

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR SECOND YEAR B.PHARM

PHARMA CEUTICS – III (UNIT OPERATION – II)

3 hrs / week

THEORY

1. Evaporation : Basic concept of phase equilibria factor affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, Mathematical problems on evaporation
2. Distillation: Rault's law, phase diagrams, volatility : simple steam and flash distillations, principles of rectification, McCabe Thiele method for calculations of number of theoretical plates. Azeotropic and extractive distillation. Mathematical problems on distillation.
3. Drying: Moisture content and mechanism of drying rate of drying and time of drying calculations : classification and type of dryers used in pharmaceutical industries and special drying methods. Mathematical problem on drying.
4. Size Reduction and size separation : Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of mill, types of mills including ball mill, hammer mill, fluid energy mill etc.,
5. Mixing: Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments.
6. Crystallization : Characteristics of crystals like purity, size, shape geometry, habit, forms size and factors affecting them. Solubility curves and calculation of and heat balances around Swenson Walker crystallizer. Supersaturation theory and its limitations. Nucleation mechanism, crystal growth, Study of various types of crystallizer, tanks. Crystallizer. Caking of crystals and its prevention. Numerical problems on yields.
7. Automated process control system : Process variable, temp, pressure, flow, level, vacuum and their measurements. Elements of automatic process control and introduction to automatic process control system. Elements of computer aided manufacturing (CAM).
8. Reactors and fundamentals of reactors design for chemical reactions.

PRACTICALS:

1. Determination of rate of evaporation, steam distillation, rectification
2. Experiment based on steam extractive and azeotropic distillation
3. Determination of rate of drying free moisture content and bound moisture content
4. Experiment to illustrate the influence of various parameters on the rate of drying
5. Experiment to illustrate principle of size reduction, laws governing energy and power requirements of size reduction
6. Experiment to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers
7. Crystallization and smooth behavior
8. Principles of extraction
9. Study of Stoke's law and sedimentation
10. Rectification

11. Particle size determination by microscopic method
12. Any other practical devised from topics covered in theory.

BOOKS RECOMMENDED:

1. Theory and practice of Industrial pharmacy by Lachman, Liberman and Kanig. Third edition
2. Pharmaceutical dosage form : Tables volume II edited by Liebrerman, Lachman and Schwartz. Second edition
3. Pharmaceutics : The science of dosage form design by M.E.Aulton (1998 edition)
4. Pharmaceutical engineering by K.Sambamurthy
5. Remington : The science and practice of pharmacy Vol-I & II 19th edition
6. Elementary chemical engineering by Max S Peters
7. Unit operation of chemical engineering (5th edition) by McCabe, Smith and Harriott
8. Perry's chemical engineer's Handbook by Robert Perry (6th edition)
9. Tutorial pharmacy : (Cooper and Gunn)

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PHARMACEUTICS -- IV (PHRM DISPOSING)

3 hrs / week

THEORY

1. **Evolution of pharmacy and pharmaceutical literature :** History of pharmacy, Historical background and importance of various Pharmacopoeias with special reference to Indian Pharmacopoeia, Unites States Pharmacopoeia, European Pharmacopoeia, British Pharmacopoeia, International Pharmacopoeia, and Extra Pharmacopoeia.
2. **Pharmacopoeial Preparations:** Principles and method of preparation of aromatic water, spirits, elixirs, syrups, glycerin, lincrus, solutions, milks and magmas, mucilage and special preparations like pyroxyllins and flexible collodions.
3. **Galenioals:** Principles and methods of extraction, preparation of infusions, decotions, Gnclures, liquid, soft and dry extracts. Introduction and classification of Pharmaceutical dosage forms.
4. **Prescription:** Various parts of prescription and their functions, handling of prescriptions, source of errors, care required in dispensing procedures including labeling of dispensed products. Preliminary knowledge of important Latin terms used in prescriptions and their translation into English.
5. **Pharmaceutical calculations and metrology:** Metric and imperial system of weight and measures used in prescriptions, Posology, calculation of doses for infants, children, adults and elderly patients, reducing and enlarging formulas percentage solutions, allegation methods, proof spirits, calculations invoicing alcohol dilutions, pH and buffer solutions, isotonic solutions, displacement value and calculations involving radioisotopes.
6. **Principles and procedures of dispensing prescriptions:** Principles involved and procedures adopted in dispensing of liquid preparations such as mixtures, suspensions emulsions, solutions, lotions and liniments, solid dosage forms such as powders, capsules, effervescent powders, tablet triturates and lozenges, paints, sprays, inhalations and poultice.
7. **Incompatibilities:** Definitions, study of types of incompatibilities, physical, chemical and therapeutic inorganic incompatibilities involving metals and their salis non-metal acids and alkalis, organic incompatibilities involving specific organic salirs, purine bases, alkaloids, pyrrozone derivatives, aminoacids, quarternary ammonium compounds, carbohydrates, glycosides, sulfonamides, local anesthetics, dyes, surfaceactive agents and vitamins. Study of examples of prescriptions containing incompatibilities and their correction and dispensing methods.

8. **Dispensing of Radiopharmaceuticals:** Therapeutic uses, diagnostic uses, facilities work area, preparation and dispensing of Radiopharmaceuticals used in and medicine.
9. Future trends in dispensing.
10. Dispensing of proprietary medicines.

3 hrs / week

PRACTICALS:

1. Dispensing of prescriptions falling under the categories of mixtures, solutions, emulsions creams, powders suppositories, capsules, pastes, jellies, lozenges, lotions, liniments, inhalations and paints.
2. Identification of various types of incompatibilities in prescriptions. Corrections and dispensing of such prescriptions.
3. Prescription of selected Pharmaceutical preparations under the category of aromatic waters, spirits, solutions, infusions, unclures and extracts.

BOOKS RECOMMENDED:

1. Cooper and Gunn's Dispensing Pharmacy
2. Pharmaceutical dispensing by Sharma and Jain
3. Dispensing Pharmacy by Husa
4. Romington's Pharmaceutics
5. Pharmaceutical Practice by Aulton and Coller

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203 PHARMACEUTICAL CHEMISTRY – II (ORGANIC)

3 hrs / week

THEORY

The subject of Organic Chemistry will be treated in its modern perspective keeping for the sake of experience the usual classification of organic compounds.

1. Structure and properties : Atomic structure. Atomic orbitals, Molecular Orbital theory, wave equation, Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals. Intramolecular forces. Bond dissociation energy polarity of bond. Polarity of molecules, structure and physical properties. Intermolecular forces, acids and base.
2. Stereochemistry : Isomerism and nomenclature and associated physicochemical properties. Optical activity. Stereoisomers, conformations.
3. Structure Nomenclature, preparation and reactions of : Alkanes, Alkenes, Alkynes, Cycloalkanes, Dienes, Benzene, Polynuclear aromatic compounds, Arenes, Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones, carboxylic acids, Functional derivatives of carboxylic acid, reactive intermediate – carbocation carbonions, carbenes, nitrene and nitrenium ions.
4. Nucleophilic aromatic substitutions : Alpha-beta unsaturated carbonyl compounds, conservation of orbital symmetry and rules, electrocyclic cycloaddition reactions. Sigmatropic reactions. Neighbouring group effects. Catalysis by transition metal complexes. Stereoselective and stereospecific reactions, organic reagents used in drug synthesis like E.C.A malononitrile. N-bromo succinamide ethylacetoacetate.
5. Heterocyclic compounds : Chemistry of some important heterocyclic compounds containing 3,4,5,6&7 atoms with one or two hetero atoms like O,N,S, Preparation and properties of furan, thiophene, pyrrole, pyrimidine, imidazole.
6. Chemistry of lipids, carbohydrates, proteins, amino acids and nucleic acids.
7. Chemistry of Glycosides : Digoxin, Digitoxin, hecogenin, sennosides, Drogynin and sorsapogenin.
8. Chemistry of alkaloids : Atropin & related compounds, Quinine, Reserpine, Morphine Papaverin, Ephedrine, Ergot and Vinca Alkaloids.
9. Chemistry of terpenes, important lignins, flavanols, quassinols, purines & Xanthines.
10. Brief account of chemistry and medicinal use of Taxol and derivatives.

PRACTICALS:

3 hrs / week

1. The students should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, p-bromoacetanilide, anthraquinone from anthracene reduction of nitrobenzene etc.)
2. Identification of organic compounds and their derivatives
3. Introduction to the use of stereomodels
4. At least five exercises in synthesis involving various heterocyclic ring systems

5. An exercise involving stereoselective synthesis of a compound resolution of racemic DL-alanic or any other example.
6. Workshop on molecular modeling of primary, secondary and tertiary structures of proteins molecular modeling on double helical structure of nucleic acid showing hydrogen bonding.

BOOKS RECOMMENDED

1. Organic Chemistry by Morrison & Boyd
2. Organic Chemistry by Brewster & McEwan
3. Organic Chemistry Vol-I & II by Finar
4. Organic Chemistry by Wingrove & S.Caret
5. Organic Chemistry by Pine & Handrickson
6. Organic Chemistry by Jerry March
7. Practical Organic Chemistry by F.G.Mann & B.C.Saunders
8. Vogel's Organic Chemistry by B.T.Furnis
9. Stereochemistry of carbon compounds by L.Eliet
10. An Introduction to the chemistry of heterocyclic compounds by R.M.Acheson
11. Basic and Pharmaceutical Practical Chemistry by Singh and Kapoor

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204 PHARMCEUTICAL ANALYSIS – I:

3 hrs / week

THEORY:

1. **Introduction:** Significance of quantitative analysis in quality control, different techniques of analysis, computation of analytical results, significant figures, concepts of errors, precision and accuracy, standard deviation of analytical equipments, fundamentals of volumetric analysis, methods of expressing concentration primary and secondary standards.
2. **Acid-base titrations:** Acid base concepts relative strength of acid and base ionization law of mass action common ion effect ionic product of water pH Henderson-Hasselbach equation buffer solutions neutralization curves, acid-base indicators and their choice and mixed indicators.
3. **Oxidation-reduction titrations:** Theory and pharmaceutical applications, strength and equivalent weights of oxidizing and reducing agents measurement of electrode potential oxidation-reduction curves and redox indicators. Titrations involving potassium permanganate ceric ammonium sulphate, potassium iodate, potassium bromate, titanous chloride sodium 2-6-dichlorophenol-indophenol, Iodimetry and iodometry .
4. **Precipitation titrations:** Principles of precipitation titrations titrations involving mercuric nitrate, ammonium or potassium thiocyanate, barium sulphate, argentometric titrations and adsorption indicators.
5. **Gravimetric analysis:** Basic concepts precipitation techniques co-precipitation post-precipitation various steps involved in gravimetric analysis and their pharmaceutical applications.
6. **Non-aqueous titrations:** Theoretical consideration, scope, limitations, titration of weak acids, weak base, indicators and precautions.
7. **Complexometric titrations:** Complexation and chelation. Warner's co-ordination number, stability of complexes, titrants, titration curves, types of complexometric titrations and methods of end point detection.
8. **Miscellaneous methods of analysis as:** Diazotization titration . Kjeldahl method of nitrogen estimation oxygen mask combustion and geometry.

PRACTICALS:

3 hrs / week

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. Acid-base titrations: Preparation and standardization of acid and base, some exercises related with determination of acid and bases separately or in mixtures form, some official assay procedures, e.g. boric acid should also be covered.
3. Oxidation-Reduction titrations: Preparation and standardization of some redox titrations, e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate,

- potassium bromate, iodine solution, titanous chloride, sodium 2, 6-dichlorophenol and ceric ammonium sulphate.
4. Precipitation titrations : Preparation and standardization of titrations like silver nitrate and ammonium thiocyanate. Titrations according to Mohr's Volhard's and Fajan's methods.
 5. Gravimetric analysis: Preparation of Goch crucible for filtration and use of sintered glass crucible, determination of water of hydration and some exercise related to gravimetric analysis should be covered.
 6. Preparation and standardization of perchloric acid and sodium / potassium / lithium methoxide. Estimation of some drugs based on it
 7. Preparation and standardization of EDTA and some assays based on it.

BOOKS RECOMMENDED:

1. Analytical chemistry by Gray D. Christian, John Wiley and sons N.Y. 5th edition 1994
2. Vogel's T.B. of quantitative chemical analysis ELBS UK. 5th edition, 1996.
3. Quantitative Analyses R.A. Day and Underwood Prentice Hall of India, 6th edn., 1993.
4. Quantitative chemical analysis by Gilbert H. Ayers. Harper and Row New York. 2nd edn., 1968.
5. Quantitative analysis by Alexeev. Mir Publishers, Moscow, First edn., 1994.
6. A.T.B of Pharmaceutical Analysis by Kenneth A. Connors, John Wiley and sons, 3rd edn., 1982.
7. Analytical Chemistry Principles by John H. Kneendy. Saunders College Publishing N.Y 2nd edn., 1990.
8. Analytical chemistry hand book by John Dean, Mc Graw Hill Inc. N.Y, 1st edn., 1995.
9. Analytical chemistry an introduction by Skoog, West and Holler, Saunders College Publishing 6th edn., 1994.
10. Fundamentals of analytical Chemistry an introduction by Skoog, West and Holler, Saunders College Publishing 7th edn., 1996.
11. Analytical chemistry by R.M Verma CBS Publishers 2nd edn., 1991.
12. Bentley and Drivers T.B of Pharmaceutical chemistry revised by L.M Atherden. Oxforde University press Bombay 8th edn., 1994.
13. Pharmaceutical analysis by T. Higuchi etc. CBS Publishers, New Delhi, First edn., 1997.
14. Basic concepts of analytical chemistry by S.M Khopkar New age International Publishers 2nd edn., 1998.
15. Instrumental methods of chemical analysis by Golen W. curing Mc Graw Hill Book Company N.Y. 5th edn., 1985.
16. Instrumental methods of analysis by Willard etc. 7th edn., 1998.
17. Chromatographic method by A. Braithwaite and F.J. Amith Blackied Academic and professional London 5th edn., 1996.
18. Principles of instrumental analysis by Skoog and Leary Saunders College Publishing 4th edn., 1996.
19. Quantitative analysis of drugs in pharmaceutical formulations by P.D Sethi, CBS Publishers N.D. 3rd edn., 1997.
20. Practical Pharmaceutical chemistry by A.H. Bookerr and Stanlake CBS Publishers N.D. 4th edn., 1997.

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205 PHARMACOLOGY- (Bio-Chemistry and Pathophysiology)

3 hrs / week

Part – I Biochemistry

1. Biochemical organisation of the cell and transport processes across cell membrane.
2. The concept of free energy, determination of change in free energy from equilibrium constant and reduction potential bioenergetics production of ATP and its biological significance.
3. Enzymes – Nomenclatures, enzyme kinetics and its mechanism of action, mechanism of inhibition, isozymes and isoenzymes in clinical diagnosis.
4. Co-enzymes : Vitamins as co-enzymes and their significance, motifs as co-enzymes and their significance.
5. Carbohydrates metabolism : Conversion of polysaccharids to glucose – phosphate glycolysis and fermentatin and their regulation, glusoneogenesis and glycogenolysis, metabolism of galactose and galactosemia. Role of sugar nucleosides in biosynthesis and pentosephosphate pathway.
6. The citric acid cycle : significance, reaction and energetic of the cycle. Amphibolic role of the cycle and glyoxalic acid cycle.
7. Lipids nmetabolism : oxidation of fatty acids, beta oxidation & energetics alpha oxidation. W-oxidation, Biosynthesis of ketones bodies and their utilisation, biosynthesis of satureate and unsatured fatty acids, control of liquids metabolism. Essential fatty acids & eicosanoids (prostaglandens, thromboxens) phosspholipids and sphingolipids.
8. Biological oxidation Redox-potetial, enzymes and co-enzymes involved in oxidation reduction its control. The respiratory chain, its role in energy capture and its control, energetics of oxidative phosphorylation, inhibitors of respiratory chain and oxidative phosphorylation and mechanism of oxidative phosphorylation.
9. Nitrogen ***** cycle : Nitrogefixation, Ammonia assimilation nitrification and nitrate assimilation, sulphare activation, sulphate reduction. Incorporation of sulphur in organic compounds, Release of sulphur from organic compounds.
10. Metabolism of ammonia and Nitrogen containing Monomers : Nitrogen balance. Biosynthesis of amino acids, catabolism of amino acids, conversion of amino acids to specialized products. Assimilation of ammonia, Urea cycle, metabolic disorders of urea cycle, metabolism of sulphure containing amino acids, porphyrin biosynthesis, formation of biosynthesis and formation of deoxynonucreoudes.

Part – II Pathophysiology

1. Basic principles of cell injury and adaptation: causes of cellular injury, pathogenesis morphology of cell injury, intracellular alteration in liquids, proteins and carbohydrates, cellular adaptation, atrophy, hypertrophy.
2. Basic mechanism involved in the process of inflammation and repair; Alternations in vascular permeability and blood flow, migration of WBCs, acute and chronic inflammation mediators of inflammation, brief outline of the process or repair.
3. Pathophysiology of common disease: like Rheumatoid arthritis, gout, epilepsy, psychosis depression, mania hypertension, angina, congestive heart failure

(CCF), arthrosclerosis myocardial infraction, diabetes,. peptic ulcer, asthma, ulcerative colitis, hepatic disorders acute and chronic renal failure, tuberculosis, urinary tract infections. sexually transmitted diseases (STD), anemia's and common types of neoplasm, wherever applicable the molecular basic should be discussed.

3 hrs / week

PRACTICALS:

1. To prepare standard [citrate, phosphate and carbonate] and measure pH.
2. Titration curve for amino acids
3. Separation of amino acids by two dimensional paper chromatography and gel electrophoresis
4. The separation of lipids by TLC
5. Separation of serum proteins by electrophoresis on cellulose acetate
6. Quantitative estimation of amino acids
7. Quantitative estimation of proteins
8. The identification or c***** amino acids of a protein
9. The determination of glucose by means of the enzyme glucose oxides.
10. The isolation and assay of glycogen from the linear and skeletal muscle of rates
11. Enzymatic hydrolysis of glucogen from the linear and skeletal muscle of rates
12. The isolation and determination of RNA and DNA
13. Effect of temperature on the activity of alpha – arnylase
14. Estimation of SGOT, SGPT, ALP and BRN in the serum.
15. Simple experiments involved in the analysis of normal and abnormal urine : collection of specimen, appearance, determination of pH, proteins, urea and creatinine.

BOOKS RECOMMENDED:

1. Harper's review of biochemistry by Martin
2. Outline of biochemistry by Conn and Stump
3. Biochemistry by Lchninger
4. Textbook of biochemistry by Haroon and Mazur
5. Textbook of biochemistry by Rama Rao
6. Textbook of biochemistry by Varunkumar Malhotra

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206 HOSPITAL PHARMACY:

2 hrs / week

THEORY:

1. Hospital pharmacy : objective and function, organization, planning and administration of modern hospital pharmacy services, layout, personnel qualification, requirements, abilities and evaluation of hospital pharmacist, workload, and remuneration of hospital pharmacist.
2. Hospital drug policy : general consideration Pharmacy and therapeutic committee – purpose, organization and functions.
Hospital formulary – Organisation, formulary content, preparation and distribution.
Pharmacy procedure manual preparation and publication.
Hospital committee – infection control committee, antibiotic policy committee and research and ethics committee.
Role ***** and practice of rational drug therapy drug exchange programs.
3. Hospital manufacturing: economical consideration and estimation of demand, layout, raw material, production planning, requirements, manpower, requirements and quality assurance, manufacturing of (including re-packing and pre-packing) sterile products small and large volume paraenteral), non-sterile products, total parenteral nutrition and intravenous additives.
4. Drug distribution: outpatient and inpatient services, unit dose drug distribution systems, floor ward stock systems, satellite pharmacy services, central sterile services and bedside pharmacy.
5. Radio pharmaceutical: radioisotope committee, role of hospital pharmacist in isotope and non isotope pharmacy.
6. Controlled drugs dispensing : Procedures for dispensing and maintenance of records and disposal of expiry drugs.
7. Sterilization techniques, procedure, application of sterilization of surgical dressing used in OT and other equipment used in hospital (Cotton bandage, adhesive tapes, IV sets, BG set ryles tubes, catheters and syringes.)
8. Surgical products: primary wound dressing, absorbents, surgical cotton, surgical gauzes, bandage, adhesive tape, protective cellulose, haemostatic, official dressings, absorbable and non-absorbable sutures, ligatures and catgut's medical prosthetic and organ replacement materials.
9. Application of computers in hospital pharmacy.

BOOKS RECOMMENDED:

- 1 Hospital pharmacy E. Hassan – Harry Kimpron Publishers.
- 2 Hospital organization & Management by Kurt Dan & Johathan – CBS Publishers
- 3 Remin***** pharmaceutical Science
- 4 Hospital pharmacy by Goyal & Parikh
- 5 Hospital pharmacy management by Robert Willam
- 6 Martindal's extra phma*****.

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207 PHARMACEUTICAL JURISPRUDENCE & ETHICS

2 hrs / week

THEORY :

- 1 Introduction
 - A Pharmaceutical legislation – a brief review
 - B Drugs and pharmaceutical industry – a brief review
 - C Pharmaceutical education – a brief reviews

- 2 An elaborate (practical oriented) study of the following
 - A Pharmaceutical ethics
 - B Pharmacy act 1948
 - C Drugs and cosmetics act 1940 and rules 1945
 - D Medicinal and toilet preparation (excise duties) act 1955
 - E Narcotic drugs and pdychotropic substances act 1985 and rules
 - F Drugs price control order

- 3 A brief study of the following with special reference to the main provisions
 - A Poisons act 1919
 - B Drugs and magic remedies (objectionable advertisements) act 1954
 - C Medical termination of pregnancy act 1970 and rules 1975
 - D Prevention of cruelty to animals act 1960
 - E State shops and establishments act and rules
 - F Finsec---- act 1968
 - G AICTE act 1987
 - H Factories act 1948
 - I Minimum wages act 1948
 - J -----
 - K Trade and merchandise act
 - L Industrial regulation act (pollution)

- 4 A brief study of the various prescription/ non prescription products, medical / surgical accessories, diagnostic aids, appliances available in the market.

BOOKS RECOMMENDED:

- 1 A textbook of forensic pharmacy by B. M. Mithal 8th edition.
- 2 A textbooks of forensic pharmacy by N. K. Jain, Vallabh Prakashan
- 3 The patents act 1970 with patents rules 1972.
- 4 The narcotic drugs and psychorropic substances act, 1985 with the prevention of illicit traffic in narcotic drugs and psychotropic substance act 1988 alongwith a**** rules and orders 1993
- 5 The medical termination of pregnancy act 1971 along with the medial termination of pregnancy rules 1975

- 6 Insecticides act 1963 together with insecticides rules 1971 and insecticides (price, stock, display and submission of reports) order 1986 alongwith with medical termination of pregnancy rules 1975.
- 7 The drugs (price control) order 1987 – alongwith new drug policy 1994 and drugs (price control) order 1995.
- 8 The opium act 1857 with opium act 1987 and opium and revenue laws act 1950
- 9 The standards of weights and measures act 1976
- 10 The pharmacy act 1998
- 11 The prevention of illicit traffic in narcotic drugs and psychotropic substances act 1988
- 12 The poison act 1999
- 13 The minimum wages act 1948
- 14 The drugs and cosmetics act 1940
- 15 The medicinal and toilet preparation act 1955
- 16 The factories act 1948
- 17 Prevention of cruelty to animals act 1960
- 18 Drugs and cosmetics act 1940 by Vijay Malik 7th edition
- 19 Pharmaceutical jurisprudence by N. K. Jain (Vallabh Prakashan)