B. Pharm 1st year Syllabus

DEPARTMENT OF PHARMACEUTICAL SCIENCES, GJUS&T, HISAR
SYLLABUS FOR BACHELOR OF PHARMACY

I Year B.Pharm

Semester- I

BPL 111
PHARMACEUTICAL CHEMISTRY – I
(Pharmaceutical Organic Chemistry)
7 credits (4-2-4)

PRACTICALS: Synthesis of selected organic compounds. Identification of organic compounds and their derivatisations. Introduction to the use of stereomodels.

BPL 112
PHARMACEUTICAL CHEMISTRY – II
(Pharmaceutical Inorganic Chemistry)
7.0 credits (4-2-4)
An outline of the methods of preparation, properties, uses, sources of impurities, tests for purity and identity, including the limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic Pharmaceuticals included in Indian Pharmacopeia monograph details. Acids and bases: Buffers, water, Gastrointestinal agents: acidifying agents, antacids, protectives and adsorbent, Cathartics. Major extra and extra-cellular electrolytes: Physiological ions, electrolytes used for replacement therapy, acid base balance and combination therapy. Essential and trace elements: transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements. Cationic and anionic compounds of inorganic drugs useful for systemic effects. Topical agents: protectives, astringents and anti-infectives. Gases and vapours: oxygen, anesthetics and respiratory stimulants. Dental products: dentrifices, anticaries agent. Complexing and chelating agents used in therapy. Miscellaneous agents: sclerosing agents, expectorants, emetics, poisons and antidotes sedatives etc. Pharmaceutical aids used in Pharmaceutical industry Antioxidants, preservatives, filter aids, adsorbents, diluents, excipients, suspending agents, colorants etc.
Inorganic
Radiopharmaceuticals
nuclear
Radiopharmaceutical, reactions, nomenclature, methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.

PRACTICALS: The background and systemic qualitative analysis of inorganic mixtures up to 4 radicals. Six mixtures to be analyzed, preferably by semi-micro methods. All identification tests for pharmaceutical, inorganic pharmaceutical and qualitative tests for cations and anions as included in the appendix of IP should be carried out.

BPL 113
PHARMACEUTICS – I
(Dispensing and Hospital Pharmacy)
7 credits (4-2-4)
Definitions and General Dispensing Procedures.

Sources of information required for Pharmacists.
Types of Dispensed products Containers, closures and labeling for dispensed products.
Sources of error and care required in dispensing prescriptions. Principles involved and procedures adopted in dispensing of typical preparations like mixtures, solutions, emulsion, creams, ointments, powders, pastes, jellies, suppositories, ophthalmamics, pastillers, lozenges, pills, lotions, liniments, inhalations, paints, sprays etc.
Incompatibilities - physical and chemical, occurrence and methods adopted in corrections. Colours flavours, sweeteners and other additives used in prescriptions. Latin terms used in prescriptions and their English equivalents.
Pharmaceutical Calculations - calculation of doses, enlarging and reducing receipes, percentage solutions, alligation, alcohol dilutions, proof spirit, isotonic solutions, displacement value etc. Hospital and its organization. Pharmacy, organization and personnel.

PRACTICAL Number of practicals based on aforementioned theory portion but including dispensing of preparations like emulsions, suspensions, solutions, creams, ointments, inhalations, liniments, paints, sprays etc.
BPL 114 REMEDIAL BIOLOGY

4 Credits (3-0-2)


BPL 114 REMEDIAL MATHS

4 Credits (4-0-0)
Algebra: revision on equation reducible to quadratics and simultaneous equations (linear and quadratic) up to two variable only. Determinants and their six important properties, solutions of simultaneous equations by Cramer’s rule. Matrices: Definition of special matrices (like unit, singular, diagonal matrices etc.) arithmetic operation on matrices, transpose, adjoint reciprocal and inverse of a matrix, solution of simultaneous equations using matrices. Partial fractions and resolution of linear and quadratic (non-repeated) partial functions. Evaluation of $e^n$, $e^{n^2}$ and $e^{n^3}$

Trigonometry: revision on angle measurement and T-ratios addition, subtraction and transformation formulae. T-ratio of multiple, sub multiple and allied angles, solution of simple trigonometric identities based on above concepts. Pharmaceutical application of logarithms. Analytical plane geometry: Cartesian co-ordinates, distance between two points, area of triangle, locus of a point, straight line, slope and intercept form, general equation of first degree.

Semester II

BPL 121 PHARMACOGNOSY – I

7 credits (4-2-4)

PRACTICALS

Number of practicals based on aforementioned theory portion and including the following: Morphological characteristic of plant families mentioned in the theory. Microscopic measurement of cells and cell contents: starch grains, calcium oxalate crystals and phloem fibres. Determination
of leaf constant such as stomatal index, stomatal number, vein-islet number, vein termination number and palisade ratio. Identification of crude drug mentioned in theory.

BPL 122 PHARMACEUTICS – II (General Pharmacy)
7 credits (4-2-4)

PRACTICALS: Number of practicals based on aforementioned theory portion and including preparation of the following : Peppermint water, cinnamon water, camphor water, chloroform water, concentrated peppermint water, concentrated cinnamon water, simple syrup, syrup of ginger, syrup of orange, syrup of tolu, compound syrup of ferrous sulphate, spirit of peppermint, spirit of chloroform, spirit of ether, strong solution of ammonium acetate, surgical solution of chlorinated soda, solution of cresol with soap, solution of ferric chloride, strong solution of iodine, solution of hydrogen peroxide tannic acid glycerin, boric acid glycerin mouth washes, nasal drops, ear drops, elixirs mucilage of acacia, mucilage of tragacanth, tincture of orange, tincture of tolu, compound tincture of ginger, tincture of lemon, tincture of tolu, tincture of nuxvomica, liquid extract of liquorice, liquid extract of ipecacuanha, liquid extract of belladona, liquid extract of senna, concentrated infusion of clove, concentrated infusion of quassia, concentrated infusion of senna, liver extract.

BPL 123 PHARMACOLOGY – I (Anatomy, Physiology and Health Education)
7 credits (4-2-4)


**BPL 124 - PHARMACEUTICAL MATHEMATICS**

4 credits (4 – 0 – 0)

Calculus : Differential : Limits and functions, differential coefficient, differentiation of standard functions, including function of a function (chain rule), differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation. Integral : integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, by partial fractions and by substitution, formal evaluation of definite integrals. Differential equations : definition and formation of ordinary differential equations, equations of first order and first degree, variable separable, homogeneous equations, linear equations (Liebnitz form) and differential equations reducible to there types. Linear differential equations of order greater than one with constant coefficients, complementary function and particular integrals of e^x, x^n, sin (ax + b) or cos (ax + b) types of functions, solution of simple simultaneous linear differential equations, Pharmaceutical transforms. Laplace transforms : definition, properties of linearity and shifting, transforms of elementary function (without proof) and inverse laplace transforms not involving Euler's theorem, transforms of derivatives, solutions of ordinary and simultaneous differential equations. Pharmaceutical statistics : concept, mathematical computations (wherever applicable) and pharmaceutical applications (wherever possible) on : Significant digits and rounding of numbers, collection of primary and secondary data through experiments of surveys sampling and complete enumeration survey, merits and limitations of various random and non-random sampling methods, data organization including frequency distributions and tabulation, diagrammatic representation of data, simple, multiple, sub-divided and floating bar diagrams, pie diagrams, 2-D and 3-D pictographic representation, graphs of frequency distributions. Measures of central tendency, ideal characteristics, mean, median, mode, GM, HM and weighted arithmetic mean form discrete and continuous frequency distribution, quartiles, deciles and percentiles, measures of dispersion, range, quartile deviation, mean deviation, standard deviation, calculation of standard deviation from discrete and continuous frequency distributions, standard error of means, coefficient of variation. Probability and events, Bayes theorem, probability theorems, probability distributions, elements of binomial and Poisson distributions, normal distribution, normal distribution curve and properties, calculation of areas under normal curve and standard normal curve (Z statistic), confidence limits, deviations from normality, Kurtosis and skewness, elements of central limit theorem. Linear correlation and regression analysis, scatter plots, method of least squares, Pearsonian coefficients of correlation and determination, definitions, of amount of explained variance, standard error of estimate and significance of regression (F). Statistical inference, type I and II errors, t-test (paired and unpaired).

**ENVIORNMENTAL STUDIES:**

Multidisciplinary nature of environmental studies: Definition, scope and importance. Natural resources- Renewable and nonrenewable resources: Natural resources and associated problems- Forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using
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Semester - III
BPL 231 PHARMACEUTICS-III (Pharmaceutical Engineering-I)
5 Credits (4-2-0)
Flow of fluids: Introduction, mechanism of fluid flow, Reynolds number and its significance, Bernoulli’s theorem, manometers and friction losses in pipes, measurement of flow rate using direct weighing or measuring, hydrodynamic methods, displacement meters and dilution methods. Regulation of flow using plug cocks, globe valves, gate valves, unidirectional valves, automatic regulating valve, butterfly valve and diaphragm valve, and water hammer
Heat Transfer: Modes of heat transfer, Fourier’s law, overall heat transfer coefficient, Stefan-Boltzman's law, single pass heater, multi-pass heater, liquid-liquid heat interchanger and finned tubes
Evaporation: Factors affecting evaporation, natural circulation evaporators e.g. evaporating pan, evaporating still, horizontal and vertical tube evaporators, forced circulation evaporators, film evaporators, multiple effect evaporation, material and energy balance of evaporators. Drying: Theory, behavior of solids during drying, static bed dryers, moving bed dryers, fluidized bed dryer and pneumatic bed dryers. Centrifugation: theory, industrial centrifugal filters and industrial centrifugal sedimenters. Filtration: Theory, filter aids, filter media, industrial filters i.e. sand filter, washing and non-washing type filter presses, rotary drum filter, leaf filters, edge filter. Humidification, dehumidification and air conditioning: Principles of Humidification, dehumidification and air conditioning, psychrometry, humidity measurement, large scale equipment for humidification and dehumidification, cooling towers. Refrigeration: Principle and equipment employed for vapor compression refrigeration, lithium bromide absorption refrigeration and steam jet refrigeration. Applications of refrigeration in Pharmacy. Size reduction: Mechanism, factors influencing, energy requirements, applications in pharmacy, grinders i.e. fluid energy mill, hammer mill, ball mill and its variants, centrifugal mill, attrition mill, edge runner mill, colloid mill, squirrel cage disintegrator, Buhrstone mill.

UCC 550 COMPUTER SCIENCE
6 Credits (4-0-4)

PRACTICALS: Number of experiments based on aforementioned theory.

BPL 233 PHARMACEUTICAL CHEMISTRY – III (Pharmaceutical Physical Chemistry)
7 Credits (4 – 2 – 4)
Behavior of gases: kinetic theory of gases, deviation from ideal behaviors and explanation. The liquid state: Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents. Solutions: Ideal and real solutions, solutions


PRACTICALS: Number of experiments based on aforementioned theory

BPL 234 PHARMACEUTICAL CHEMISTRY- IV (Pharmaceutical Analysis - I)
7 Credits (4 – 2 – 4)
Introduction: Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, significant figures, rules for retaining significant digits, types of errors, mean deviation and standard deviation, statistical treatment of small data sheets, selection of sample, precision and accuracy, fundamentals of volumetric analysis, method of expressing concentration, primary and secondary standards. Acid Base Titrations: acid base concepts, role of solvent, relative strength of acids and bases, ionization law, law of mass action, common ion effect, ionic product of water, pH, hydrolysis of salts, Henderson Hessellbach equation, buffer solutions, neutralization curves, acid-base indicators, theory of indicators, choice of indicators, mixed indicators, polyprotic system, polyamine and amino acid systems, amino acid titration, application in assay of \( \text{H}_2 \text{PO}_4 \), NaOH, CaCO\(_3\) etc. Oxidation Reduction Titrations: concepts of oxidation and reduction, redox reactions, strength and equivalent weights of oxidizing and reducing agents. Theory of redox titrations, cell representations, measurement of electrode potential. oxidation-reductions, potassium iodate titrations, potassium bromate titrations, titanous chloride titrations, sodium 2,6- dichlorophenol idophenol titration, pharmaceutical applications. Precipitations Titrations: precipitation reactions, solubility products, effects of acids, temperature and solvent upon the solubility of a precipitate. Argentiometric titrations, ammonium of potassium thiocyanate titrations, mercuric nitrate titrations, methods: Mohr's method, Volhards method, Fajans method and pharmaceutical applications. Gravimetric Analysis; preparation of Gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises to gravimetric analysis shall be covered. Non-aqueous Titrations: titration curves, masking and demasking agents, types of complexometric titrations, metal ion indicators, factors influencing the stability of complexes, applications. Miscellaneous method of analysis; Diazotization titration, Kjeldahl nitrogen determination, Karl fishcher titration, determination of alcohol in liquid galenicals, oxygen flask combustion, Extraction procedure, separation of drug from Excipients, liquid-liquid extraction, separation of mixtures by extraction, distribution law, successive extraction, the Craig method of multiple extraction, continuous counter-current extraction, effect of temperature, pH, inert solute, association, ion-pair formation, the emulsion problem in extraction. Fundamentals of Chromatography Introduction and theory of underlying different types of chromatography techniques like- Column chromatography, thin layer chromatography, paper and circular chromatography, adsorbents and solvents used in these techniques. Electrochemistry: the electric cell, electrode potential, half cells, types of half cells, sign convention, Nernst equation, the salt bridge, activity series, standard potential, standard hydrogen electrode, measuring the relative voltage of half cells, calculations of standard potential, reference


electrodes, indicator electrodes. Potentiometry: theoretical considerations, ion-selective electrodes, measurement of potential, location of end point equipment, analytical application, direct measurement of a metal concentration, differential curve, determination of ksp, pH measurement dead-stop titrations; pH meter, pH definition, relation to pH to potential, equipment and applications. Conductance and high frequency titrations and their applications. Coulometric titrations, its principles and applications, controlled potential coulometry, cell design, instrumentation, advantages and limitations, and electrode selection. Polarography and its applications: theory of mass transport processes, current processes, current potential relationship, polarization, choice of electrodes, effect of oxygen, instrumentation, calculation of concentration, laboratory design and safety. Amperometric titrations and its applications.

PRACTICALS: Number of experiments based on aforementioned theory

Semester – IV
BPL 241 PHARMACEUTICS-IV (Pharmaceutical Microbiology)
7 Credits (4 – 2 – 4)
Introduction to the science of microbiology-ancient theories concerning the origin of life, contribution of great scientists to this science, with particular reference to the contributions of the following scientists: A.V. Leeuwenhoek, Louis Pasteur, Edward Jenner, Robert Koch, Alexander Fleming, Joseph Lister. Microscopy: Microscopes, their magnification, resolution, illumination and filters, working of different types of microscopes, micrometry. Classification of microbes. Nutrition, cultivation isolation and identification of bacteria, fungi and viruses. Bacterial enzymes – classification, nomenclature, production by fermentation, extraction methods, immobilization techniques and applications of bacterial enzymes in general and detailed account of following bacterial enzymes : alpha amylase ( diastase ) and proteases. Disinfection, factors affecting disinfection, dynamics of disinfection, disinfectants and antiseptics and their evaluation. Sterilization, different methods, applications and evaluation of sterilization methods. Aseptic technique. Microbial standardisation of antibiotics ( ampicillin, streptomycin ), Vitamins ( Vitamin B-12, Niacin ) and calcium pentothenate. Fermentation: Types of media used; factors affecting, control of various parameters during fermentation. A detailed account of the industrial fermentation process for manufacture of penicillin, streptomycin, glutamic acid; Lysine, citric acid, Vit.B_{12}.

PRACTICALS: Number of experiments based upon afore mentioned theory and including experiments devised to prepare various types of culture media, sub culturing of common aerobic and anaerobic bacteria, fungus and yeast, various staining methods, various methods of isolation and identification of microbes, sterilizing techniques and evaluation of sterilizing techniques, evaluation of aseptics and disinfectants, testing and sterility of pharmaceutical products as per I.P. requirements, evaluation of potency of antibiotics and vitamins etc.

BPL 242 PHARMACEUTICAL CHEMISTRY – V (Pharmaceutical Biochemistry)
7 Credits (4 – 2 – 4)
PRACTICALS: Number of experiments based on aforementioned theory portion.

BPL 243 PHARMACOGNOSY-II
7 Credits (4 – 2 – 4)

PRACTICALS: Number of experiments based on aforementioned theory portion and including the following: Identification of crude drugs listed in theory. Microscopic study of some important glycosides containing crude drugs as underlined above. Study of powdered drugs. Standardization of some traditional drug formulations. Studies of microscopic characters of some important drugs in entire and powdered form. Chemical evaluation of powdered drugs.

BPL 244 PHARMACEUTICS –V (Forensic pharmacy)
4 credits (4-0-0)
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Semester – V.
BPL 351 PHARMACEUTICS –VI (Physical Pharmacy)
6 Credits (4-0-4)

PRACTICALS: Number of experiments based upon aforementioned theory and including the following: Determination of latent heat, vapor pressure and critical point. Studies on polymorphs, their identification and properties. Determination of particle size, particle size distribution and surface areas using various methods of particle size analysis. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc. Determination of surface/interfacial tension, HLB values and critical micellar concentration of surfactants. Study of rheological properties of various types of systems using different viscometers. Studies of different types of colloid and their properties. Preparation of various types of suspensions and
determination of their sedimentation parameters. Preparation and stability studies of emulsions. Studies on different types of complexes and determination of their stability constants. Determinations of half-life rate constant and order of reaction. To study the influence of various factors on the rate of reaction. Accelerated stability testing, shelf life determination and expiration dating of pharmaceuticals. Preparation of pharmaceutical buffers and determination of buffer capacity. Experiments involving tonicity adjustments

**BPL 352 PHARMACEUTICS-VII (Dosage Form Design)**

*6 Credits (4-0-4)*

Preformulation studies: Study of physical properties of drug like physical form, particle size, shape, density, wetting dielectric constant, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability. Study of chemical properties of drug like hydrolysis, oxidation, reduction, recemization, polymerization etc., and their influence on formulation and stability of products. Study of prodrugs in solving problems related to stability, bioavailability and elegance of formulation. Radiopharmaceuticals: fundamentals of radio pharmacy, therapeutic applications of isotopes, diagnostic applications of isotopes, use of radioisotopes in basic research, product development, product production, process control and quality control. Liquid formulations, formulation and industrial production of liquid and semi-solid formulation like suspension, syrup, emulsions and ointments. Skin: structure and physiology, physiology of sweating, physiology of skin secretions formulations, preparations for skin of face and hands, formulation, preparation and evaluation of cleansing creams, cold creams, cleansing lotions, foundation creams, moisturizing creams, skin tonics, handy and body lotion. Hairs, structure and functions, formulation, preparation and evaluation of shampoos, dandruff preparation, hair creams, and fixers, hair colorants, hair remover (depilatories), shaving sticks and after shave lotion. Formulation, preparation and evaluation of other cosmetics like nail lacquers, anti-perspirants and deodorants, tooth powders and tooth paste.

**PRACTICALS:**

Experiments illustrative of the portion covered in the theory portion of the syllabi and including the following: Formulation, preparation, packing and presentation of the following class of dosage forms using laboratory scale equipment's syrups, dry syrups drops, suspensions, solubilized systems, emulsions and topical applications. Preparation and quality control of (a) cold cream (b) vanishing cream (c) Cleansing lotion and creams (d) moisturizing creams (e) skin tonics, (f) hair creams and hair conditioners (g) shampoos (h) hair colorant (i) depilatory (j) shaving creams and sticks (k) tooth powder (l) tooth pastes (m) after shave lotions and other cosmetics. Experiments to illustrate comparative study of suspending agents, emulsifying agent and antioxidant preservatives. Preformulation studies including drug-excipient, compatibility studies, effect of stabilizers, preservatives etc. in dosage form design. Stability evaluation of various dosage forms and their expiring dating.

**BPL 353 PHARMACEUTICAL CHEMISTRY-VI (Medicinal chemistry-I)**

*7 Credits (4-2-4)*


Mode of action, uses, Structure activity relationship including physiochemical properties of the following classes of drugs. Drugs acting at Synaptic and neuro-effector junction sites: Cholinergics and anticholinergics, antispasmodics, antiulcer drugs, ganglionic stimulants, Neuromuscular blocking agents, sympathomimetic agents including biosynthesis of adrenergic neurotransmitter, adrenergic drugs and adrenoceptor blockers. Autocoids: Antihistamines, Ecosanoids, Anti-inflammatory agents (nonsteroidal), analgesic and antipyretics. Drugs affecting Uterine Motility: Oxytocics including oxytocin, ergot alkaloids and prostaglandins. Diuretics and

PRACTICALS: Number of experiments based on the above mentioned theory portion and including the following: Synthesis of selected drugs from the course content. Establishing the pharmacopoeial standards of drug synthesized.

BPL 354 PHARMACOLOGY-II
6 Credits (4-0-4)

PRACTICALS:
Introduction to Experimental Pharmacology: To record the concentration response curve (CRC) of acetylcholine using rat ileum To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using frog rectus abdominal muscle preparation. Experiments on Central Nervous system: Recording of spontaneous motor activity; analgesia, anticonvulsant activity, muscle relaxant activity of drugs using simple experiments. To study the effect of autonomic drugs on rabbit eye.

UCC 551 PRESENTATION AND COMMUNICATION SKILLS
Communication skills: Essentials of communication skills, small group communication techniques, group discussion etc. Public speaking techniques, body language – verbal and non-verbal cues, Interview – Kinds of interview-as interviewee, as interviewer. Workshops: Mock interviews, group discussions, JAM sessions [just a minute], dress codes. Presentation Skills: Pre-presentation preparation, presentation skills, post-presentation follow-up, Presentation aids- audio, visual, audio-visual and printed aids, computer aides presentations- use of power point. Meetings – Convening – Managing – Post meeting follow up : organizing, meeting manners, presiding over a meeting-participating in a meeting. Written presentation, Language of writing, preparation of C.V./Resume, official correspondence, report writing.

Semester – VI.
BPL 361 PHARMACEUTICS-VIII (Pharmaceutical Engineering)
7 Credits (4-2-4)
Distillation: Raoult's law, volatility, boiling point diagrams, azeotropic mixtures, equilibrium diagrams, types of distillation, rectification, rectifying columns, downcomers, material and energy balance of a rectifying column, reflux ratio, determination of number of theory plates, H.E.T.P.
and steam distillation. Extraction: Factors affecting, equipment for extraction of solids i.e. fixed bed diffusion battery, continuous diffusion battery, basket extractor, Rotocel extractor and Dorr agitator; equipment for liquid-liquid extraction i.e. extraction towers and Podbielniak extractor. Mixing: Definition, objectives, mechanism, uniformity index, factors influencing selection of suitable mixer. Study of equipment employed for solid-solid, liquid-liquid and solid-liquid mixing. Emulsification equipment. Size separation: Screening equipment i.e. trommels, rotex and hummer; air suspension methods i.e. air separator and cyclone separators; hydraulic separation i.e. elutriation and double cone emulsifier. Crystallization: Crystal forms, habit, Mier's supersaturation theory, crystallizers based on supersaturation, by cooling (i.e. tank crystallizers, agitated batch crystallizers and Swenson-Walker), adiabatic cooling (i.e. vacuum crystallizers) and evaporation (i.e. Krystal crystallizers). Material and energy balance of crystallizer. Corrosion and its prevention: Types of corrosion causes of corrosion and method for combating corrosion. Materials for pharmaceutical plant construction: factors affecting the selection of a material for pharmaceutical plant, ferrous metals (i.e. cast iron, steel and stainless steels), nonferrous metals (i.e. Copper and its alloys, aluminium, tin sliver, nickel and alloys), nonmetals i.e. glass, slate, asbestos, rubber, plastics and timber. Industrial hazards and safety precautions: Mechanical-chemical-electrical-fire-dust hazards, safety requirements, accident records etc. Transportation of materials: Liquids: Pumps i.e. airlift, ejector, piston plunger, egg, diaphragm, gear, screw, centrifugal and self-priming. Gases: Ejectors, compressors, fans and blowers. Solids: Intermittent and continuous methods in vertical, horizontal and inclined plane. Introduction: Significance of Engineering Drawing in Pharmaceutical Industry, drawing instruments and their uses, lines, lettering and dimensioning. Scales: Construction of plain scales, vernier scale, diagonal scale, comparative scale and isometric scale. Isometric projections: Theory, isometric views and projections, construction of isometric projections/views of two-dimensional and three-dimensional objects. Orthographic projections: Theory, types, and construction of drawing in both first angle and third angle. Various methods of sectioning i.e. full section, half section, removed section, partial section, and offset section. Conversion of orthographic projections into isometric projections/views. Drawing of machine parts and simple pharmaceutical equipment. Methods of depicting layouts of various sections of a pharmaceutical unit.


BPL 362 PHARMACEUTICAL CHEMISTRY-VII (Heterocyclic compounds and Natural products)
5 Credits (4-2-0)
**BPL 363 PHARMACOLOGY- III**  
**7 Credits (4-2-4)**
Pharmacology of Cardiovascular System: Digitalis and cardiac glycosides. Antihypertensive drugs. Antiangiinals, Antiarrythmics, Antihyperlipidemics, Diuretics  

**PRACTICALS:**
Experiments on Isolated Preparations: To record the CRC of 5-HT on rat fundus preparation. To record the CRC of histamine on guinea pig ileum preparation. To record the CRC of oxytocin using rat uterus preparation. To find out the strength of the given sample on using a suitable isolated muscle preparation by Matching Assay, Three point assay

**BPL 364 PHARMACOGNOSY-III**  
**6 Credits (4-0-4)**

**PRACTICALS:** Number of experiments based on aforementioned theory portion and including the following: Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical importance. Exercises on paper and thin layer chromatographic evaluation of herbal drug constituents.

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**Semester VII**

**BPL 471 Pharmaceutics-IX (Biopharmaceutics and Pharmacokinetics)**  
**7 Credits (4-2-4)**
special reference to one compartment model after I.V. drug administration, Michaelis Menten equation, determination of non-linearity (saturation mechanism).


PRACTICALS: Number of experiments based on aforementioned theory topics, should be conducted.

BPL 472 Pharmaceutical Chemistry-VIII (Medicinal Chemistry-II)
7 Credits (4-2-4)
Drug metabolism. Functionization reactions (Phase I)- Oxidation, reduction and hydrolytic reactions. Conjugation reactions: Glucuronic acid conjugation, sulphate conjugation, conjugation with amino acids, glutathione conjugation, acetylation, methylation. Chemistry and principles of prodrug design. Mode of action, uses, structure activity relationship including physicochemical properties of the following classes of drugs: Drugs acting on Central nervous System: General anesthetics, Local anesthetics, Hypnotics and sedatives, opioid analgesics, antitussives, anticonvulsants, antiparkinsonian drugs, CNS stimulants, psychopharmacological agents (neuroleptics, antidepressants, anxiolytics). Steroids and related drugs: Steroidal nomenclature and stereochemistry; androgens and anabolic agents; oestrogens and paragestational agents; adrenocorticoids. Chemotherapeutic agents

PRACTICALS: Number of experiments based upon aforementioned theory portion.

BPL 473 Pharmaceuticals-X (Packaging Technology)
5 Credits (4-2-0)
Introduction: Definition, life history of a package, qualities of the package, purpose of packaging, hazards encountered by the package, various types of inner and outer packages, selection of a suitable package and child resistant package. Packaging materials: Detailed study with regard to composition packaging characteristics, advantages, economics and limitations of paper, glass, plastics, metals and rubber as packaging materials. Strip Packing: Significance of Strip Packing, advantages, economics and limitation of Strip Packing, Strip Packing machinery, films employed in Strip Packing (including composites and laminates) and evaluation of films and strips packs. Blister Packaging: Blister packing materials, significance of Blister packing, advantages, economics and limitation of blister packing, blister packing machinery, various types of blister packages, evaluation of blister package.

Product Packaging: General principles of packaging of sterile products. Various types of containers used for sterile products including small volume and large volume parenterals. Types of closures used for the sterile products. Sterile product filling and sealing machinery i.e. ampoule filling and sealing machine. Limitations and merits of various packages. Evaluation of the sterile product packages. Labeling: Types of label, Labeling requirements as per Drugs and Cosmetics act, packaging inserts and machinery employed for labeling.

BPL 474 Pharmacognosy-IV
6 Credits (4-0-4)
Role of medicinal and aromatic plants in national economy. World-wide trade in medicinal plants and derived products with special reference to diosgenin (discorea), taxol (taxus sps), digitalis, tropane alkaloid containing plants, datura, cinchona, ipecac, liquorice, ginseng, Aloe vera, Valerian, rouwolfia and plant containing laxatives (Senna, Rhubarb). A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India, Utilization and production of phytoconstituents of poppy, ergot, tropane alkaloids (Belladona), vinca, aloes, digitalis, discorea Utilization of aromatic plants and derived products with special reference to menthol, citral, sandwood oil, vetiver oil, geranium oil and eucalyptus oil. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Application of plant tissue culture in pharmacognosy. Chemotaxonomy of medicinal plants. Marine pharmacognosy, novel medicinal agents from marine sources. Natural allergens and photosensitizing agents. Natural colours, Plant bitters and sweeteners

PRACTICALS: Number of experiments based on aforementioned theory and including the following: Isolation of some selected phytoconstituents studied in theory. Extraction of volatile oils and their chromatographic profiles. Some experiments in plant tissue culture.

Semester VIII
BPL 481 Pharmaceutics-XI (Pharmaceutical Technology)
7 Credits (4-2-4)


BPL 482 PHARMACOLOGY - IV
5 Credits (4-2-0)
Drugs Acting on the Gastrointestinal Tract: Laxatives and antidiarrhoeal agents. Emetics and anti-emetics. Anti-ulcer agents
Chemotherapy: General principles of chemotherapy. Sulphonamides and co-trimoxazole. Antibiotics: Penicillins, Cephalosporins, Chloramphenicol, Erythromycin, Quinolones and Miscellaneous Antibiotics.
Principles of Toxicology:
Definition of poison, general principles of treatment of poisoning with a particular reference to organophosphorus and atropine poisoning. Heavy metals and heavy metal antagonists viz. arsenic, lead and mercury.

BPL 483 Pharmaceutical Chemistry-IX (Pharmaceutical Analysis-II)
7 Credits (4-2-4)

**PRACTICALS:** Number of experiments based on aforementioned theory portion and including the following: Using official procedure involving instrumental techniques, carry out the quantitative estimation of at least ten formulations containing single drug or more than one drug. Using flame photometry, carry out the estimation of Na\(^+\), K\(^+\), Ca\(^{2+}\) ions. Carry out the IR of samples having different functional groups (\(-\text{COOH}; -\text{COOR}, CONHR-1\(^{\circ}\), 2\(^{\circ}\), 3\(^{\circ}\); -\text{NH}_2, -\text{NHR}, -\text{OH}, etc.) Workshop to interpret the structure of samples organic compounds using UV, IR, NMR and MS.

BPL 484 Pharmaceutics-XII (Pharmaceutical Management)
4 Credits (4-0-0)