

**SEMESTER-VII  
SCHEME OF TEACHING**

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		CREDITS	
		T	P	T	P
B701T	Pharmaceutical Technology Theory	4	--	3	--
B701P	Pharmaceutical Technology Practical	--	3	--	3
B702T	Drug Delivery Systems Theory	4	--	3	--
B702P	Drug Delivery Systems Practical	--	3	--	3
B703T	Clinical Pharmacy-I Theory	3	--	3	--
B703P	Clinical Pharmacy-I Practical	--	3	--	2
B704T	Medicinal Chemistry-II Theory	3	--	2	--
B704P	Medicinal Chemistry-II Practical	--	3	--	3
B705T	Pharmacognosy-V Theory	4	--	3	--
B705P	Pharmacognosy-V Practical	--	3	--	3
B706P	Elective Projects	--	3	--	2
	Total	36		30	

**SCHEME OF EXAMINATION**

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS			
				THEORY		PRACTICAL	
		T	P	University level evaluation	Institute level evaluation	University level evaluation	Institute level evaluation
B701T	Pharmaceutical Technology Theory	3	--	80	20	--	--
B701P	Pharmaceutical Technology Practical	--	3	--	--	80	20
B702T	Drug Delivery Systems Theory	3	--	80	20	--	--
B702P	Drug Delivery Systems Practical	--	3	--	--	80	20
B703T	Clinical Pharmacy-I Theory	3	--	80	20	--	--
B703P	Clinical Pharmacy-I Practical	--	3	--	--	80	20
B704T	Medicinal Chemistry-II Theory	3	--	80	20	--	--
B704P	Medicinal Chemistry-II Practical	--	3	--	--	80	20
B705T	Pharmacognosy-V Theory	3	--	80	20	--	--
B705P	Pharmacognosy-V Practical	--	3	--	--	80	20
B706P	Elective Projects	--	3	--	--	80	20
	Total	33		400	100	480	120

## B. PHARM SEMESTER - VII

**SUBJECT** : **Pharmaceutical Technology**  
**SUBJECT CODE** : **B701T & B701P**  
**RATIONALE** : The course enables the student to learn the basic technology involved in manufacturing of drug formulations.

**COURSE OBJECTIVES** :

1. To learn the basic manufacturing processes their integration and final product development.
2. The care to be taken to maintain quality and purity of drug formulations, impact of environmental factors and methods to regulate the same for better quality of manufacturing.

**LEARNING OUTCOMES:**

1. Explain the technology involved in manufacturing of various dosage forms.
2. Develop the dosage forms at laboratory scale
3. Evaluate the quality of these drug formulations using various tests.

**PREREQUISITES: Pharmaceutical unit operations**

**TEACHING AND EVALUATION SCHEME:**

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B701T & B701P	Pharmaceutical Technology	4	3	7	3	3	20	20	80	80	200

**B701T Pharmaceutical Technology**

Challenges, general formulation , manufacturing methods, automation, packaging, evaluation and stability studies of:		
1	Tablets : Granulation, Compression and Coating. Ideal requirements, Advantages and Disadvantages of tablets. Types of tablets with characteristic features and suitability /applications. General formulation for all types of tablets. Different methods of preparation of tablets: Direct compression, Wet granulation and Dry granulation. (Equipments used and flow diagrams) Factors affecting choice of manufacturing method, Comparison of all methods. Tablet defects: Reasons and remedies. Troubleshooting in tablet manufacturing. Tablet tooling-types with characteristic features. Tablet coating: Objectives, advantages and disadvantages. Types of coating—Sugar coating Film coating and enteric coating. (Coating compositions, applications/uses) Coating equipments, Area requirements, Hazards. IPQC and QC of all types of tablets. Packaging and stability testing of tablets.	20
2	Capsules--Hard Gelatin capsules, Soft gelatin capsules, Microcapsules. Objectives, Ideal requirements, Advantages and disadvantages. Determination of capsule size. Factors affecting selection of type of capsule and size. Preparation of capsule shell, QC parameters, and problems of capsule shell. Area requirements. Preparation of core formulations for all types of capsules. IPQC and QC and stability testing of capsules, Microencapsulation: Objectives, applications, disadvantages, F & D, E valuation of microcapsules.	15
3	Liquid s: Ideal requirements, advantages, disadvantages and suitability of liquid orals and Topical liquids. Challenges, general formulations, method of manufacturing (equipments and flow diagrams) of oral and Topical solutions, Suspensions, Emulsions, Antacid and Dry syrups. IPQC and QC and stability study of all liquid dosage forms.	15
4	Sterile Preparations: Ideal requirements, advantages, disadvantages and suitability of Injections and Ophthalmics.	15

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	Challenges , general formulations, method of manufacturing (equipments and flow diagrams) of SVP, LVP, Parenteral emulsions, Dry powder for injection and Ophthalmics (Solutions, suspensions, ointment and gels). Area and Personnel requirements. Environment control in parenteral manufacturing area. IPQC and QC and stability study of Sterile dosage forms.	
5	Semisolids: Ointments, Creams, Gels, Pastes, Suppositories. Objectives, Disadvantages, Challenges , General formulation, Manufacturing methods (equipments and flow diagrams), IPQC and QC and stability testing of semisolid dosage forms.	15
6	Aerosols: Objectives, Disadvantages, Challenges, General formulation, Manufacturing methods (equipments and flow diagrams), IPQC and QC and stability testing.	10
7	Radiopharmaceuticals: Preparation of radioisotopes, Applications in pharmaceuticals	05
8	Cosmetics: Oral care products, Shampoo, Lipstick, Nail cosmetics, Skin creams. General formulation and evaluation of products.	05

### B701P Pharmaceutical Technology Practical

1	Design, development and evaluation of controlled release dosage forms.
2	Experiments to illustrate Preparation, Physical & Chemical evaluation of Tablets.
3	Experiments to illustrate Preparation, Physical & Chemical evaluation of Capsules and microcapsules
4	Preparation, evaluation and packing of solution, suspensions and emulsions
5	Preparation, evaluation and packing of aerosols
6	Evaluation of materials used in pharmaceutical packaging

### BOOKS RECOMMENDED:

1.	“The Theory And Practice of Industrial Pharmacy”, Lachman Leon, Varghese Publication
2.	“Cosmetics : Science And Technology Vol-1,2,3”, Balsam M.S., Krieger Publication
3.	“Drug Formulations Manual”, Kohli D.P.S, Eastern Publication
4.	“Pharmaceutical Dosage Forms : Parenteral Medications Vol-1,2 & 3”, Avis Kenneth E. Ed., Marcel Dekker Publication
5.	“Pharmaceutical Dosage Forms : Disperse Systems Vol-1,2 & 3”, Lieberman Herbert A. Marcel Dekker Publication
6.	“Pharmaceutical Dosage Forms : Tablets Vol-1”, Lieberman Herbert A., Marcel Dekker Publication
7.	“Aerosol Science And Technology”, Reist Parker C., Technomic Publishing
8.	“Encyclopedia of Pharmaceutical Technology Vol 1-22”, Swarbrick James, Marcel Dekker Publication
9.	“Pharmaceutical Dissolution Testing Vol-49”, Banakar Umesh V., Marcel Dekker Publication
10.	“Process Instrumentation Dynamics And Control For Chemical Engineers : Computer Control, Solution, of Gate Problems With A P.C. Disk”, Chaudhuri Ray, Asian Book Pvt. Ltd.
11.	“Sterile Dosage Forms - Their Preparation And Clinical Application”, Turco Salvatore J, Lea and Febiger Publication

**SUBJECT : Drug Delivery Systems**  
**SUBJECT CODE : B702T & B702P**

**RATIONALE:** This subject discusses principles of development of new drug delivery systems through each route along with objectives and limitations. It also discusses the manufacturing techniques and approaches for preparing modified release dosage forms along with their characterization methods.

**COURSE OBJECTIVES:** At the end of the course the student should be able to:

1. Understand strategy for developing NDDS for given drug candidate.
2. Understand the basic principles of developing CR dosage forms and suitability criteria for drug for particular route of administration and type of DDS.

**LEARNING OUTCOMES:** At the end of the course the student will be able to:

1. Choose correct DDS for given drug candidate with suitable route of administration.
2. Justify the rationale for DDS.
3. Know proper characterization methods for each DDS.

**PREREQUISITES: Physical Pharmaceutics.**

**TEACHING AND EVALUATION SCHEME:**

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B702T & B702P	Drug Delivery Systems	4	3	7	3	3	20	20	80	80	200

**CONTENTS:**

1	Principles of Controlled Release Drug Delivery Systems: Definitions and Differentiation of various terms - Controlled Release, Sustained Release, Delayed Release, Repeat Action, Site Specific, Pulsed Release Systems. Classification of DDS – Based on Route of Administration, Based on drug release mechanisms. Suitability criteria of drug candidate for DDS - Physico-chemical Properties and Biopharmaceutical Properties. Techniques of Bioavailability enhancement of Drug Products	15
2	Oral DDS: Dissolution based, Diffusion based, Erosion Controlled Systems. Osmotic DDS. Methods of Preparation of Oral Controlled Release Systems and Evaluation.	20
3	Parenteral Controlled Release Systems: Objectives, Release mechanisms, Advantages and Disadvantages. Approaches for Parenteral Controlled Release - Solutions, Suspensions, Emulsions, Microspheres, Vesicular DDS, Nanoparticulate Systems. Methods of Evaluation.	10
4	Targeted /Site Specific DDS-Objectives, Advantages and Disadvantages. Approaches - Carrier mediated systems (Liposomes, Nanoparticles, Microcapsules and microspheres, Resealed erythrocytes), Colon targeting systems, Gastro-Retentive Systems, and Intestinal release/Enteric coated systems.	15
5	Transmucosal Drug Delivery System - Objectives, advantages, disadvantages of: Formulation approaches for Ocular DDS, Buccal DDS, Nasal DDS, Pulmonary DDS, Rectal DDS, and Vaginal DDS.	20
6	Transdermal DDS	20

	Structure and Physiology of Skin, Percutaneous Absorption mechanisms. Objectives, Advantages and Disadvantages of transdermal Drug Delivery. Suitability of Drug candidates for Transdermal route. Formulation Approaches and its Applications Evaluation of Transdermal System. Brief introduction of Iontophoresis, Phonophoresis and Sonophoresis.	
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**B702P Drug Delivery Systems Practical**

Preparation and Characterization of	
1	Solid Dispersions
2	Microspheres
3	Matrix Tablets
4	Floating Tablets
5	Fast Dissolving Tablets
6	Transdermal and Transmucosal DDS

**BOOKS RECOMMENDED:**

1.	“Modern Pharmaceutical Vol-121”, Gilbert S Banker, Marcel Dekker Publication
2.	“Pharmaceutics The Science Of Dosage From Design”, Aulton Michael E., Elbs Publication
3.	“The Theory And Practice Of Industrial Pharmacy”, Lachman Leon, Varghese Publication
4.	“Ansel’s Pharmaceutical Dosage Forms And Drugs Delivery System”, Loyd V Allen, B I Publication
5.	“Encyclopedia of Pharmaceutical Technology Vol 1-22”, Swarbrick James, Marcel Dekker Publication
6.	“Controlled and Novel Drug Delivery”, Jain N.K., CBS Publication
7.	“Progress In Controlled and Novel Drug Delivery Systems”, Jain N. K. Ed., CBS Publication
8.	“Advances In Controlled And Novel Drug Delivery”, Jain N.K., CBS Publication
9.	“Controlled Drug Delivery Vol-29”, Robinson Joseph R., Marcel Dekker Publication

## B. PHARM SEMESTER - VII

**SUBJECT** : **Clinical Pharmacy-I**  
**SUBJECT CODE** : **B703T & B703P**  
**RATIONALE** : The subject introduces the clinical pharmacy to the students with basic principles of clinical pharmacokinetics and clinical toxicology. It also discusses the drugs used in special populations and diseases and clinical laboratory tests and their interpretations.

**COURSE OBJECTIVES** : Upon completion of this semester course it is expected that student should be able to

1. Understand the elements of clinical and pharmaceutical care and provide comprehensive care
2. Interpret the laboratory results to aid the clinical diagnosis and management
3. Provide integrated, critically analyzed drug and poison information to enable health care professionals and information seekers in the efficient use of medicine;

**LEARNING OUTCOMES:** At the end of the course the student will be able to:

1. Understand roll of clinical pharmacist.
2. Perform in hospital in clinical department.
3. Understand common medical terminology and diseases.
4. Collect and manage patient data.

**PREREQUISITES:** Basic Pharmacology, Anatomy Physiology, Community Pharmacy

**TEACHING AND EVALUATION SCHEME:**

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B703T & B703P	Clinical Pharmacy-I	3	3	6	3	2	20	20	80	80	200

**CONTENTS:**

1	Introduction to Clinical pharmacy, concept (clinical, community, hospital and social pharmacy), objectives and scope	01
2	Basic concepts of clinical pharmacokinetics and individualization of drug therapy	02
3	Drugs used in special populations: Pediatrics, Geriatrics, Pregnancy and lactation	14
4	Drug induced diseases Blood disorders: Liver diseases, Kidney diseases, Hypersensitivity reactions, Cardiac and Pulmonary disorders.	06
5	Interpretation of common clinical laboratory tests and its significance: Hematological tests (Blood picture) and Coagulation tests (PT, PTT, BT, CT), Liver function tests (SGPT, SGOT, ALP, Acid phosphatase, bilirubin, LDH, GGT), Renal function tests (creatinine, BUN, cysteine C) Cardiac markers (CK, Troponins, D-dimer, ANP), Inflammatory markers (ESR, CRP), Others (uric acid, electrolytes-Na, K).	18
6	Clinical toxicology: Introduction to toxicology, general treatment of poisoning, systemic antidotes, treatment of following poisons: Insecticides, Heavy metal, Narcotic Barbiturates and Organophosphorus	10
7	Drug interactions (DI): Introduction, mechanisms, types of DI, drug-drug interactions, drug-food interactions, drug-herb interactions	04
8	Pharmacovigilance (PV): Concept including adverse event (AE), Adverse drug reaction (ADR), Serious adverse drug reaction (SADR), objectives of PV	04

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9	Drug therapy monitoring: concept, goal and significance of Prescription monitoring, Therapeutic drug monitoring- warfarin, lithium, digoxin, phenytoin	04
10	Concept of essential drug and rational drug use	02
11	Pharmacoeconomics: concept, types of cost and methods	02
12	Patient counseling: skills and process; taking patient history	02
13	Diagnosis and management of cardiovascular diseases: Hypertension Congestive heart failure, Angina, Acute myocardial infarction, Dysrhythmia	15
14	Diagnosis and management of CNS disorders: Concepts of psychological & neurological illnesses Epilepsy, Parkinsonism, Schizophrenia, Depression	16

### B703P Clinical Pharmacy-I Practical

1. Review of prescription/medication order for deficiencies of prescription.
2. Review of prescription/medication order for finding drug interactions.
3. Case studies of adverse drug reactions.
4. Orientation and demonstration of patient counseling.
5. Patient counseling for diseases conditions mentioned in syllabus.
6. Case studies of disease conditions mentioned in syllabus.
7. Any other practicals based theory syllabus.

### BOOKS RECOMMENDED: (LATEST EDITION OF BOOKS)

1. A Handbook Of Experiments In Pre-Clinical Pharmacology By Kasture
2. Basic Principles Of Clinical Research And Methodology By Gupta SK
3. Clinical Pharmacy And Therapeutics By Herfindal
4. Clinical Pharmacy And Therapeutics By Roger Walker
5. Textbook Of Biopharmaceutics And Clinical Pharmacokinetics By Keane Bil
6. Applied Therapeutics: The Clinical Use Of Drugs By Koch And Kimble
7. Basic And Clinical Pharmacology By Katzung
8. Basic And Clinical Pharmacology Made Memorable By Luty Jason
9. Clinical Interpretation Of Laboratory Test By Widmann Frances
10. Encyclopedia Of Clinical Pharmacy By Dipiro Joseph
11. Principles Of Clinical Pharmacology By Atkinson Arthur
12. A Text Book Of Clinical Pharmacy Practice: Essential Concepts And Skills By Parthasarthi
13. Clinical Pharmacology By Bennet
14. Clinical Pharmacology By Laurence
15. Meylers Side Effects Of Drugs VOL 1 – 6 By Aronson J.K
16. Clinical Pharmacokinetics : Concepts And Application By Rowland Macolm
17. CLINICAL PHARMACY By Tipnis
18. Modern Pharmacology With Clinical Applications By Craig Charles
19. Oxford Text Book Of Clinical Pharmacology And Drug Therapy By Grathame Smith
20. Handbook Of Clinical Pharmacy By Yadav A.V
21. Aids To Clinical Pharmacology And Therapeutics By Rees John
22. CLINICAL TOXICOLOGY By Marsha Ford
23. Contemporary Perspectives On Clinical Pharmacotherapeutics By Kamlesh Kohli
24. Element Of Clinical Pharmacy By R K Goyal
25. MCQs IN CLINICAL PHARMACOLOGY By Mant Timothy
26. Selected Topics In Clinical Pharmacology By Kshirsagar

**B. PHARM SEMESTER - VII**

**SUBJECT** : Medicinal Chemistry-II  
**SUBJECT CODE** : B704T

**RATIONALE** : This subject is an extension of Medicinal Chemistry studied in previous semester. Further Therapeutic classes are explored.

**COURSE OBJECTIVES** : To learn the structure, Structure activity relationship, physicochemical properties and therapeutic uses of drugs belonging to various therapeutic classes

**LEARNING OUTCOMES:**

- 1) Draw correct chemical structure of drugs and its classification
- 2) Give IUPAC name of drugs
- 3) Narrate physicochemical properties and Structure activity relationship with biological activity.
- 4) Carry out synthesis of certain drugs and its application.

**PREREQUISITES:** Knowledge of Pharmacology and Organic Chemistry

**TEACHING AND EVALUATION SCHEME:**

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B704T B704P	Medicinal Chemistry-II	3	3	6	2	3	20	20	80	80	200

**CONTENTS:**

1	Drugs acting in Infective diseases-Sulfonamides and Quinolones Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Anti-infective agents (including sulphonamide).	10
2	Antibiotics Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Antibiotics, beta-lactams, tetracyclines, aminoglycosides, macrolides, chloramphenicol and miscellaneous antibiotics.	20
3	Chemotherapy of fungal infections, tuberculosis and leprosy Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Drugs used in Chemotherapy of fungal infections, tuberculosis and leprosy.	10
4	Chemotherapeutic agents used in Protozoal, Parasitic and other infection Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Chemotherapeutic agents used in Protozoal, Parasitic and other infection	05
5	Antineoplastic agents Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Antineoplastic agents, Immunosuppressive and immunostimulants.	10
6	Anti-viral Chemotherapy Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Anti-viral including anti-HIV agents.	10



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7	Diagnostic agents and Pharmaceutical Aids Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Diagnostic agents, Pharmaceutical Aids.	05
8	Steroids and related drugs Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Steroids and related drugs: Steroidal nomenclature and stereochemistry, androgens and anabolic agents, estrogens and progestational agents, adrenocorticoids.	10
9	Protein, hormones and related drugs Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Amino acids, peptides, nucleotides and related drugs (Thyroid and anti thyroid drugs, Insulin and oral hypoglycemic agents, Peptidomimetics and nucleotidomimetics).	15
10	Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs: Drugs affecting uterine motility-Oxytocics (including oxytocin, ergot alkaloids and prostaglandins).	05

### B704P Medicinal Chemistry-II Practical

1.	Introduction to separation and Identification of organic binary mixtures and importance of solubility in separation of mixture.
2-9	To separate and identify the given organic Liquid-Liquid binary mixture.
10	To study reaction monitoring by Thin Layer Chromatography (TLC).
11	To synthesize sulphanilamide from acetanilide. (Step 1)
12	To synthesize sulphanilamide from acetanilide. (Step 2)
13	To synthesize phthalimide from phthalic anhydride.
14	To synthesize anthranilic acid from phthalimide.
15	To synthesize N-phenyl anthranilic acid from <i>o</i> -chlorobenzoic acid
16	To study IR and proton NMR spectra of compound.

### BOOKS RECOMMENDED:

1	Block, J. and Beale, J. M. Eds., Wilson and Giswold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams & Wilkins, Philadelphia, 2004
2	Lemke, L. T., Williams, D. A., Victoria F Roche, V. F. Principles of Medicinal Chemistry, Lippincott Williams & Wilkins, Philadelphia, 2007.
3	Furniss, B.S. Hannaford, A.J., Smith, P.W.G., Tatchell, A.R., Vogel's Textbook of Practical Organic Chemistry, Pearson Education (ELBS/Longman group), London, 1989.
4	Mann, F. G. & Saunder, B. C., Introduction to Practical Organic Chemistry, 1 <sup>st</sup> Edition, Longmans, Green, London, 1941.
5	Shriner, R. L., Hermann, C. K. F., Morrill, T. C., The Systematic Identification of Organic Compounds, John Wiley & Sons, USA, 2003.
6	Thomas, G., Fundamentals of Medicinal Chemistry, 1 <sup>st</sup> Edition, John Wiley & Sons, 2003.
7	Abraham, D. J., Ed., Burger's Medicinal Chemistry and Drug Discovery, Vol. 1-6, 6 <sup>th</sup> Edition, John Wiley & Sons, New Jersey, 2003. Lednicer, D., Strategies for Organic Drug Synthesis & Design, John Wiley & Sons, USA, 1998.
8	Kar, A., Medicinal Chemistry, New Age International Publishers, New Delhi, 2007.
9	Ladu, B. N., Mandel H.G. & E. L. Way, Fundamentals of Drug Metabolism & Disposition, William & Wilkins Co., Baltimore.

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10	Finar, I.L., Organic Chemistry, Vol. I & II, 6 <sup>th</sup> Edition, Pearson Education (ELBS/Longman group), London, 2004.
11	Nogradey, T., Medicinal Chemistry: A Molecular and Biochemical Approach, Oxford University Press, New York, Oxford, 2005.
12	Silverstein, R. M., Basseler, G. C., Morrill, T.C., Spectrometric Identification of Organic Compounds, John Wiley & Sons, USA, 1967.
13	Kemp, W., Organic Spectroscopy, 3 <sup>rd</sup> Edition, W.H. Freeman & Company/ELBS, London, 1991.
14	Taylor, J. B and Triggle, D. J., Comprehensive Medicinal Chemistry II, Vol. 1-8, Quantitative Drug Design, Elsevier Ltd., 2007
15	Martin, Y. C. Quantitative Drug Design- A Critical Introduction (Medicinal Research Monograph, Vol. 8) Marcel Dekker Inc., New York, 1978.
16	Lednicer, D. Strategies for Organic Drug Synthesis & Design, Vol 1-6, John Wiley & Sons, USA, 2002.
17	Jurs, P. C. Computer Software Application in Chemistry, 2 <sup>nd</sup> Edition, John Wiley & Sons, New York, 1996.
18	Block, J. and Beale, J. M. Eds., Wilson and Giswold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams & Wilkins, Philadelphia, 2004
19	Lemke, L. T., Williams, D. A., Victoria F Roche, V. F. Principles of Medicinal Chemistry, Lippincott Williams & Wilkins, Philadelphia, 2007.

## B. PHARM SEMESTER - VII

**SUBJECT** : Pharmacognosy-V  
**SUBJECT CODE** : B705T & B705P  
**RATIONALE** : This subject is further extension of the subject studied in earlier semesters. Additionally tissue culture techniques and preparation of specialized Ayurvedic products will be taught in this subject

### COURSE OBJECTIVES :

- 1) To learn general morphological and microscopical characters of crude drugs
- 2) To understand general methods of checking purity of herbal drugs.
- 3) Introduce Ayurvedic formulations
- 4) Introduce the fundamentals of tissue culture techniques.

**LEARNING OUTCOMES:** The student should be able to:

- 1) Identify the crude drugs belonging to different classes based on morphological, microscopical and chemical properties.
- 2) Narrate the therapeutic and pharmaceutical uses of these drugs

**PREREQUISITES:** Biology and Pharmacognosy of semester-III, IV, V and VI

### TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B705T & B705P	Pharmacognosy-V	4	3	7	3	3	20	20	80	80	200

### CONTENTS:

1	Chemistry, Isolation, Estimation, Biogenetic pathway, Biosynthesis and pharmacological properties of the following natural compounds	
	<ul style="list-style-type: none"><li>• Terpenoids: Limonene, Menthol, carvone, Sitosterol, lupeol</li></ul>	15
	<ul style="list-style-type: none"><li>• Carotenoids : <math>\beta</math>-Carotene</li></ul>	5
	<ul style="list-style-type: none"><li>• Glycosides: Digitoxin, Sennoside, Diosgenin</li></ul>	10
	<ul style="list-style-type: none"><li>• Alkaloids: Atropine, Quinine, Reserpine, Morphine, Ephedrine, ergot, caffeine, piperine</li></ul>	20
	<ul style="list-style-type: none"><li>• Lignans- Podophylotoxin</li></ul>	5
	<ul style="list-style-type: none"><li>• Flavonoids- Rutin</li></ul>	5
2	Current good manufacturing practices for herbal medicines (schedule T).	15
3	The holistic concept of drug administration in traditional systems of medicine. Introduction to Ayurvedic preparation like Arishtas, Asavas, Gutikas, Tailas, Churna, Lehya & Bhasma.	25

### B705P Pharmacognosy-V Practical

1	Introduction to Soxhlet extraction process
2	Isolation and identification of glycyrrhizinate from glycyrrhiza powder
3	Isolation of andrographolide from <i>Andrographis paniculata</i>
4	Isolation and identification of Quinine sulphate from cinchona bark.
5	Isolation and identification of nicotine picrate from tobacco leaves.
6	Isolation and identification of calcium citrate from lemon juice & pectin from lemon peel

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7	Isolation and identification of caffeine from different brand of tea.
8	Isolation and identification of piperine from piper fruit powder.
9	Estimation of sennoside in senna powder.
10	Estimation of total tannin in Amla, Bahera, Harde powder and TRIFALA Churna.
11	Estimation of total flavonoids in the given sample
12	Estimation of total vasaka alkaloids by titrimetric method.
13	Estimation of total Rauwolfia alkaloids by colorimetric method.
14	Estimation of total phenolics in given sample
15	Estimation of carvone/citral

### BOOKS RECOMMENDED:

1.	Harborne J. B., Phytochemical Methods : A Guide To Modern Techniques Of Plant Analysis
2.	Paul And Devick, Medicinal Natural Products
3.	O.P. Agrawal, Chemistry Of Natural Products
4.	Chatwal Gurdeep R., Organic Chemistry Of Natural Products, Himalaya Publication
5.	Finar, Organic Chemistry Vol. Ii, Chemistry Of Natural Products, Elbs Publication
6.	Anasari, Pharmacognosy Textbook Of Natural Products, Latest Edition.
7.	Ashutosh Kar, Pharmacognosy And Pharmacobiotechnology, New Age International Publication
8.	Bruneton Jean, Pharmacognosy : Phytochemistry Medicinal Plants, Lavoisier Publishing
9.	Wagner, Plant Drug Analysis, Springer Verlag Publication
10.	Ayurvedic Pharmacopoeia Of India
11.	Ayurvedic Formulary of India (Formulations)

**B. PHARM SEMESTER - VII****SUBJECT : Elective Projects****SUBJECT CODE : B706P****RATIONALE :** The subject involves practical work either Lab. Work, or field work related to the theoretical aspect of respective subject. The experimental work is associated with result analysis and constructive conclusions. The total exercise help students to learn how to conduct Project work.**TEACHING AND EVALUATION SCHEME:**

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS	EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS		INTERNAL		EXTERNAL		
						Theory	Practical	Theory	Practical	
B706P	Elective Projects	-	3	3	2	--	20	--	80	100

**B706P ELECTIVE PROJECT SUBJECT CODE**

SPECIALIZATION	SUBJECT CODE	SUBJECTS
A. Pharmacology	706P-A1	Preclinical Toxicology
	706P-A2	Good Clinical Practice in Clinical Research
B. Pharmaceutical Chemistry	706P-B1	Validation in Pharmacy
	706P-B2	Advanced Organic Chemistry
C. Pharmaceutics & Pharmaceutical Technology	706P-C1	Stability Study of Pharmaceuticals
	706P-C2	Cosmetic Technology
D. Pharmacognosy	706P-D1	Standardization of crude drugs and their herbal formulations
	706P-D2	Phytochemical Screening of Herbal Drugs
E. Entrepreneurship Development	706P-E	Entrepreneurship Development