Scheme of Evaluation (Choice Based Credit System)
Bachelor of Pharmacy (B. Pharm.)

SEVENTH SEMESTER

S. No.	Subject Code	Subject Name	L--T--P	T/P Marks (ESE)	Sessional	Total	Credit
Theory							
1.	*RPH-733/* *RPH-741*	Pharmaceutical Chemistry-VIII (Medicinal Chemistry-III)/ Pharmaceutics-XI Pharmaceutical Marketing & Management	3---0---0	70	30	100	3
2.	*RPH-734/* *RPH-740*	Pharmaceutics-IX (Biopharmaceutics & Pharmacokinetics)/ Pharmaceutics-X Pharmaceutical Biotechnology	3---0---0	70	30	100	3
3.	*RPH-735*	Pharmacology-III (Pharmacology & Pharmacovigilance)	3---0---0	70	30	100	3
4.	*RPH-736*	Pharmacognosy-IV	3---0---0	70	30	100	3
5.	*RPH-737*	Pharmaceutical Analysis-III (Pharmaceutical Analysis & Quality Assurance)	3---0---0	70	30	100	3
Practical/ Project							
6.	*RPH-734P/* *RPH-740P*	Pharmaceutics-IX (Biopharmaceutics & Pharmacokinetics) Practical/ Pharmaceutics-X (Pharmaceutical Biotechnology) Practical	0---0---4	50	50	100	2
7.	*RPH-735P*	Pharmacology-III (Pharmacology & Pharmacovigilance) Practical	0---0---4	50	50	100	2
8.	*RPH-736P*	Pharmacognosy-IV Practical	0---0---4	50	50	100	2
9.	*RPH-737P*	Pharmaceutical Analysis-III (Pharmaceutical Analysis & Quality Assurance) Practical	0---0---4	50	50	100	2
10.	*RPH-738P*	Hospital Training-II		50	50	100	1
TOTAL						**1000**	**24**

EIGHTH SEMESTER

S. No.	Subject Code	Subject Name	L--T--P	T/P Marks (ESE)	Sessional	Total	Credit
Theory							
1.	*RPH-839*	Pharmaceutical Chemistry-IX (Chemistry of Natural Products)	3---0---0	70	30	100	3
2.	*RPH-840/* *RPH-834*	Pharmaceutics-X Pharmaceutical Biotechnology/ Pharmaceutics-IX (Biopharmaceutics & Pharmacokinetics)	3---0---0	70	30	100	3
3.	*RPH-841/* *RPH-833*	Pharmaceutics-XI Pharmaceutical Marketing & Management/ Pharmaceutical Chemistry-VIII (Medicinal Chemistry-III)	3---0---0	70	30	100	3
4.	*RPH-842*	Pharmaceutics-XII (Food & Nutraceuticals)	3---0---0	70	30	100	3
5.	*RPH-843* *(A)* *(B)* *(C)* *(D)* *(E)*	Elective (Computational Methods in Drug Design Good Manufacturing Practices Clinical Pharmacy Standardization of Herbal Drugs Research Methodology)	3---0---0	70	30	100	3
Practical/ Project							
6.	*RPH-839P*	Pharmaceutical Chemistry-IX (Chemistry of Natural Products) Practical	0---0---4	50	50	100	2
7.	*RPH-840P/* *RPH-834P*	Pharmaceutics-X Pharmaceutical Biotechnology Practical/ Pharmaceutics-IX (Biopharmaceutics & Pharmacokinetics) Practical	0---0---4	50	50	100	2
8.	*RPH-842P*	Pharmaceutics-XII (Food & Neutraceuticals) Practical	0---0---4	50	50	100	2
9.	*RPH-843P* *(A)* *(B)* *(C)* *(D)* *(E)*	Elective Computational Methods in Drug Design Project Good Manufacturing Practices Project Clinical Pharmacy Project Standardization of Herbal Drugs roject Research Methodology Project	0---0---4	50	50	100	2
10.	*RPH-844P*	Report on Industrial/ Research Laboratory Visit		50	50	100	2
TOTAL						**1000**	**24**

SEVENTH SEMESTER

RPH-733/RPH-833

PHARMACEUTICAL CHEMISTRY-VIII (MEDICINAL CHEMISTRY-III)

Classification, mode of action, uses, recent advances and structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only).

Unit I

Steroidal drugs: Introduction, classification, nomenclature, and stereochemistry of-

Androgens and anabolic steroids: Testosterone, Stanazolol. ***Estrogens and progestogens:*** Progesterone, Estradiol. ***Adrenocorticoids:*** Prednisolone, Dexamethasone.

Unit II

Chemotherapy of microbial infections:

Antibiotics: Penicillin, Semi-synthetic Penicillins (Ampicillin), Cephalosporins (Cefepime), Chloramphenicol, Tetracyclines (Doxycycline), Aminoglycosides, Macrolides.

Antifungals: Ketoconazole and Clotrimazole.

Antiseptics & disinfectants: Chlorhexidine.

Unit III

Chemotherapy of microbial infections:

Synthetic antibacterials: Sulphonamides (Sulphamethoxazole, Sulphadiazine, Sulphacetamide), Quinolones/Fluoroquinolones (Nalidixic acid, Ofloxacin).

Antimycobacterial agents: PAS, Ethambutol, Isoniazid, Dapsone.

Unit IV

Chemotherapy of parasitic infections:

Antimalarials: Chloroquine, Primaquine, Pyrimethamine.

Antiamoebics: Ornidazole, Diloxanide.

Anthelmintics: Albendazole.

Unit V

Cancer chemotherapy: Alkylating agents (Chlorambucil, Carmustine), Antimetabolites
(Methotrexate, 5-Fluorouracil), Anticancer antibiotics (Doxorubicin).

Antiviral/Anti-HIV agents: Amantadine, Acyclovir, Zidovudine, Saquinavir, Raltegravir.

BOOKS RECOMMENDED

1. Abraham D.J., Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.
2. Block J.H. and Beale J.M., Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins, Philadelphia.
3. Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., Foyes Principles of Medicinal Chemistry, Lippincott Williams and Wilkins, Philadelphia.
4. Vardanyan R.S. and Hruby V.J., Synthesis of Essential Drugs, Elsevier, Philadelphia.
5. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, New York.
7. Patrick G.L., An Introduction to Medicinal Chemistry, Oxford University Press, New York.
8. Hansch C., Comprehensive Medicinal Chemistry, Pergamon Press, U.K.
9. Dharuman J., Chemistry of Synthetic Drugs, AITBS Publishers, New Delhi.
10. Mann F.G. and Saunders B.C., Practical Organic Chemistry, Orient Longman Limited, New York.
11. Furniss B.S., Hannaford A.J., Smith P.W.G. and Tatchell A. R., Vogel's Textbook of Practical Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.), New Delhi.

RPH-734/RPH834

PHARMACEUTICS-IX (BIOPHARMACEUTICS & PHARMACOKINETICS)

Unit I

Introduction to biopharmaceutics and pharmacokinetics and their role in formulation development. Mechanism of absorption, physicochemical and pharmaceutical factors influencing absorption, drug distribution, volume of distribution and distribution coefficient. Plasma protein binding and its significance.

Unit II

Significance of plasma drug concentration measurement.

Compartment models and non-compartment models: Definition and scope.

Pharmacokinetics of drug absorption: Zero order and first order absorption rate constant. Determination of absorption rate constant using Wagner-Nelson and Loo-Reigelman method.

Unit III

Compartment kinetics: One compartment and preliminary information of multicompartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intra venous (I.V.) bolus and I.V. infusion.

Unit IV

Dosage adjustment in patients with renal and hepatic disease. Clinical Pharmacokinetics: Definition and scope.

Unit V

Brief introduction to bioavailability and bioequivalence: Definition and significance.

Measurement of bioavailability.

Introduction to i*n-vivo in-vitro* correlation (IVIVC) and its significance. Review of regulatory requirements for conduction of bioequivalence studies.

RPH-734P/RPH834P

PHARMACEUTICS-IX (BIOPHARMACEUTICS & PHARMACOKINETICS) PRACTICAL

Suggested Practicals

1. *In-vitro* drug release study of the any powder, uncoated tablet, capsule, film-coated tablet, sustained release tablet and fast release (M.D, Dispersible etc.) tablet using various dissolution media.
2. To determine the % protein binding of some drugs.
3. To determine the effect of protein binding on drug bioavailability.
4. To calculate various Pharmacokinetic parameters from zero order drug release data, first order drug release data, blood data of *I.V.* bolus injection (one compartment model) and urinary excretion data of *I.V.* bolus. Injection using both methods (Rate of elimination & sigma minus method one compartment model).
5. To study *in-vitro* drug- drug interactions.
6. To study the passive diffusion of a drug using cellophane membrane.
7. To study the passive diffusion of a drug using egg membrane.
8. To determine the various Pharmacokinetic parameters from the given blood data of oral administration of dosage form.
9. Determination of bioavailability by urinary method.
10. Determination of bioequivalence by dissolution method.

BOOKS RECOMMENDED

1. Notari, R.E, Biopharmaceutics and Pharmacokinetics-An introduction, Marcel Dekker Inc. New York.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, New York.
3. Wagner J.G. Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.
4. Wagner J.G. Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.G. Basel, Switzerland.
5. Gibaldi, M., Biopharmaceutics & Clinical Pharmacokinetics, Pharma Book Syndicate, Hyderabad.
6. Robert, Rodriguezdiaz, Analytical Techniques for Biopharmaceuticals Development.
7. Curry, S. H., Drug Disposition & Pharmacokinetics, Pharma Book Syndicate, Hyderabad.

RPH-735

PHARMACOLOGY-III (PHARMACOLOGY & PHARMACOVIGILANCE)

Unit I

Pharmacology of endocrine system: Hypothalamic and pituitary hormones, thyroid hormones and thyroid drugs. Parathormone, Calcitonin and Vitamin D, Insulin, oral hypoglycemic agents and Glucagon. Corticosteroids, androgens and anabolic steroids, Estrogens, Progesterone and oral contraceptives, drugs acting on the uterus.

Unit II

Chemotherapy: General principles of chemotherapy. Sulfonamides, Quinolones, Beta-lactam antibiotics, Chloramphenicol, Tetracyclines, Macrolides and Aminoglycosides.

Chemotherapy of parasitic infections: Tuberculosis, leprosy, malaria, fungal infections, viral diseases.

Unit III

Naturopathy: History, definitions, mechanism and its effect on various systems, hydrotherapy, mud therapy, chromotherapy, acupressure, aromatherapy and therapeutic massage.

Unit IV

Pharmacovigilance: Scope, definition and aims of pharmacovigilance and pharmacoepidemiology, therapeutic index- LD_{50} and ED_{50}, drug interactions.

Adverse drug reactions: Classification, mechanism, predisposing factors and causality assessment. Role of clinical pharmacist in reporting, evaluation, monitoring, prevention and management of ADR, drug induced diseases affecting different organ systems.

Fixed dose drug combinations (FDDCs): Rational and irrational combinations, FDDCs in Indian scenario.

Unit V

Epidemiological methods: ***Case control study:*** Selection of cases, selection of controls, matching, measurements of exposure, analysis, odds ratio, bias in case control study, advantages, disadvantages.

Cohort study: Concept, framework, combination of prospective and retrospective cohort study, relative risk, attributable risk, advantages, disadvantages.

RPH-735P

PHARMACOLOGY-III (PHARMACOLOGY & PHARMACOVIGILANCE) PRACTICAL

Suggested Practicals

1. To calculate the pA_2 value of Atropine and Chlorpheniramine.
2. Bioassay of Ach, Histamine and Oxytocin on suitable isolated preparations using matching assay, bracketing assay, interpolation, three point assay and four point assay.
3. Bioassay of histamine and acetylcholine using matching and interpolation method on rat and guinea pig.

The experiments should be conducted using software, wherever possible.

BOOKS RECOMMENDED:

1. Rang M.P., Dale MM, Riter JM, Pharmacology Churchill Livingstone, China.
2. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
3. Satoskar & Bhandarkar: Pharmacology & Pharmacotheropeutics, Popular Prakashan Pvt. Ltd., Bombay.
4. Ghosh M.N. Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
5. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall International, New Delhi.
6. Ronald D. Mann & Elizabeth B. Andrews, Pharmacovigilance, John Wiley & Sons, West Sussex, England.
7. Waller and Patrick, An Introduction to Pharmacovigilance, John Wiley & Sons, West Sussex, England.
8. Mohanta G.P., Elementary Pharmacovigilance, PharmaMed Press, Hyderabad.
9. Mohanta G.P., Manna P.K., Textbook of Pharmacovigilance: Concept and Practice, PharmaMed Press, Hyderabad.
10. Grover J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
11. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
12. Barar F.S.K : Text Book of Pharmacology, Interprint, New Delhi.
13. Goodman & Gilman, The Pharmacological basis of Therapeutics, Eds: Hardman J.G., Limbird Le, Molinoss P.B., Ruddon R.W. & Gil A.G., Pergamon Press, U.K.
14. Laurene, D.R. & Bennet P.N.; Clinical Pharmacology, Churchill Livingstone, Harlow, England.
15. Paul L., Principles of Pharmacology, Chapman and Hall, New York.
16. Ravi Shanker K., Kiranmayi G.V.N., Pharmacology: A Companion Handbook with Illustrations, PharmaMed Press, Hyderabad.

17. Singh S. J., History and Philosophy of Naturopathy, Nature Cure Council of Medical Research, Lucknow.
18. Bakhru H. K., Complete Handbook of Nature Cure, Jaico Publishing House, New Delhi.
19. Pizzorno J. E., Murray M. T., The Encyclopedia of Natural Medicine, Simon & Schuster, New York, USA.
20. Sheffield Bioscience Programs, U.K. ISBN. 1-8747558-02-6.

RPH-736

PHARMACOGNOSY-III

Unit I

Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes/adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs-

Pyridine-piperidine: Tobacco, Areca and Lobelia.

Tropane: Belladona, Hyoscyamus, Datura, Coca and Withania. **Quinoline and isoquinoline:** Cinchona, Ipecac and Opium. **Indole:** Ergot, Rauwolfia, Catharanthus and Nux-vomica.

Unit II

Imidazole: Pilocarpus.

Steroidal: Veratrum and Kurchi.

Alkaloidal amine: Ephedra and Colchicum.

Glycoalkaloid: Solanum. **Purines:** Coffee and Tea **Quinazoline:** Vasaka.

Unit III

Production and utilization of phytoconstituents: Calcium sennosides, Diosgenin, Solasodine, Podophyllotoxins, Tropane alkaloids, Isoquinoline alkaloids and Quinoline alkaloids.

Unit IV

Plant tissue culture: Historical development of plant tissue culture, type of culture, nutritional requirements, growth and maintenance, factors affecting plant tissue culture. Applications of plant tissue culture in pharmacy.

Unit V

Introduction to herbal fingerprinting using HPTLC technique. Introduction to herbal drug interactions.

Introduction to bioactive compounds enhancing bioavailability such as- Piperine, Vitamin K.

RPH736-P

PHAMACOGNOSY-IV PRACTICAL

Suggested Practicals

1. To study the morphology and microscopy of Datura and Withania.
2. To study the morphology and microscopy of Ipecac and Rauwolfia.
3. To study the morphology and microscopy of Catharanthus and Nux-vomica.
4. To study the morphology and microscopy of Ephedra and Kurchi.
5. To study the morphology and microscopy of Solanum and Vasaka.
6. a) Morphology of Areca, Colchicum.
   b) Transverse section of Catharanthus leaf and Kurchi bark.
7. To study the TLC profile of Catharanthus leaf.
8. To study the TLC profile of Withania root.
9. Chemical test of Tea, Tobacco, Datura and Withania.
10. Chemical test of Nux-vomica, Ephedra and Kurchi.
11. Preparation of different callus cultures using various parts of plants.
12. Study of micopropogation using callus culture.
13. Effect of various plant hormones on micropropogation.

BOOKS RECOMMENDED

1. Trease, G.E., and Evans, W.C., Pharmacognosy, Bailliere Tindall East Baorne, U.K.
2. Wallis. T.E. “Text Book of Pharmacognosy” J&A Churchill Ltd., London.
3. Kokate C.K., Gokhale A.S., Gokhale S.B., Cultivation of Medicinal Plants, Nirali Prakashan.
4. Tyler V.E., Lynnr B. and Robbers J.E., Pharmacognosy, 8th Edition, Lea & Febiger, Philadelphia.
5. Harborne J.B., Phytochemical Methods, Chapman & Hall International Edition, London.
6. Medicinal Plants of India, Vol. I & II, Indian Council of Medical Research, New Delhi.
7. Nadkarni A.K., Indian Materia Medica, Vol- 1&2, Popular Prakashan (P) Ltd., Bombay.
8. Sukh Dev, A Selection of Prime Ayurvedic Plant Drugs, Anamaya Publisher New Delhi.
9. Indian Herbal Pharmacopoeia, Vol. I & II, ICMR & RRL, Jammu.
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. The Wealth of India, Raw Materials (All volumes), Council of Scientific & Industrial Research, New Delhi.

12. Rastogi R. P. and Mehrotra B.N., Compendium of Indian Medicinal Plants I-IV, Publications & Information Directorate/Central Drug Research Institute, New Delhi.
13. Wallis T.E., Analytical Microscopy, J&A Churchill Ltd., London.
14. Kokate C.K., Practical Pharmacognosy, Vallabh Prakashan, New Delhi.
15. Iyengar M.A., Pharmacognosy of Powdered Crude Drugs, PharmaMed Press, Hyderabad.
16. Iyengar, M.A. and Nayak S.C.K., Anatomy of Powdered Crude Drugs, PharmaMed Press, Hyderabad.

RPH-737

PHARMACEUTICAL ANALYSIS-III
(PHARMACEUTICAL ANALYSIS & QUALITY ASSURANCE)

Unit I

Ultra violet and visible spectroscopy: Principle and origin of spectra, quantitative laws, chromophores and auxochromes, factors affecting absorption, instrumentation- single and double beam spectrophotometer, Woodward-Fieser rule, applications.

Infra-red spectroscopy: Principle, effect of hydrogen bonding and conjugation on absorption band, instrumentation, interpretation of IR spectra of simple compounds (Ethanol, Benzaldehyde). FTIR, applications of IR spectroscopy in pharmaceutical analysis.

Unit II

NMR spectroscopy: Principle of ^{1}H-NMR, chemical shift and factors affecting it, shielding and desheilding, spin-spin coupling and coupling constant, spin-spin splitting, instrumentation, NMR active compounds and study of ^{1}H-NMR spectra of- Ethanol, Benzaldehyde. Introduction to^{13}C-NMR.

Unit III

Mass spectrometry: Principle, fragmentation pattern in relation to molecular structure and functional groups including McLafferty rearrangement, ionization techniques (CI, FAB, ESI, MALDI), instrumentation, applications, mass spectra of some simple compounds (Ethanol, Benzaldehyde).

Unit IV

Miscellaneous techniques: Principle, instrumentation and applications of atomic absorption spectroscopy, fluorimetry and flame photometry.

Introduction to gel electrophoresis, scanning electron microscopy (SEM) and transmission electron microscopy (TEM).

Unit V

Quality Assurance: Basic concept of quality, difference between QC and QA, quality audit, types of quality audits, concept of TQM, ISO 9000 series. Elementary study of WHO guidelines. Different documents prepared by QA department (batch manufacturing record, master formula record, validation master plan). Basic concept of validation, types of validation, different validation parameters, protocols for process validation.

RPH-737P

PHARMACEUTICAL ANALYSIS-III
(PHARMACEUTICAL ANALYSIS & QUALITY ASSURANCE) PRACTICAL

1. Determination of λ_{max} of different compounds by UV-visible spectrophotometry.
2. Verification of Beer's law.
3. Determination of unknown concentration of some drugs by UV-visible spectrophotometry.
4. Simultaneous estimation of multi-component drugs by UV-visible spectrophotometry.
5. Determination of factors which affect λ_{max} by UV-visible spectrophotometry.
6. Interpretation of IR, Mass and NMR spectra.
7. Assay of official formulations containing single and more active ingredients using instrumental techniques.
8. Assay of pharmaceutical substances by flame spectrophotometry (NaCl, KCl oral sachet).
9. Separation of a protein mixture using gel electrophoresis.
10. Formation and maintenance of different documents/records formed by QA department.

BOOKS RECOMMENDED

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Becket A. H. and Stenlake J. B., Practical Pharmaceutical Chemistry Vol. I and II, The Athlone Press of the University of London.
3. Chatten L. G., A text book of Pharmaceutical Chemistry, Vol. I & II, Marcel Dekker, New York.
4. Willard H.H.,Merrit L.L., Dean J.A.,Settle P.A., Instrumental Methods of analysis, Van Nostrand Renhold, New York.
5. Obonson J.W.R., Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
6. Parikh V.H., Absorption Spectroscopy of Organic Molecules, Addison-Wesley Publishing Co., London.
7. Silverstein R.M.,and Webster F.X., Spectrometric Identification of Organic Compounds, John Wiley & Sons.
8. Skoog V., Principles of Instrumental Analysis, Holler-Neimen.
9. Kemp W., Organic spectroscopy, 3rd Edition, Palgrave, New York.
10. Kalsi P.S., Spectroscopy of Organic Compounds, New Age International Publishers, New Delhi.

11. Pavia D.L.,Lampman G.M., and Kriz G.S., Introduction to spectroscopy, 3rd Edition, Harcourt College Publishers, Philadelphia.
12. Florey K., Analytical Profile of Drug Substance (All volume), Academic Press, Elsevier.
13. WHO-Quality Assurance of Pharmaceuticals, Vol. I & II, AITBS Publisher & Distributors, Delhi.
14. Berry I.R. and Harpaz, D., Validation of API, 2ndEdition, CRC Press.

RPH-738P

HOSPITAL TRAINIGNG-II

Training of students at a hospital establishment for a minimum duration of 45 days. The hospital training shall include: First aid (wound dressing, artificial respiration etc.), different routes of injection, study of patient observation charts, prescriptions and dispensing, simple diagnostic reports etc.

May be performed at the end of the 6th semester.

EIGHTH SEMESTER

RPH-839

PHARMACEUTICAL CHEMISTYRY-IX (CHEMISTRY OF NATURAL PRODUCTS)

Unit I

General methods of isolation and separation of plant constituents, qualitative tests for the detection of plant constituents. Application of spectral techniques in the structure determination of natural products.

Biogenetic investigations and basic metabolic pathways (Alkaloids, Terpenes, Steroids). Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance (Atropine, Quinine, Papaverine, Morphine and Reserpine).

Unit II

Extraction, isolation and structure elucidation of **alkaloids:** Tropanes (Atropine);
Phenanthrenes
(Morphine); Quinolines (Quinine); Isoquinolines (Papaverine); Indoles (Reserpine).

Unit III

Extraction, isolation and structure elucidation of-

Glycosides: Digoxin. **Flavonoids:** Quercetin. **Lignans:** Podophyllotoxin. **Purines**: Caffeine.

Unit IV

Extraction, isolation and structure elucidation of- **Terpenoids**: Camphor, Menthol, Citral.

Carotenoids: β- Carotene.

Vitamins: α -Tocopherol.

Quassinoids: Quassin.

Unit V

Natural allergens, photosensitizing agents and fungal toxins. Role of natural products in drug discovery and development.

Recent developments of natural products used as anticancer agents, antidiabetics, antimalarials and immunomodulators.

RPH-839P

PHARMACEUTICAL CHEMISTYRY-IX
(CHEMISTRY OF NATURAL PRODUCTS) PRACTICAL

Suggested Practicals

1. Isolation of Caffeine from tea leaves.
2. Isolation of Piperine from black pepper.
3. Isolation of Hesperidin from orange peel.
4. Isolation of Clove oil from clove.
5. Isolation of Caraway oil from caraway.
6. Isolation of Cumin oil from cumin.
7. To study the TLC profile of extracted oils.
8. To perform the column chromatography of any available herb.
9. To study the paper chromatographic profile of glycone portion separated from senna.
10. To isolate the active constituent of any available drug with the help of preparative TLC.
11. Quantitative determination of Ascorbic Acid present in amla.

BOOKS RECOMMENDED

1. Brain K.R. and Turner T.D., The Practical Evaluation of Phytopharmaceutical, Wright, Bristol.
2. Kokate C.K., "Practical Pharmacognosy" Vallabh Prakashan, New Delhi.
3. Stahl E., Thin Layer Chromatography: A Laboratory Hand Book, Springer International Edition, New York.
4. Harborne J.B., Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis, Springer (India) Pvt. Ltd., New Delhi.
5. Dewick P.M., Medicinal Natural Products: A Biosynthetic Approach, John Wiley and Sons Ltd., England.
6. Wagner H., Plant Drug Analysis, Springer, Berlin.
7. Cutler S.J. and Cutler H.G., Biologically Active Natural Products: Pharmaceuticals, CRC Press, London.

8. Manitto P., Biosynthesis of Natural Products, BSP Books Pvt. Ltd., Hyderabad.
9. Finar I.L.,Organic chemistry, Volume II: Stereochemistry and the Chemistry of Natural Products, Pearson Education, New Jersey.
10. Indian Herbal Pharmacopoeia, Indian Drug Manufacturers Association and Regional Research Laboratory, Jammu.
11. Agarwal O.P., Organic Chemistry, Natural Products, Krishna Prakashan Media (P) Ltd., Meerut.
12. Evans V.C., Trease and Evans Pharmacognosy, Harcourt Publishers Ltd., Sydney.
13. Wallis T. E., Textbook of Pharmacognosy, CBS Publishers and Distributors, New Delhi.
14. Kokate C.K., Practical Pharmacognosy, Vallabh Prakashan, Delhi.
15. Jarald E.E. and Jarald S.E., Textbook of Pharmacognosy and Phytochemistry, CBS Publishers and Distributors Pvt. Ltd., New Delhi.
16. Tyler V.E., “Pharmacognosy” Lea & Febiger, Philadelphia.
17. Deore S.L., Khadabadi S.S., Baviskar B.A., Pharmacognosy and Phytochemistry: A Comprehensive Approach, PharmaMed Press, Hyderabad.
18. Prasad M. R, Rao A.R., Advanced Medicinal Chemistry: A Laboratory Guide, PharmaMed Press, Hyderabad.

RPH-840/ RPH-740

PHARMACEUTICS-X (PHARMACEUTICAL BIOTECHNOLOGY)

Unit I

Immunology and immunological preparations: Principles, antigen and haptens, immune system, cellular and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of vaccine.

Unit II

Recombinant DNA technology: A brief introduction to genetic engineering and techniques, production of r-DNA and their application, development of hybridoma for monoclonal antibodies and their application, protoplast fusion and biotechnological production of products such as Insulin and Somatotropin.

Unit III

Antibiotics: Screening of soil for organisms producing antibiotics. Fermentor: Basic design, control of different parameters and application. Isolation of mutants and factors affecting mutation.

Unit IV

Microbial transformation: Introduction, types of reactions mediated by microorganisms, selection of organisms, methodology of biotransformation, process improvements with special reference to steroids.

Unit V

Enzyme immobilization: Sources of enzymes, techniques of immobilization of enzymes and cell, advantages and limitation of immobilization, application of immobilization in pharmacy. Biotechnological production and pharmaceutical application of enzymes such as penicillinase, α-galactosidase, amylases and proteases.

RPH-840P/ RPH-740P

PHARMACEUTICS-X (PHARMACEUTICAL BIOTECHNOLOGY) PRACTICAL

Suggested Practicals

1. Estimation of protein in given sample.
2. Production of protoplast fused cells by chemical method.
3. Production of protoplast fused cells by mechanical method.
4. Estimation of immunological reaction (blood group etc.).
5. Assay of antibiotics.
6. Screening of soil for antibiotic producing microorganisms.
7. Immobilization of drug.
8. Immobilization of enzyme.
9. Immobilization of cell.
10. Protein estimation by gel electrophoresis.
11. Isolation of enzymes from natural sources.

BOOKS RECOMMENDED

1. Prescott and Dunn's Industrial Microbiology, CBS Publishers and Distributors, New Delhi.
2. Vyas S.P. and Dixit V.K., Pharmaceutical Biotechnology, CBS Publication, New Delhi.
3. Kieslich K. , Biotechnology, Verleg Chernie, Switzerland.
4. Standury P.F.,Whitaker A. & Hall S.J. ,Principles of Fermentation, Aditya Book Private Limited, New Delhi.
5. Crueger W. & Crueger A, Biotechnology- A Textbook of Industrial Microbiology, Panima Publishing Corporation, Delhi.

RPH-841/ RPH-741

PHARMACEUTICS-XI (PHARMACEUTICAL MARKETING & MANAGEMENT)

Unit I

Concepts of management: Definition, administrative management (planning, organizing, staffing, directing and controlling). Entrepreneurship development, introduction to operative management (personnel, materials, production, financial management).

Unit II

Principles of management: Coordination, communication, motivation, decision making, leadership, innovation and creativity.

Production management: A brief study of the different aspects of production management, methodology of activities: performance evaluation, review technique, maintenance management.

Unit III

Pharmaceutical marketing: Introduction to pharmaceutical marketing. Functions, buying, selling, transportation, storage and finance. Feedback information, channels of distribution, wholesale, retail, department store. Introduction to e-commerce (online shopping, online banking, pretail, marketing to prospective and established customers) and start up business.

Unit IV

Salesmanship: Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, recruitment, training, performance appraisal of sales force.

Unit V

Market research: Definition, steps and limitations of market research. Market segmentation and market targeting. Major concepts in demand measurement, estimating current demand. Geo-demo- graphic analysis. Estimating industry sales.

BOOKS RECOMMENDED

1. Beri, Marketing Research .Tata Mc Graw Hill Publishing Company Limited, New Delhi.
2. Chary S.N, Production and Operations Management. Tata Mc Graw Hill Publishing CompanyLimited, New Delhi.
3. Datta A.K., Materials Management. Prentice Hall of India Private Limited, New Delhi.
4. Massie L. Joseph, Essentials of Management. Prentice Hall of India Private Limited,

New Delhi.

5. Shreenivasan K.R., An Introduction to Industrial Management. Vikas Publishing House Private Limited, New Delhi.
6. Daver Rustam S., Salesmanship and Publicity. Vikas Publishing House Private Limited, New Delhi.
7. Mukopadhyay S., Pharmaceutical Selling, Sterling Publishers.
8. Koontz H, Weihrich H, Essentials of Management. Tata Mc Graw Hill Publishing Company Limited, New Delhi.
9. G Vidya Sagar, Pharmaceutical Industrial Management, Pharma Med Press, Hyderabad.
10. Micky C Smith, Principles of Pharmaceutical Marketing.CBS Publishers and Distributors, New Delhi.
11. Chaganti S.R., Pharmaceutical Marketing in India: Concept, strategy and cases. Pharma Med Press, Hyderabad.

RPH-842

PHARMACEUTICS-XII (FOOD & NEUTRACEUTICALS)

Unit I

Introduction to food technology.

Food Processing: Freezing, changes in food during refrigerated storage, progressive freezing, Ice crystal damage, effect of dehydration, microwave heating and drying methods on food products.

Unit II

Food packaging and preservation: Properties of packaging material used for food packaging, influence of packaging material on changes of food stuffs, brief description of packaging of frozen, dried products and thermally processed foods.

Brief description of food preservation and its methods.

Unit III

Neutraceuticals: Introduction, classification, categories and rational of use of neutraceuticals.

Brief description to dietary supplements, fortified foods, functional foods and phytoneutraceuticals.

Unit IV

Development and marketing of neutraceutical products: Supercritical fluid extraction technology-basics and application for extraction of neutraceuticals from various sources, Packaging, label claims. Regulatory aspects of neutraceutical products in India.

Unit V

Testing of neutraceuticals and food products: Testing of microbial load, nutritional value, heavy metals, calorific value and neutraceutical label claim test.

Brief introduction to Agmark, Bureau of Indian Standards (BIS) and Food Safety and Standards Authority of India (FSSAI).

RPH-842P

PHARMACEUTICS-XII (FOOD & NEUTRACEUTICALS) PRACTICALS

Suggested Practicals

1. Preparation of traditional health products e.g. Gulkand, Amla syrup
2. Formulation of health drinks.
3. Preparation and testing of some food products.
4. Testing of food packaging materials.
5. Preparation and testing of some neutraceuticals.

BOOKS RECOMMENDED

1. Potter, N. M., Food Science, CBS Publishers and Distributors, New Delhi.
2. Manay, S. and Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, New Delhi.
3. Frazier W.C. and Westhoff, D.C., Food Microbiology, TMH, New Delhi.
4. Krammer, A. and Twigg B.A., Quality control for food industry, Third edition, AVI, West port.
5. Ranganna S., Handbook of Analysis and Quality control for Fruit and Vegetables Products, Tata McGraw Hill, New Delhi.
6. Girdharilal, Preservation of Food and Vegetables, ICAR, New Delhi.
7. Fellows P., Food Processing Technology: Principles and Practice, Ellis Horwood Ltd, Horwood.
8. Earle R. L., Unit Operations in Food Processing, Pergamon Press, New York.
9. Deore, S. L. Khadbadi S. S., and Baviskar B. A., Pharmacognosy and Phytochemistry: A Comprehensive Approach, PharmaMed Press, Hyderabad.
10. Robert E.C., Wildman, R., Taylor C. Wallace., Handbook of Nutraceuticals and Functional Foods, Second Edition. CRC Press, Boca Raton.

ELECTIVE

RPH-843(A)

COMPUTATIONAL METHODS IN DRUG DESIGN

Unit I

Introduction to drug design concept, rational approaches of drug design, role of computational chemistry in drug design. The concept of drug likeness and druggability.

Chemometrics: Introduction to multivariate analysis, linear (PCA, MLR, PLS) and non-linear methods, validation tools. Introduction to some statistical softwares (such as; SPSS, Graph Pad Prism etc.).

Unit II

Molecular Modeling: Introduction to the principles of molecular mechanics, quantum mechanics, molecular dynamics and their applications in drug design.

Unit III

Quantitative structure activity relationship (QSAR): Basic concepts of QSAR, molecular descriptors (2D and 3D parameters), biological parameters, tools and techniques, quantitative models, validation of models, introduction to 2D and 3D QSAR methodologies.

Unit IV

Virtual screening: Introduction to some molecule databases. Ligand based and structure based virtual screening. Similarity searching, various methods of similarity searching and their applications in virtual screening: QSAR modeling, pharmacophore modeling, shape based screening, fingerprint based screening etc.

Unit V

Structure based drug design: Protein Data Bank, molecular graphics, design of enzyme inhibitors, receptor based drug design, molecular docking and protein homology modeling. Introduction to bioinformatics and some drug design softwares (free and commercially available).

RPH-843(A)P

COMPUTATIONAL METHODS IN DRUG DESIGN PROJECT

Projects based on-

1. To perform the Hansch and Free-Wilson analysis for the given dataset.
2. To develop and validate a 3D-QSAR model on a given dataset.
3. To develop and validate a 3D-Pharmacophore model on a given dataset.
4. To create a 3D-QSAR based hypothesis for virtual screening on a small molecule dataset.
5. To create a shape-based pharmacophore query on a set of aligned molecules and perform a virtual screening on a small molecule dataset.
6. To perform the virtual screening on a small molecule dataset using different fingerprint methods.
7. To perform molecular docking simulation and study various non-covalent interaction in protein-ligand complex.
8. To perform a homology modeling for a given target using modeler.
9. To perform the structure based virtual screening on a small molecule dataset.
10. To perform the different machine learning methods on a given dataset.
11. To perform the drug-likeness (ADMET) for small molecules.

BOOKS RECOMMENDED

1. Patrick G.L., An Introduction to Medicinal Chemistry, Oxford University Press.
2. Perun T.J. and Propst C.L., Computer-aided Drug Design Methods and Applications, Saurabh Prakashan Pvt.Ltd., New Delhi.
3. Veerapandian P., Structure-based Drug Design, Sirohi Brothers Pvt. Ltd., Noida.
4. Burger A., A Guide to the Chemical Basis of Drug Design, A Wiley Interscience Publication (John Wiley & Sons), New York.
5. Wermuth C.G., The Practice of Medicinal Chemistry, Elsevier.
6. Purcell W.P., Bass G.E., Clayton J.M., Strategy of Drug Design: A Guide to Biological Activity, Pharmamed Press, Hyderabad.
7. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, NewYork.
8. Abraham D.J., Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.
9. Ananda Kumar T.D., Elementary Pharmacoinformatics, PharmaMed Press, Hyderabad.

RPH-843(B)

GOOD MANUFACTURING PRACTICES

Unit I

Introduction to good manufacturing practices (GMP), good clinical practices (GCP) and good laboratory practices (GLP). Schedule M.

Standard operating procedure (SOP): Introduction, preparation, validation and revision.

Unit II

Documentation: Protocols, forms and maintenance of records in pharmaceutical industry, preparation of document for investigational new drug (IND), new drug application (NDA), abbreviated new drug application (ANDA) and export registration.

Unit III

Introduction to 21-Code of federal regulations. Current good manufacturing practices (c-GMP) guidelines according to United States Food and Drug Administration (USFDA), difference between GMP and c-GMP.

Unit IV

Pharmaceutical product recall: Recall classification, strategy for effective recall, FDA requested recall, firm initiated recall, recall status reports, termination of recall.

Introduction to finished product reprocessing and salvaging.

Unit V

Sampling: Introduction, WHO guidelines, sampling plans and techniques, operating characteristics curves, maintenance of sampling records of finished product and packaging material.

RPH-843(B)P

GOOD MANUFACTURING PRACTICES PROJECT

Projects based on-

1. Study the steps to generate SOP.
2. Generation and validation of SOP for Autoclave.
3. Generation and validation of SOP for Dissolution apparatus.
4. Generation and validation of SOP for Centrifuge.
5. Generation and validation of SOP for Balance (electronic and dispensing).
6. Generation and validation of SOP for Cleaning.
7. Generation and validation of SOP for Hot air oven.
8. Generation and validation of SOP for Disintegration apparatus.
9. Generation and validation of SOP for Friability apparatus.
10. Generation and validation of SOP for Incubator.
11. Generation of Master formula record.
12. Generation of Batch formula record.

BOOKS RECOMMENDED

1. Willing, Tuckerman and Hitchings, Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker, New York.
2. Garfield, Quality Assurance Principles for Analytical Laboratories, Published by Oxford University Press, USA.
3. Potdar M. A., Current Good Manufacturing Practices for Pharmaceuticals. PharmaMed Press, Hyderabad.
4. Loftus and Nash, Pharmaceutical Process Validation, Taylor & Francis, New York.
5. Florey, Analytical Profile of Drugs (All volumes), Academic Press, United States.
6. Indian Pharmacopoeia.
7. United States Pharmacopoeia.
8. British Pharmacopoeia.

RPH-843(C)

CLINICAL PHARMACY

Unit I

Introduction to clinical pharmacy: Definition, development and scope of clinical pharmacy. Variability in human response to drugs and influence of disease processes: Drug handling and prescribing in the elderly, infants and children. Drug usage in pregnancy and in breast-feeding women. Prescribing for patients with renal or hepatic disease. Pharmacogenetics: implications for altered or unusual drug handling. Pharmacoepidemiology.

Unit II

Data analysis and compiling: The patient's case history, communication skills including patient medication history interview, patient counseling. Pharmacoeconomics.

Medical writing: Regulatory and educational medical writing.

Literature review and meta-analysis: Process, methods and application, research, report and paper/ thesis writing.

Pharmacovigilance programme of India (PvPI) and Geneva (UPSALA).

Unit III

Daily activities of clinical pharmacists: Drug therapy monitoring (medication chart view, clinical review), therapeutic drug monitoring, ward round participation, drug utilization evaluation/ review (DUE)/ (DUR). Quality assurance of clinical pharmacy services.

Unit IV

Research design and conduct of clinical trials: Research support including planning and execution of clinical trials. Schedule Y, GLP, GCP and ICH Guidelines, trial master file and ethical requirements. Various phases of clinical trials. Categories of Phase IV studies. Bioavailability (BA) and bioequivalence (BE) studies and the estimation with the help of plasma-concentration profile curve. Statistical analysis plan (SAP) and its importance in clinical research.

Unit V

Data collection and biostatistical analysis: Statistical principles underlying clinical trials, data handling and role of biostatistician.

Sample size calculation, types of variables, Type I error and type II errors, application of parametric and non-parametric tests, confidence intervals, outliers. Data analysis with the help of bio-statistical software.

RPH-843(C)P

CLINICAL PHARMACY PROJECT

Projects based on-

Epidemiological survey and comparison of prescribed therapeutic agents/diagnostic reports on different diseases such as- Cardiovascular disorders, central nervous system disorders, gastro intestinal tract disorders, hormonal disorders, pathogenic diseases.

BOOKS RECOMMENDED

1. Scott L.T., Basic skills in interpreting laboratory data, American Society of Health System Pharmacists Inc., USA.
2. Rowland and Tozer, Clinical Pharmacokinetics, Williams and Wilkins Publication, Philadelphia, USA.
3. Shargel L., Biopharmaceutics and Applied Pharmacokinetics, Prentice Hall publication, New Delhi.
4. Parthasarthi G., Nyfort-Hansen K. and Nahata M.C., A Text book of Clinical Pharmacy Practice-Essential Concepts and Skills, Orient Longman, Chennai.
5. Colledge N.R., Walker B. R. and Stuart H., Ralston Davisson's Principles and Practice of Medicine, ELBS/Churchill Livingstone, Edinburgh, U.K.
6. Herfindal E.T. and Hirashman J.L., Clinical Pharmacy and Therapeutics Williams and Wilkins, Philadelphia, USA.
7. Wagner J.G., Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A G Basel, Switzerland.
8. Katzung B., Masters S. and Trevor A., Basic and Clinical Pharmacology, McGraw Hill Professional, U.K.
9. Spilker B. and Schoenfelder J., Data Collection Forms in Clinical Trials, Raven Press, New York.
10. Roger and Walker; Clinical Pharmacy and Therapeutics, Churchill, Livingston, London.
11. Stockley I.H., Drug interactions, Pharmaceutical Press, London.
12. Ravishankar K., Kiranmayi G.V.N., Clinical Pharmacy and Pharmacotherapeutics, PharmaMed Press, Hyderabad.

RPH-843(D)

STANDARDIZATION OF HERBAL DRUGS

Unit I

Commerce and quality control of natural medicinal plants products, organoleptic, microscopical, physical and chemical evaluation of crude drugs.

Unit II

Standardization of plant material as per WHO guidelines.

Unit III

Methods of extraction and modern techniques for the isolation, purification, separation estimation and characterization of active plant constituents.

Unit IV

Analysis of official formulations derived from crude drugs, including some ayurvedic preparations.

Unit V

General methods of screening of natural products for following biological activity:

a) Anti-inflammatory

b) Hypoglycaemic

c) Antifertility

e) Psychopharmacological.

RPH-843(D)P

STANDARDIZATION OF HERBAL DRUGS PROJECT

Projects based on-

1. Standardization of Ayurvedic liquid formulations on the basis of the following parameters- viscosity, pH, loss on drying, foaming index, chromatography.
2. Standardization of Ayurvedic powdered formulations on the basis of following parameters- extractable matter by using various solvents, ash value, stomatal and stomatal index, trichomes and their types, loss on drying, foaming index, fiber content, chromatography.
3. Stability studies of herbal products as per WHO guidelines.

BOOK RECOMMENDED

1. Trease, G.E., and Evans, W.C., Pharmacognosy, Bailliere Tindall East Baorne, U.K.
2. Tyler V.E., Lynnr B. and Robbers J.E., Pharmacognosy, 8th Edition, Lea & Febiger, Philadelphia.
3. Harborne J.B., Phytochemical Methods, Chapman & Hall International Edition, London.
4. Pharmacoepial Standards for Ayurvedic Formulations, CCRAS, Delhi.
5. Dhavan B.N. and Srimal R.C., The Use of Pharmacological Techniques for Evaluation of Natural Products. CDRI, Lucknow.
6. Brain K.R. and Turner T.D, The Practical Evaluation of Phytopharmaceuticals, Wright, Bristol.
7. Peach K. and Tracey MV, Modern Methods of Plant Analysis, Springer, Berlin.
17. Indian Herbal Pharmacopoeia, Vol. I & II, ICMR & RRL, Jammu.
8. Chaudhary. R.D., Herbal Drug Industry, Eastern Publisher, New Delhi.
9. Deore S.L., Khadabadi S.S., Baviskar B.A., Pharmacognosy and Phytochemistry: A Comprehensive Approach, PharmaMed Press, Hyderabad.
10. Nadkarni A.K., Indian Materia Medica, Vol- 1&2, Popular Prakashan (P) Ltd., Bombay.
11. Sukh Dev, A Selection of Prime Ayurvedic Plant Drugs, Anamaya Publisher New Delhi.
12. Indian Ayurvedic Pharmacopoeia, Govt. of India.
13. The Wealth of India, Raw Materials (All volumes), Council of Scientific & Industrial Research, New Delhi.
14. Mukherjee P.K., Quality Control of Herbal Drugs, Business Horizones Pharmaceutical Publisher, New Delhi.

RPH-843(E)

RESEARCH METHODOLOGY

Unit I

Fundamentals of research: Meaning and objective of research, types of research (basic, applied and patent oriented), defining research problem, research design including various methods, research process and steps involved.

Literature survey and documentation: Methods of literature survey, use of library, books, journals, e-journals, thesis, chemical abstracts and patent database, importance of documentation, documentation techniques, use of computer programs/packages (online resources such as- scientific search engines and online servers) in literature survey and documentation.

Unit II

Data collection and data analysis: Execution of the research, observation and collection of data, types of data (primary and secondary), methods of data collection, sample size, sampling procedure and methods. Data processing and analysis strategies. Research hypothesis (experimental and non-experimental), hypothesis testing (parametric and non-parametric tests), types of errors and their control, generalization and interpretation of results. Use of statistical softwares/ packages in data analysis (SPSS, Graph Pad Prism).

Unit III

Technical writing and reporting of research: Types of research report: Dissertation and thesis, research paper, review article, short communication, conference presentation, meeting report etc. Structure and organization of research reports: Title, abstract, key words, introduction, methodology, results, discussion, conclusion, acknowledgement, references, footnotes, tables and illustrations. Use of reference managing softwares (such as- MENDELEY, ENDNOTE). Impact factor, rating, indexing and citation of journals.

Detailed study of 'Instruction to Authors' of any ACS or ScienceDirect journal, a thorough understanding of steps involved in submitting articles electronically to any ACS or ScienceDirect journal (registration, new article submission, tracking process, submitting revised articles).

Unit IV

Research ethics, ethical consideration during animal experimentation including CPCSEA guidelines, impact of research on environment and society, commercialization of research, intellectual ownership, plagiarism and use of plagiarism detection softwares such as

TURNITIN, VIPER etc., responsibility and accountability of the researchers. Academia-Industry interface and research.

Project cost management: Cost analysis of the project, cost incurred on raw materials, procedure, instrumentation and biological testing.

Unit V

Funding agencies and research grants: Introduction to various research funding agencies such as-DST, DBT, AICTE, UGC, CSIR, ICMR, AAYUSH, and DRDO along with their functions in India. Writing a research project and procurement of research grant.

RPH-843(E)P

RESEARCH METHODOLOGY PROJECT

Projects based on-

1. Literature survey, data collection, formulation and testing of hypothesis, interpretation of results on a particular research project.
2. Use of statistical packages/ programs (such as SPSS, Graph Pad Prism) in data analysis.
3. Collection, compilation and execution of computational programs for research benefits.
4. Manuscript preparation, communication and follow-up of a research paper/review article.
5. Writing a research project for the procurement of research grant/travel grant from any funding agency.
6. Preparation and presentation of a research report (Oral and Poster presentations using Microsoft PowerPoint Package, Microsoft Publisher etc.).

BOOKS RECOMMENDED

1. Kothari C.R., Research Methodology Methods and Techniques, 2nd Edition, Wishwa Prakashan, New Delhi.
2. Lokesh K., Methodology of Educational research, 3rd revised Edition,Vikash Publishing House Pvt. Ltd., New Delhi.
3. Kumar R., Research Methodology, 2nd Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
4. Rao G.N., Research Methodology and Qualitative Methods, B.S. Publications, Hyderabad.
5. Saunders M., Lewis P.and Thornhill A., Research Methods for Business Students,3rdEdition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
6. Bolton S. and Bon C., Pharmaceutical Statistics: Practical and Clinical Applications, 4th edition, Marcel Dekker, New York.
7. Matad V., Anusuya D., Medicomarketing Writing, PharmaMed Press, Hyderabad.
8. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

RPH-844P

REPORT ON INDUSTRIAL/ RESEARCH LABORATORY VISIT

Visit of students to an industrial establishment or an approved research laboratory. The industrial/ research laboratory visit shall include: in case of industry- visit to different sections and subsections of the industry, an idea about the functioning of the industry, product range of the industry and various approvals of the industry; in case of research laboratory- visit to different departments of the laboratory, an idea about the interdisciplinary coordination, contribution of the laboratory to the society and various approvals of the laboratory. A proper report of the same shall be submitted by the students, which shall be subsequently evaluated to assess the impact of the visit.

May be performed at the end of the 7th semester.