

Third Year B.Pharm

301. Pharmaceutical Microbiology & Biotechnology (Theory)

302 Biological Pharmacy And Fermentation Technology [Theory]

303 Medicinal Chemistry - I (Theory)

304 Pharmaceutical Analysis -II (Instrumental Analysis And Quality Assurance) [Theory]

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301. Pharmaceutical Microbiology & Biotechnology (Theory)

Part 1: Pharmaceutical Microbiology

1. Introduction, scope, contributions of great scientists to microbiology. [2]
2. Structure of bacterial cell. [2]
3. Classification of microbes and their taxonomy, actinomycetes, bacteria, [5]
rickettsia, spirochetes, fungi and viruses.
4. Microscopy: Different types of microscopes, micrometry. [2]
5. Identification of Microbes: Morphological, Stains and types of staining [4]
techniques and biochemical methods for S.typhi, E.coli, amylase activity, production of gas, indole production, lactose fermentation.
6. Nutrition, cultivation, isolation & count of bacteria, fungi, viruses. [4]
7. Control of Microbes [22]
 1. Sterilization : Significance and scope, classification, D-value, F- value, Z-value, methods for sterilization, Pharmacopoeial standards, Sterilization indicators- biological and chemical.
 2. Disinfectants: Classification, mode of action, uses of various disinfectants, evaluation of disinfectants, effectiveness of antimicrobial preservatives.
8. Sterility testing of pharmaceutical products as per IP. [4]
9. Microbial assay of Antibiotics Vitamins & Aminoacids as per IP [3]
10. Pharmacopoeial microbial limit tests as per IP [2]

Part II Pharmaceutical Biotechnology (theory)

1. Genetic Recombination: [12]
Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope IntornA, Monoclata, ORTAHOCLONE OKT3, Referon-A, Recombivax HB etc.
Introduction to Genetics Structure of DNA & RNA, Synthesis of DNA, Genes mutation. Introduction of Recombination technology.
2. Microbial transformation: [2]
Introduction, types of reactions mediated by micro-organisms, design of biotransformation processes and its improvements.

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3. Enzyme immobilization: [6]
Introduction, methods and applications of immobilized enzymes
Techniques of immobilization of enzymes,
Immobilisation of bacteria and plant cells.
 4. Study of diagnostic aids produced by biotechnology. [2]
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Pharmaceutical Microbiology & Biotechnology (Practicals)

1. Experiments devised to prepare various types of culture media. Subculturing of common aerobic and anaerobic bacteria, fungus and yeast, various methods of isolation and identification of microbes, sterilisation techniques and validation of sterilizing techniques, evaluation of antiseptics and disinfectants, testing the sterility of pharmaceutical products as per I.P. requirements, microbial assay of antibiotics and vitamins etc..

Books Recommended :

1. Text book of Microbiology by Pelczar
 2. Microbiology by Lippincot
 3. Microbiology by Prescott
 4. Pharmaceutical Biotechnology by V.K.Dixit & S.P.Vyas
 5. Biochemical Engineering by Bailey & Ollis
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302 Biological Pharmacy And Fermentation Technology [Theory]

1. **Blood products and plasma substitutes: [6]**

Collection, processing labeling and storage of whole human blood, concentrated human RBC, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin foam, plasma substitutes-ideal requirements, PVP, dextran etc., control of blood products as per I.Pand B.P.

2. **Surgical Products: [7]**

Defination, primary wound dressing, absorbent surgical cotton, surgical gauzes, bandages, adhesive tape, protective cellulosic hemostastics, official dressing, absorbable and nonabsorbable sutures, catgut. Standardization of surgical products, Packaging and labeling of surgical products in general. Medical prosthetics and organ replacement materials.

3. **Immunology and Immunological Preparations [16]**

Principles, antigens and haptens, immune system, cellular, humoral immunity, immunological tolerance, antigen-antibody reactions and their applications. Hypersensitivity, Active and passive immunization, vaccines their preparation, standardisation and storage. Antibodies, Nonspecific defence mechanisms of body, Vaccines- diphtheria, tetanus toxoid, cholera, pertussis, plaque, BCG, rabies, polio, measles, typhoid, new generation vaccines-hepatitis, AIDS, malaria, diagnostic preparations

4. **Fermentation: [16]**

Screening of soil for organisms producing antibiotics, general screening methods, isolation and preservation of pure cultures. Mutants, factors influencing rate of mutation. Fermenter, its design, control of different parameters, design of fermentation process. media, sterilization (fermenter, media, air, etc.), Isolation of fermentation products. Detailed production of

1. selected antibiotics: penicillins, streptomycins, tetracyclines
2. vitamin B 12, Riboflavin
3. others: citric acid, alcohol

5. **Allergenic Extracts: [3]**

Types of allergy, allergens, diagnosis of allergy, sensitivity testing, treatment of allergy, preparation, testing and standardisation of allergenic extracts.

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Biological Pharmacy And Fermentation Technology [Practicals]

1. Collection processing, storage and fractionation of blood.
2. Experiments to illustrate preparation, physical and biological evaluation of surgical dressings.
3. Exercises involving simple fermentation processes.

Books Recommended:

1. Remington's Pharmaceutical Sciences
 2. Cooper & Gunn's Tutorial Pharmacy
 3. I.P., B. P., USP.
 4. Principles of Fermentation Technology by Whittaker & Hall
 5. Industrial Microbiology by Prescott & Dunn
 6. Biopharmaceuticals: Biochemistry & Biotechnology by G. Walsh
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303 Medicinal Chemistry - I (Theory)

1. **Basic principles of Medicinal chemistry: [9]**

Physico-chemical aspects (Optical, geometric and bioisomerism of drug molecules and biological action, Drug-receptor interaction including transduction mechanism and G-proteins. Principles of drug design (Theoretical Aspects): Traditional analog (QSAR) and mechanism based approaches (Introduction to graph theory, applications of quantum mechanics), Computer Aided Drug Designing (CADD) and molecular modelling.

2. **Synthetic procedures of selected drugs:**, mode of action, uses Structure Activity Relationship (SAR) including physicochemical properties of the following class of drugs should be covered. Bio-chemical approaches in drug designing wherever applicable should be discussed.

1. **Drugs acting at synaptic and neuro-effector junction sites: [9]**

1. Cholinergic and Anticholinesterases.
2. Adrenergic drugs.
3. Antispasmodic and antiulcer drugs.
4. Neuromuscular blocking agents.

SAR of sympathomimetic amines, Acetylcholine analogs and antimuscarinics. Synthesis of Adrenaline, Noradrenaline, Isoprenaline, Salbutamol, Amphetamine, Naphajoline, Phenylephrine, Methacholine chloride, Neostigmine bromide, Pyridostigmine, Cyclopentolate, Dicyclomine and Succinyl choline chloride.

2. **Autocoids: [6]**

1. Antihistamines
2. Eicosanoids SAR of Antihistamines.
Synthesis of Mepyramine , Diphenhydramine, Chlorpheniramine, Promethazine, Chlorocyclizine Omeprazole, Phenindamine, tripriding, meclizine, cimetidine, Astemizole, pheniramine, Ranitidine, cyproheptadine..

3. **Drugs affecting uterine motility. [2]**

Oxytocin (including oxytocin, ergot alkaloids, and prostaglandins)

4. **Chemotherapeutic agents [20]**

1. Antibacterials:- Antibiotics, Antimicrobials, Sulphonamides, Quinolones antibacterials, Antimetabolites.
2. Antivirals:- Anti AIDS, Antioncogenic virals

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3. Antirickettsials and Antimycoplasmals
4. Antiprotozoles:- Antimalarials, Antiamoebics, Other antiprotozoles
5. Antifungals:- Antibiotics, Synthetics
6. Antimetazoals (Anthelmentics)
7. Antiseptics and Disinfectants
8. Antineoplastics SAR of Penicillines , Tetracyclines and Sulphonamides. Synthesis of Chloroquine, Pyrimethamine, Sulphadiazine, Sulphamethoxazole, Sulphacetamide, Trimethoprim, Cycloserine, Chloramphenicol, Nitrofurantoin, Isoniazide, Ethambutol, Depsone Clofazimine, Ampicillin, saibactan, 6-aminopenicillanic acid.
5. **Immunosuppressive agents [2]**
6. **Diagnostic agents [2]**

Medicinal Chemistry -I (Practical)

1. Exercises based on QSAR: Hansch and Free Wilson methods
2. Establishing the pharmacopoeial standards of the drugs synthesised.
3. Determination of partition co-efficient, Dissociation constant and Molar refractivity of compounds for QSAR analysis.
4. Workshop on stereo models use of some selected drugs.
5. Synthesis of selected drugs from the course content involving two or more steps and their spectral analysis.
6. Establishing the pharmacopoeial standards of the drugs synthesised.

Books Recommended:

1. Medicinal Chemistry by Burger
 2. Text book of Organic Medicinal and Pharm. Chem. by Wilson & Gisvold
 3. Principles of Medicinal Chemistry by Foye, Williams and Lemke
 4. A Hand book of Organic Analysis by Clarke
 5. A Text book of Practical Organic Chemistry by Vogel
 6. Quantitative Organic Analysis by Cheronis
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304 Pharmaceutical Analysis -II (Instrumental Analysis And Quality Assurance) [Theory]

A. Quality Assurance:- [11]

1. GLP, ISO 9000, TQM, Quality Review and Quality Documentation.
2. Regulatory control, Regulatory drug analysis, Interpretation of Analytical data
3. Validation, Quality audit, Quality of Equipment, Validation of equipment, Validation of analytical procedure.

B. The theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be discussed

1. Ultraviolet and visible spectrophotometry. [15]
2. Fluorimetry. [4]
3. Infrared spectrophotometry. [8]
4. Nuclear magnetic resonance spectroscopy including C-13 NMR [10]
5. Mass Spectrometry [9]
6. Flame Photometry. [3]
7. Emission Spectroscopy. [3]
8. Atomic Absorption Spectroscopy. [3]
9. X-ray Diffraction. [6]
10. Radioimmunoassay. [3]

Pharmaceutical Analysis-II [Practicals]

1. Using official procedure involving instrumental techniques, carry out the quantitative estimation of atleast ten formulation containing single drug or more than one drug.
2. Using flame photometry, carry out the estimation of Na⁺, K⁺, Ca⁺⁺ ions.
3. Carry out the IR of sample having different functional groups [-COOH, -CONHR, Primary, Secondary, Tertiary amine and alcohol, etc].
4. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR, and MS.

Books Recommended:

1. A Text book of Pharma. Analysis by Connors
2. Practical Pharma. Chemistry Part I & II by Buckett and Stenlake
3. Instrumental Methods of Analysis by Willard
4. Instrumental Methods of Chemical Analysis by Ewing

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5. Instrumental Methods of Analysis by Chatwal and Anand
 6. The Quantitative Analysis of Drug by D.C.Garatt
 7. Organic Chemistry by Morison and Boyd
 8. Spectroscopy of Organic Compounds by P.S.Kalsi
 9. Spectrometric Identification of Organic Compounds by Silverstein
 10. Application of Absorption Spectroscopy of Org. Compd. by J.R.Dyer
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305 Pharmacology And Chemotherapy (Theory)

1. **General pharmacology [18]**
 - a. Introduction to pharmacology, sources of drugs, dosage forms and 9 routes of administration. Mechanism of action, combine effect of drugs, factors modifying drug action, tolerance and dependence, Pharmacogenetics, drug receptors, dose response relationship.
 - b. Absorption, Distribution, Metabolism and excretion of drugs. Principles of 9 Basic and Clinical Pharmacokinetics. Adverse Drug Reactions and treatment of Poisoning, ADME drug interactions
 2. **Pharmacology of peripheral Nervous system: [18]**
 - a. Neurohumoral transmission (autonomic and somatic) 3
 - b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, 11 adrenergic receptor and neuron blocking agents, ganglionic stimulants and blocking agents.
 - c. Neuromuscular blocking agents. 2
 - d. Local anesthetic agents. 2
 3. **Autocoids: [8]**
 - a. Histamine, 5-HT and their antagonists. 4
 - b. Prostaglandins, thromboxane and leukotrienes. 2
 - c. Pentagastrin, cholecystokinin, Angiotensin, Bradykinin and substance P. 2
 4. **Chemotherapy [28]**
 - a. General principles of chemotherapy. 2
 - b. Sulphonamides, co-trimoxazole, Quinolones, nitrofurans. 4
 - c. Antibiotics:- Betalactams, Macrolides 8
Tetracyclines, Aminoglycosides, Chloramphenicol, and Miscellaneous Antibiotics.
 - d. Chemotherapy of tuberculosis, leprosy, fungal Diseases, viral diseases, 7 urinary tract infections and sexually Transmitted Diseases [STD].
 - e. Chemotherapy of malignancy and Immunosuppressive Agents. 3
 - f. Chemotherapy of the parasitic diseases:- Helmenthiasis, malaria, 4 amoebiasis and other Protozoal infections
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Pharmacology And Chemotherapy (Practical)

1. **Introduction to experimental pharmacology :**
 1. Preparation of different solutions for experiments.
 2. Drug dilution, use of molar and w/v solutions in experimental pharmacology.
 3. Common laboratory animals and anesthetics used in animal studies.
 4. Commonly used instruments in experimental pharmacology.
 5. Some common and standard techniques. Bleeding and intravenous injection intragastric administration procedures for rendering animals unconscious, stunning of rodents, pithing of frogs, chemical anaesthesia.
2. **Experiments on various preparations of Animal tissues or using computer softwares:**
 1. Study of different routes of administration of drugs in mice/rats.
 2. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice.
 3. Evaluation of Local anaesthetics.
3. **To study the effect of autonomic drugs on rabbits eye or using computer software:**
4. **To study the effects of various agonists and antagonists and their characterization using isolated preparation like frog's rectus abdominus muscle and isolated ileum preparations of Rat Guineapig and Rabbit. (Demonstration or Computer simulation)**
5. **Experiments on Isolated preparations (Computer Software may be used as substitute):**
 - a. To record the Concentration Response Curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.
 - b. To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using frog rectus abdominus muscle preparation of frog.
 - c. To record the CRC of 5-HT on rat fundus strip preparation.
 - d. To record the CRC of Histamine on guinepig ileum.
 - e. To record the CRC of noradrenaline on rat anococcygeus muscle .
 - f. To record the CRC of oxytocin using rat uterus.

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6. Pharmacology of Cardiovascular System (Computer Software may be used as substitute):

- . To study the inotropic and Chronotropic effects of drugs on isolated & Perfused Frog Heart.
- a. To Study the effects of drugs on Normal & Hypodynamic Frog Heart.

Books Recommended:

1. Pharmacological basis of therapeutics by Goodman & Gillman
 2. Medical pharmacology by Goth
 3. Pharmacology by Gaddum
 4. Pharmacology and pharmacotherapeutics by Satoshkar & Bhandarkar
 5. Essentials of Pharmacotherapeutics by F.S.K. Barar
 6. Lewis Pharmacology by Crossland
 7. Textbook of pharmacology by Bowman & Rand
 8. Essentials of medical pharmacology by K.D. Tripathi
 9. Pharmacology by Rang & Dale
 10. Elements of Pharmacology by Dr. Derasari & Dr. Gandhi
 11. Drug interactions by Hansten
 12. Introduction to general toxicology by Aries Simonsis & Offermeier
 13. Toxicology: The basic science of poisons by Casorett & Doull
 14. Clinical pharmacology by Lawrence
 15. Principles of drug action by Goldstein Aronow & Kalaman
 16. Drug Treatment by Aveyrey
 17. Fundamentals of experimental pharmacology by M.N. Ghosh
 18. Handbook of experimental pharmacology by S.K. Kulkarni
 19. Pharmacological experiments on isolated preparations by Perry
 20. Practicals in pharmacology by Dr. Goyal
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306 Pharmacognosy - II (Theory)

1. Study of the biological sources, cultivation, collection, commercial varieties, [22] chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups containing glycosides.
 - a. Saponins: Glycyrrhiza, Ginenseng, Dioscorea, Sarsaparilla and Senega. 6
 - b. Cardioactive sterols : Digitalis, Squill, Strophanthus and Thevitia. 6
 - c. Anthraquinone cathartics: Aloe, Senna, Rhubarb and Cascara. 6
 - d. Psoralea, Ammi, Gentian, Saffron, Chirata, Quassia. 4
2. Study of the biological sources, cultivation, collection, commercial varieties, [25] chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups containing alkaloids.
 - a. Pyridine - Piperidine : Tobacco, Areca and Lobelia. 3
 - b. Tropane : Belladonna, Hyoscyamus, Datura, Dubosia, Coca and 4 Withania.
 - c. Quinoline and isoquinoline : Cinchona, Ipecac, Opium. 5
 - d. Indole : Ergot, Rauwolfia, Chatharanthus , Nux-vomica and 6 Physiostigma.
 - e. Imidazole : Pilocarpus 1
 - f. Steroidal: veratrum and kurchi 1
 - g. Alkaloidal amine : Ephedra and Colchicum 2
 - h. Glycoalkaloid : Solanum should be taught from Trease and Evans 1 latest edition.
 - i. Purines : Coffee, Tea and Coca. 2
3. Studies of traditional drugs : [18]
Common vernacular names, Botanical sources, morphology, chemical nature of chief constituents, pharmacological categories and common uses of following indigenous drugs :
Amla, Kantkari, Malkangani, Satavari, Tylophora, Bhilawa, Kalijiri, Kaner, Gaduchi, Brahmi, Adusa, Arjuna, Ashoka, Methi, Lasun, Palash, Majith, Guggul, Godh Kalimusli, Taila, Rasna, Punarnva, Chitrak, Apamarg, Gokhru, Shankhpushpi, Bahera, Chirata, Tulsi, Vidang, Cassia tora and Churnas, Leaps, Lehyas and herbo-mineral preparations.

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4. Biological sources, preparation, identification tests and uses of the [2] following enzymes. Diastase, Papain , Pepsin, Trypsin, Pancreatin
 5. General techniques of biosynthesis studies and basic metabolic [6] pathways. An introduction to biogenesis of secondary metabolites of pharmaceutical importance.
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306 Pharmacognosy - II (Practical)

1. Identification of crude drugs listed in theory by morphological characters.
2. Microscopical studies of some selected drugs mentioned in theory :- Datura, Vasaka, Hyoscyamus, Belladonna, Withania, Cinchona, Ephedra, Ipecac, Rauwolfia, Nuxvomica, Vinca, Digitalis, Glycyrrhiza, Senna.
3. Microscopical studies of selected powdered drugs of single or mixture of two to three components :- Datura, Vasaka, Hyoscyamus, Belladonna, Cinchona, Ipecac, Rauwolfia, Nuxvomica, Digitalis, Glycyrrhiza, Senna, Rhubarb.
4. Identification of traditional drugs mentioned in theory by morphological and microscopical characters (where necessary).
5. Identification of unorganized drugs mentioned in theory by morphological characters and chemical tests.

Books Recommended:

1. Pharmacognosy by G.E.Trease and W.C.Evans
2. Text book of Pharmacognosy by T.E.Wallis
3. Pharmacognosy by V.E.Tylor,L.R.Brady and J.E.Robbers
4. Text book of Pharmacognosy by Dr.C.S.Shah and Prof. J.S.Qadry
5. Pharmacognosy by S.S.Handa and V.K.Kapoor
6. Pharmacognosy by Prof.C.K.Kokate,Prof.A.P.Purohit & S.B.Gokhale
7. Text book of Pharmacognosy by Dr. Mohammed Ali
8. The Wealth of India (Raw Material & Industrial Product)
9. Compendium of Indian Medicinal Plant Vol. I,II,III & IV
10. Cultivation and Utilization of Aromatic Plants by Atal & Kapoor
11. Cultivation and Utilization of Medicinal Plants by Atal & Kapoor
12. Text book of Pharmacognosy by Steiniger and Hansel
13. Text book of Pharmacognosy by Ramsted

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14. Powdered Vegetable Drugs by B.P.Jeckson & D.W.Snewden
 15. Biosynthetic products for cancer chemotherapy by George pattit
vol I,II,III, Plenum press Newyork
 16. Natural products as Medicinal agents Ed. J.L.Beal, and
Reinhard Hippocrates Verleg
 17. Medicinal plant glycosides- Sim. Toronto.
 18. Medicinal plant Alkaloids- Sim. Toronto.
 19. Ayurvedic pharmacopeia.
 20. Practical Pharmacognosy by Iyenger
 21. Practical Pharmacognosy by C.K.Kokate
 22. I.P., B.P., U.S.P.
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307. Pharmaceutical Industrial Management (Theory)

1. Basic Principles of Management: [10]
Introduction of Management, Evolution of Management Theories, Introduction of basic Management functions (Planning, Organization, Leading and Controlling), Planning: Decision Making, Strategic and Short Term Planning, Advantages of Planning, Organizing: Organizational Departments, Organizational Design and Organizational Structure, Leading: Leadership styles and various leadership models, Communication, Controlling: Methods of Effective control concept of Quality Management, Basics of Inventory Management.
2. Organisational Behaviour: [4]
Motivation-Maslow's theory, Herzberg's theory, Three Need Theory, Group Behavior
3. Pharmaceutical Marketing: [12]
Introduction to Pharmaceutical Marketing, Organization of Marketing department, Market Research, Market information system, Market Segmentation, Pricing Policies, Channels of Distributions, Advertising, Sales Promotion (With Specific Reference to Pharmaceutical Industries), Study of Marketing Strategies of Major Player in Indian Pharmaceutical Industry.
4. Salesmanship: [6]
Sales Force Management: Recruiting and Selecting Sales Personnel, Motivating and Compensating Sales Personal, the sales budget, Quotas, Sales Territories, Sales control and Cost Analysis, The Effective sales executive.
5. Accountancy for Pharmacist: [9]
Principles of Accountancy: ledger posting and book entries, preparation of trial Balance, columns of cash book, Bank reconciliation statement, rectification of Errors, profits and loss account, balance sheet, purchase keeping and pricing of Stocks, treatment of cheques, bills of exchange, promissory notes and hundies, documentary bills. (Preliminary idea)
6. Economics and Foreign Trade: [5]
Principles of economics with special reference to the laws of demand and Supply, demand schedule demand curves, WTO, Briefing about new EXIM policy of Government of India with special reference to Pharmaceutical Industry, Export-Import Procedure.
7. Industrial sociology: [2]

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8. Meaning types role of industry in national development. Problems of Librelisation and Globalisation w.r.t pharmaceutical industry. History of labour movement in India problems of trade unions in India (collective bargaining industrial disputes, causes and remedies), labour welfare.

Books Recommended :

1. Principles of Accountancy - S.P.Gupta
 2. Principles of Accountancy - M.C.Shukla
 3. Marketing Management – Rajan Saxena
 4. Marketing Management - Kotler
 5. Principles & Practice of Management - L.M.Prasad
 6. Principals of Management - Stoner
 7. Current Documents Related to EXIM Policy, WTO etc.
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