SYLLABI OF BACHELOR OF PHARMACEUTICAL SCIENCES

FIRST YEAR B. PHARMACY

1.1 (T) PHARMACEUTICS-I
(Theory) 90 Hrs. (3 hrs per week)

Topic No	Name of the topic and contents	Hrs
	SECTION-I	
1	**Introduction to Pharmaceutics and its scope**- definition of Pharmacy, Pharmaceutics. Area of Pharmaceutics- Physical pharmacy, Biopharmaceutics, Pharmaceutical Technology, Microbiology, Dispensing and Pharmacy Practices. Historical background and development of profession of pharmacy and pharmaceutical Industry in India.	2
2	**Introduction to pharmacopoeias and other compendia.**	2
3	Definition of Drug, New Drug as per D&C Act 1940, steps for New Drug Development- filing of INDA (Investigational new drug application), clinical research, filing of NDA (New Drug Application).	3
4	**Brief Introduction to Good Manufacturing Practices & Quality Assurance**	2
5	**Introduction to Dosage forms -** Classification of the basis of nature, routes of administration (only definitions), concept of new drug delivery system-sustained release & targeted drug delivery system with some examples.	6
6	**Concept of pre-formulations and formulation-** Introductory aspects of physicochemical properties with their application, types of additives with examples.	6
7	Concept of Bio-availability, Bioequivalence, Biopharmaceutics, Absorption, and Mechanism of absorption. Concept of drug distribution, Concept of drug metabolism and concept of drug excretion. Drug efficiency & dose response concept. Physiological consideration of various routes of administration	7
8	**Radiopharmaceuticals:** Radioactivity, Production and Quality control of radiopharmaceuticals.	3
9	**Packaging:** Containers, closures, and materials for them, unit dose packing.	4
10	**Alternative systems of medicine:** Ayurveda, Homoeopathy, Unani and Siddha.	3
	SECTION-II	
11	**Solution** –Definition, factors affecting rate of solution, methods used to improve solubility and preformulation studies. Types of ingredients used during formulation. Manufacturing processes involved in liquid oral preparation. Evaluation (Viscosity determination, weight per ml & specific gravity, deliverability) including control on raw materials, in process control and finished Product controls. Formulation - syrups, elixirs, aromatic water, linctuses, ENT preparations and paints, mouth washes.	12

12	Equipments used in manufacturing & packing of oral solution, liquid mixing- mechanism of mixing, Impeller, Propeller mixers, Paddle mixer, baffles, prevention of aeration & foam.	3
13	**Filtration & Clarification**: factors affecting rate of filtration, types of filter media used, filter aids, plate& frame filter with modification, leaf filter, rotary filter & hydro extractors.	5
14	**Size Reduction**: Importance in pharmacy, factors affecting size reduction Grinding mills of various types like Hammer mill, Multimill, Ball mill, Edge and End runner mill, Fluid energy mill.	4
15	**Size Separation:** Standards of sieves as per official books, powder gradation, size distribution methods, techniques for size separation.	4
16	**Powders-** formulation preparation & evaluation of various powders like Dusting powder, oral rehydration powder, tooth powders, & dry syrup formulation. Mechanism of powder mixing, factors affecting mixing, Sigma & ribbon blender, Paddle mixer, Tumblers like cubes & double cone, Planetary mixer & Equipments used in the production of powders.	7
17	**Granule manufacturing as a dosage form:-** Methods of granulation, Environmental controls required for manufacturing of effervescent granules. Pouch filling machine.	3

1.1 PHARMACEUTICS -I

(Practical) 90 Hrs. (3 hrs/week)

1. Wherever possible Pharmacopoeial products should be prepared.
2. Latest textbooks and pharmacopoeias should be referred.
3. For all preparations tests will include organoleptic tests and simple tests such as density (wt/ml), specific gravity, angle of repose, bulk density etc: student are not expected to perform assays and other long time evaluation parameters. Only simple tests are to be performed in the university examination.
4. Only two preparations should be given in the annual practical examination and one of that should be evaluated by simple tests

[1] Monophasics:

1) Solution

A) Aqueous Iodine Solution (Lugol) IP
B) Tincture of Iodine IP
C) Solution of Cresol With Soap IP
D) Surgical Chlorinated Soda Solution B.P.C
E) Paracetamol Pediatric Solubalised Drops
F) Strong Solution Ammonium Acetate
G) Magnesium Citrate Solution NF12

2) Aromatic Waters

A) Concentrated Dill Water BP
B) Dill Water
C) Conc. Anise Water BPC

D) Chloroform Water
E) Gripe Water-Modified Aromatic Water

3) Liniments
A) Liniment of Turpentine IP
B) Liniment of Camphor B.P.C
C) Soap Liniment

4) Syrups
A) Simple Syrup IP
B) Artificial Syrup
C) Cough Syrup

5) Elixirs
A) Piperazine Citrate Elixir B.P.C

6) Linctus
A) Simple Linctus
B) Medicated linctus.

7) Ear And Nose Preparation
A) Ear Drop Containing Antibiotics (Ex. Gentamycin /Chloramphenicol)
B) Ephedrine Hydrochloride Nasal Drop

[2] Glycerites

A) Glycerin Of Boric Acid I.P
B) Tannic Acid Glycerin I.P
C) Glycerin Of Starch I.P

[3] Powders

A) Oral Rehydration Powder
B) Dry Syrup Formulation For Reconstitution
C) Talcum Powder, Tooth Powder
D) Effervescent Granules.

Recommended Books

1. Ansel's Introduction to Pharmaceutical dosage forms & Drug Delivery Systems
2. Modern Dispensing Pharmacy by A. P. Pawar. & R .S. Gaud, 2nd Ed, Career Publication.
3. Pharmaceutics the Science of dosage form design by M. E. Aulton 2nd Ed. Churchill Livingstone.
4. Dittert, Sprouls American pharmacy (J. B. Lipincott)
5. Martin, Remington's Pharmaceutical Sciences, (2005)

6. Harkishin Singh, Pharmacopoeias and Formularies, Vallabh Prakashan, New Delhi.
7. M.L Shroff of General Pharmacy Series.
8. A Text Book of Pharmaceutical Formulations by B. M. Mithal, 6th Ed., Vallabh Prakashan, Delhi
9. The Theory & Practice of Industrial Pharmacy by L. Lachman & H. A. Liebermann, 3rd Ed., Varghese Publishing House, New Delhi.
10. Indian Pharmacopoeia 1996, British Pharmacopoeia 2004, British Pharmaceutical Codex, United State Pharmacopoeia 28, National Formulary 23 2005.
11. Introduction to Pharmaceutical Engineering by A.R. Paradkar 10th Ed, Nirali Prakashan, Pune.

1.2 MODERN DISPENSING PRACTICES
(Theory) 60 Hrs. (2 hrs per week)

Topic No	Name of the topic and contents	Hrs.
	SECTION-I	
1	**Pharmacy profession:** Code of Pharmaceutical Ethics Pharmacy as a career Pharmacist as health care provider.	2
2	**Prescription and its parts** Types, parts of prescription Responding to prescription, pricing of prescription.	2
3	**Meaning of compounding and dispensing** Fundamental operations in compounding and dispensing, containers, closures for dispensed products, labeling of dispensed medicines, Storage and stability of medicines.	3
4	**Good compounding and dispensing practices:** Personnel, house keeping, building. Documentations – Introduction to prescription filling, drug profile, PMR, ADR, Purchase records, Stock records, Idiosyncratic cases	3
5	**Pharmaceutical calculations** Alligations, percentage calculations, molarity, normality, millimoles, milliequivalence calculations, Isotonic solutions, proof spirit, improvisation and dilution of dosage forms.	3
6	**Posology** – Meaning, factors affecting dose, calculation of doses for infants and children.	2
7	**Patient counseling:** Steps involved. Patient counseling about diseases and medicines and for prescription drugs. Pharmacist consultation for OTC and Cosmetics.	3
8	**Types, formulation, compounding and dispensing aspects of:** 1. Solutions – mouthwash, gargles, syrups, linctus, elixirs, enemas, ENT preparations 2. Suspensions (with respect to stability)	7

	3. Emulsions (with respect to stability)	

SECTION-II

Topic No	Name of the topics	Hrs.
9	**Types, formulation, compounding and dispensing aspects of:** 1. Ointments, pastes, gels, creams 2. Powders – Divided, bulk, granules 3. Pills, Tablet triturates 4. Pastilles, lozenges	5
10	**Suppositories and pessaries** – Bases, additives, preparation, displacement value and calculations	3
11	**Incompatibilities in prescription** – Study of various types of incompatibilities: physical, chemical and therapeutic with examples of drug-drug and drug – food interactions. Methods to remove these incompatibilities.	3
12	Drug law related to retail pharmacy and Code of ethics.	3
13	**Sutures and ligatures** Classification, processing, sterilization, packaging and quality control.	3
14	**Compounding and dispensing aspects of:** 1. Sterile products like injections, eye drops and ointments, insulin injections 2. Novel drug delivery systems like controlled release dosage forms, inhalers.	3
15	**Community Pharmacy:** 1. Organization and structure of retail and wholesale drug store-types of drug store and design, legal requirements for establishment, maintenance and drug store, dispensing of proprietary products, maintenance of records of retail and wholesale, role of pharmacist in community healthcare and education. 2. Self-medication, Rational drug use, Drug information Services, Role of pharmacists in family planning, HIV/AIDS, Asthma, Tuberculosis, Hypertension, Diabetes.	5

1.2 MODERN DISPENSING PRACTICES
(Practical) 90 Hrs. (3 hrs/week)

1. Practical shall include explanation of principle of handling of prescription, patient medication records, principles of compounding and dispensing including Calculations.
2. This should be explained under various headings such as principle, compounding, container, storage, dose, some special label conditions (if any) and should be supported by dispensing of proprietary preparations.
3. Only 2 preparations shall be given in Annual practical Exam. No evaluation shall be given in Examination.

Compounding and dispensing of prescriptions:

1. For Oral Topical use
    a. Zinc Sulphate and Zinc Chloride Mouth Wash

b. Potassium Permanganate Gargle
c. Phenol Glycerin
d. Mandles Paint BPC

2. For body cavities
a. Ephedrine nasal drops
b. Sodium Bicarbonate Ear drops
c. Soap Enema

3. For topical use
d. Camphor Liniment
e. Collodion Salicylic Acid

4. Suspensions
a. Pediatric Kaolin Mixture
b. Magnesium Trisilicate Mixture
c. Pediatric Chalk Mixture
d. Inhalation containing Menthol and Eucalyptus
5. Emulsions
a.
b. Emulsions for Internal Use Containing Acacia
c. White Liniment
d. Oily Calamine Lotion
6. Benzyl Benzoate Application Ointments
a. Sulphur Ointment
b. Whitfield's Ointment
c. Methyl Salicylate Ointment
d. Lubricating Jelly
7. Powders
a. Zinc Starch and Talc dusting powder
b. Effervescent Granules of Sodium Sulphate
c. Eutectic powder containing Menthol and Camphor
8. Suppositories
a. Bismuth Subgallate suppository
b. Glycerin Suppository
9. Moulded solid dosage forms
a. Tablet triturate, Lozenges
b. Pills
10. Dispensing and patient counseling
a. OTC product
b. Cosmetics preparation
c. Inhalers
d. Insulin injections
e. Anti hypertensive

Recommended books for theory and practicals:

1) The Science and Practice of Pharmacy-Remington A.H Gennero, 21 st edition (Mack Publication)
2) Pharmaceutical practice – Winfield and Richards 3 rd edition (ELBS publication)
3) Dispensing for Pharmacy students- Cooper and Gunns, 12 th edition
4) Cooper and Gunn's Tutorial pharmacy, edited by Carter S.J, 6 th edition.
5) Pharmaceutical Calculations Ansel and Stocklosa, 10 th edition.
6) Bentleys Text book of Pharmaceutics, Rawlins 8 th (ELBS publication)
7) Dispensing Pharmacy Dr. A. P. Pawar and R.J. Goud 2 nd edition (Career publications)
8) Indian Pharmacopoeia 1996 (Volume I and II)
9) Indian Pharmacopoeia 2007 (Volume I and II)
10) British Pharmacopoeia 2005 (Volumes I, II, III)
11) British Pharmaceutical codex 1973
12) Handbook of Community Pharmacy, career Publication, Dr. A. P. Pawar
13) USP/ NF.

1.3 (T) PHARMACEUTICAL INORGANIC CHEMISTRY
(Theory) 90 Hrs. (3 hrs per week)

Topic No	SECTION-I	Hrs.
1	**Nuclear Chemistry** Structure of nucleus, methods of nuclear radiation measurement, nuclear reaction, fusion and fission Radiation dosimetry Radio opaque contrast medium, (Therapeutic and diagnostic applications of radio pharmaceuticals).	07
2	**Pharmacopoeia and monograph** Different pharmacopoeia and contents of official monograph.	05
3	**Purity of Pharmaceuticals** and factors affecting purity of pharmaceuticals limit test for chlorides sulphates arsenic, iron, lead, heavy metals as per I.P.	12
4	Hardness of water, methods to remove hardness of water, different official waters and official quality control tests for waters.	05
5	**Pharmaceutical aids and necessities-** Acids, bases, buffers, antioxidants, preservatives, adsorbents, diluents, Excipients, suspending agents. Colorants etc.	08
6	**Important inorganic gases** used in pharmacy: Oxygen, Nitrogen, Nitrous Oxide, carbon dioxide, Helium, Ammonia and their compounds as per I.P.	08
	SECTION II	
	Inorganic and Medicinal Agents	
7	**Electrolytes** Extra and intracellular ions: Chlorides, Phosphate, Bicarbonate, Na, K, Ca, Mg. Electrolytes used for replacement therapy, physiological acid base balance.	08

	Electrolyte used in acid-base therapy, Electrolytes combination therapy. Sodium chloride injection, Ringer solution lactated, Ringer injections, sodium acetate, potassium bicarbonate, sodium citrate, sodium lactate, ammonium chloride.	
8	**Dental products.**	04
9	**Antidotes**: Classification, Sodium thiosulphate, Sodium nitrite.	04
10	**Gastrointestinal tract agents:** i. Acidifying agents- dil HCl ii. Antacids: Sodium bicarbonate, aluminum hydroxide, Aluminum phosphate, Basic aluminum carbonate, Calcium Phosphate, Magnesium carbonate, Milk of magnesia. iii. Protectives and adsorbents-Bismuth compounds, bismuth sub carbonate, Bismuth subgallate, Bismuth sodium tartarate, Kaolin, Activated charcoal, pectin. Saline cathartics – Sodium phosphate, Sodium potassium tartarate, Magnesium carbonate, magnesium oxide.	10
11	**Essential and trace ions** Absorption, distribution, physiological role. Official compound of Fe, Cu, Zn, Mn, I, Fe-Ferrous sulfate. Iron sorbite injection, ferric ammonium citrate, ferric chloride, Cu- Copper sulfate, 14-Iodine, Potassium iodide, Sodium iodide, Zn-Zinc sulphate.	08
12	**Expectorants and emetics:** Ammonium chloride, Potassium iodide, Antimony Potassium tartarate. Mode of action of all compounds.	06
13	**Topical agents-**General introduction and mode of action: a. Protectives- Talc, zinc oxide, Calamine, Zinc stearate, Titanium dioxide, aluminum compounds. b. Antimicrobials and astringents: Hydrogen peroxide solution, Sodium perborate, zinc peroxide, Potassium permanganate, Sodium hydrochloride, Iodine solution and nitrate, Mercuric oxide, Mercuric chloride and sulphate, Boric acid, Selenium sulfide, Zinc sulfate.	05
Note: For official compounds, general properties assays storage and uses should be discussed		

1.3 (P) PHARMACEUTICAL INORGANIC CHEMISTRY
(Practical) 90 Hrs. (3 hrs per week)

1. Semi-micro inorganic qualitative analysis of mixtures containing two acidic and two basic radicals (10 mixtures).
2. Limit test for Chlorides, Sulfate, Iron and Lead
3. Preparation of some inorganic pharmaceutical compounds (Minimum 5).
4. Standardization of compounds belonging to different categories as per pharmacopoeia (Minimum 5).

Recommended Books for Theory & Practicals

1. Inorganic, Medicinal and Pharmaceutical Chemistry by J. H. Block, E. B. Roche, Indian edition, Varghese Publication.
2. Modern Inorganic Pharmaceutical Chemistry by C. A. Dicher.

3. Concise Inorganic Chemistry – J. D. Lee.
4. Bentley & Driver's Text Book of Pharmaceutical Chemistry Revised by L. M. Atherden, 8th edition, Oxford Medical Publications.
5. Pharmaceutical Inorganic Chemistry by Dhake & Tipnis, 2nd edition.
6. Indian Pharmacopoeia 2008.
7. Remington The Science and Practice of Pharmacy by Remington, 20th edition, Lipincott, William and Wilkins.
8. Advanced Inorganic Chemistry, 18th Edition, Cotton & Wilkinson (Wiley Eastern Ltd., Delhi).
9. Inorganic Pharmaceutical Chemistry (Practical), 2nd Edition, Dhake & Belsare.
10. Vogel's Text Book of Quantitative Analysis, 5th Ed.
11. Vogel's Quantitative Inorganic Analysis.
12. Wilson & Gisvold's Principles of Organic and Medicinal Chemistry
13. Harkishan Singh & A. K. Kapoor – Principles of Inorganic Chemistry

1.4 (T) PHARMACEUTICAL ORGANIC CHEMISTRY - I
(Theory) 90 Hrs. (3 Hrs. per week)

Topic No	SECTION-I	Hrs.
1	**Structure of Organic Molecule** a. Atomic Orbitals, b. Hybridization, c. Sigma and Pi bonds, d. Intermolecular forces and related properties, e. Conjugation, f. Bond length and bond energies	07
2	**IUPAC Nomenclature of organic compounds.**	03
3	**Stereo Chemistry** a. Structural Isomerism, b. Geometrical Isomerism, c. Enantiomerism.	05
4	**Factors affecting electron availability** a. Inductive effects, b. Resonance effects, c. Hyper conjugation, d. Steric effects, e. Application of these factors on the strength of acids and bases Bond length, **f.** Tautomerism**.**	06
5	**Reaction Mechanisms** a. Types of reagent, b. Types of reaction intermediates, c. Types of Mechanism, **d.** Collision and transition state theories.	06
6	**Nucleophilic substitution at saturated and aryl carbon atom.** a. Relation between Kinetics and mechanism of SN1 and SN2 reactions, SNi b. Sterochemical Implications.	09

	c. Factors affecting Nucleophilic substitution reactions I. Effect of Solvent, II. Effect of Structure, III. Effect of Nucleophile, IV. Effect of leaving group. d. Application of these in preparation and reactions alkyl halides, alcohols, epoxides. e. Nucleophile substitutions at aryl carbon atom.	
7	**Benzene and Aromaticity** Aromatic electrophilic substitution Electrophilic attack on benzene, Nitration, halogenation, sulphonation, Friedal Craft alkylation and acylation, diazo-coupling. Orientation in Mono-substituted benzene, Electrophilic substitution in other aromatic compounds (Naphthalene)	09
	SECTION-II	
8	**Electrophilic addition to C-C multiple bonds:** a. Addition of Halogen b. Addition of Halogen acid and orientation of addition. c. Other addition reaction to olefins: i. Hydration, ii. Hydroxylation, iii. Hydrogenation, **iv.** Ozonolysis.	09
9	**Nucleophilic addition to C = O.** a. Structure and Reactivity. b. Addition of water, alcohols, thiols, hydrogen cyanide, sodium bisulphite, hydride ion, derivatives of ammonia to aldehydes and ketones. c. Carbon Nucleophile additions. Aldol condensation. Knoevengel condensation. Dieckman condensation. Roformatski reaction. Canizarro reaction and Michael condensation.	09
10	**Elimination reactions** a. Elimination reaction. b. E1, E2 and E1 (cb) Mechanism. c. Orientation in E1 and E2 reactions (Saytzaff and Hoffmann elimination). d. Elimination versus substitution.	09
11	**General chemistry of amines and carboxylic acids** a. Preparation of amines b. Reactions of amines, c. Preparation of aliphatic carboxylic acids, d. Reactions of aliphatic carboxylic acid. e. Preparation and reactions of carboxylic acid derivatives	09
12	**General chemistry of phenols & sulphonic acids and derivatives** a. Preparation of Phenols b. Reaction of Phenols c. Preparation of sulphonic acids and derivatives d. Reactions of sulphonic acids	09

1.4 (P) PHARMACEUTICAL ORGANIC CHEMISTRY – I
(Practical) 90 Hrs. (3 hrs/week)

1. Qualitative Analysis of Organic Compounds including characteristics of elements functional group, characterization of unknown organic compound by derivatization.
2. Preparation, Crystallization and determination of physical constants, covering following types of reactions:

a. Acetylation, Benzoylation, Recommended preparation – acetanilide, β-napthyl benzoate Aspirin.
b. Electrophilic substitution in aromatic ring:
i. Bromination, preparation of p-bromo acetanilide, 2,4,6 trinitrophenol (Picric acid).
ii. Nitration of acetanilide.

Recommended Books for theory & practicals

1. Organic Chemistry by Morrison & Boyd, 6th edition, Pearson Education.
2. Organic Chemistry by Pine, 5th edition, TATA McGraw Hill.
3. Advanced Organic Chemistry: Reaction, Mechanism and Structure by Jerry March 4th edition, A Wiley-Interscience Publication.
4. Advanced General Organic Chemistry a Modern Approach by Sachin Kumar Gosh, Reprinted 2007, New Central Book Agency (P) Ltd, Calcutta.
5. Fundamental of Organic Chemistry by T.W. Graham, Wiley- International, New York.
6. Organic Chemistry by Clyden Greeves, 1st edition, Warren Oxford Press.
7. Vogl's Text Book of Practical Organic Chemistry- Brian Furniss, Antony Hannaford, Peter Smith, Austrin (Eds), 5th edition, ELBS Publication, Singapore, 1997.
8. Introduction to Organic laboratory Techniques – a Contemporary Approach by Donald L. Pavia, Gary M. Camp man, Georage S. Kriz (Eds), 2nd edition, C.B.S. College Publishing, USA, 1982.
9. Organic Syntheses by A. H. Blatt (Ed), 6th edition, Vol. 1-10, 1950, John Wiley & sons, London.
10. Experimental Pharmaceutical Organic Chemistry, A Becnchtop Manual by K. S. Jain, P. B. Miniyar & T. S. Chitre, 2nd Edition Carrier publications,.
11. Organic Chemistry by Bahl & Bahl
12. Organic Chemistry by I. A. Finar
13. Reaction Mechanism by Peter Sykes

1.5 (T) HUMAN ANATOMY & PHYSIOLOGY
(Theory) 90 Hrs. (3 Hrs/Week)

Topic No	SECTION-I	Hrs.
1	Basic terminologies used in anatomy and physiology	03
2	Structure of cell, its components- Their structures and functions, movement of materials across plasma membrane	03
3	Elementary tissues of human body- epithelial, connective, muscular, and nervous	04

	tissues-their subtypes and characteristics	
4	The Blood-composition and functions of blood, RBC, WBC, Platelets, Haemopoiesis, blood groups, mechanism of Clotting, anemia, disorders of blood (definitions only)	07
5	Cardiovascular system- Blood vessels-anatomy of heart, conducting elements of heart, cardiac cycle and heart sounds, blood vessels and circulation (pulmonary coronary, systemic and portal), ECG, Blood pressure (Maintenance and regulation), disorders of cardiovascular system (definitions only)	10
6	Lymphatic system- Lymph (Formation, composition, functions, circulation), lymph node (structure and functions), spleen and its functions, disorders of lymphatic system (definitions only)	05
7	Respiratory system- Anatomy of respiratory organs and their functions, mechanism and regulation of respiration, physiology of respiration, transport of gases, respiratory volumes, methods of artificial respiration, and disorders of respiratory system (definitions only)	06
8	Digestive system- Anatomy and physiology of organs of digestive system, secretions and functions of salivary glands, stomach, liver, pancreas, small intestine, large intestine, role of enzymes in digestion and absorption of food, disorders of digestive system (definitions only)	06
SECTION-II		
9	Urinary system- Anatomy and physiology of parts of urinary system, structure of nephron, formation of urine, Renin-angiotensin system, Balance (acid base, electrolyte and water), renal clearance tests and physiology of micturition, disorders of urinary system (definitions only)	05
10	Endocrine system- Anatomy and physiology of hormones of pituitary gland, adrenal gland, parathyroid gland, pancreas, gonads (testis and ovary), disorders of endocrine system (definitions only)	08
11	Reproductive system- Anatomy and physiology of various parts of male and female reproductive systems, physiology of menstruation, spermatogenesis and oogenesis, disorders of reproductive system (definitions only)	05
12	Nervous system- Classification of nervous system, Anatomy and physiology of parts of brain (cerebellum, pons, medulla oblongata, thalamus, hypothalamus, and functional areas of cerebrum), extra pyramidal system, limbic system, Spinal cord (Structure and reflexes), cranial nerves (Names and functions), Autonomous nervous system (sympathetic and parasympathetic), fundamentals of neurotransmitters, process of neuroconduction and neurotransmission. disorders of nervous system (definitions only)	16
13	Sense organs- Anatomy and physiology of ear and eye, disorders of eye and ear (definitions only)	03
14	Muscular system- Characteristics and functions of muscle tissue, neuromuscular junction, physiology of muscle contraction, disorders of muscular system (definitions only)	03
15	Integumentary system: Structure and functions of skin, thermoregulation	03
16	Sports physiology: Muscles in exercise, respiration in exercise, CVS in exercise, body heat in exercise, body fluid and salts in exercise	03

Recommended Books

1. Chatterjee, C.C., Human Physiology. Medical Allied Agency, Kolkata.
2. Chaudhari S K. Concise Medical Physiology. New Central Book Agency (P) Ltd., Calcutta.
3. Ganong, W.F., Review of Medical Physiology. Prentice-Hall International, London.
4. Guyton, A.C., Textbook of Medical Physiology. W. B. Saunders Co., Philadelphia, USA.
5. Jain, A.K., Textbook of Physiology. Avichal Publishing Co., New Delhi.
6. Singh, I., BD Chaurasia's Human Anatomy. CBS Publisher and Distributors, New Delhi.
7. Tortora, G.J. and Grabowski, S.R., 2005. Principals of Anatomy and Physiology. Harper Collins College Publishers, New York.
8. Vander, A.J., Sherman, J.H. and Luciano, D.S., Human Physiology. McGraw-Hill Publishing Co., USA.
9. Wagh, A. and Grant, A., Ross and Wilson's Anatomy and Physiology in Health and Illness. Churchill-Livingstone, London.
10. West, J.B., Best and Taylor's Physiological Basis of Medical Practice. Williams and Wilkins, Baltimore, USA.
11. Warwick, R. and Williams, P., Gray's Anatomy. Longman, London.
12. Chaudhari S K. Concise Medical Physiology. New Central Book Agency (P) Ltd., Calcutta.

1.5 (P) HUMAN ANATOMY & PHYSIOLOGY
(Practical) 90 Hrs. (3 Hrs/Week)

1. Determination of Haemoglobin content of blood
2. Determination of RBC count and colour index of blood
3. Determination of blood groups
4. Determination of respiratory volumes
5. Recording of Blood pressure of normal volunteer
6. Osteology-Study of appendicular skeleton
7. Osteology -Study of axial skeleton
8. Study of Joints
9. Determination of Total WBC count of blood
10. Determination of Differential WBC count of blood
11. Determination of Bleeding time
12. Determination of Clotting time
13. Recording of ECG of healthy volunteer
14. Study of following systems with the help of models and charts
15. Histology- Study of permanent slides of organs and tissues

16. Study of different family planning devices
17. Study of following systems with the help of models and charts (Digestive system, Cardiovascular system, Lymphatic system, Respiratory system, Urinary system, Endocrine system, Reproductive system, Nervous system, Sense organs)

Recommended Books

1. Chaudhari, A.R., Textbook of Practical Physiology. Paras Publishers, New Delhi.
2. Chaudhari, A.R., Viva in Physiology. Paras Publishers, New Delhi.
3. DiFiore-Mariano, S.H., Atlas of Human Histology. Lea and Febiger, Philadelphia.
4. Garg, K., Bahel, I. and Kaul, M., A Textbook of Histology. CBS Publishers and Distributors, New Delhi.
5. Goyal, R.K., Patel, N.M. and Shah, S.A., Practical Anatomy, Physiology and Biochemistry. B. S. Shah Prakashan, Ahmedabad.
6. Ranade, V.G., Joshi, P.N. and Pradhan, S., Textbook of Practical Physiology. Pune Vidyarthi Griha Prakashan, Pune.
7. Singh, I., BD Chaurasia's Human Anatomy. CBS Publisher and Distributors, New Delhi.
8. Singh, I., Textbook of Human Histology. Jaypee brothers Medical Publishers, New Delhi.

1.6 (T) PHARMACUETICAL ENGINEERING
(Theory) 60 Hrs. (2 Hrs./Week)

Topic No	Name of the topic and contents	Hrs
	SECTION-I	
1	**Heat Transfer**: Mechanisms-conduction, convection, radiation, Fourier's law, Stefan Boltzeman's constant, Kirchoff's law, heat transfer- between fluid & solid boundary, boiling liquids, condensing vapor's, heat exchangers-heat transfer in parallel flow & counter flow, tubular heat exchangers, Plate heat exchangers, applications, steam tapes-mechanical, thermostatic & thermodynamic.	6
2	**Crystallization**: Crystallization-crystal form, theories of supersaturation, nucleation, crystal growth, classification of crystallizers, tank, Swenson walker, vacuum, circulating magma, DTB and growth type crystallizers, caking of crystals.	5
3	**Evaporation**: theory, evaporator capacity – heat & material balances, factors influencing hear transfer coefficients, Evaporators- pan, tubular (horizontal, vertical-short, long & their subtypes), wipe film, centrifugal rotary, multiple evaporator- economy, capacity, methods of feeding etc, Evaporator accessories-condensers, vacuum pump, removal of condensate, entrainment separators,	8

	foam.	
4	**Environmental control**: Air handling, air conditioning, Refrigeration, water vapour- air mixture, humidity & particulates in air refrigeration. Application of environmental control in Pharma departments like powder, tablets, capsules.	4
5	**Boilers**: Introduction, classification, accessories & mounting.	2
	SECTION-II	
6	**Flow of fluids**: fluid statics- pressure, pressure measurement- manometers & pressure gauge, fluid dynamics, mechanism of fluid flow, material & energy balance, pressure differential flow meter- principal, orifice meter, pitot tube, Variable area flow meter- principal, rotameter orifice & plug meter, quantity flow meters. Fluid flow through packed beds- Poiseulli's approach, Kozeny's approach.	7
7	**Mass transfer**: molecular diffusion in gases & liquids, mass transfer in turbulent & laminar flow, theories of interphase mass transfer.	2
8	**Extraction**: theory of solid-liquid, liquid- liquid, extraction, equilibrium stage determination, application of triangular diagram, extractors, study of galenicals.	4
9	**Distillation**: vapour liquid equilibrium, distillation of miscible systems, boiling point diagram, equilibrium distillation, differential distillation, rectification, fractionating column, heat & material balance, factors affecting plate efficiency, molecular distillation, separation of azotropes, and distillation of immiscible system.	5
10	**Drying**: mechanism, theory, factors affecting, Dryer- tray dryer, fluidized bed dryer, spray dryer, freeze dryer, flash dryer, drum dryer.	5
11	**Corrosion**: mechanisms, factors influencing corrosion process, method of combating it.	2

Recommended Books

1. W. McCabe, J. C. Smith, P. Harriot; Unit Operation of Chemical Engineering; McGraw Hill, (1993)
2. W.I. Badger and J.T. Banchero, Introduction to Chemical engineering; McGraw Hill, (1988)
3. M.S. Peters, K. D. Timmerhaus; Plant design and economics for to Chemical Engineering; McGraw Hill.
4. E. Ganderton; Pharmaceutical unit Operation; Academic press.
5. Perry's Handbook of Chemical engineering; McGraw Hill;(1984)
6. A. R. Paradkar, Introduction to Pharmaceutical Engineering, Nirali Prakashan, 10th Ed. 2007.

1.7 (T) COMPUTER APPLICATIONS & BIO-STATISTICS
(Theory) 60 Hrs. (2 hrs per week)

Topic	**Name of the topic and contents**	**Hrs**

No		
	SECTION-I: COMPUTER APPLICATIONS	
1	**Fundamentals of computer applications.** Introduction: what is computer? Characteristics, basics binding blocks CPU,I/O memory, history and generations) data representation(need for binary systems, representation of characters, ASCII, EBCDIC) Input devices (type, working), keyboard, mouse, special purpose. I/P devices and applications like MICR, Bar codes, Scanner, etc Output devices (type, working applications), monitor, printer, plotter memory devices, primary memory –R/W, ROM etc extended, expanded memory, secondary memory-floppy, HDD, CD-ROM, tape, DVD etc Multimedia: types of data processing-batch, online and real time. Software: classification, applications, System Software-O.S., compilers, interpreters.	06
2	**WINDOWS:** Introduction to operating systems. Introduction to M.S.-WINDOWS. What is GUI and WINDOWS? Concepts of toolbars, menus, title bars, controls, dialogue box, status bar, message box and mouse operations program manager-all options	08
3	**MS office** MS words create and open document, edit your documents Advanced editing-find text, replace text, check spellings, using auto correct/auto text, save and exit document, using multiple documents, print documents, format documents.	04
4	**MS EXCEL**. Start excel, Open/create spreadsheet, Save/exit spreadsheet, Edit spreadsheet using formula and functions, Format spreadsheet, print spreadsheet	02
5	**Introduction to MS PowerPoint**	02
6	**Introduction to Microsoft outlook**	02
7	**Introduction to MS –excel**	02
	SECTION-II: BIOSTATISTICS	
8	**Collection and organization of data**: Graphical and pictorial presentation of data**,** measures of central tendency and dispersion, sampling techniques, sample size, coefficient of variation, mean, error, precision and accuracy.	03
9	**Probability**: Probability distributions, normal, binomial, and multinomial distributions, Poisson distributions, continuous data distributions, fiducial limits, probit and logit analysis.	06
10	**Regression & correlation:** Linear regression and correlation, method of least squares, Significance of correlation & regression, Computation of coefficient of correlation.	04
11	**Parametric tests**: Testing hypothesis, types of errors, and tests of significance based on normal distributions. Tests of significance for correlation coefficient.	04
12	**Nonparametric tests**: Data characteristics and nonparametric procedures chi-square test, sign test rank test.	03
13	**Experimental designs**: Randomization completely randomized and Latin square designs, crossover and parallel designs and factorial design.	03
14	**Statistical quality control**: Concept and statistical control charts	06

15	**Small sample test** a) Based on T distribution b) Based on F distribution c) Based on chi-square distribution	05

1.7 COMPUTER APPLICATIONS AND BIOSTATISTICS
(Practical) (1 hr demo per week)

1. Calculation of mean and variance, correlation coefficient and fitting of linear equation, Preparation of frequency table.
2. Sorting of numerical data
3. Sales analysis, finding area wise sales, Percentage of sales.
4. Inventory control and order processing system.
5. Generation of graphs.
6. Resizing of windows, mouse tutorials, switching from one application to another.
7. Creating e-mail account.
8. Preparation of PowerPoint presentation.

Recommended Books for Theory & Practicals

1. Manual for MS office.
2. Computer fundamentals by P. K. Sinha. Third edition, BPB Publication.
3. Computing essentials by Ti mothy. J. O'Leary.
4. Fundamentals of Computers by V. Raja Raman.
5. Biostatistics and Computer Sciences. Nirali Prakashan. Second Edition, 1998. by Prof. Y. I. Shah, Dr. A. R. Paradkar and Prof. M. G. Dhaygude.
6. Computer Programming. I and II by Mrs. Seneca Phadake. Technova Publications,Pune. Second Edition. 1998.
7. Computer and Common sense. By R. Hunt, J. Shelly, Fourth Edition, Prentice- Hall of India, New Delhi-1997
