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Item No. 4.103

# UNIVERSITY OF MUMBAI



**Syllabus for the First Year B.Pharm.**

**Programe : Bachelor of Pharmacy**

**Course : B.Pharm.**

**(Semester I & II)**

(As per Credit Based Semester and Grading System with  
effect from the academic year 2012–2013)

2	<b>Modern Theory of Organic Bonding</b>	12
2.1	Molecular Orbital Theory, Strengths and drawbacks Concept of Group orbitals	
2.2	Qualitative Molecular Orbital Theory (QMOT), Rules of QMOT	
2.3	Symmetry and Symmetry Operations, e.g. $MH_3$ and $MH_3Y$ systems M.Os of planar methyl, Walsh diagram – pyramidal methyl, bonding in planar and pyramidal forms of methyl Consideration of $NH_3$ and $BH_3$	
2.4	The orbitals of $CH_2$ group, M.Os of $MH_2$ group, molecular orbitals of $H_2O$	
2.5	Building larger molecules e.g. ethane, ethylene, formaldehyde, methyl chloride, allyl system, boranes	
2.6	Orbitals of reactive intermediates – carbocations, carbenium ions, carbanions, radicals and carbene	
2.7	Bonding in organometallics	
2	<b>Kinetics and Reaction Mechanisms.</b>	12
2.1	Energy surfaces, reaction coordinate diagrams, activated complex/transition state rate and rate constants, reaction order and rate laws	
2.2	Transition state theory and its relationship to Arrhenius Rate law, Boltzmann distributions and dependence on temperature, methods of determination of activation parameters and Arrhenius parameters with some examples	
2.3	Principles of Kinetic Analysis Kinetic Experiments, First order kinetics, second order kinetics, pseudo-first order kinetics, equilibrium kinetics and initial-rate kinetics, some ideas about methods for following kinetics	
2.4	Temperature dependence on Reaction rates, kinetic isotope effects	
2.5	Hammond Postulate, reactivity vs selectivity, Curtin-Hammett Principle, microscopic reversibility, kinetic vs thermodynamic control	
3	<b>Acid-Base Catalysis</b> General principles of catalysis, Forms of catalysis – electrophilic catalysis, acid-base catalysis, nucleophilic catalysis, covalent catalysis, phase transfer catalysis, Brønsted Acid-base catalysis, correlation of reaction rates with acidity functions.	7
4	<b>Charge transfer complexes and reactions</b> Definition of complex, charge-transfer transition, donors and acceptors, ground state charge-transfer contribution The teacher could try to relate these concepts to drugs effects on macromolecular targets	4
<b>Total</b>		<b>45</b>

**In ALL subjects the teacher should adopt the latest edition of the books, hence the specific edition and year of publication have been omitted**

#### **Books**

1. Eric V Anslyn and Dennis A Dougherty, Modern Physical Organic Chemistry, John Wiley. (Main Book to be adopted for teaching this course).
2. Neil Isaacs, Physical Organic Chemistry, Pearson Education.
3. Louis P Hammett, Physical Organic Chemistry, McGraw Hill Education.
4. Edward M Kosower, An Introduction to Physical Organic Chemistry, John Wiley and Sons, Inc
5. Atkins' Physical Chemistry, Peter Atkins and Julio De Paula, International Student Edition, Oxford University Press.

Sr. No	TOPICS	HOURS
1.	<p><b>States of matter:</b></p> <ul style="list-style-type: none"> <li>▪ The Gaseous state: Ideal and Real gases, The Ideal gas Law, Kinetic Molecular Theory, The van der Waals equation for real gases, Critical phenomenon, critical constants and their determination (Problems)</li> <li>▪ The Liquid state: Liquefaction of gases and methods (Linde's, Claude's and Faraday's method), application of liquefaction in aerosols – introduction to the concept, vapour pressure of liquids, Clausius – Clapeyron equation (No derivation)</li> <li>▪ The Solid State: Crystalline solids, Polymorphism, Solvates, Amorphous solids, melting point and heat of fusion, melting point and intermolecular forces</li> <li>▪ The Liquid Crystalline state: Structure, properties and significance of liquid crystals</li> <li>▪ The Supercritical fluid state</li> </ul>	12
2.	<p><b>Physical properties of Drug Molecules</b></p> <ul style="list-style-type: none"> <li>▪ Additive, constitutive and colligative properties with examples</li> <li>▪ Dipole moment, Dielectric constant and significance to pharmacy, concept of polarizability, molar polarization</li> <li>▪ Refractive index and molar refraction, Principle and working of Abbe's refractometer, Application of molar refraction to determine structures</li> <li>▪ Optical rotation, Specific rotation and its applications</li> </ul>	6
3.	<p><b>Solutions of Non-electrolytes</b></p> <ul style="list-style-type: none"> <li>▪ Units for expressing concentration</li> <li>▪ Ideal and real solutions, Raoult's law, deviation from Raoult's law Methods to measure vapour pressure lowering and its application (problems)</li> <li>▪ Distillation of binary mixtures and azeotropic distillation. Concept of steam distillation</li> <li>▪ Elevation of boiling point and determination of molecular weight (problems). Depression of freezing point and determination of molecular weight (problems)</li> <li>▪ Osmotic pressure: Concept, methods to determine osmotic pressure, molecular weight determination from osmotic pressure.</li> </ul>	12
4.	<p><b>Thermodynamics</b></p> <ul style="list-style-type: none"> <li>▪ Definition, Applications and Limitations</li> <li>▪ Homogenous and Heterogenous systems, Types of systems – Open, Closed, Adiabatic, Isothermal</li> <li>▪ Types of properties – Intensive and Extensive property</li> <li>▪ Equilibrium and Non-equilibrium states,</li> <li>▪ Types of processes - Isothermal, Adiabatic, Isobaric, Isochoric, Cyclic process, Reversible and irreversible process</li> <li>▪ First law of thermodynamics</li> <li>▪ Enthalpy, heat capacity, <math>C_p - C_v = R</math> (Derivation)</li> <li>▪ Work of expansion against constant pressure,</li> <li>▪ Isothermal work of expansion against variable pressure</li> <li>▪ Thermochemistry:</li> <li>▪ Heat of reaction, Heat of formation, Heat of combustion, Heat of solution- Differential and Integral heat of solution,</li> <li>▪ Bond energy – Calculation of Heat of reaction from bond energy data, Kirchoff's equation, Hess's law of constant heat summation</li> <li>▪ Second law of thermodynamics</li> </ul>	12

	<ul style="list-style-type: none"> <li>▪ Carnot theorem, Efficiency of heat engine, Entropy</li> <li>▪ Third law of thermodynamics</li> <li>▪ Free energy and its applications: Pressure and Temperature coefficients of free energy, Maximum net work, Criteria for equilibrium,</li> <li>▪ Chemical potential (only definition),</li> <li>▪ Gibbs Helmholtz equation,</li> <li>▪ Clausius Clapeyron equation (No derivation),</li> <li>▪ van't Hoff equation (No derivation)</li> <li>▪ Problems</li> </ul>	
<b>5.</b>	<p><b>Properties of solutions of Electrolytes</b></p> <ul style="list-style-type: none"> <li>▪ Electrolysis</li> <li>▪ Faradays laws of electrolysis</li> <li>▪ Electrolytic conductance, Specific conductance, Equivalent conductance, Molecular conductance</li> <li>▪ Transport number</li> <li>▪ Measurement of conductance</li> <li>▪ Variation of equivalent conductance with dilution</li> <li>▪ Arrhenius theory of electrolytic dissociation- colligative properties activity coefficient, coefficient expressing colligative properties</li> <li>▪ Theory of strong electrolytes</li> <li>▪ Degree of dissociation</li> <li>▪ Kohlrausch's law of independent migration of ions</li> <li>▪ Applications of conductivity measurements - Conductometric titrations and solubility of a sparingly soluble salt</li> <li>▪ Equivalent conductance of a weak electrolyte at infinite dilution</li> <li>▪ Degree of dissociation of a weak electrolyte</li> <li>▪ Problems</li> </ul>	<b>6</b>
	<b>Total</b>	<b>48</b>

#### Books

1. P. J. Sinko, 'Martin's Physical Pharmacy and Pharmaceutical Sciences' Fifth edition, Lippincott Williams and Wilkins, Indian Edition distributed by B.I.Publications Pvt Ltd, 2006.
2. Bahl and Tuli, 'Essentials of Physical Chemistry' S.Chand and Company Ltd. Ramnagar, New Delhi-110055.
3. U. B.Hadkar, 'A Textbook of Physical Pharmacy', 9th Edition, Nirali Prakashan, Pune 2008.
4. U. B.Hadkar, T.N.Vasudevan and K.S. Laddha, 'Practical Physical Pharmacy', Yucca Publishing House, Dombivali, 1994
5. Findlay, 'Practical Physical Pharmacy' revised and edited by J.A. Kitchener, 8th Ed. Longmans, Green and company Ltd. 1967.

Sr.no.	Details	Hours
1.	Brief introduction to human body and organization of human body	1
2.	Structural and functional characteristics of following tissues 1) Epithelial 2) Connective 3) Nervous 4) Muscle	2
3.	Detailed structure of cell membrane and trans-membrane movement of substances	2
4.	Components and functions of lymphatic system <ul style="list-style-type: none"> <li>• Lymphatic organs and tissues</li> <li>• Organization of lymph vessels</li> <li>• Formation and flow of lymph</li> </ul>	3
6.	Pathophysiology of following diseases <ul style="list-style-type: none"> <li>• AIDS</li> <li>• Autoimmune diseases (Rheumatoid arthritis, Grave's disease, Myasthenia Gravis, Rheumatic fever)</li> <li>• Hypersensitivity and types of hypersensitivity reactions.</li> </ul>	2
7.	Haematology <ul style="list-style-type: none"> <li>• Composition of blood</li> <li>• Functions of blood elements</li> <li>• Erythropoiesis and life cycle of RBC.</li> <li>• Synthesis of Haemoglobin</li> <li>• Leucopoiesis</li> <li>• Immunity: Basics and Types</li> <li>• Coagulation of blood</li> <li>• Blood groups</li> </ul>	8
8.	Pathophysiology of following diseases <ul style="list-style-type: none"> <li>• Anaemias – Types of anaemias</li> <li>• Polycythemia : Physiological and polycythemia vera</li> <li>• Leucopenia</li> <li>• Leukocytosis</li> <li>• Thrombocytopenia</li> <li>• Leukemia</li> </ul>	3
9.	Basic mechanism involved in the process of inflammation and repair. <ul style="list-style-type: none"> <li>• Alteration in vascular permeability and blood flow.</li> <li>• Migration of WBC</li> <li>• Acute and chronic inflammation</li> <li>• Brief outline of the process of repair.</li> </ul>	5
9.	Structure and properties of following muscles <ul style="list-style-type: none"> <li>• Cardiac muscles</li> <li>• Smooth muscles</li> <li>• Skeletal muscles</li> <li>• Neuromuscular transmission and contraction of skeletal muscle</li> <li>• Energy metabolism in the muscle</li> <li>• Types of muscle contractions</li> <li>• Muscle tone</li> </ul>	9
<b>Total</b>		<b>35</b>

## **REFERENCES FOR ANATOMY, PHYSIOLOGY & PATHOPHYSIOLOGY**

Latest editions of the following books can be referred

1. Ross & Wilson, Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone
2. Gerard J. Tortora & Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.
3. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.
4. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander  
Published by Churchill Livingstone
5. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques
6. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
8. Harsh Mohan, Text book of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

## Objectives

1	To study the importance of environmental science and environmental studies
2	To know the importance of key to the future of mankind.
3	To study continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, issues like economic productivity and national security
4	Study of Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues.

Sr. No.	Details	Hrs
1	<b>Multidisciplinary Nature of Environmental Studies:</b> <ul style="list-style-type: none"> <li>• Scope and Importance</li> <li>• Need for Public Awareness</li> <li>• Depleting Nature of Environmental resources such as Soil, Water, Minerals, and Forests.</li> <li>• Global Environmental Crisis related to Population, Water, Sanitation and Land.</li> <li>• Ecosystem: Concept, Classification, Structure of Ecosystem, overview of Food chain, Food web and Ecological Pyramid</li> </ul>	5
2	<b>Sustainable Development</b> <ul style="list-style-type: none"> <li>• Concept of sustainable development</li> <li>• Social, Economical and Environmental aspect of sustainable development.</li> <li>• Control Measures: 3R (Reuse, Recovery, Recycle), Appropriate Technology, Environmental education, Resource utilization as per the carrying capacity.</li> </ul>	5
3	<b>Environmental Pollution:</b> <ul style="list-style-type: none"> <li>• Air Pollution: Sources, Effects of air pollution with respect to Global Warming, Ozone layer Depletion, Acid Rain, Photochemical smog, Two Control Measures, Bag house Filter, Venturi scrubber. Case Study: Bhopal Gas Tragedy</li> <li>• Water Pollution: Sources and Treatment, Concept of waste waters - Domestic &amp; Industrial and treatment. Case Study: Minamata Disease.</li> <li>• Land Pollution: Solid waste, Solid waste Management by Land filling, Composting.</li> <li>• Noise Pollution; Sources and Effects</li> <li>• E-Pollution: Sources and Effects.</li> </ul>	10
4	<b>Environmental Legislation:</b> <ul style="list-style-type: none"> <li>• Overview</li> <li>• Ministry of Environment and Forests (MoE&amp;F). Organizational structure of MoE&amp;F.</li> <li>• Functions and powers of Central Control Pollution Board.</li> <li>• Functions and powers of State Control Pollution Board.</li> <li>• Environmental Clearance, Consent and Authorization Mechanism.</li> <li>• Environmental Protection Act</li> <li>• Any two case studies pertaining to Environmental Legislation.</li> </ul>	5
5	<b>Renewable sources of Energy:</b> <ul style="list-style-type: none"> <li>• Limitations of conventional sources of Energy.</li> <li>• Various renewable energy sources.</li> <li>• Solar Energy: Principle, Working of Flat plate collector &amp; Photovoltaic cell.</li> </ul>	5

	<ul style="list-style-type: none"> <li>• Wind Energy: Principle, Wind Turbines.</li> <li>• Hydel Energy: Principle, Hydropower generation.</li> <li>• Geothermal Energy: Introduction, Steam Power Plant</li> </ul>	
6	<b>Environment and Technology</b> <ul style="list-style-type: none"> <li>• Role of Technology in Environment and health</li> <li>• Concept of Green Buildings, Indoor air pollution</li> <li>• Carbon Credit: Introduction, General concept.</li> <li>• Disaster Management: Two Events: Tsunami, Earthquakes, Techniques of Disaster Management</li> <li>• Case Study: Earthquake in Japan</li> </ul>	5
	<b>Total</b>	35

### Books

1. Hazardous Waste Incineration, Brunner R.C., McGraw Hill Inc
2. Global Biodiversity Assessment, Heywood V.H and Waston R.T., Cambridge Univ. Press
3. Environmental Science systems & Solutions, Mckinney M.L. and School R.M., Web enhanced edition.
4. Fundamentals of Ecology, Odum E.P., W.B. Saunders Co. USA.
5. Textbook of Environmental studies by Erach Bharucha, University Press.
6. Environmental Studies by R. Rajagopalan, Oxford University Press.
7. Essentials of Environmental Studies by Kurian Joseph & Nagendran, Pearson Education
8. Renewable Energy by Godfrey Boyle, Oxford Publications.
9. Perspective Of Environmental Studies, by Kaushik and Kaushik, New Age International
10. Environmental Studies by. Anandita Basak, Pearson Education
11. Textbook of Environmental Studies by Dave and Katewa, Cengage Learning
12. Environmental Studies by Benny Joseph, Tata McGraw Hill



**Communication Skills****3 hrs/week**

S.No.	(Topic)	Hours
1.0	Remedial study of grammar, Review of grammar and vocabulary. Effective use of dictionary, Phonetics	10
1.1	Conditionals/Tenses, relative clauses, subject–verb agreement, passive voice	
2.0	Written Communication	7
2.1	Discuss a topic of general interest, but related to science in about 300 words. (Analyze, comment, argue, reflect, persuade, etc.) (can also be used for oral presentations by the students, followed by discussion).	
3.0	Oral Communication	5
3.1	Consulting a dictionary for correct pronunciation (familiarity with phonetics symbols and stress-marks only)	
3.2	(ii) Dialogue	
4.0	Scientific Writing	8
4.1	Writing a Scientific Report on a project undertaken or an experiment conducted (theory + practice)	
5.0	Soft Skills	
5.1	Gestures/ postures – Body language, gesture, posture.	2
5.2	Group discussion – Giving up of PREP, REP Technique, how body language during group discussion.	2
5.3	Presentation skills: (i) How to make a Power Point presentation (ii) Body language during presentation; Resume writing: Cover letter, Career objectives, Resume writing (tailor made)	4
5.4	Mock Interview: Each student to face an interview and to demonstrate the above taught skills.	2
	Total	40

**Books**

1. English Grammar, Beaumont Digty and Colin Granger, An International reference practice book, London, Heinmann.
2. The right word at the right time A guide to the English language and how to use it, Elison John, The Reader's Digest
3. Study writing, Hamplyons Liz & Ben Heasley, Cambridge University Press.
4. Basic Business Communication, Lesiker Raymond.V and Maire E Hatley, New York, Tata McGraw Hill

### **Physical Pharmacy Laboratory - I**

**4 hrs/week**

1. Determination of refractive index, molar refraction. Using water as a reference standard, to determine refractive index of two organic solvents and their mixtures and to determine composition of unknown. To determine RI of a solid (KCl) from two concentrations of solid solutions.
2. Viscosity: To determine the composition of the unknown binary mixture.
3. Polarimetry: Different concentrations of sugar, determination of unknown concentration and specific rotation.
4. Determination of molecular weight by Rast camphor method.
5. Determination of heat of solution of benzoic acid.
6. Partition coefficient of benzoic acid between benzene and water.

#### **Demonstration**

Landsberger method.

#### **Books**

U.B. Hadkar, T.N. Vasudevan, K.S.Laddha, 'Practical Physical Pharmacy', Yucca Publishing House, Dombivali

**Anatomy, Physiology and Pathophysiology – Lab.I**

**(4 hr./week)**

Sr.no.	Details	Hours
1.	Hematology 1. Red Blood Cell (RBC) Count 2. Total Leukocyte Count 3. Differential Leukocyte (WBC) Count 4. Hemoglobin content of blood 5. Bleeding / Clotting Time 6. Blood groups 7. Erythrocyte Sedimentation Rate (ESR) / Hematocrit (Demonstration)	
2.	Study of human skeleton	
3.	Microscopic study of permanent slides Tissues : - Columnar, Cuboidal, Squamous, Ciliated Epithelium - Cardiac / Skeletal / Smooth muscle - Ovary, Testis, Liver, Pancreas, Thyroid, Tongue, Stomach, Intestine, Kidney, Lung, Spinal Cord, Cerebrum, Artery, Vein	
4.	Measurement of blood pressure	
5.	Tutorial / Discussion on some common investigational procedures used in diagnosis of diseases with the help of charts / slides Name and Importance of following tests : 1. Electroencephalogram (EEG) in diagnosis of Epilepsy 2. Use of Positron emission tomography (PET) Computed tomography scan (CT Scan), Single photon emission computed tomography (SPECT) in diagnosis. 3. Use of flow cytometry as a diagnostic tool. 4. Electrocardiogram (ECG) in diagnosis of cardiac arrhythmia 5. Liver Function Tests – - Serum Bilirubin, - serum glutamate oxaloacetate transaminase (SGOT) - serum glutamate pyruvate transaminase (SGPT) - Urine Bilirubin, - Urine Urobilinogen, 6. Kidney Function Tests - Serum Creatinine, - Serum Urea, Uric Acid - Blood Urea Nitrogen (BUN) 7. Blood Glucose 8. Serum Cholesterol / Triglycerides 9. Serum Alkaline phosphatase (ALT) 10. Serum Acid phosphatase (APT) 11. Serum Lipase 12. Serum Amylase 13. Serum Calcium 14. Serum lactate dehydrogenase (LDH) 15. Thyroid Function Tests – T <sub>3</sub> , T <sub>4</sub> 16. Prothrombin time (PT) 17. Partial thromboplastin time (PTT) 18. Activated partial thromboplastin time (APTT) 19. Diagnostic tests for infectious diseases like - Malaria - Tuberculosis - Dengue - H1N1 swine flu - Typhoid	

**Books**

1. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander, Published by by Churchill Livingstone
2. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques, Published by Elseviers Publications
3. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India
4. C. L. Ghai, Text book of Practical Physiology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

**Computer Lab****4 hrs/week**

Sr. No.	Topic	Hours per week
1	Introduction to Computers.	2
2	History of Computer development and respective generation: Abacus, Napier's Bones, Slide rule, Pascal's Calculator. General use of computers in everyday life. Computer Classification: Mainframe, Mini and Micro Computers, comparison of Analog & Digital Computers, Hardware and Software. Calculator and Computer	3
3.1	Operating Systems: Introduction to types of operating systems, UNIX, MS-DOS, etc. RAM, ROM, Virtual Memory etc	3
3.2	Students should learn on Windows and Linux OS based systems use of basic Windows and Linux commands	3
4.1	Type of Languages: Conventional languages; their advantages, limitations; C, Pascal, FORTRAN, Programming of these languages	4
4.2	Students should be taught some programming in BASIC and C	4
5.1	Introduction to Computer Networks: Architecture of seven layers of communications	3
5.2	Students should be taken to a computer lab with has a network and shown the basic connections and operation of different types of networks.	2
6.1	Introduction to Data Structure: Like Queues, list, trees, Binary trees algorithms, Flow chart, Structured Systems, Analysis and development, Ingress-SQL, Gateways etc. Statistics, methodologies.	9
6.2	Basic Language: Constants and Variables: Character set, constants, variables, Naming the variables getting data into memory, LET, INPUT, READ. DATA, Print Statement Expressions: Arithmetic expression, Hierarchy of operations, Rules of Arithmetic, Evaluation of expressions, Relational expressions, Logical operations, Library functions Printer Control: Comma and semicolon control, the TAB function, PRINT, LPRINT Functions and Subroutines: User defined functions, subroutines, subscripted variables The above concepts should be introduced practically to students with examples, while working on a computer system.	
7	Computer Graphics:	2
8	Computer applications in pharmaceutical area and in clinical studies	3

**Books**

1. Basic Electronics and Computer Applications, Rajiv Khanna, New Age International Publishers
2. Fundamentals of Computers, V. Rajaraman, Prentice Hall of India Pvt. Ltd.
3. Schaums Outline Series, Theory and Problems of Introduction to Computer Science, Francis Scheid, McGraw Hill Book Co.