramine.
- **Miscellaneous agents:** Trazodone, Venlafaxine, Duloxetine, Mirtazepine, Agomelatin

#### **E. Pharmacology of Antianxiety drugs [2 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antianxiety drugs:

- a. **Benzodiazepines:** Diazepam, Oxazepam, Lorazepam, Chlordiazepoxide, Alprazolam
- b. **Azapirones:** Buspirone, Gepirone, Ispapirone
- c. **Sedative antihistaminic:** Hydroxyzine
- d. **β- adrenergic blocker:** Propranolol

#### **F. Pharmacology of Antimanic drugs [2 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antimanic drugs

- a. **Lithium**
- b. **Anticonvulsants:** Sodium valproate, Carbamazepine, Lamotrigine
- c. **Atypical antipsychotics:** Olanzapine, Risperidone, Quetiapine, Aripiprazole

#### **G. Pharmacology of Narcotic analgesics and antagonists [3 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Narcotic analgesics and antagonists:

- a. **Opioid μ-receptor agonists:**
  - i **Natural opium alkaloids:** Morphine, Codeine
  - ii **Semisynthetic opioids:** Diacetylmorphine, Pholcodeine, Ethylmorphine
  - iii **Synthetic opioids:** Pethidine, Methadone, Fentanyl, Tramadol
- b. **Complex action opioids:**
  - i **Agonist-antagonists:** Nalorphine, Pentazocine, Butorphanol
  - ii **Partial μ-agonist + κ-antagonist:** Buprenorphine
- c. **Pure opioid antagonists:** Naloxone, Naltrexone, Nalmefene
- d. **Endogenous opioid peptides**

## H. Pharmacology of CNS stimulants [1 Hr]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of CNS stimulants.

- a. **Convulsants:** Strychnine, Picrotoxin
- b. **Analeptic:** Doxapram
- c. **Psychostimulants:** Amphetamines, Cocaine, Caffeine

## Unit 5: Pharmacology of Cardiovascular System [4 Hrs]

### i. Pharmacology of Anti-hypertensive drugs

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Anti-hypertensive drugs

#### a. Diuretics:

- **Thiazides:** Hydrochlorothiazide, Chlorthalidone, Indapamide
- **High ceiling:** Furosemide
- **Potassium Sparing:** Spironolactone, Eplerenone, Amiloride

#### b. RAS inhibitors:

- **ACE inhibitors:** Captopril, Enalapril, Lisinopril, Perindopril, Ramipril, Fosinopril, Quinapril
- **ARBs:** Losartan, Candesartan, Valsartan, Telmisartan, Irbesartan, Olmesartan
- **Direct Renin inhibitor:** Aliskiren

#### c. CCBs:

- Phenyl alkylamine: Verapamil
- Benzothiazepine: Diltiazem
- Dihydropyridines: Nifedipine, Amlodipine, Lacidipine, Felodipine, Nitrendipine, Nicardipine

#### d. Vasodilators:

- **Arteriolar:** Minoxidil, Hydralazine, Diazoxide
- **Both arteriolar and venular:** Sodium nitroprusside

#### e. Sympathetic inhibitors:

- **$\beta$  blockers:** Propranolol, Metoprolol, Atenolol
- **$\alpha+\beta$  blockers:** Carvedilol, Labetalol
- **$\alpha$  blockers:** Prazosin, Terazosin, Doxazosin
- **Central sympatholytics:** Methyldopa, Clonidine

### ii. Pharmacology of Anti-anginal drugs [3 Hrs]

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Anti-anginal drugs:

**A. Nitrates:**

- a. Short acting: Glyceryltrinitrate, Isosorbidedinitrate (sublingual)
- b. Long acting: Isosorbidedinitrate (oral), Isosorbidemononitrate, Erythrityl tetranitrate

**B.  $\beta$ -blockers:** Propranolol, Atenolol, Metoprolol

**C. CCBs:**

- Phenyl alkylamine: Verapamil,
- Benzothiazepine: Diltiazem,
- Dihydropyridines: Nifedipine, Amlodipine, Lacidipine, Benidipine, Nimodipine, Felodipine, Nitrendipine, Nicardipine
- Potassium channel opener: Nicorandil
- Others: Trimetazidine, Ranolazine, Ivabradine, Dipyridamole

**iii. Pharmacology of Anti-arrhythmic drugs [3 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Anti-arrhythmic drugs:

- a. **Class I:** Quinidine, Procainamide, Disopyramide, Lidocaine, Mexiletine, Propafenone, Flecainide
- b. **Class II:** Propranolol, Esmolol
- c. **Class III:** Amiodarone, Dronedarone, Dofetilide, Ibutilide
- d. **Class IV:** Verapamil, Diltiazem
- e. **Others:** Adenosine, Digoxin

**iv. Pharmacology of Drugs used in congestive heart failure [3 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Drugs used in congestive heart failure:

**a. Inotropic agents:**

- **Cardiac glycosides:** Digoxin,
- **Sympathomimetics:** Dopamine, Dobutamine
- **PDE-III inhibitors:** Amrinone, Milrinone

**b. RAS inhibitors:** ACEIs, ARBs

**c. Diuretics:** Furosemide, Thiazides

**d. Vasodilators:** Nitrates, Hydralazine, Sodium nitroprusside

**e.  $\beta$ -blockers:** Metoprolol, Bisoprolol, Nebivolol, Carvedilol

**f. Aldosterone antagonists:** Spironolactone, Eplerenone

**v. Pharmacology of Anti-hyperlipidemic drugs [2 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Anti-hyperlipidemic drugs:

- a. **Statins:** Lovastatin, Simvastatin, Pravastatin, Atorvastatin, Rosuvastatin, Pitavastatin
- b. **Bile acid sequestrants:**Cholestyramine, Colestipol
- c. **Lipoprotein lipase activators:**Clofibrate, Gemfibrozil, Benzafibrate, Fenofibrate
- d. **Lipolysis and TG synthesis inhibitor:** Nicotinic acid
- e. **Sterol absorption inhibitor:** Ezetimibe

vi. **Pharmacology of Anti-coagulants [3 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Anti-coagulants

a. **Parenteral anticoagulant**

- Indirect thrombin inhibitors: Heparin, Low molecular weight heparins
- Direct thrombin inhibitors: Bivalirudin, Argatroban

b. **Oral anticoagulants:** Warfarin sodium, Phenindione, Rivaroxaban

vii. **Pharmacology of Fibrinolytic drugs [1 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Fibrinolytic drugs: Streptokinase, Urokinase, Alteplase, Reteplase, Tenecteplase

viii. **Pharmacology of Antiplatelet drugs [2 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antiplatelet drugs (antithrombotic drugs): Aspirin, Dipyridamole, Clopidogrel, Ticlopidine

ix. **Pharmacology of Diuretics [2 Hrs]**

After the completion of the course, students will be able to

Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Diuretics:

A. **High-ceiling:** Furosemide, Bumetadine, Torsemide

B. **Medium efficacy:**

- a. **Thiazides:**Hydrochlorothiazide, Hydroflumethiazide, Benzthiazide
- b. **Thiazide-like:**Chlorthalodone, Metolazone, Xipamide, Indapamide, Clopamide

C. **Weak diuretics:**

- a. **Carbonic anhydrase inhibitor:**Acetazolamide
- b. **Osmotic diuretics:**Mannitol, Isosorbide, Glycerol
- c. **Potassium sparing diuretics:**

- **Aldosterone antagonist:** Spironolactone, Eplerenone
- **Renal epithelial Na<sup>+</sup> channel inhibitor:** Amiloride, Triamterene

### **Unit 6: Pharmacology of Antidiuretics [1 Hr]**

After the completion of the course, students will be able to Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Antidiuretics: Vasopressin.

### **Unit 7: Pharmacology of vitamins [5 Hrs]**

After the completion of the course, students will be able to Discuss Classification and Pharmacological action of vitamins.

### **Unit 8: Pharmacology of Local Anaesthetics [2 Hrs]**

After the completion of the course, students will be able to Discuss Classification, Mechanism, Pharmacological action, Side effects and Contraindications of Local Anaesthetics

#### **A. Injectable anaesthetic**

- Low potency, short duration: Procaine, Chlorprocaine
- Intermediate potency and duration: Lidocaine (Lignocaine), Prilocaine
- High potency, long duration: Tetracaine (Amethocaine), Bupivacaine, Ropivacaine, Dibucaine (Cinchocaine)

#### **B. Surface anaesthetic**

- Soluble: Cocaine, Lidocaine, Tetracaine, Benoxinate
- Insoluble: Benzocaine, Butamben, Oxethazaine

### **Unit 9: Gene Therapy [2 Hrs]**

After the completion of the course, students will be able to Discuss principle of Gene Therapy