S. No.	Content
1.	**Micromeritics and powder rheology** Particle size and distribution, average particle size number and weight distribution, particle number, methods of determining particle size and volume, optical microscopy, sieving, sedimentation, determining surface areas, permeability, adsorption, derived properties of powders, porosity, packing arrangement densities, bulkiness and flow properties.
2.	**Surface and interfacial phenomenon** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tension, spreading coefficient, adsorption and liquid interfaces, surface active agents, HLB classification, solubilization, detergency, absorption at solid interfaces, solid gas and solid-liquid interfaces, complex films, electrical properties of interfaces.
3.	**Viscosity and rheology** Newtonian systems, law of flow, kinematics viscosity, effect of temperature, non- Newtonian systems, pseudoplastics, dilatant, plastic, thixotropy in formulations, determination of viscosity and thixotropy by capillary, falling ball, rotational viscometer, application of rheology in pharmacy.
4.	**Dispersion systems** a. Colloidal dispersions: Definition, types, properties of colloids, protective colloids, application of colloids in pharmaceutical industry and research. b. Suspensions and emulsions: Interfacial properties of suspended particles settling in suspension, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, significance of electrical properties in dispersions, controlled flocculation, flocculation in structured vehicles, rheological considerations, emulsions: types, theories, physical stability.
5.	**Buffer** Buffer equations and buffer capacity in general. Buffers in pharmaceutical systems, preparations and stability, buffered isotonic solutions. Measurements of tonicity calculations and methods of adjusting isotonicity.
6.	**Solubility** Dielectric constant and solubility, solubility of solids in liquids, ideal and non-ideal solutions, solvation and association in solutions, solubility of salts in water, solubility of slightly soluble and weak electrolyte, calculating solubility of weak electrolytes as influenced by pH, influence of solvents on the solubility of drugs, combined effect of pH and solvents, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition, extraction, preservatives action of weak acids in emulsions, drug action and distribution coefficient. Techniques to improve the aqueous solubility of poorly water-soluble molecules. Concepts of dissolution and diffusion.

7.	**Pharmaceutical Impurities** Impurities in pharmaceutical substances, sources, types and effects of impurities. Limit tests for heavy metals like lead, iron, arsenic, mercury & for chloride & sulphate as per Indian Pharmacopoeia.
8.	**Monographs** Monograph & its importance, various tests included in monographs as per I. P. A study of the following compounds with respect to their methods of preparation, assay, & pharmaceutical uses of sodium citrate, calcium carbonate, copper sulphate, light and heavy kaolin, ammonium chloride & ferrous gluconate.
9.	**Various classes of therapeutic agents:** A detailed study of the following classes with respect to drug nomenclature, classification, physicochemical properties, mode of action, structure-activity relationships, synthesis of prototype molecules, drug metabolism, therapeutic uses & side effects of following classes of drugs: a) Antimalarials b) Antiamoebic agents c) Anthelmintic agents d) Antibacterial drugs e) Antifungal agents f) Antiviral agents g) Thyroid & antithyroid drugs h) Antiallergic agents i) Antiulcer agents & Proton Pump Inhibitors j) Hypoglycemic agents k) Sedative-hypnotics l) Antiepileptic agents m) Neuroleptics n) Anti-anxiety drugs o) Antibiotics p) Steroids q) Narcotic analgesics r) Adrenergic drugs s) Cholinergic agents t) Drugs used in neuromuscular disorders u) Hypertensive, antihypertensive, & antianginal agents v) Diuretics w) Eicosanoids, prostaglandins, prostacyclins & thromboxanes
10.	**Introduction to dosage form** Definition of the drug. New drug and dosage form. The desirable properties of a dosage form, the need of dosage form. Ideas about the available type of dosage forms and new drug delivery system.
11.	**Sources of drug information** Introduction to Pharmacopoeia with reference to IP, BP, USP and International Pharmacopeia. Study of structure/features (index) general notice and compartment of monographs of excipients, drug and drug product.

	Other sources. Textbooks, journals, internet (drug information system, online database, patient/ consumer information and non- print material. Classification of information, primary, secondary and tertiary. Nomenclature of the drug.
12.	**Pharmaceutical Plant, location, layout** Plant location and layout of an industry. Various factors affecting locational aspects of chemical and pharmaceutical plants. The layout of plant building and importance of flow sheet, the difference between scientific process and technological process, the layout of various departments, equipment, and product layout v/s process layout.
13.	**Preformulation studies** Consideration of Importance, physical properties, physical forms, particle size, crystal forms, bulk control, solubility, wetting, flow cohesiveness, compressibility, organoleptic properties and its effect on final product consideration of Chemical properties, hydrolysis, oxidation, racemization, polymerization, isomerization, decarboxylation, enzymatic decomposition, formulation additives, stabilizers, suspending and dispersing agents dyes, solid excipients etc. and its effect on quality of finished product.
14.	**Dosage form necessities and additives** Antioxidants, preservatives, coloring agents, flavoring agents and diluting agents, emulsifying agents, suspending agents, ointment bases, solvents, and others.
15.	**Allopathic dosage form: Preformulation and formulation development including selection of excipients, methods of preparation, characterization and pharmaceutical uses of following category of allopathic dosage forms:** a) Biological products b) Capsules c) Tablets d) Parenterals- product requiring sterile packaging e) Suspensions f) Emulsions g) Suppositories h) Semisolids i) Pharmaceutical Liquids j) Pharmaceutical Aerosols k) Ophthalmic preparations l) Powders
16.	**Stability of active pharmaceutical ingredients and formulated products** Requirements, drug regulatory aspects, pharmaceutical products stability, shelf life, overages, containers, closures. Reaction rate and order, acid-base catalysis, destabilization and accelerated stability testing.
17.	**Prolonged action pharmaceuticals**

	Benefits, limitations, oral products, terminology, drug elimination rate, types and construction of implants products, product evaluation, parenteral products, absorption and evaluation.
18.	**Novel drug delivery systems** Critical fluid technology, transdermal drug delivery system, controlled drug delivery system, multiple emulsion, nanoparticles, targeted drug delivery system, aerosols, inhalation & new products reported etc.
19.	**GMP and validation** Introduction to GMP, QC and QA. Concept and need of good manufacturing practice guidelines. Elements of GMP covering controls of area and processes and product. Regulations related to GMP. Introduction of the validation process. Types of validation. The brief methodology of process, equipment and instrument validation.
20.	**Packaging materials** Role and features of pharmaceutical packing materials. Glass, plastic, rubber, metal and paper as pharmaceutical packaging material. General quality control of pharmaceutical packages. Primary, secondary and tertiary packaging materials. Child resistant and pilfer-proof packaging.
21.	**Cosmetics** Formulation and preparation of dentifrices, hair creams, lipsticks, face powders, shaving preparations, skin creams, shampoos, hair dyes, depilatories, manicure preparations etc.
22.	**Pilot plant scale-up techniques** Need, organization and layout, scale-up techniques for solid and liquid dosage forms. Technology transfer.
23.	**Detailed pharmacology including classification, mechanism of action and therapeutic uses of following categories of drugs:** a) Drugs acting on nervous system. b) Drugs acting on cardiovascular system. c) Drugs acting on urinary system. d) Drugs acting on respiratory system. e) Drugs acting on endocrine system. f) Drugs acting on gastrointestinal tract.
24.	**Pharmacology of chemotherapeutic drugs** General principles of chemotherapy. Sulphonamides and co-trimoxazole. Antibiotics- Penicillin's, cephalosporins, chloramphenicol, Macrolides, quinolones and fluoroquinolones. Tetracyclines. Aminoglycosides and miscellaneous antibiotics. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, AIDS, protozoal diseases, worm infections, urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy.
25.	**Principles of toxicology**

	Definition of poison. General principles of treatment of Poisoning. Treatment of poisoning due to heavy metals, insecticides, opioids and other addict forming drugs. Study of acute, sub-acute and chronic toxicity as per OECD guidelines (Guidelines 420, 423, 425, 407, 408, 451/452).
26.	**Classification of crude drugs** Based on alphabetical, morphological, pharmacological, chemical, taxonomical and chemotaxonomic methods: organized and unorganized drugs: official and unofficial drugs. Plants, animals and minerals: marine products: plant tissue culture.
27.	**Techniques in microscopy** Details of mountants, clearing agents, chemo microscopic (microchemical) reagents.
28.	**Introduction to phytoconstituents** Definition, classification, chemical tests and pharmaceutical importance of: carbohydrates and their derivatives, fats and proteins, alkaloids, glycosides, flavonoids, steroids, saponins, tannins, resins, lipids and volatile oils.
29.	**Pharmaceutical aids** Biological sources, chemical constituents, adulterants and uses of: Starches, acacia gum, tragacanth, sterculia, guar gum, pectin, arachis oil, castor oil, sesame oil, cottonseed oil, olive oil, cotton, silk, wool, regenerated fibers, asbestos, kaolin, prepared chalk, kieselguhr.
30.	**Adulteration and evaluation of crude drugs** Different methods of adulteration: Evaluation of drugs by organoleptic, microscopic, physical, chemical and biological methods. Deterioration of herbal drugs by insects.
31.	**Classification, sources, chemical constituents, identification test, adulterants and uses of plants containing following categories of phytoconstituents:** a) Carbohydrates & lipids b) Tannins c) Volatile oils d) Resinous drugs e) Glycosides f) Alkaloids
32.	**Extraction and isolation techniques** General methods used for the extraction, isolation and identification of alkaloids, lipids, glycosides, flavonoids, saponins, volatile oils and resins. Application of column, paper and thin layer chromatographic techniques, for the isolation of phytopharmaceuticals.
33.	**Phytopharmaceuticals** Isolation, identification and estimation of: caffeine, eugenol, digoxin, piperine, tannic acid, diosgenin, hesperidin, berberine, calcium sennosides,

	rutin, glycyrrhizin, menthol, ephedrine, quinine, andrographolides and guggulipids.
34.	**Quality control and standardization of herbal drugs** Quality control of herbal drugs as per WHO, AYUSH and Pharmacopoeial Guidelines-Extractive values, ash values, chromatographic techniques (TLC, HPTLC and HPLC) for determination of chromatographic markers. Determination of heavy metals, insecticides, pesticides and microbial load in herbal preparations.
35.	**Herbal formulations** Principals involved in Ayurveda, Sidha, Unani, Chinese and Homeopathic systems of medicines. Preparation of Ayurvedic formulations like aristas, asava, ghutika, tailia, churna, avaleha, ghrita and bhasmas: Determination of alcohol contents in arishtas & asavas.
36.	**Herbal cosmetics** Importance of herbals as shampoos (soapnut), conditioners and hair darkeners, (amla, henna, hibiscus, tea), skin care (aloe, turmeric, lemon peel, vetiver).
37.	**Acid-base titrations** • Definitions of acids & bases according to Arrhenius & Lewis theory. Definitions of normality, molarity, molality, & equivalent weight. Primary & secondary standards with examples & differences between them. Standardization of strong acids & bases using primary & secondary standards. Preparation of standard solutions of & calculations of equivalent weights of oxalic acid, potassium acid phthalate, calcium chloride dihydrate, & sodium carbonate. Calculation of factors involved in standardization of sodium hydroxide, hydrochloric acid, & oxalic acid. Direct, back & differential titrations. Application of direct & back titrations to preparations like boric acid & borax in a mixture, ammoniated mercury, milk of magnesia, & zinc oxide ointment. • Law of mass action, acid-base equilibria, pH scale, pH & hydronium ion concentrations in aqueous systems, calculations of pH for weak acids & weak bases. Use & applications of pH meter. Hydrolysis of salts. Strengths of acids & bases, dissociation constant. • Theory of acid-base indicators. Neutralization [titration] curves. • Definition, different types of buffers [chemical & biological], & their composition. Buffer capacity, buffered isotonic solutions. Calculations involving preparation of various buffer capacity solutions. Biological & pharmaceutical applications of buffers.
38.	**Non-aqueous titrations** Acid-base definitions according to Lowry-Bronsted, Lewis & Arrhenius concept. Factors affecting strengths of acids & bases. Intrinsic structure & surrounding environment. Protophilic, protogenic, amphiprotic & aprotic solvents. Acid-base equilibria in non- aqueous media. Titrants & indicators used for the assay of acidic & basic substances. Preparation of perchloric acid,

	formation of onium ion. Assay of 1°, 2°, 3° amines & amine hydrochlorides using perchloric acid & the reactions involved in it. Standardization of sodium ethoxide solution. Assay of phenols & phenobarbitone. General applications of non-aqueous titrations.
39.	**Oxidation-reduction titrations** Definition of oxidation, reduction, oxidizing & reducing agent. Equivalent weight, the concept of half reactions. Systematic balancing of half reactions with respect to: a. Oxalic acid-$KMnO_4$, b. $FeSO_4$-ceric nitrate, & c. 12-sodium thiosulphate solution titrations. Calculation of equivalent weight of oxalic acid, $KMnO_4$, $FeSO_4$, permanganate & 12-sodium thiosulphate solution from half reactions. Calculation of factors for titrations mentioned in a, b & c. a. Redox titrations: $KMnO_4$ as a self-indicator, its preparation, standardization, & use in the assay of ferrous gluconate tablets, H_20_2, & $NaNO_2$ solution. b. Iodimetric & iodometric titrations. Definitions & difference between iodimetry & iodometry. Preparation, standardization of iodine solution. Assay of ascorbic acid & sulphur ointment by iodimetry. Assay of copper sulphate & ferric chloride by iodometry. c. Bromometric titrations. d. Iodate titrations. Definition. Preparation, standardization & use of KIO_3 in the assay of ascorbic acid & KO. e. Cerimetric titrations. Preparation, standardization & use of eerie solutions in the assay of paracetamol tablets. Its advantages over permanganate solutions. f. Bromine titrations. Preparation, standardization & use of bromine solution in the assay of phenol & isoniazid tablets. g. Potassium dichromate titrations. Preparation, standardization & use of potassium dichromate solution in the assay of ferrous ammonium sulphate.
40.	**Precipitation titrations** The principle of solubility product & sparingly soluble salts. Titrants & indicators used in Mohr's, Volhard's, & Fajan's methods. Preparation & standardization of silver nitrate & ammonium thiocyanate solutions. Assay of sodium chloride by Mohr's method, use of nitrobenzene in the assay of halides, ammonium chloride, & thiourea by Volhard's method. Calculation of factors in argentometric titrations. Titration curve method. General applications of precipitation titrations.
41.	**Complexometric titrations** Difference between double salts & co-ordinate compounds. Definitions of coordination number of metal ions, ligands- uni-, bi-, & multidentate. Complexing, chelating, & sequestering agents with respective examples. Structure of complexes of platinum with ammonia. Ethylenediamine tetraacetate [EDTA] as a multidentate ligand in complexometry. Coordinate

	compounds of EDTA with bi-, tri-, & tetravalent metal ions. Stability of complexes & factors affecting it, use of buffers in EDTA titrations. Selective analysis of ions based on pH adjustments, use of masking & demasking agents, pM or metal ion indicators. Standardization of EDTA solution, titration curves, and examples of assays carried out by direct & back titrations & by replacement of one complex by the other. Applications of complexometry in the assays of calcium gluconate, milk of magnesia, zinc undecenoate ointment, & aluminium hydroxide gel. Assay of NaF by indirect titration.
42.	**Gravimetry** Principles of gravimetry. Factors affecting precipitation, formation, & properties of the precipitate. Colloidal state. Impurities in the precipitate, conditions of precipitation. Precipitation from homogenous solutions, washing, drying, & ignition of the precipitate. Experimental techniques of drying & ignition.
43.	**Extraction techniques** Liquid-liquid extraction, separation of mixtures by extraction. Distribution law. Successive & multiple extraction [Craig method], continuous counter-current extraction. Effect of temperature & pH on extraction. Inert solute, associate ion pair formation, emulsion problem in extractions.
44.	**Potentiometry** Theory, ion-selective electrodes, measurement of potential, redox titration curve, pH measurement, the relation of pH to potential.
45.	**Miscellaneous methods of analysis including following:** Diazotization titrations, Kjeldahl nitrogen estimation, Karl Fisher titrations and Oxygen flask combustion method.
46.	**Calibration of instruments**
47.	**General principles of spectroscopy** Wave-particle duality, wave properties, particulate properties. Line & band spectrum. Electromagnetic spectrum. Absorption & emission spectroscopy. Understanding of terms such as absorbance, transmittance, absorptivities, molar absorptivity, J_{max}, the effect of solvent & pH on J_{max}.
48.	**Ultraviolet-visible spectrometry** Different electronic transitions. Auxochromes & their effects, auxochromic, bathochromic & hypsochromic shifts [red & blue shifts]. Beer-Lambert law, its derivation, deviations in Beer's law. Single & double beam spectrophotometers covering sources of radiations, different monochromators, detectors such as barrier cell, photocell, photomultiplier tube. Photodiode array detector. Applications of this technique in qualitative & quantitative estimations giving emphasis on problem-solving. Fieser-Woodward rules for calculations of theoretical J_{max} values.
49.	**Spectrofluorimetry**

	Principle, definitions & types of luminescence. Mechanism of fluorescence & phosphorescence. Singlet & triplet states & intersystem crossing. Fluorescence yield & factors affecting it. Quenching of fluorescence & fluorescence quenchers. Structure & fluorescence. A brief discussion of instrumentation. Applications of fluorimetry in pharmaceutical industry and research.
50.	**Flame photometry & atomic absorption spectrometry** Principle & instrumentation with emphasis on working & importance of different components. Temperature, flame absorption & emission profiles. Interferences & their avoidance. Quantitative estimations & applications.
51.	**Infrared spectrometry** Infrared region in EM spectrum. The principle, different stretching & bending vibrations. Components [& their working] of a dispersive instrument. Fourier transform technique, Fourier transform instruments & their comparison with dispersive instruments. Sample handling techniques. Functional group & fingerprint regions in the spectrum. Functional groups identification & their use in the characterization of compounds. Problems based on the identification of functional groups from spectra of unknown compounds.
52.	**Proton nuclear magnetic resonance spectrometry** The principle involved in the technique. Knowledge about fundamental terms involved such as quantized absorption, flipping of nucleus, spin number, magnetic moment, magnetogyric ratio, relaxation, etc. Equations relating these terms to the frequency of radiation & magnetic field [without derivation of the equations]. Types of relaxation processes. Low & high-resolution instruments. A brief discussion on the low-resolution instrumentation [60 MHz]. Quantitative knowledge of the relationship between MHz & magnetic field. An introduction to superconductivity magnets. Solvents & reference standards used. Setting up of NMR scale. Sample preparation. Shielding & deshielding of a proton & its effect on chemical shifts. Discussion on & importance of equivalent & nonequivalent protons [number of signals], chemical shifts [position of signal] & their calculation from the spectrum, chemical shifts of different H's, splitting [multiplicity] of a signal, coupling constants [J values], integration [area under the signal]. Importance of these terms in identification [or confirmation] of different functional groups. Significance & contribution of J value in stereochemistry. Prediction [expected theoretical values] of chemical shifts & multiplicities for all protons from simple structures containing up to 12-1S carbons. An introduction to FT-technique & its significance in ^{13}C-NMR spectrometry.
53.	**Mass spectrometry** Principle. Low & high-resolution instruments. Components & importance of each in brief. Different types of mass spectrometric techniques. Brief knowledge of Chemical Ionization mass spectrometry. Calculations of hydrogen deficiency index [HDI] or unsaturation index [UI]. Base or parent peak, molecular ion, M^{+1}, M^{+2} peaks. Calculations of molecular weight based on M^{+1} & M^{+2} peaks. Formation of molecular ion & further fragmentation. Rearrangements in mass spectrometry. Major modes of fragmentations of

	hydrocarbons, hydroxyl compounds, halogen compounds, aldehydes, ketones, carboxylic acids, and amines. Introduction to recent advances in MS.
54.	**Polarography** Principle & instrumentation. llkovich equation [no derivation] & its importance. Dropping mercury electrode [DME], saturated calomel electrode. Liquid-liquid junction potential, polarographic cell. Explanation of origin of the S-shaped C-V curve. Applications of this technique. Amperometric titrations, principles, instrumentation, & applications.
55.	**Nephelometry & turbidimetry** Principles, Tyndall effect. Duboscq turbidimeter. Eeel's nephelometer. Applications.
56.	**Principal and applications of chromatography including following:** Thin layer chromatography, Paper chromatography, Column chromatography, Gas Chromatography-Mass spectroscopy, High performance thin layer chromatography, high pressure/performance liquid chromatography and Liquid Chromatography-Mass spectroscopy Statistical treatment to experimental data. Sampling techniques & applications in pharmaceutical industry.
57.	**Microscopy and staining technique** The principle, ray diagram, construction, working and applications of light compound, dark field, phase contrast, Fluorescence & electron microscope. The concept of resolving power, Magnification power, numerical aperture and angular aperture and working distance. The principal application of oil immersion microscopy. Theory of staining, principle and technique of staining procedure- Monochrome, Gram, acid-fast, negative, capsule, endospore.
58.	**Biology of microorganisms** Cultural characteristics, pure culture techniques of Bacteria, Morphology and fine structure of bacteria, Nutritional requirement and type of culture media, growth and growth curve of bacteria, physical condition for growth, measurement of bacterial growth (Counting Methods), Reproduction in bacteria, genetic exchange - transformation, conjugation, and transduction, development of drug resistance by recombination and mutation, preservation of bacterial culture. Biochemical properties (sugar fermentation and IMVIC test). Pathogenesis of Staphylococcus, Mycobacterium. Salmonella Introductory study of disease-causing rickettsia, the importance of actinomycetes in antibiotic production.
59.	**Fungi and viruses** a) Fungi: - Introduction, general characteristics, morphology, the industrial and medical significance of Saccharomyces Cerevisiae, Penicillium and Aspergillus, Candida Albicans, Epidermophyton, and trichophyta. b) Viruses: - Introduction, structure and general properties Bacteriophages - Lytic and Lysogenic cycle, Epidemiological uses of Bacteriophages, human viruses - Cultivation and Multiplication virus-host cell interaction, Pathogenesis of HIV and Prions, types of Tumor viruses.

60.	**Aseptic techniques** The omnipresence of microorganisms, the importance of asepsis, sources of contamination and methods of prevention, Principle, construction & working of laminar airflow bench.
61.	**Sterilization & disinfection** a) Concept and classification, principle and methods of sterilization, Mechanisms of cell injury. b) Construction working & applications of moist heat & dry heat sterilizer, gamma radiation sterilizer, filtration sterilizer. Indicators of sterilization, microbial death, kinetic terms-D value, z value. c) Terminology of chemical antimicrobial Agents, Chemical classification of different disinfectants, characteristics of ideal disinfectants, factors affecting the action of disinfectants, evaluation methods (RW Coeff.), Kelsey Sykes test, Chick Martin test.
62.	**Microbial spoilage** Types of spoilage, factors affecting spoilage of pharmaceutical products.
63.	**Vaccines and sera** Manufacturing (seed lot system) and quality control of bacterial vaccines & Toxoids (Tetanus, TAB, Cholera, BCG, DPT), Viral vaccine (Polio- Salk Sabin, Rabies, MMR, Hepatitis, Chickenpox, influenza), Antisera (diphtheria, tetanus), antiviral Antisera (rabies). Preparation of allergenic extracts & diagnostics.
64.	**Microbial assays** Importance, general methods of assay of antibiotics (Cup & plate method, paper disc method, turbidometry, dilution method), methods for fungicidal & antiviral compounds, assay, microbial limit tests.
65.	**Bio-pharmaceutics** a. The fate of drug after drug absorption, various mechanisms for drug absorption, drug concentration in blood, biological factors in drug absorption, physicochemical factors, dosage form consideration for gastrointestinal absorption. b. Drug Absorption: • Gastrointestinal absorption-biological considerations. • Gastrointestinal absorption - physicochemical considerations. • Gastrointestinal absorption-role of the dosage form.
66.	**Pharmacokinetics** Compartmental and non-compartmental pharmacokinetics. Biotransformation, drug disposition-distribution, drug disposition-elimination. Variability-Body weight, age, sex and genetic factors. Pharmacokinetic variability diseases. Pharmacokinetic variability-drug interactions. Individualization and optimization of drug dosing regimens.

67.	**Bioavailability and bioequivalence** Quality parameters of dosage forms. Assay methods & its validation. Physicochemical properties of drugs & added substances and its effect on preparations and biological availability of dosage forms. Pharmaceutical properties of dosage forms, disintegration, dissolution rate. Biological, pharmacological effects of dosage forms. Factors affecting Bioavailability, Determination of bioavailability. Significance of bio-equivalence studies. Statistical analysis of bioequivalence studies. Development, scale up & post approval changes [SUPAC] & *in vitro* [dissolution] *in vivo* [plasma concentration profile] correlation or IV/IV correlation (IVIVC). Multi stage - Bioequivalence studies. Therapeutic equivalence. Titration design for clinical rationales. New Drug Application [NDA].
68.	**Heat transfer** Source of heat, mechanism of heat transfer, the laws of heat transfer, steam and electricity as heating media, determination of requirement of the amount of steam/electrical energy, steam pressure, boiler capacity, mathematical problems on heat transfer, steam traps and reducing valve, lagging etc.
69.	**Evaporation** The basic concept of phase equilibrium, factors affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, mathematical problems on evaporation.
70.	**Distillation** Raoult's law, phase diagram, volatility: simple steam and flash distillation, principles of rectification, Mc-Cabe Thiele method for calculations of a number of theoretical plates, azeotropic and extractive distillation, mathematical problems on distillation.
71.	**Drying** Moisture content and mechanism of drying, the rate of drying and time of drying calculations, classifications and types of dryers, dryers used in pharmaceutical industries and special drying methods like freeze drying and lyophilization, mathematical problems in drying.
72.	**Size reduction and size separation** Definition, objectives of size reduction, factors affecting size reduction, laws governing in energy and power requirement of a mill, types of mills including ball mill, hammer mill, fluid energy mill, micronizer, Quadro co-mil, multi mill etc.
73.	**Extraction** Theory of extraction, extraction methods, equipment for various types of the extraction process.
74.	**Crystallization** Characteristics of crystals like purity, size, shape, geometry, habit, forms, size

	and factors affecting them. Solubility curves and calculation curves and calculations of heat balance around S Swanson's Walker crystallizer, supersaturation theory and its limitations, Nucleation mechanism, crystal growth, study of various types of crystallizers, tanks, agitated batch, Swanson's Walker, single vacuums, circulating magma and crystal crystallizers, cracking of crystals and its prevention. Numerical problems on yields. Introduction to polymorphism.
75.	**Filtration** Theory of filtrations, filter aids, filter media, industrial filters, including filter press, rotary filter, edge filters, filter leaf and laboratory filtration equipment etc., Factors affecting filtration, mathematical problems on filtrations, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters and centrifugal sedimentars.
76.	**Dehumidification and humidity control** Basic concept and definition, wet bulb and adiabatic saturation temperatures, psychometric count and measurement of humidity, application of humidity measurement in pharmacy, equipment for humidification and dehumidification operations.
77.	**The Pharmacy Act**
78.	**Drugs and Cosmetics Act 1940, Rules 1945**
79.	**The New Drugs and Clinical Trials Rules, 2019**
80.	**Narcotic Drugs and Psychotropic Substances Act, and Rules thereunder.**
81.	**Drugs and Magic Remedies (Objectionable Advertisements) Act 1954.**
82.	**Medicinal and Toilet Preparations (Excise Duties) Act 1955, Rules 1976.**
83.	**Drug (Price Control) Order.**
84.	**Shops and Establishment Act.**
85.	**Factory Act.**
86.	**Consumer Protection Act.**
87.	**Industrial Development and Regulation Act 1951.**
88.	**Introduction to Intellectual Property Rights and Indian Patent Act 1970.**
89.	**An Introduction to Standard Institutions and Regulatory Authorities such as BIS, ASTM, ISO, TGA, USFDA, MHRA, ICH, WHO.**
90.	**Prevention of Food Adulteration Act 1954 and Rules**

91.	**Pharmaceutical calculations**
92.	**Preparations of formulations involving allegation, alcohol dilution, isotonic solution.**
93.	**Study of current patent and proprietary products, generic products and selected brand products, indications, contraindications, adverse drug reactions, available dosage forms and packing of** a) Antihypertensive drugs b) Antiamoebic drugs c) Antihistaminic drugs d) Antiemetic drugs e) Antacids and ulcer healing drugs f) Antidiarrheals and laxatives g) Respiratory drugs h) Antibiotics i) Analgesics and antipyretic drugs
94.	**Compounding and dispensing of following prescriptions** a) Mixtures, solutions, emulsions b) Lotions c) Liniments d) Powder e) Granules f) Suppositories g) Ointments/ paste h) Cream i) Inhalations