COURSE BOOK B. PHARM II YEAR

(Autonomous)

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CURRICULUM STRUCTURE & SYLLABUS

Effective from the Session: 2025-26

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1. Teaching Scheme of (B. Pharm. II Year)

3rd SEMESTER

S.No	Course Type	BOS	Subject Code	Subject Name	Academic Learning (AL)			Continuous Internal Examination (CIE)		Mid Sem Exam (MSE)	End Semester Examination (ESE) Theory	Total	Credit
					L	T	P	MSE	CA	TOTAL		CIE+ ESE	Cr
1	B. Pharm	KSOP	BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	0	15	10	**25**	75	100	4
2	B. Pharm	KSOP	BP302T	Physical Pharmaceutics I – Theory	3	1	0	15	10	**25**	75	100	4
3	B. Pharm	KSOP	BP303T	Pharmaceutical Microbiology –Theory	3	1	0	15	10	**25**	75	100	4
4	B. Pharm	KSOP	BP304T	Pharmaceutical Engineering –Theory	3	1	0	15	10	**25**	75	100	4
5	B. Pharm	KSOP	BPH2 309	Human Values and Professional Ethics	2	0	0	15	10	**25**	75	100	NC
Lab/Internship/Project Work/workshop													
1	B. Pharm	KSOP	BP305P	Pharmaceutical Organic Chemistry II – Practical	0	0	4	10	5	**15**	35	50	2
2	B. Pharm	KSOP	BP306P	Physical Pharmaceutics I – Practical	0	0	4	10	5	**15**	35	50	2
3	B. Pharm	KSOP	BP307P	Pharmaceutical Microbiology – Practical	0	0	4	10	5	**15**	35	50	2
4	B. Pharm	KSOP	BP308P	Pharmaceutical Engineering –Practical	0	0	4	10	5	**15**	35	50	2
Total Hours = 34 hrs					**14**	**4**	**16**					**700**	**24**

4th SEMESTER

S No.	Course Type	BOS	Subject Code	Subject Name	Academic Learning (AL)			Continuous Internal Examination (CIE)		Mid Sem Exam (MSE)	End Semester Examination (ESE) Theory	Total	Credit
					L	T	P	MSE	CA	TOTAL		CIE+ ESE	Cr
1	B. Pharm	KSOP	BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	0	15	10	**25**	75	100	4
2	B. Pharm	KSOP	BP402T	Medicinal Chemistry I – Theory	3	1	0	15	10	**25**	75	100	4
3	B. Pharm	KSOP	BP403T	Physical Pharmaceutics II – Theory	3	1	0	15	10	**25**	75	100	4
4	B. Pharm	KSOP	BP404T	Pharmacology I – Theory	3	1	0	15	10	**25**	75	100	4
5.	B. Pharm	KSOP	BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	0	15	10	**25**	75	100	4
6	B. Pharm	KSOP	BPH2 410	Biomedical Waste Management	2	0	0	15	10	**25**	-	25	0.2
Lab/Internship/Project Work/workshop													
1	B. Pharm	KSOP	BP406P	Medicinal Chemistry I – Practical	0	0	4	10	5	**15**	35	50	2
2	B. Pharm	KSOP	BP407P	Physical Pharmaceutics II – Practical	0	0	4	10	5	**15**	35	50	2
3	B. Pharm	KSOP	BP408P	Pharmacology I – Practical	0	0	4	10	5	**15**	35	50	2
4	B. Pharm	KSOP	BP409P	Pharmacognosy and Phytochemistry I – Practical	0	0	4	10	5	**15**	35	50	2
Total Hours = 38 hrs					**17**	**5**	**16**					**725**	**28.2**

2. Theory Courses Detail Syllabus

Course Code: BP301T	Course Name: Pharmaceutical Organic Chemistry-II Theory	L	T	P	C
Course Offered in: KIET School of Pharmacy		3	1	0	4

Pre-requisite: NA

Course Objectives: Upon completion of the course the student shall be able to:

- Write the structure, name and the type of isomerism of the organic compound.
- Write the reaction, name the reaction and orientation of reactions.
- Account for reactivity/stability of compounds.
- Prepare organic compounds.

Course Outcome: After completion of the course, the student will be able to

1. Illustrate the structure, properties, chemical reactions and uses of benzene and its derivatives.
2. Examine the structure, properties, chemical reactions and uses of phenols, aromatic amines and aromatic acids.
3. Determine the structure, chemical reactions and analytical constants and significance of oil and fats.
4. Illustrate the structure, synthesis, chemical reactions and medicinal uses of polynuclear hydrocarbons.
5. Illustrate the structure, properties, chemical reactions and uses of cycloalkanes.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	2	-	-	2	1	-	2	1	1
CO2	3	-	2	-	-	2	1	-	2	1	1
CO3	3	-	2	-	-	2	1	-	2	1	1
CO4	3	-	2	-	-	2	1	-	2	1	1
CO5	3	-	2	-	-	2	1	-	2	1	1

Unit 1	Benzene and its derivatives	10 hours

A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule.
B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel Crafts alkylation-reactivity, limitations, Friedel Crafts acylation.
C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction.
D. Structure and uses of DDT, Saccharin, BHC and Chloramine T.

Unit 2	Phenols, Aromatic Amines, Aromatic Acids	10 hours

Phenols - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols.

Aromatic Amines - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts.

Aromatic Acids– Acidity, effect of substituents on acidity and important reactions of benzoic acid.

Unit 3	Fats and Oils	10 hours

Fatty acids – reactions.

Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

Analytical constants– Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value– significance and principle involved in their determination.

Unit 4	Polynuclear Hydrocarbons	08 hours

Synthesis, reactions of Polynuclear Hydrocarbons

Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.

Unit 5	Cycloalkanes	07

		hours
Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.		
	Total Lecture Hours	**45 hours**

Textbook:

1. Organic Chemistry by Morrison R.T., Boyd R.N. and Bhattacharjee, S.K. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.), New Delhi.

2. Organic Chemistry by I.L. Finar, Volume-I, Pearson Education Ltd, New Delhi.

Reference Books:

1. Organic Chemistry by Morrison R.T., Boyd R.N. and Bhattacharjee, S.K. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.), New Delhi.
2. Organic Chemistry by Jonathan Clayden, Nick G. S. Warren. Oxford University Press, Oxford.
3. Organic Chemistry by G. Marc Loudon, Oxford University Press, Oxford.
4. Organic Chemistry by Francis A. Carey and Robert M. Giuliano, Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Strategic Applications of Named Reactions in Organic Chemistry by Laszlo Kurti and Barbara Czako, Elsevier Academic Press.

Mode of Evaluation

MSE		**CA**					**ESE**	**Total**
MSE1 30	**MSE2 30**	**CA1 3**	**CA2 3**	**CA3 (ATT) 4**				
Avg. of MSE1 & MSE2 and converted to 15		**10**					**75**	**100**

Course Code: BP305P	Course Name: Pharmaceutical Organic Chemistry -II (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Learn essential techniques like recrystallization, steam distillation, and oil value determination (acid, saponification, and iodine values).
- Perform key reactions such as acylation, halogenation, nitration, oxidation, hydrolysis, diazotization, and condensation to synthesize pharmaceutical intermediates.
- Understand insight into functional group transformations and reaction mechanisms relevant to medicinal chemistry.
- Ensure to follow good laboratory practices (GLP), proper chemical handling, and accurate documentation of experimental results.

Course Outcome: After completion of the course, the student will be able to

1. Apply laboratory techniques such as recrystallization and steam distillation for purification and isolation of chemical compounds.
2. Determine acid value, saponification value, and iodine value of oils using standard analytical procedures.
3. Synthesize a variety of organic compounds through acylation, halogenation, nitration, oxidation, hydrolysis, diazotization, and other named reactions.
4. Interpret experimental outcomes and practice safe handling of chemicals, while maintaining proper documentation and following good laboratory practices.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	3	1	-	-	2	2	1	1	3
CO2	3	1	3	1	-	-	2	2	1	1	3
CO3	3	1	3	1	-	-	2	2	1	1	3
CO4	3	1	3	1	-	-	2	2	1	1	3

List Of Practical's (Indicative & Not Limited To)

1.Experiments involving laboratory techniques:
   a) Recrystallization.
   b) Steam distillation.

2. Determination of following oil values (including standardization of reagents):
   a) Acid value.
   b) Saponification value.
   c)Iodine value.

3. Preparation of compounds
   a) Benzanilide/Phenyl benzoate/Acetanilide from Aniline/Phenol/Aniline by acylation reaction.
   b) 2,4,6-tribromo aniline/para bromo acetanilide from Aniline.
   c) Acetanilide by halogenation (Bromination) reaction.
   d) 5-nitrosalicylic acid/meta di-nitrobenzene from salicylic acid/ nitro benzene by nitration reaction.
   e) Benzoic acid from benzyl chloride by oxidation reaction.
   f) Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
   g) 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
   h) Benzil from benzoin by oxidation reaction.
   i) Dibenzal acetone from benzaldehyde by Claisen-Schmidt reaction.
   j) Cinnammic acid from benzaldehyde by Perkin reaction.
   k) p-Iodo benzoic acid from p-amino benzoic acid.

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2 NA	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BP302T	Course Name: Physical Pharmaceutics-I (Theory)	L	T	P	C
Course Offered in: KIET School of Pharmacy		3	1	0	4

Pre-requisite: NA

Course Objectives: Upon completion of the course the student shall be able to:

- Understand various physicochemical properties of drug molecules in the designing the dosage forms.
- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
- Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Outcome: After completion of the course, the student will be able to

1. Illustrate the parameters related to solubility of the drugs.
2. Analyze states of matter, properties, and physicochemical properties of drug molecules.
3. Explore about surface and interfacial phenomenon.
4. Illustrate the fundamental principles behind complexation and protein binding with proper examples.
5. Illustrate the concepts of pH, buffers, and isotonic solutions along with their measurements and/or adjustments.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	1	-	-	-	1	1	-	2
CO2	3	1	2	1	-	-	-	1	1	-	2
CO3	3	1	2	2	-	-	-	1	1	-	2
CO4	3	1	2	2	-	-	-	1	1	-	2
CO5	3	1	2	1	-	-	3	1	1	-	2

Unit 1	Solubility of drugs	10 hours

Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems.

Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications.

Unit 2	States of Matter and properties of matter, Physicochemical properties of drug molecules	10 hours

State of matter, changes in the state of matter, latent heats, vapor pressure, sublimation critical point, eutectic mixtures, gases, aerosols– inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.

Unit 3	Surface and interfacial phenomenon	10 hours

Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB scale, solubilization, detergency, adsorption at solid interface.

Unit 4	Complexation and protein binding	08 hours

Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

Unit 5	pH, buffers and Isotonic solutions	07

		hours
Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.		
	Total Lecture Hours	**45 hours**

Textbook:

1. Physical Pharmaceutics by C.V.S. Subramanyam. CBS Publication
2. Textbook of Physical Pharmacy by Gaurav Jain & Roop K. Khar, Reed Elsevier India Pvt. Ltd., New Delhi.

Reference Books:

1. Physical Pharmacy by Alfred Martin, Lippincott Williams and Wilkins, USA.
2. Tutorial Pharmacy by Cooper and Gunn, CBS, New Delhi.
3. Pharmaceutical Calculations by Stocklosam J., Lea & Febiger, Philadelphia.
4. Pharmaceutical Dosage forms: Disperse systems by Lieberman H.A, Lachman C, Volume 3, Marcel Dekker Inc.
5. Physical Pharmaceutics by Ramasamy C. and Manavalan R., PharmaMed Press, Hyderabad.
6. Laboratory Manual of Physical Pharmaceutics by C.V.S. Subramanyam. J., Thimma Settee.
7. Experimental Pharmaceutics by Eugene, Parott, Burgess Pub. Co., UK.
8. Physical Pharmaceutics by Shotton E & Ridgeway K, Oxford University Press, London.
9. Essentials of Physical Pharmacy by D.V. Derle, BSP Book Pvt. Ltd., Hyderabad.
10. Pharmaceutics: The Design and Manufacture of Medicines by Aulton M.E, Churchill Livingstone.

Mode of Evaluation

MSE		**CA**			**ESE**	**Total**
MSE1 30	**MSE2 30**	**CA1 3**	**CA2 3**	**CA3 (ATT) 4**		
Avg. of MSE1 & MSE2 and converted to 15		**10**			**75**	**100**

Course Code: BP306P	Course Name: Physical Pharmaceutics – I (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Develop skills to determine drug solubility, pKa values, and partition coefficients, essential for formulation and bioavailability studies.
- Analyze surface tension, hydrophilic-lipophilic balance (HLB) of surfactants, and critical micellar concentration (CMC) to understand emulsion and micelle formation.
- Evaluate Freundlich and Langmuir adsorption isotherms using activated charcoal and determine stability constants and donor-acceptor ratios for drug complexes.

Course Outcome: After completion of the course, the student will be able to

1. Determine key physicochemical properties of drugs such as solubility, pKa, and partition coefficient using standard analytical methods.
2. Analyze binary systems and phase equilibria through techniques like the critical solution temperature (CST) method and surface tension determination.
3. Evaluate surfactant properties, including HLB number and critical micellar concentration (CMC), using saponification and experimental techniques.
4. Determine stability constants and donor-acceptor ratios of drug complexes using solubility and pH titration methods, and interpret adsorption isotherms using Freundlich and Langmuir models.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	-	1	-	-	-	-	2
CO2	3	2	2	2	-	1	-	-	-	-	2
CO3	3	2	2	2	-	1	-	-	-	-	2
CO4	3	2	2	2	-	1	-	-	-	-	2

List Of Practical's (Indicative & Not Limited To)

1. Determination the solubility of drug at room temperature.
2. Determination of pKa value by Half Neutralization/Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water.
4. Determination of Partition co- efficient of Iodine in CCl_4 and water.
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method.
6. Determination of surface tension of given liquids by drop count and drop weight method.
7. Determination of HLB number of a surfactant by saponification method.
8. Determination of Freundlich and Langmuir constants using activated charcoal.
9. Determination of critical micellar concentration of surfactants.
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method.
11. Determination of stability constant and donor acceptor ratio of Cupric Glycine complex by pH titration method.

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BP303T	Course Name: Pharmaceutical Microbiology (Theory)	L	T	P	C
Course Offered in: KIET School of Pharmacy		3	1	0	4

Pre-requisite: NA

Course Objectives: Upon completion of the subject student shall be able to;

- Understand methods of identification, cultivation and preservation of various microorganisms.
- To understand the importance and implementation of sterilization in pharmaceutical processing and industry.
- Learn sterility testing of pharmaceutical products.
- Carried out microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceutical industries.

Course Outcome: After completion of the course, the student will be able to

1. Illustrate the scope and applications of pharmaceutical biotechnology
2. Analyze various staining and sterilization techniques used in pharmaceutical biotechnology
3. Outline evaluation methods of antiseptics, disinfectants, and sterility testing as per different pharmacopeias.
4. Explain the significance of the clean area, methods, and standardization of microbial assay of biological products.
5. Analyze microbial spoilage, preservation of pharmaceutical products & processes, and application of tissue cell culture in pharmaceutical research.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	1
CO2	3	2	1	2	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	2
CO4	3	2	1	1	1	-	-	-	-	1	2
CO5	3	2	1	-	1	-	-	-	-	1	2

Unit 1	Introduction, history of microbiology	10 hours

Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

Unit 2	Bacteria Identification and Sterilization Techniques	10 hours

Identification of bacteria using staining techniques (simple, Gram's & Acid-fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators.

Unit 3	Morphology of Microbes and Evaluation of Antimicrobial Agents	10 hours

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Unit 4	Aseptic Area & Methods of Microbiological Assay	08 hours

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

Unit 5	Microbial Contaminations & Cell culture	07 hours

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.
Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

Total Lecture Hours	45 hours

Textbook:

1. Ananthnarayan and Paniker's Textbook of Microbiology, edited by C.K.J. Paniker, Orient-Longman, Hyderabad.
2. Pharmaceutical Microbiology by N.K. Jain, Vallabh Prakashan, Delhi.

Reference Books:

1. Pharmaceutical Microbiology by W.B. Hugo and A.D. Russel: Blackwell Scientific Publications, Oxford London.
2. Industrial Microbiology by Prescott and Dunn., 4th edition, CBS Publishers & Distributors, Delhi.
3. Microbiology by Pelczar and Chan Kreig, Tata McGraw Hill, New Delhi.
4. Lippincott's Illustrated Reviews-Microbiology by Harvey, Champe and Fisher, Lippincott Williams and Wilkins, New Delhi.
5. Principles and Practices of Contamination Control and Cleanrooms by C.K. Moorthy, Pharma Book Syndicate, Hyderabad.
6. Pharmaceutical Microbiology by Malcolm Harris, Balliere Tindall and Cox., The Williams & Wilkins Co., NY.
7. Fundamental Food Microbiology by Bibek Ray and Arun Bhunia, CRC Press, NY.
8. Industrial Microbiology by Rose, Butterworths, USA.
9. Fundamentals of Microbiology by Frobisher M., Hinsdill et al., 9th ed., Japan.
10. Cooper and Gunn's Tutorial Pharmacy, CBS Publisher and Distribution.
11. Microbial Technology by Peppler, Academic Press.
12. I.P., B.P., U.S.P. - latest editions.
13. Fundamentals of Microbiology by Edward, Benjamin Cummings, USA.
14. Bergey's Manual of Systematic Bacteriology, Williams and Wilkins, Philadelphia.
15. Disinfection and Sterilization- Theory and Practice, General and Industrial Chemistry Series by Sykes G., E & F.N. Spon Ltd., London.
16. General Microbiology by Stanier R.Y., Ingraham, J.L., Wheelis M.L., Painter P.R., Macmillan Press Limited, London.
17. Microbiology: An Introduction by Tortora, G.J., Funke, B.R. and Case, C.L., Pearson India Education Services Pvt. Ltd., Noida.
18. Pharmaceutical Dosage Forms: Parenteral Medications by Sandeep Nema, John D. Ludwig, Informa Healthcare.

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 3	CA2 3	CA3 (ATT) 4		
Avg. of MSE1 & MSE2 and converted to 15		10			75	100

Course Code: BP307P	Course Name: Pharmaceutical Microbiology (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Understand the operation of essential microbiology lab instruments such as B.O.D. incubator, laminar flow, autoclave, and microscopes, along with sterilization techniques for glassware and media.
- Learn subculturing techniques, preparation of nutrient media, staining methods (Gram's, acid-fast), pure culture isolation, and motility determination.
- Perform sterility testing, bacteriological analysis of water, and microbiological assay of antibiotics using cup plate and other methods.
- Conduct biochemical tests to characterize microorganisms and assess their metabolic properties for pharmaceutical applications.

Course Outcome: After completion of the course, the student will be able to

1. Apply knowledge of microbiological equipment, sterilization of glassware and media preparation for experimental use.
2. Perform subculturing, staining techniques, and isolation of pure microbial cultures using standard microbiological methods.
3. Apply microbiological assays, including antibiotic potency testing, sterility testing, and bacteriological analysis of water.
4. Analyze microbial characteristics through motility tests, biochemical identification, and apply techniques for quality control in pharmaceutical microbiology.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	-	-	1	1	-	1
CO2	3	3	2	3	2	-	-	1	1	-	1
CO3	3	3	1	3	2	-	-	1	1	-	1
CO4	3	3	1	3	2	-	-	1	1	-	1

List Of Practical's (Indicative & Not Limited To)

1. Introduction and study of different equipment and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid-fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water.
10. Biochemical test.

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BP304T	Course Name: Pharmaceutical Engineering (Theory)	L	T	P	C
Course Offered in: KIET School of Pharmacy		3	1	0	4

Pre-requisite: NA

Course Objectives: Upon completion of the course the student shall be able to:

- To know various unit operations used in pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in pharmaceutical industries.

Course Outcome: After completion of the course, the student will be able to

1. Understand the basic concepts related to fluid flow and equipment's used in size reduction and size separation in pharmaceutical industry.
2. Explain process of heat transfer and various equipment's used in evaporation and distillation.
3. Examine various processes and equipment used in drying and mixing.
4. Apply the concept of filtration and centrifugation for processing of pharmaceutical products.
5. Explore the different material for pharmaceutical plant construction, including corrosion and its prevention.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	-	-	1	1	-	-	1	1
CO2	3	1	1	-	-	1	-	-	-	1	1
CO3	3	1	1	1	-	1	-	-	-	1	1
CO4	3	1	1	1	-	1	-	-	-	1	1
CO5	3	1	1	1	-	1	1	-	-	1	1

Unit 1 **Flow of Fluids & Size Reduction** **10 hours**

Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturi meter, Pitot tube and Rotameter.

Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

Unit 2 **Heat Transfer, Evaporation & Distillation** **10 hours**

Objectives, applications & Heat transfer mechanisms. Fourier's law Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation.

Unit 3 **Drying & Mixing** **10 hours**

Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing.

Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier.

Unit 4	Filtration & Centrifugation	08 hours

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seitz filter.

Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Nonperforated basket centrifuge, semi continuous centrifuge & super centrifuge.

Unit 5	Materials of pharmaceutical plant construction, corrosion and its prevention	07 hours

Factors affecting during materials selected for pharmaceutical plant construction, Theories of corrosion, types of corrosion and their prevention. Ferrous and non-ferrous metals, inorganic and organic non-metals, basic of material handling systems.

Total Lecture Hours	45 hours

Textbook:

1. Pharmaceutical Engineering by K. Sambamurthy, New Age International (P) Ltd., New Delhi.
2. Pharmaceutical Engineering Principles and Practices by C.V.S Subrahmanyam et al., Vallabh Prakashan, Delhi.

Reference Books:

1. Introduction to Chemical Engineering b y Walter L. Badger & Julius Banchero, Tata McGraw Hills, New Delhi.
2. Solid Phase Extraction, Principles, Techniques and Applications by Nigel J.K. Simpson- Latest edition.
3. Unit Operation of Chemical Engineering by McCabe Smith, McGraw Hills, New Delhi.
4. Remington Practice of Pharmacy by Martin, Latest edition.
5. Lachman/Lieberman's Theory and Practice of Industrial Pharmacy by Roop K. Khar, S.P.
6. Vyas, F.J. Ahmad and G.K. Jain, CBS Publishers & Distributers Pvt. Ltd., New Delhi.
7. Cooper and Gunn's Tutorial Pharmacy edited by S.J. Carter, CBS Publishers & Distributers Pvt. Ltd., New Delhi.
8. Unit Operations by G.G. Brown, CBS Publishers & Distributers Pvt. Ltd., New Delhi.
9. Perry's Chemical Engineers' Handbook by R.H. Perry and D.W. Green, McGraw-Hill, USA.
10. Aulton's Pharmaceutics: The Design and Manufacture of Medicines; 3rd edition, Churchill Livingstone, UK.
11. Bentley's Textbook of Pharmaceutics edited by E.A. Rawlins, Reed Elsevier India Pvt. Ltd., New Delhi.
12. Pharmaceutical Process Engineering by Anthony J. Hickey and David Ganderton, Vol-112, Drugs and Pharmaceutical Sciences, Marcel Dekker, Inc., USA.

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 3	CA2 3	CA3 (ATT) 4		
Avg. of MSE1 & MSE2 and converted to 15		10			75	100

Course Code: BP308P	Course Name: Pharmaceutical Engineering (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Understand heat and mass transfer principles in pharmaceutical processes, including moisture content determination, drying curves, and humidity measurement techniques.
- Perform size reduction, particle size analysis, and granule evaluation, while applying size reduction laws and studying equipment efficiency like ball mills and blenders.
- Learn the construction, working, and applications of pharmaceutical equipment, and analyze processes such as distillation, filtration, crystallization, and drying for optimized production.

Course Outcome: After completion of the course, the student will be able to

1. Determine radiation constants, heat transfer coefficients, drying curves, moisture content, and humidity using appropriate experimental methods.
2. Perform particle size analysis, size reduction experiments, and evaluate equipment efficiency using sieving techniques, ball mills, and blending studies.
3. Analyze factors influencing filtration, evaporation, distillation, and crystallization kinetics in pharmaceutical processes.
4. Understand the construction, working, and applications of pharmaceutical equipment such as tablet machines, fluidized bed coaters, mixers, and dryers.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	-	-	2	2	1	1	-	3
CO2	2	1	1	-	-	2	2	1	1	-	3
CO3	2	1	1	-	-	2	2	1	1	-	3
CO4	2	1	1	-	-	2	2	1	1	-	3

List Of Practicals (Indicative & Not Limited To)

1. Determination of radiation constant of brass, iron, unpainted and painted glass.
2. Steam distillation – To calculate the efficiency of steam distillation.
3. To determine the overall heat transfer coefficient by heat exchanger.
4. Construction of drying curves (for calcium carbonate and starch).
5. Determination of moisture content and loss on drying.
6. Determination of humidity of air – From wet and dry bulb temperatures- use of Dew point method.
7. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, dehumidifier.
8. Size analysis by sieving – To evaluate size distribution of tablet granulations –Construction of various size frequency curves including arithmetic and logarithmic probability plots.
9. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond coefficients, power requirement and critical speed of Ball Mill.
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
11. Factors affecting rate of filtration and evaporation (Surface area, Concentration and Thickness/viscosity).
12. To study the effect of time on the rate of crystallization.
13. To calculate the uniformity Index for given sample by using Double Cone Blender.

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BPH2 309	Course Name: Human Values and Professional Ethics	L	T	P	C
Course Offered in: KIET School of Pharmacy		2	0	0	NC

Pre-requisite: NA

Course Objectives: Upon completion of the course the student shall be able to:

- Develop a strong foundation in moral values, integrity, and ethical behavior essential for responsible pharmaceutical practice.
- Learn about ethical guidelines, legal responsibilities, and professional conduct in pharmacy to ensure patient safety and public trust.
- Understand the pharmacist's role in society, emphasizing public health, environmental sustainability, and ethical decision-making in pharmaceutical care.
- Cultivate empathy, teamwork, and leadership skills while balancing personal and professional responsibilities with ethical awareness.

Course Outcome: After completion of the course, the student will be able to

1. Discuss the need, basic guidelines, content and process of Value Education under the light of "Universal Human Values"
2. Explore the concept of harmony in the Human being (Myself)being "I" and "body" as separate entity.
3. Ensure the concept "harmony" in the family and society keeping family as part of Undivided Society.
4. Appraise harmony in the nature and existence imbibing the role of an individual in maintaining the harmony within nature and existence.
5. Interpret the holistic approach of harmony in relation with Professional Ethics.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	2	-	3	1	3	-	1	-	2
CO2	-	-	2	-	3	1	3	-	1	-	2
CO3	-	-	2	-	3	2	3	-	2	-	2
CO4	-	-	2	-	3	2	3	-	3	3	2
CO5	-	-	2	-	3	2	3	-	3	3	2

Unit 1	Need, Basic Guidelines, Content and Process for Value Education	6 hours

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit 2	Understanding Harmony in the Human Being	6 hours

Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

Unit 3	Understanding Harmony in the Family and Society	6 hours

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family):

Samadhan, Samridhi,Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family.

Unit 4	**Understanding Harmony in the Nature and Existence**	**6 hours**

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-Astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

Unit 5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**6 hours**

Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics:

a. Ability to utilize the professional competence for augmenting universal human order,
b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems

Strategy for transition from the present state to Universal Human Order:

a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers,
b. At the level of society: as mutually enriching institutions and organizations.

Total Lecture Hours	**30 Hours**

Textbook:

1. A Foundation Course in Human Values and Professional Ethics by R.R. Gaur, R Sangal, G P. Bagaria, 2009.

Reference Books:

1. Energy & Equity by Ivan Illich, 1974, the Trinity Press, Worcester, and Harper Collins, USA.
2. Small Is Beautiful: A Study of Economics As If People Mattered by E.F. Schumacher, 1973, Blond & Briggs, Britain.
3. How the Other Half Dies by Sussan George, 1976, Penguin Press. Reprinted 1986, 1991.
4. Limits to Growth – Club of Rome's report by Donella H. Meadows, Dennis L. Meadows,
5. Jorgen Randers, William W. Behrens III, 1972, Universe Books.
6. Jeevan Vidya Ek Parichay by A. Nagraj, 1998, Divya Path Sansthan, Amarkantak.
7. Science and Humanism by P.L. Dhar, RR Gaur, 1990, Commonwealth Publishers.
8. Human Values by A.N. Tripathy, 2003, New Age International Publishers.
9. How to Practice Natural Farming by Subhas Palekar, 2000, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
10. Fundamentals of Ethics for Scientists & Engineers by E G Seebauer & Robert L. Berry, 2000, Oxford University Press.
11. Engineering Ethics (including Human Values) by M Govindrajran, S Natrajan & V.S. Senthil Kumar, Eastern Economy Edition, Prentice Hall of India Ltd.
12. Foundations of Ethics and Management by B.P. Banerjee, Excel Books.

Mode of Evaluation

MSE		**CA**			**ESE**	**Total**
MSE1	**MSE2**	**CA1**	**CA2**	**CA3**		
45	**45**	**6**		**(ATT) 4**		
Avg. of MSE1 & MSE2 and converted to 15		**10**			**75**	**100**

Course Code: BP401T	Course Name: Pharmaceutical Organic Chemistry III	L	T	P	C
Course Offered in: KIET School of Pharmacy		3	1	0	4

Pre-requisite: NA

Course Objectives: At the end of the course, the student shall be able to:

- Understand the methods of preparation and properties of organic compounds
- Explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- Know the medicinal uses and other applications of organic compounds.

Course Outcome: After completion of the course, the student will be able to

1. Illustrate about Stereo isomerism, Optical isomerism.
2. Illustrate about Geometrical isomerism and Conformational isomerism.
3. Outline the nomenclature, classification, synthesis, and reaction of some heterocyclic compounds.
4. Summarize the Synthesis, reactions, and medicinal uses of some heterocyclic compounds.
5. Outline some important synthetic name reactions.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	-	-	-	3	-	-	-	2
CO2	3	1	2	-	-	-	3	-	-	-	2
CO3	3	1	2	-	-	2	3	-	2	-	2
CO4	3	1	2	-	-	-	3	-	2	-	2
CO5	3	1	2	-	-		3		2	-	2

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

Unit 1	Stereoisomerism	10 hours

Optical isomerism –Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules
DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers
Reactions of chiral molecules; Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute

Unit 2	Geometrical isomerism	10 hours

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems); Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.
Stereospecific and stereoselective reactions

Unit 3	Heterocyclic compounds	10 hours

Nomenclature and classification
Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene
Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

Unit 4	Synthesis, reactions and medicinal uses of following compounds/derivatives:	08 hours

Pyrazole, Imidazole, Oxazole and Thiazole.
Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, Azepines and their derivatives

Unit 5	Reactions of synthetic importance	07 hours

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation.

Total Lecture Hours	45 hours

Textbook:

a) A text book of organic chemistry – Arun Bahl, B.S. Bahl.
b) Heterocyclic Chemistry by Raj K. Bansal
c) Heterocyclic Chemistry by T.L. Gilchrist

Reference Books:

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. Organic Chemistry by Morrison and Boyd Computer Aided Manufacturing, P.N. Rao, N.K. Tewari, T.K. Kundra
3. Organic Chemistry by Francis A. Carey and Robert M. Giuliano, Tata McGraw Hill Publishing Company Ltd., New Delhi.

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 3	CA2 3	CA3 (ATT) 4		
Average of 2 MSE and converted to 15		10			75	100

Course Code: BP402T	Course Name: Medicinal Chemistry– I (Theory)	L	T	P	C
Course Offered in: KIET School of Pharmacy		3	1	0	4

Pre-requisite: NA

Course Objectives: Upon completion of the course the student shall be able to:

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- Know the Structural Activity Relationship (SAR) of different class of drugs
- Write the chemical synthesis of some drugs.

Course Outcome: After completion of the course, the student will be able to

1. Understand basics of medicinal chemistry, physiochemical and stereochemical properties in relation to drug design and drug metabolism.
2. Explore the chemistry of drugs acting on Adrenergic system.
3. Explore the chemistry of drugs acting on Cholinergic system.
4. Illustrate chemistry of drugs acting on CNS such as sedatives, hypnotics, antipsychotics, and anticonvulsants.
5. Explain the chemistry of general anaesthetics, narcotics & non-narcotic analgesics, and anti-inflammatory agents.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	-	-	3	3	-	3	2	3
CO2	3	1	1	-	-	3	1	-	3	1	2
CO3	3	1	1	-	-	3	1	-	3	1	2
CO4	3	1	1	-	-	3	1	-	3	1	2
CO5	3	1	1	-	-	3	1	-	3	1	2

Note: Study of the development of following classes of the drugs. Classification, mechanism of action, uses of drugs mentioned in the course, structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

Unit 1	Introduction to Medicinal Chemistry	10 hours

History and development of medicinal chemistry Physicochemical properties in relation to biological action
Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.
Drug metabolism: Drug metabolism principles- Phase I and Phase II; Factors affecting drug metabolism including stereo chemical aspects.

Unit 2	Drugs acting on Autonomic Nervous System	10 hours

Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine; Adrenergic receptors (Alpha & Beta) and their distribution.
Sympathomimetic agents: SAR of Sympathomimetic agents
Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.
Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.
Agents with mixed mechanism: Ephedrine, Metaraminol.
Adrenergic Antagonists:
Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.
Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol

Unit 3	Cholinergic neurotransmitters	10 hours

Biosynthesis and catabolism of acetylcholine.
Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.
Parasympathomimetic agents: SAR of Parasympathomimetic agents

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine. **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible)**: Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion. **Cholinesterase reactivator**: Pralidoxime chloride. **Cholinergic Blocking agents**: SAR of cholinolytic agents **Solanaceous alkaloids and analogues**: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*. **Synthetic cholinergic blocking agents:** Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride		
Unit 4	**Drugs acting on Central Nervous System**	**08 hours**
A. **Sedatives and Hypnotics**: **Benzodiazepines:** SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem **Barbiturates**: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital **Miscelleneous**: Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde. **B. Antipsychotics** Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Trifluprom azine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride. **Ring Analogues of Phenothiazeines**: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine. **Fluro buterophenones**: Haloperidol, Droperidol, Risperidone. **Beta amino ketones**: Molindone hydrochloride. **Benzamides**: Sulpieride **C. Anticonvulsants:** SAR of Anticonvulsants, mechanism of anticonvulsant action **Barbiturates**: Phenobarbitone, Methabarbital. **Hydantoins**: Phenytoin*, Mephenytoin, Ethotoin **Oxazolidinediones**: Trimethadione, Paramethadione **Succinimides**: Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**: Phenacemide, Carbamazepine* **Benzodiazepines**: Clonazepam **Miscellaneous**: Primidone, Valproic acid , Gabapentin, Felbamate		
Unit 5	**Drugs acting on Central Nervous System**	**07 hours**
General anesthetics: **Inhalation anesthetics**: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. **Ultra-short acting barbitutrates:** Methohexital sodium*, Thiamylal sodium, Thiopental sodium **Dissociative anesthetics:** Ketamine hydrochloride**.*** **Narcotic and non-narcotic analgesics** Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate. **Narcotic antagonists**: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. **Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.		
	Total Lecture Hours	**45 hours**
Textbook: 1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry. 2. Foye's Principles of Medicinal Chemistry.		

3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Organic Chemistry by I.L. Finar, Vol. II.
6. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
7. Text book of practical organic chemistry- A.I.Vogel.

Reference Books:

1. Remington's Pharmaceutical Sciences.
2. Martindale's extra pharmacopoeia.
3. Indian Pharmacopoeia

Mode of Evaluation

MSE		CA			ESE	Total	
MSE1 30	MSE2 30	CA1 3	CA2 3	CA3 (ATT) 4			
Average of 2 MSE and converted to 15		10			75	100	

Course Code: BP406P	Course Name: Medicinal Chemistry – I (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Learn the synthesis of medicinal compounds like pyrazoles, benzimidazoles, barbiturates, and phenothiazines.
- Quantitatively analyze drugs such as chlorpromazine, phenobarbitone, atropine, ibuprofen, aspirin, and furosemide.
- Determine the partition coefficient of drugs to understand their lipophilicity and pharmacokinetics.
- Apply Good Laboratory Practices (GLP), analytical techniques, and problem-solving skills in pharmaceutical chemistry.

Course Outcome: After completion of the course, the student will be able to:

1. Illustrate the synthesis of some heterocyclic drugs or intermediates.
2. Analyze the purity of some heterocyclic drugs.
3. Analyze the partition coefficient of some drugs.
4. Evaluate some organic and inorganic compounds through chemical tests.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	-	1	2	2	2	2	3
CO2	3	2	1	1	-	1	3	2	2	-	3
CO3	3	2	-	-	-	-	2	2	2	2	-
CO4	3	2	-	-	-	-	-	-	-	2	-

List Of Practical's (Indicative & Not Limited To)

I. Preparation of drugs/ intermediates

- 1,3-pyrazole
- 1,3-oxazole
- Benzimidazole
- Benzotriazole
- 2,3- diphenyl quinoxaline
- Benzocaine
- Phenytoin
- Phenothiazine
- Barbiturate

II. Assay of drugs

- Chlorpromazine
- Phenobarbitone
- Atropine
- Ibuprofen
- Aspirin
- Furosemide

III. Determination of Partition coefficient for any two drugs

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BP403T	Course Name: Physical Pharmaceutics-II (Theory)	L	T	P	C
Course Offered in: KIET School of Pharmacy		3	1	0	4

Pre-requisite: NA

Course Objectives:

- Understand various physicochemical properties of drug molecules in the designing the dosage forms
- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Outcome: After completion of the course, the student will be able to

1. Examine the types, general characteristics, and effect of various factors on Colloidal dispersions
2. Identify the rheological behavior of fluids and the principles of deformation of solids.
3. Analyze the theories, types, various properties, and stability of coarse dispersions like suspensions and emulsions.
4. Analyze various aspects of micrometrics.
5. Analyze the effects of kinetics, degradation factors and common reactions on the stability of drugs including accelerated stability studies and their prevention.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	3	-	-	-	-	-	-	2
CO2	3	1	2	3	-	-	-	-	-	-	2
CO3	3	1	2	3	-	-	-	-	-	-	2
CO4	3	1	2	3	-	-	-	-	-	-	2
CO5	3	1	2	3	-	1	1	1	1	1	2

Unit 1	Colloidal dispersions	7 hours

Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

Unit 2	Rheology	8 hours

Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.

Unit 3	Coarse dispersion:	10 hours

Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

Unit 4	Micromeritics	10 hours

Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

Unit 5	Drug stability	10 hours

Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention

	Total Lecture Hours	45 hours

Textbook:

1. Tutorial pharmacy by Cooper and Gunn.
2. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
3. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.

<table>
<tr><td colspan="6">4. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc
5. Physical Pharmaceutics by Ramasamy C, and Manavalan R</td></tr>
<tr><td colspan="6">Reference Books:
1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.</td></tr>
<tr><td colspan="6">Mode of Evaluation</td></tr>
<tr><td colspan="2">MSE</td><td colspan="3">CA</td><td rowspan="2">ESE</td><td rowspan="2">Total</td></tr>
<tr><td>MSE1
30</td><td>MSE2
30</td><td>CA1
3</td><td>CA2
3</td><td>CA3
(ATT)
4</td></tr>
<tr><td colspan="2">Average of 2 MSE and converted to 15</td><td colspan="3">10</td><td>75</td><td>100</td></tr>
</table>

Course Code: BP407P	Course Name: Physical Pharmaceutics- II (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Determine particle size, size distribution, bulk density, true density, porosity, and flow properties.
- Measure viscosity of liquids and semisolids using Ostwald's and Brookfield viscometers.
- Assess sedimentation volume with varying suspending agents and concentrations.
- Determine first- and second-order reaction rate constants and conduct accelerated stability studies.

Course Outcome: After completion of the course, the student will be able to

1. Evaluate particle size, particle size distribution, and derived properties of the powder.
2. Calculate the viscosity of viscous samples using different methods.
3. Evaluate the prepared suspension and emulsion formulations.
4. Evaluate the kinetics of chemical reactions with stability studies.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	-	-	1	-	1	1	1
CO2	3	2	2	3	-	-	1	-	1	1	1
CO3	3	2	2	3	-	-	2	-	1	1	2
CO4	3	2	2	3	-	-	2	-	1	1	2

List Of Practical's (Indicative & Not Limited To)

1. Determination of particle size, particle size distribution using sieving method.
2. Determination of particle size, particle size distribution using microscopic method.
3. Determination of bulk density, true density and porosity.
4. Determine the angle of repose and influence of lubricant on angle of repose.
5. Determination of viscosity of liquid using Ostwald's viscometer.
6. Determination sedimentation volume with effect of different suspending agent.
7. Determination sedimentation volume with effect of different concentration of single suspending agent.
8. Determination of viscosity of semisolid by using Brookfield viscometer.
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order.
11. Accelerated stability studies.

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BP404T	Course Name: Pharmacology-I (Theory)	L	T	P	C
Course Offered in: KSOP		3	1	0	4

Pre-requisite: NA

Course Objectives:

- Understand the pharmacological actions of different categories of drugs
- Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
- Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- Observe the effect of drugs on animals by simulated experiments
- Appreciate correlation of pharmacology with other bio medical sciences.

Course Outcome: After completion of the course, the student will be able to

1. Acquire concept of general pharmacology and pharmacokinetics.
2. Analyze the mechanism of action of drugs, related adverse drug reaction, and drug interactions
3. Apply the implications of peripheral nervous system in treatment of associated diseases.
4. Apply the implications of central nervous system in treatment of neurological diseases
5. Audit the significance of drugs in pharmacotherapy of various diseases and management of adverse effects.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1
CO1	3	-	2	-	-	3	3	-	2	-	3
CO2	3	-	2	-	-	3	3	2	2	-	3
CO3	3	-	2	-	-	3	3	-	2	-	3
CO4	3	-	2	-	-	3	3	-	2	-	3
CO5	3	-	2	-	-	3	3	2	2	-	3

Unit 1	General Pharmacology	8 hours

Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination

Unit 2	General Pharmacology	12 hours

Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

Adverse drug reactions: Drug interactions (pharmacokinetic and pharmacodynamic)

Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

Unit 3	Pharmacology of drugs acting on peripheral nervous system	10 hours

Organization and function of ANS

Neurohumoral transmission,co-transmission and classification of neurotransmitters.

Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).

Local anesthetic agents

Drugs used in myasthenia gravis and glaucoma

Unit 4	Pharmacology of drugs acting on central nervous system	8 hours

Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.

General anesthetics and pre-anesthetics.

Sedatives, hypnotics and centrally acting muscle relaxants.

Anti-epileptics Alcohols and disulfiram		
Unit 5	**Pharmacology of drugs acting on central nervous system**	**07hours**
Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. Drugs used in Parkinsons disease and Alzheimer's disease. CNS stimulants and nootropics. Opioid analgesics and antagonists Drug addiction, drug abuse, tolerance and dependence.		
	Total Lecture Hours	**45 hours**

Textbook:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
4. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
5. K. D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
6. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
7. Modern Pharmacology with clinical Applications, by Charles R. Craig & Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
9. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan,

Reference Books:

1. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
2. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins

Mode of Evaluation

MSE		**CA**			**ESE**	**Total**
MSE1 **30**	**MSE2** **30**	**CA1** **3**	**CA2** **3**	**CA3 (ATT)** **4**		
Average of 2 MSE and converted to 15		**10**			**75**	**100**

Course Code: BP408P	Course Name: Pharmacology-I (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Learn fundamental principles, instruments, and techniques used in preclinical drug evaluation.
- Study laboratory animals, their maintenance as per CPCSEA guidelines, and ethical considerations in pharmacological research.
- Analyze drug effects on CNS, skeletal muscles, ocular tissues, and locomotor activity using software-based simulations.
- Perform simulated studies on drug administration routes, metabolism, anesthetics, and pharmacodynamic responses.

Course Outcome: After completion of the course, the student will be able to

1. Understand the CCSEA guidelines for laboratory animals, including ethical considerations, instrumentation, and essential techniques used in experimental pharmacology.
2. Understand the different routes of drug administration in mice and rats, along with key laboratory techniques for studying drug effects on physiological functions.
3. Understand the effect of enzyme inducers on sleeping time in mice, drug effects on ciliary motility in frogs, and pharmacological actions on the central and peripheral nervous systems.
4. Apply the concept of experimental methodologies to assess anticatatonic and anxiolytic activities, as well as the effects of local anesthetic agents in animal models.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	2	-	2	2	2	3	-	3
CO2	3	1	2	2	-	2	2	2	3	-	3
CO3	3	1	2	2	-	2	2	2	3	-	3
CO4	3	1	2	2	-	2	2	2	3	-	3

List Of Practical's (Indicative & Not Limited To)

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus.
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using Rota-rod apparatus.
11. Effect of drugs on locomotor activity using Actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods.

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by software and videos.

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2 -	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BP405T	Course Name: Pharmacognosy and Phytochemistry I (Theory)	L	T	P	C
Course Offered in: KSOP		3	1	0	4

Pre-requisite: NA

Course Objectives:

- To know the techniques in the cultivation and production of crude drugs
- To know the crude drugs, their uses and chemical nature
- Know the evaluation techniques for the herbal drugs
- To carry out the microscopic and morphological evaluation of crude drugs

Course Outcome: After completion of the course, the student will be able to

1. Appraise the sources, classification and quality control of herbal drugs.
2. Attain the knowledge of the cultivation & production of crude drugs and conservation of medicinal plants.
3. Illustrate the concepts of Plant Tissue Culture and to describe properties of edible vaccines.
4. Acquire the knowledge of traditional systems of medicine and to summarize properties of various secondary metabolites.
5. Explore the properties and applications of plant fibers, hallucinogens, carbohydrates, lipids, proteins, enzymes and marine products.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11
CO1	3	-	-	-	-	-	-	-	-	-	2
CO2	3	-	2	-	-	-	2	-	-	2	2
CO3	3	-	2	3	-	-	-	-	-	2	2
CO4	3	-	2	-	-	2	-	-	-	-	2
CO5	3	-	2	-	-	2	-	-	-	-	2

Unit 1	Introduction to Pharmacognosy	10 hours

Definition, history, scope and development of Pharmacognosy

Sources of Drugs – Plants, Animals, Marine & Tissue culture

Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

Unit 2	Cultivation, Collection, Processing and storage of drugs of natural origin	10 hours

Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

Unit 3	Plant tissue culture	07 hours

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines

Unit 4	Pharmacognosy in various systems of medicine	10 hours

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

Unit 5	Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs	08 hours

Plant Products:
Fibers - Cotton, Jute, Hemp
Hallucinogens, Teratogens, Natural allergens
Primary metabolites:
General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:
Carbohydrates: Acacia, Agar, Tragacanth, Honey
Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).
Lipids (Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax
Marine Drugs:
Novel medicinal agents from marine sources

Total Lecture Hours	45 hours

Textbook:

1. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
7. Anatomy of Crude Drugs by M.A. Iyengar

Reference Books:

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Text Book of Pharmacognosy by T.E. Wallis

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE 2 30	CA1 3	CA2 3	CA3 (ATT) 4		
Average of 2 MSE and converted to 15		10			75	100

Course Code: BP409P	Course Name: Pharmacognosy and Phytochemistry I (Practical)	L	T	P	C
Course Offered in: KIET School of Pharmacy		0	0	4	2

Pre-requisite: NA

Course Objectives: This course aims to:

- Perform chemical tests on natural substances like tragacanth, acacia, gelatin, starch, honey, castor oil, and agar.
- Determine stomatal number & index, vein islet & termination number, palisade ratio, starch grains, calcium oxalate crystals, and fiber dimensions.
- Assess ash values, extractive values, moisture content, swelling index, and foaming properties of crude drugs.
- Apply quantitative techniques such as the Lycopodium spore method for starch grain analysis and microscopy for structural studies.

Course Outcome: After completion of the course, the student will be able to

1. Describe quantitative microscopy for determining the leaf constant.
2. Determine the size of cellular content by micrometry technique using eyepiece micrometer.
3. Evaluate the crude drugs on the basis of WHO guidelines.
4. Analyze the crude drugs by chemical tests.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	-	1	-	-	-	-	3
CO2	2	2	2	2	-	1	-	-	-	-	3
CO3	3	3	3	3	-	3	3	-	-	-	3
CO4	3	3	3	3	-	3	-	--	-	-	3

List Of Practicals (Indicative & Not Limited To)

1 . Analysis of crude drugs by chemical tests:
(i) Tragacanth.
(ii) Acacia.
(iii) Gelatin.
(iv) Starch.
(v) Honey.
(vi) Castor oil.
(vii) Agar.
2. Determination of stomatal number and index.
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer.
5. Determination of Fiber length and width.
6. Determination of number of starch grains by Lycopodium spore method.
7. Determination of Ash value.
8. Determination of Extractive values of crude drugs.
9. Determination of moisture content of crude drugs.
10. Determination of swelling index and foaming.

Total Lecture Hours: 4 hrs./week

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 3	CA2 -	CA3 (ATT) 2		
Avg. of MSE1 & MSE2 and converted to 10		5			35	50

Course Code: BPH2 410	Course Name: Biomedical Waste Management	L	T	P	C
Course Offered in: KIET School of Pharmacy		2	0	0	0.2

Pre-requisite: NA

Course Objectives: The students shall be able:

- To understand the fundamentals of hazardous wastes and also the types, and sources of hazardous as well as biomedical wastes.
- To understand about the characteristics of various types of hazardous and biomedical wastes.
- To understand in detail about the storage, collection and transport of hazardous and biomedical wastes, and also to study about the methods used for handling and segregation of wastes.
- To improve the knowledge on the waste processing techniques which includes incineration, solidification and stabilization of hazardous wastes

Course Outcome: After completion of the course, the student will be able to

1. Understand the concept of healthcare waste.
2. Analyze the impact of biomedical waste on health.
3. Analyze the WHO guidelines and policies on healthcare waste management.
4. Apply the different treatment technologies in-site and off-site and waste minimization recycling and disposal technologies.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	3	-	-	3	2		2	3	2
CO2	3	-	3	-	-	3	3	2	1	3	2
CO3	3	2	3	2	2	3	2	3	2	3	2
CO4	3	2	3	3	-	3	1	2	1	3	2

Unit 1	Introduction	6 hours

Introduction, Definition of General and Hazardous health care waste, Infectious waste, Genotoxic waste, Waste Sharps, Biomedical waste – categories Categorization and composition of Biomedical waste. Specification of materials. Colour coding. Sources of Health care wastes, Hospitals & health care establishments & other sources.

Unit 2	Health impacts	4 hours

Health Impacts of Biochemical waste. Direct & Indirect hazards. Potential health hazards. Persons at risk. Basic information about infection. Infection agents on organizations, spread of infection, Basic information about Hospital acquired infection.

Unit 3	Legislation and policies on Health care waste management	6 hours

1. Biomedical waste Management and handling Rules, 1998 and its amendment thereafter. CPCB guidelines. (Central pollution control board) Some idea on Safe disposal of Radioactive waste Rules, 1995 guideline of BARC.
2. International Scenario World Health Organization guidelines on

a) Management of wastes from Hospital waste
b) Management of hospital wastes
c) Developing countries

Basic steps in Health Care Waste Management Segregation at the point of generation sharp Decontaminating/Disinfections unit container for autoclaving Sharp waste containers for storage & transportation autoclaving/shedding /incrimination/ biohazard symbols. Microwave, Hydropulping, plasma torch.
Collection & Handling of waste
On site Pre-treatment of waste

Unit 4	Mechanical Treatment & Chemical Disinfections	8 hours

1. Mechanical Treatment & Chemical Disinfections
2. Store & Off-site transportation
3. Treatment- in-site & off-site (common treatment facilities)
4. Liquid waste treatment Different technologies, cost aspect
5. Conventional Treatment Technologies

a) Wet thermal technology
b) Incineration - different models Alternative Treatment Technologies Microwave Technology Rotaclave system Hydro clave system Electro Thermal Reactivation (ETP) Treatment Process Electron beam Technology Plasma Pyrolysis /Gasification systems

Unit 5	Treatment of General/Non-infectious wastes	06 hours

1. Treatment of General/Non-infectious wastes

a. Composting Rotating Jumbling system French composting
b. Vermi-composting

2. Disposal Technologies
a) Sharp Disposal pit
b) Deep- burial pit
c) Secured Land fill

3. Waste Minimization Recycling, Re-use

Total Lecture Hours	**30 hours**

Textbook:
1. R.C.Goyal, Hospital Administration and Human Resource Management, PHI – Fourth Edition, 2006.
2. Dr. Shahnawaz Hamid, A Handbook on Biomedical Waste, Notion Press, 2019

Reference Books:
1. V.J. Landrum, Medical Waste Management and disposal, Elsevier, 1991.

Mode of Evaluation

MSE		CA			ESE	Total	
MSE1 45	**MSE2 45**	**CA1 6**	**CA2**	**CA3 (ATT) 4**			
Average of 2 MSE and converted to 15				**10**	**NA**	**25**	

Annexure-1

B. Pharm 3rd Semester Course Evaluation Structure

The evaluation of the B. Pharm course consists of both theory and lab assessments. The assessments are divided into multiple components as outlined below.

Theory Evaluation Plan

1.Continuous Assessment (CA) for BP301T, BP302T, BP303T, BP304T - Total Marks: 10
- CA-1: 3 Marks (Based on Assignment/Quiz/Class test/Presentation/GD/Seminar)
- CA-2: 3 Marks ((Based on Teacher Assessment)
- CA-3: 4 Marks (Based on attendance)

2.Continuous Assessment (CA) for Value Added Course BPH2 309 - Total Marks: 10
- CA-1: 6 Marks (Based on Assignment/Quiz/Class test/Presentation/GD/Seminar)
- CA-3: 4 Marks (Based on attendance)

3. Mid-Semester and End-Semester Evaluations BP301T, BP302T, BP303T, BP304T
Total Marks: 25 Internal, 75 External
- MSE-1: 30 Marks
- MSE-2: 30 Marks } MSE1 and MSE2 converted to 15 marks
- CA: 10 Marks (Based on continuous assessment)
- ESE: 75 Marks (externally evaluated)

4. Mid-Semester and End-Semester Evaluations BPH2 309
Total Marks: 25 Internal, 75 External
- MSE-1: 45 Marks
- MSE-2: 45 Marks } MSE1 and MSE2 converted to 15 marks
- CA: 10 Marks (Based on continuous assessment)
- ESE: 75 marks (externally evaluated)

Practical Evaluation Plan

1.Continuous Assessment (CA) for BP305P, BP306P, BP307P, BP308P - Total Marks: 5
- CA-1: 3 (Based on Lab record/Viva voce)
- CA-3: 2 Marks (Based on attendance)

2. Internal and External Marks Distribution for BP305P, BP306P, BP307P, BP308P
- MSE1: 40 marks
- MSE2: 40 marks } MSE1 and MSE2 converted to 10 marks
- CA: 5 Marks
- External: 35 Marks (Practical ESE)

Annexure-2

B. Pharm 4th semester Course Evaluation Structure

The evaluation of the B. Pharm course consists of both theory and lab assessments. The assessments are divided into multiple components as outlined below.

Theory Evaluation Plan

1.Continuous Assessment (CA) for BP401T, BP402T, BP403T, BP404T, and BP405T - Total Marks: 10
- CA-1: 3 Marks (Based on Assignment/Quiz/Class test/Presentation/GD/Seminar)
- CA-2: 3 Marks ((Based on Teacher Assessment)
- CA-3: 4 Marks (Based on attendance)

2.Continuous Assessment (CA) for Value Added Course BPH2 410 - Total Marks: 10
- CA-1: 6 Marks (Based on Assignment/Quiz/Class test/Presentation/GD/Seminar)
- CA-3: 4 Marks (Based on attendance)

3. Mid-Semester and End-Semester Evaluations BP401T, BP402T, BP403T, BP404T, and BP405T
Total Marks: 25 Internal, 75 External
- MSE-1: 30 Marks
- MSE-2: 30 Marks } MSE1 and MSE2 converted to 15 marks
- CA: 10 Marks (Based on continuous assessment)
- ESE: 75 Marks (externally evaluated)

4. Mid-Semester and End-Semester Evaluations BPH2 410
Total Marks: 25 Internal
- MSE-1: 45 Marks
- MSE-2: 45 Marks } MSE1 and MSE2 converted to 15 marks
- CA: 10 Marks (Based on continuous assessment)
- ESE: NA

Practical Evaluation Plan

1.Continuous Assessment (CA) for BP406P, BP407P, BP408P, BP409P - Total Marks: 5
- CA-1: 3 (Based on Lab record/Viva voce)
- CA-3: 2 Marks (Based on attendance)

2. Internal and External Marks Distribution for BP406P, BP407P, BP408P, BP409P
- MSE1: 40 marks
- MSE2: 40 marks } MSE1 and MSE2 converted to 10 marks
- CA: 5 Marks
- External: 35 Marks (Practical ESE)