

# GANPAT UNIVERSITY

## FACULTY OF PHARMACY

### TEACHING AND EXAMINATION SCHEME

Program		Bachelor of Pharmacy (B.Pharm)	Branch	-				Semester	2				Version	3.0.0.0				
Effective from		2018-19		Effective for batches admitted onwards				2018-19										
S. N	Subject Code	Subject Name	Theory / Practical	Teaching Scheme								Examination Scheme						
				Credit				Hours Per Week				Theory Marks			Practical Marks			Total Marks
				Le	Tu	Pr	Total	Le	Tu	Pr	Total	CE	SE	ES	CE	SE	ES	
1	BPH201	Human Anatomy and Physiology II	Theory / Practical	3	1	2	6	3	1	4	8	10	15	75	10	15	75	200
2	BPH202	Pharmaceutical Organic Chemistry I	Theory / Practical	3	1	2	6	3	1	4	8	10	15	75	10	15	75	200
3	BPH203	Pharmaceutical Engineering	Theory / Practical	3	1	2	6	3	1	4	8	10	15	75	10	15	75	200
4	BPH204	Computer Applications in Pharmacy	Theory / Practical	3	-	1	4	3	-	2	5	10	15	75	10	15	75	200
5	BPH205	Environmental Sciences	Theory	3	-	-	3	3	-	-	3	10	15	75	-	-	-	100
Total				15	3	7	25	15	3	14	32	50	75	375	40	60	300	900

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FACULTY OF PHARMACY												
Program	Bachelor of Pharmacy				Branch/Spec.	B.Pharm.						
Semester	II				Version	3.0.0.0						
Effective from Academic Year	2018-19		Effective for the batches Admitted onwards		2018-19							
Subject code	BPH201		Subject Name	Human Anatomy and Physiology - II								
Teaching scheme				Examination scheme								
	Le	Tu	Pr	Total	Marks	CE	SE	ES	Total	Duration	SE	ES
Hours	3	1	4	8	Theory	10	15	75	100	Theory	1 hr.	3 hr.
Credit	3	1	2	6	Practical	10	15	75	100	Practical	4 hr.	4 hr.
<b>Pre-requisites</b>												
Nil												
<b>Scope and Objectives:</b>												
Upon completion of the course student shall be able to												
	<ul style="list-style-type: none"> <li>Explain the gross morphology, structure and functions of various organs of the human body.</li> <li>Describe the various homeostatic mechanisms and their imbalances.</li> <li>Identify the various tissues and organs of different systems of human body.</li> <li>Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time test and also record blood pressure, heart rate, pulse and respiratory volume.</li> <li>Appreciate coordinated working pattern of different organs of each system</li> <li>Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.</li> </ul>											
<b>Learning Outcome:</b>												
	<ul style="list-style-type: none"> <li>This course increased awareness amongst students about functioning of the human body will be achieved. This course would prepare students with basic knowledge for best possible patient care.</li> <li>This course is designed to impart a fundamental knowledge on the structure and functions of the human body.</li> <li>Upon accomplishment of this course students would be able to understand therapeutic aspects of drugs betterly.</li> </ul>											
<b>Syllabus- Theory</b>												
Unit	Content											Hrs
1	<b>Nervous system:</b> Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters <b>Central nervous system:</b> Meninges, ventricles of brain and cerebrospinal fluid. structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)											10
2	<b>Digestive System:</b> Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. <b>Energetics:</b> Formation and role of ATP, Creatinine Phosphate and BMR.											6
3	<b>Respiratory system</b> Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods <b>Urinary system</b> Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney											10
4	<b>Endocrine system</b> Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders											10
5	<b>Reproductive system</b> Anatomy of male and female reproductive system, Functions of male and female reproductive system,											9

	sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition. <b>Introduction to genetics</b> Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	
<b>Syllabus-Practical</b>		
1	To study the integumentary and special senses using specimen, models, etc.,	
2	To study the nervous system using specimen, models, etc.,	
3	To study the endocrine system using specimen, models, etc	
4	To demonstrate the general neurological examination	
5	To demonstrate the function of olfactory nerve	
6	To examine the different types of taste.	
7	To demonstrate the visual acuity	
8	To demonstrate the reflex activity	
9	Recording of body temperature	
10	To demonstrate positive and negative feedback mechanism	
11	Determination of tidal volume and vital capacity	
12	Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens	
13	Recording of basal mass index	
14	Study of family planning devices and pregnancy diagnosis test	
15	Demonstration of total blood count by cell analyser	
16	Permanent slides of vital organs and gonads	
<b>Text books</b>		
1	Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi	
2	Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York	
3	Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA	
4	Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A	
5	Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A	
6	Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi	
7	Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi	
8	Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi	
<b>Reference books</b>		
1	Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA	
2	Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A	
3	Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata	

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## FACULTY OF PHARMACY

Program	Bachelor of Pharmacy			Branch/Spec.	B.Pharm.							
Semester	II			Version	3.0.0.0							
Effective from Academic Year	2018-19			Effective for the batches Admitted onwards	June 2018							
Subject code	BPH202			Subject Name	Pharmaceutical Organic Chemistry I							
Teaching scheme					Examination scheme							
	Le	Tu	Pr	Total	Marks	CE	SE	ES	Total	Duration	SE	ES
Hours	3	1	4	8	Theory	10	15	75	100	Theory	1 hr.	3 hr.
Credit	3	1	2	6	Practical	10	15	75	100	Practical	4 hr.	4 hr.
<b>Pre-requisites</b>												
Nil												
<b>Scope and Objectives:</b>												
This course deals with the fundamentals of Organic chemistry.												
<b>Learning Outcome:</b>												
By the end of this course, the students shall have good understanding of the basic concepts of Organic Chemistry with reaction mechanisms.												
Students shall be able to describe preparation and reaction of organic compounds.												
The course may help the students in understanding novel approaches in synthesis.												
<b>Syllabus- Theory</b>												
<b>Unit</b>	<b>Content</b>											<b>Hrs.</b>
1	<b>Classification, nomenclature and isomerism:</b> Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds											7
2	<b>Alkanes and Alkenes</b> SP hybridization in alkanes, Halogenation of alkanes, uses of paraffins, Stabilities of alkenes, SP hybridization in alkenes, E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 versus E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.											7
3	<b>Conjugated dienes:</b> Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement											3
4	<b>Alkyl halides:</b> SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform											6
5	<b>Alcohols-</b> Qualitative tests, Structure & uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol											4
6	<b>Carbonyl compounds (Aldehydes and ketones):</b> Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde											9
7	<b>Carboxylic acids:</b> Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phtalate, Methyl salicylate and Acetyl salicylic acid											6
8	<b>Aliphatic amines</b> - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine											3

<b>Syllabus-Practical</b>	
1	Systematic qualitative analysis of organic compounds and preparation of their derivative such as Benzoic acid, acetanilide, alpha nepthol, paratoludene, nepthalene, anthracene, resourcinoletc
2	Synthesis of important medicinal agents based on reaction mechanism such as nitration, sulfonation, halogenation, esterification etc.
3	Following compounds shall be synthesized. Acetanilide, P-nitro acetanilide, Phthalimideetc
4	Construction of molecular models
<b>Text books</b>	
1	Organic Chemistry, Robert T. Morrison and Robert N. Boyd, 6th ed., PH I Learning Pvt. Ltd., New Delhi, 2008
2	Introduction to Organic Chemistry I &II by HetalPrajapati, Nirav&Roopalprakashan
3	Organic Chemistry, Vol I and II by I. L. Finar, 6th ed., Pearson Education, New Delhi, 2000
4	Practical Organic Chemistry by Hitesh Raval and Sunil Baldania, Nirav&Roopalprakashan
5	Vogel's text book of Practical Organic Chemistry
6	Practical Pharmaceutical Organic Chemistry-1 by ArvindUmarkar.
7	Advanced Practical organic chemistry by N.K.Vishnoi.
<b>Reference books</b>	
1	Advanced Organic Chemistry, Jerry March, 4th ed., Wiley India, 2007
2	Organic Chemistry, G. Marc Loudon, 4th ed., Oxford University Press, 2004.
3	Textbook of Organic Chemistry by B.S. Bahl& ArunBahl.
4	Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

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Program	Bachelor of Pharmacy				Branch/Spec.	B.Pharm.						
Semester	II				Version	3.0.0.0						
Effective from Academic Year	2018-19		Effective for the batches Admitted onwards 2018-19									
Subject code	BPH203		Subject Name	Pharmaceutical Engineering								
Teaching scheme				Examination scheme								
	Le	Tu	Pr	Total	Marks	CE	SE	ES	Total	Duration	SE	ES
Hours	3	1	4	8	Theory	10	15	75	100	Theory	1 hr.	3 hr.
Credit	3	1	2	6	Practical	10	15	75	100	Practical	4 hr.	4 hr.
<b>Pre-requisites</b>												
Nil												
<b>Scope and Objectives:</b>												
This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.												
<b>Learning Outcome:</b>												
<p>Upon completion of the course the student shall be able to</p> <ul style="list-style-type: none"> <li>➤ know various unit operations used in Pharmaceutical industries.</li> <li>➤ understand the material handling techniques.</li> <li>➤ perform various processes involved in pharmaceutical manufacturing process.</li> <li>➤ carry out various test to prevent environmental pollution.</li> <li>➤ appreciate and comprehend significance of plant lay out design for optimum use of resources.</li> <li>➤ appreciate the various preventive methods used for corrosion control in Pharmaceutical industries</li> </ul>												
<b>Syllabus- Theory</b>												
Unit	Content											Hrs
1	<b>Flow of fluids:</b> Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.											5
2	<b>Size Reduction:</b> 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.											3
3	<b>Size Separation:</b> 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.											2
4	<b>Heat Transfer:</b> Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.											2
5	<b>Evaporation:</b> 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.											4
6	<b>Distillation:</b> Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation											4
7	<b>Drying:</b> 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											5
8	<b>Mixing:</b> 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											5
9	<b>Filtration:</b> 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 Seidtz filter											5
10	<b>Centrifugation:</b> Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.											5
11	<b>Materials of pharmaceutical plant construction, Corrosion and its prevention:</b> Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.											5

<b>Syllabus-Practical</b>	
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 – i) 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, de humidifier
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's 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
<b>Text books</b>	
1	Physical pharmaceutics- C.V.S Subrahmanyam et al., VallabhPrakashan Latest edition.
2	Pharmaceutical Engineering-I and II - G.K.Jani, B. S. Shah Prakashan
3	Pharmaceutical Engineering, Thakur Publication
4	Pharmaceutical Engineering, K. Sambamurty, New Age Publication
<b>Reference books</b>	
1	Introduction to chemical engineering – Walter L Badger & Julius Banchemo, Latest edition.
2	Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition.
3	Unit operation of chemical engineering – McCabe Smith, Latest edition.
4	Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5	Remington practice of pharmacy- Martin, Latest edition.
6	Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7	Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition

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Program	Bachelor of Pharmacy				Branch/Spec.	B.Pharm.						
Semester	II				Version	3.0.0.0						
Effective from Academic Year	2018-19			Effective for the batches Admitted onwards	2018-19							
Subject code	BP204TP			Subject Name	Computer Applications in Pharmacy							
Teaching scheme					Examination scheme							
	Le	Tu	Pr	Total	Marks	CE	SE	ES	Total	Duration	SE	ES
Hours	3	-	2	5	Theory	10	15	75	100	Theory	1 hr.	3 hr.
Credit	3	-	1	4	Practical	10	15	75	100	Practical	4 hr.	4 hr.
<b>Pre-requisites</b>												
Nil												
<b>Scope and Objectives:</b>												
This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.												
<b>Learning Outcome:</b>												
Upon completion of the course the student shall be able to <ul style="list-style-type: none"> <li>➤ know the various types of application of computers in pharmacy</li> <li>➤ know the various types of databases</li> <li>➤ know the various applications of databases in pharmacy</li> </ul>												
<b>Syllabus- Theory</b>												
Unit	Content											Hrs
1	<b>Number system:</b> Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division <b>Concept of Information Systems and Software :</b> Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project											9
2	<b>Web technologies:</b> Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products. Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database											9
3	<b>Application of computers in Pharmacy –</b> Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System											9
4	<b>Bioinformatics:</b> Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery											9
5	<b>Computers as data analysis in Preclinical development:</b> Chromatographic data analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMs)											9
<b>Syllabus-Practical</b>												
1	Design a questionnaire using a word processing package to gather information about a particular disease.											
2	Create a HTML web page to show personal information.											
3	Retrieve the information of a drug and its adverse effects using online tools											
4	Creating mailing labels Using Label Wizard , generating label in MS WORD											
5	Create a database in MS Access to store the patient information with the required fields Using access											
6	Design a form in MS Access to view, add, delete and modify the patient record in the database											
7	Generating report and printing the report from patient database											
8	Creating invoice table using – MS Access											
9	Drug information storage and retrieval using MS Access											
10	Creating and working with queries in MS Access											
11	Exporting Tables, Queries, Forms and Reports to web pages											
12	Exporting Tables, Queries, Forms and Reports to XML pages											



<b>Recommended Books</b>	
1	Computer Application in Pharmacy – William E. Fassett –Lea and Febiger,600 South Washington Square, USA, (215) 922-1330.
2	Computer Application in Pharmaceutical Research and Development –Sean Ekins– Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3	Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4	Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd.,4435/7, Ansari Road, Daryagani, New Delhi - 110002

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Program	Bachelor of Pharmacy			Branch/Spec.	B.Pharm.							
Semester	II			Version	3.0.0.0							
Effective from Academic Year	2018-19			Effective for the batches Admitted onwards	2018-19							
Subject code	BP205TT			Subject Name	Environmental Sciences							
Teaching scheme				Examination scheme								
	Le	Tu	Pr	Total	Marks	CE	SE	ES	Total	Duration	SE	ES
Hours	3	0	0	3	Theory	10	15	50	75	Theory	1 hr.	2 hr.
Credit	3	0	0	3	Practical	--	--	--	--	Practical	--	--
<b>Pre-requisites</b>												
Nil												
<b>Scope and Objectives:</b>												
Upon completion of the course student shall be able to												
	<ul style="list-style-type: none"> <li>• Create the awareness about environmental problems among learners.</li> <li>• Impart basic knowledge about the environment and its allied problems.</li> <li>• Develop an attitude of concern for the environment.</li> <li>• Motivate learner to participate in environment protection and environment improvement.</li> <li>• Acquire skills to help the concerned individuals in identifying and solving environmental problems.</li> <li>• Strive to attain harmony with Nature.</li> </ul>											
<b>Learning Outcome:</b>												
	<ul style="list-style-type: none"> <li>• Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.</li> </ul>											
<b>Syllabus- Theory</b>												
Unit	Content											Hrs
1	The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources											15
2	Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)											15
3	Environmental Pollution: Air pollution; Water pollution; Soil pollution											15
<b>Recommended Books</b>												
1	Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore											
2	Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.											
3	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India											
4	Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p											
5	Clark R.S., Marine Pollution, Clarendon Press Oxford											
6	Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p											
7	De A.K., Environmental Chemistry, Wiley Eastern Ltd.											
8	Down of Earth, Centre for Science and Environment											