Course Details

Name of the Courses: Phay

Sl. No.	Course Name	Course Code	Level (UG / PG)	No. of Contact hours/week	Credit
1.	Physical Pharmaceutics - I	BP302T	UG	4	-
2.					
3.					
4.					

Course Outcomes:

Course Name: Physical Pharmaceutics I

CO 1. Describe the properties of solution with different solubility expressions and determine the solubility of drugs.

CO 2. Demonstrate firm foundations in the fundamentals and application of physicochemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage forms.

CO 3. Explain the role of surfactant, interfacial phenomenon of solid-gas, solid-liquid and liquid-liquid interfaces and underster the idea of adsorption isotherm.

CO 4. Explain the method of tonicity adjustment of biological fluids and suggest buffers for pharmaceutical use and describe detailed idea

CO-5. of complexation of drug action and drug protein binding.

CO 6.

Mapping of Course Outcome (COs) to Program Outcome POs)

Course Outcomes (COs)	Program Outcome POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11
CO1	M	L	M	L							
CO2	H	ML	M	L							
CO3	H	ML		L			M		L		
CO4	H	ML		L							
CO5											

Text Books:

1. Physical Pharmaceutics - I, C.V.S. Subrahmanyam.
2. Physical Pharmacy, Agarwal and Khanna.
3.

Reference Books:

1. Physical Martin's Physical Pharmacy.
2.
3.
4.

Content Delivery Methodology:

Course Outcomes	Delivery Methods	Supporting Tools
CO1	power point presentation, class room, Youtube videos	class test, notes, pdfs, ppts
CO2	- Do -	- Do -
CO3	- Do -	- Do -
CO4	- Do -	- Do -

Assessment Protocol:

Course Outcomes	Bloom's Taxonomy Level	Assessment Tools
CO1	Level 2: Understanding	class tests, quiz, assignments, and Dem exam
CO2	Level 2: Explain/Describe	- Do -
CO3	Level 2: Explain	- Do -
CO4	Level 2: Explain	- Do -

List of Experiments

Course Name: Physical Pharmaceutics (P) Course Code: BP306P

Semester: 3rd & B.Pharm Weekly Contact Hours: 04 No. of Batches: 3

Expt. No	Name of the Expt.
01.	To determine the molar mass or molecular weight of unknown substance by Rast-Camphore method.
02.	To determine partition co-efficient for the distribution of iodine between water and carbon tetra chloride.
03	To determine the bulk density, true density, and porosity of given sample of powder.
04.	To determine the partition co-efficient of Benzoic acid between benzene and water
05	To determine the solubility of solids at different temperature
06.	To determine the pKa value of weak acid (acetic A)
07.	To determine the surface tension of given liquid by drop count and drop weight method using Stalagmometer.
08.	Determination of CMC of a surfactant by surface measurment by Stalagmometa method.
09.	To determine the HLB value of an given surfactant
10.	To determine the required HLB value for the oil phase to be incorporated in the emulsion.
11.	To analyse copper-glycine complex by pH titration method and determine its stability constant.
12.	To prepare acetate buffer (acetic a and sodium acetate) solution to measure the pH and calculate the pKa.

Teaching-Learning Plan

Program Level & Semester: B. Pharm, 3rd Semester

No. of classes per week:

Lecture No.	Unit / Chapter	Syllabus Topics to be Covered
01	I	Solubility of drugs – Introduction & Solubility Expression
02	I	Mechanism of solute solvent Interaction, Ideal solubility parameters.
03	I	Solvation and Association.
04	I	Solubility of gas in liquids.
05	I	Solubility of liquids in liquids.
06	I	Raoult's law, real solutions
07.	I	Factors influencing solubility of drug.
08	I	Solubility Parameters.
09	I	Partially miscible liquids, critical soln temp.
10	I	Distribution law, its limitations and applications
11	I	Diffusion principle in biological system.
12	II.	States of matter – Introduction.
13	II.	Solid state – Crystallization & polymorphism
14	II	Glassy state & Liquid crystalline state
15	II.	Changes in States of matter
16	II	Latent heat, vapour pressure.
17	II	Eutectic Mixtures & Sublimation
18	II.	Relative humidity & Liquid complexes.

Teaching-Learning Plan

Course & Code: Physical Pharmaceutics - I

Academic Session: Aug - Dec 2019 Section: B

Mode of Delivery Used	Text / Ref. Book / e-Resource	Date of Lecture		Remarks	Signature of Principal
		Scheduled	Actual		
Chalk & duster	CVS Subramanyan / S.P. Agarwal	02/08/19	02/08/19		2D 02.8.19
Chalk & Duster	- Do -	06/08/19	06/08/19		2D 06.8.19
ppt / classroom	- Do -	07/08/19	07/08/19		2D 07.8.19
classroom	- Do -	08/08/19	08/08/19		2D 08.8.19
Classroom	- Do -	09/08/19	09/08/19		2D 09.8.19
ppt.	- Do -	13/08/19	13/08/19		2D 13.8.19
Chalk & Duster	- Do -	14/08/19	14/08/19		2D 14.8.19
Chalk & Duster	- Do -	16/08/19	16/08/19		2D 16.8.19
Classroom	- Do -	19/08/19	19/08/19		2D 19.8.19
Classroom	- Do -	21/08/19	21/08/19		2D 21.8.19
Classroom	- Do -	26/08/19	26/08/19		2D 26.8.19
Classroom	- Do -	27/08/19	27/08/19		2D 27.8.19
Chalk & Duster	CVS Subramanyan S.P. Agarwal	04/09/19	28/08/19		2D 28.8.19
ppt. presentation	CVS Subramanyan Internet	06/09/19	30/08/19		2D 30.8.19
ppt. presentation	- Do -	28/08/19	02/09/19		2D 02.9.19
- Do -	CVS Subramanyan SP Agarwal	30/08/19	03/09/19		2D 03.9.19
classroom	CVS Subramanyan SP Agarwal	02/09/19	04/09/19		2D 04.9.19
classroom	CVS Subramanyan SP Agarwal	03/09/19	06/09/19		2D 06.9.19

Teaching-Learning Plan

Program Level & Semester: B Pharm, 3rd Semester (Sec B)

No. of classes per week: 4.

Lecture No.	Unit / Chapter	Syllabus Topics to be Covered
19	II	Aerosols & Inhalers.
20	II	Introduction – Physical properties of drug molecule.
21	II	Refractive Index.
22	II	Optical Rotation.
23	II	Dielectric constant
24	II	Dipole Moment
25	II	Dipole moment – Application.
26	II	Dissociation Constant
27	II	Dissociation Constant – Application
28	II	– Class Test –
29	III	Liquid interface, Surface tension.
30	III	Surface free energy.
31	III	Measurement of surface tension – methods.
32	III	– Continued. –
33	III	CMC & its Application, spreading coefficient
34	III	HLB value & its calculation.
35	III	Adsorption Isotherm – types.
36	III	Freundlich Adsorption Isotherms.

Teaching-Learning Plan

Course & Code: Physical Pharmaceutics -I.

Academic Session: Aug -Dec 2019 Section: B

Mode of Delivery Used	Text / Ref. Book / e-Resource	Date of Lecture		Remarks	Signature of Principal
		Scheduled	Actual		
Chalk & Duster	CVS Subramanyam PV publication	09/09/19	09/09/19		09.9.19
powerpoint	-Do-	10/09/19	10/09/19		10.9.19
classroom	CVS Subramanyam PV publications	11/09/19	11/09/19		11.9.19
Classroom	CVS Subramanyam	13/09/19	13/09/19		13.9.19
Classroom	CVS Subramanyam	16/09/19	16/09/19		16.9.19
chalk & duster	CVS Subramanyam	20/09/19	17/09/19		17.9.19
-Do-	-Do-	20/09/19	20/09/19		20.9.19
Oral	CVS Subramanyam	24/09/19	23/09/19		23.9.19
Oral	CVS Subramanyam	24/09/19	24/09/19		24.9.19
—	—	—	25/09/19		25.9.19
Powerpoint	S.P. Agarwal Rajesh Khanna	27/09/19	27/09/19		27.9.19
powerpoint	S.P. Agarwal Rajesh Khanna	30/09/19	30/09/19		30.9.19
Oral	-Do-	11/10/19	11/10/19		1.10.19
Oral	SP Agarwal, AK Seth	14/10/19	14/10/19		14.10.19
powerpoint	SP Agarwal AK Seth	15/10/19	15/10/19		15.10.19
powerpoint	SP Agarwal, AK Seth	16/10/19	16/10/19		16.10.19
Oral	-Do-	21/10/19	21/10/19		21.10.19
Oral	-Do-	22/10/19	22/10/19		22.10.19

Teaching-Learning Plan

Program Level & Semester:

No. of classes per week:

Lecture No.	Unit / Chapter	Syllabus Topics to be Covered
37	III.	Langmuir Adsorption Isotherm, BET Equation
38	III.	Wetting and Detergency.
39.	IV.	Complexation — Introduction & Ligand.
40	IV.	Classification of Complexes
41	IV.	Method of Analyses of Complexes.
42	IV.	Protein — drug binding.
43	IV	— Continued. —
44	V.	Sorensen's pH scale, Introduction, Application.
45	V	pH determination methods
46	V	Buffer equation, Buffer capacity
47	V	Application of Buffer in biologic system
48	V	Buffered Isotonic solution.
49	V.	Class Test.

Girijananda Chowdhury Institute of Pharmaceutical Science

Azara, Guwahati, Assam - 781017

THEORY / GPAT

CLASS ATTENDANCE

Program: B. Pharm Semester: 3rd Section: B

Course: Physical Pharmaceutics - I No. of Classes per week:

Date of Lecture: [illegible]

Sl. No.	Roll No.	Name of Students	Prev No. / %	1	2	3	4	5	6	7	8	9	10	11	12
1	18BCC011053	Kamalini Rota		A	1	2	3	4	5	6	7	8	9	10	11
2	54	Khyati Mishra		1	2	3	4	A	5	6	7	8	A	9	10
3	55	Kristhamani Choudhury		1	2	3	4	5	6	7	8	9	10	11	12
4	56	Madhusmita Goswami		1	2	3	4	5	6	7	8	A	9	10	11
5	57	Madhusmita Kashyap		1	2	3	4	5	6	7	8	9	10	11	12
6	58	Manjur Hussain		1	2	3	4	5	A	A	A	6	7	8	9
7	59	Nandita Roy		1	2	3	4	5	6	A	7	8	9	10	11
8	60	Mominul Alam		1	2	3	4	5	A	A	A	6	7	8	9
9	61	Mridul Das		1	2	3	4	5	6	7	8	9	10	11	12
10	62	Mrigangka Das		1	2	3	4	5	A	6	7	8	9	10	11
11	63	Mukul Das		1	2	3	4	5	6	7	8	9	10	11	12
12	64	Nabanita Paul		1	2	3	4	5	6	7	8	9	10	11	12
13	65	Mohammad Anwar		1	2	3	4	5	6	7	8	9	10	11	12
14	66	Nayan Jyoti Bora		A	1	2	3	4	5	6	7	8	9	10	11
15	67	Nayan Jyoti Saikia		1	2	3	4	5	6	7	8	9	10	11	12
16	68	Nayan Moni Saikia		1	2	3	4	5	A	A	A	6	7	8	9
17	69	Nikumoni Ahmed		1	2	3	4	5	A	A	6	7	A	A	8
18	70	Nishanta Rakshit		1	2	3	4	5	6	7	A	8	9	A	10
19	71	Pamilina Basumat		1	2	3	A	4	5	6	7	8	9	10	11
20	72	Pragya Bhanu Sarma		1	2	3	4	5	A	6	7	8	A	9	10
21	73	Pritam Goswami		1	2	3	4	5	6	7	8	9	10	11	12
22	74	Pubali Goswami		1	2	3	4	A	5	A	6	7	8	9	10
23	75	Puja Kalita		1	2	3	4	5	6	7	8	9	10	11	12
24	76	Rahul Saha		1	2	3	4	5	A	A	6	7	8	9	10
25	77	Rajdeep Medhi		1	2	3	4	A	5	6	7	8	9	10	11
26	78	Rashmita Dutta		1	2	3	4	5	6	7	8	9	10	11	12
27	79	Rina Das		1	2	3	4	5	6	7	8	9	10	11	12
28	80	Rimi Sarkar		1	2	3	4	5	6	7	8	9	10	11	12
29	82	Ritumoni Baruah		1	2	3	4	5	6	7	8	9	10	11	A
30	84	Ritu Raj Jogi		1	A	2	3	4	5	6	7	8	9	10	A
31	85	Rupam Thakuria		1	2	3	4	5	6	7	8	9	10	11	12
32	86	Sahil Zaman		1	A	2	3	4	Ⓐ	Ⓐ	Ⓐ	Ⓐ	5	6	7
33	87	Sanghamitra Upadhya		1	2	3	4	5	6	7	8	9	10	A	11
34	88	Sanjana Choudhury		1	2	3	4	5	6	7	8	9	10	11	12
		Signature of Teacher													

Sl. No.	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Total No. of Class Attended	% Attendance
1	12	13	14	15	16	17	18	19	20	21	22	23	24	A	25	26	27	28	A	29		
2	11	12	13	A	15	16	17	18	19	20	21	22	23	24	25	A	26	27	A	28		
3	13	14	15	16	17	18	19	A	20	21	22	23	24	25	26	27	28	29	30	31		
4	12	13	Ⓐ	Ⓐ	Ⓐ	Ⓐ	Ⓐ	Ⓐ	Ⓐ	Ⓐ	Ⓐ	14	15	16	17	18	19	20	A	21		
5	13	A	14	15	16	17	18	19	20	A	21	22	23	24	25	26	27	28	29	A		
6	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	A	25	26	27	28		
7	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
8	10	11	12	13	14	15	16	17	18	19	20	21	22	A	23	24	25	26	A	27		
9	13	14	A	15	16	17	18	19	A	20	21	22	23	24	A	A	25	26	A	27		
10	12	13	A	14	15	16	17	18	A	19	20	A	21	22	A	A	23	24	A	25		
11	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	A	28	29	30	31		
12	13	14	15	16	17	18	19	A	20	21	22	23	24	25	26	27	28	29	A	A		
13	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	A	31		
14	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	A	30		
15	13	14	15	16	17	18	19	20	21	22	A	A	23	24	25	26	27	28	29	30		
16	10	11	A	A	12	13	A	14	15	16	A	A	A	17	18	19	20	21	22	23		
17	9	10	11	12	13	14	15	16	17	18	19	20	21	A	22	23	24	A	25	Ⓐ		
18	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
19	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
20	11	12	13	14	15	A	16	17	18	19	20	21	22	23	24	25	26	A	A	27		
21	13	14	15	16	17	A	18	19	20	21	22	23	24	25	26	27	28	29	A	30		
22	11	12	13	14	15	A	16	17	18	19	20	21	22	23	24	25	26	27	A	28		
23	13	14	15	16	A	17	18	19	20	A	21	22	23	A	24	25	26	27	28	29		
24	11	12	13	14	15	A	16	17	18	19	20	21	22	23	A	24	25	A	A	26		
25	12	13	A	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	A	29		
26	13	14	15	16	17	18	19	20	A	A	21	22	23	24	25	26	27	A	A	A		
27	13	14	15	16	A	17	18	A	Ⓐ	Ⓐ	Ⓐ	Ⓐ	19	20	A	21	22	23	A	24		
28	13	14	15	16	17	18	19	20	21	A	22	23	24	25	A	A	26	27	A	28		
29	12	13	14	15	16	17	A	18	19	20	A	21	22	23	24	25	26	27	28	29		
30	11	12	13	14	15	16	A	17	18	19	A	A	20	21	22	A	A	A	23	24		
31	13	14	15	16	17	18	19	20	A	21	A	A	22	23	24	25	26	27	28	29		
32	8	9	A	10	A	11	12	A	13	14	15	A	16	17	Ⓐ	A	18	19	20	21		
33	12	13	14	15	16	17	A	18	19	A	A	20	21	22	23	24	25	26	27	28		
34	13	14	15	16	17	18	19	20	21	A	22	23	24	25	26	27	28	29	A	30		
Signature of Teacher																						

1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
Benzil from Benzoin by oxidation reaction.
Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction
Cinnammic acid from Benzaldehyde by Perkin reaction
P-Iodo benzoic acid from P-amino benzoic acid

Recommended Books (Latest Editions)

Organic Chemistry by Morrison and Boyd
Organic Chemistry by I.L. Finar , Volume-I
Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
Organic Chemistry by P.L.Soni
Practical Organic Chemistry by Mann and Saunders.
Vogel's text book of Practical Organic Chemistry
Advanced Practical organic chemistry by N.K.Vishnoi.

8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45Hours

Scope: The course deals with the various physics and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon the completion of the course 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 nad determination of expiry date of formulations

Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT-I **10 Hours**

Solubility of drugs: 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

10Hours

UNIT-II

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymerphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

08 Hours

UNIT-III

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.

08Hours

UNIT-IV

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

07 Hours

UNIT-V

pH, buffers and Isotonic solutions: 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.

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

- Determination the solubility of drug at room temperature
- Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
- Determination of Partition co- efficient of benzoic acid in benzene and water
- Determination of Partition co- efficient of Iodine in CCl_4 and water
- Determination of % composition of NaCl in a solution using phenol-water system by CST method

Determination of surface tension of given liquids by drop count and drop weight method

Determination of HLB number of a surfactant by saponification method

Determination of Freundlich and Langmuir constants using activated char coal

Determination of critical micellar concentration of surfactants

Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method

Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

Recommended Books: (Latest Editions)

Physical Pharmacy by Alfred Martin

Experimental Pharmaceutics by Eugene, Parott.

Tutorial Pharmacy by Cooper and Gunn.

Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.

Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.

Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.

Physical Pharmaceutics by Ramasamy C and ManavalanR.

Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee

Physical Pharmaceutics by C.V.S. Subramanyam

Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45Hours

Scope:

Study of all categories of microorganisms especially for the production of alchol antibiotics, vaccines, vitamins enzymes etc..

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.

CO-PO

Subject: Physical Pharmaceutics I (Theory), Semester: 3rd semester, (BP302T)

Course outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1: Describe the properties of solution with different solubility expressions and determine the solubility of drugs.	M	L	M	L							
CO2: Demonstrate firm foundations in the fundamentals and application of physico-chemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage forms.	H	L	M	L							
CO3: Explain the role of surfactant, interfacial phenomenon of solid-gas, solid-liquid & liquid-liquid interfaces and understand the idea of adsorption isotherms.	H	L		L							
CO4: Explain methods of tonicity adjustment of biological fluid and suggest buffers for pharmaceutical use and describe detailed ideaof complexation of drug action & drug protein binding.	H	L		L			M		L		

Subject: Physical Pharmaceutics I (Practical)

Semester: 3rd semester (BP 306 P)

Course outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1: Perform, record and analyze the results of physicochemical tests to describe property, identity, purity, solubility of substances.	M	H	M	L					L		L
CO2: Determine important analytical values by using modern instrumentation and classical techniques.	M	M	H	H					M		L
CO3: Conduct experiments and interpret data for development of safe intraperitoneal formulations.	M	M	M	L			M		M		

PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services.
PO2	Plan, design, conduct experiments, analyze and interpret data.
PO3	Identify, analyse and resolve problems in professional activities within realistic constraints
PO4	Use current techniques, hands-on skills and modern tools to be productive resource for organization
PO5	Act efficiently as a leader or part of a team in multidisciplinary areas to accomplish tasks.
PO6	Demonstrate the ability to plan and implement professional activities.
PO7	Practice ethically and create awareness in society about the effective and safe use of medicines.
PO8	Communicate effectively for better coordination and performance in global scenario
PO9	Practice the role of a pharmacist in healthcare system for the greater benefit of the society
PO10	Perform and sustain in different environments and culture.
PO11	Motivate, encourage to update skills and knowledge through lifelong learning.

COURSE OUTCOMES OF SESSIONAL QUESTION PAPERS

DEPARTMENT OF PHARMACEUTICS

B.Pharm 3rd semester

PHYSICAL PHARMACEUTICS I (BP302T)

1st Sessional Examination

Aug-Dec 2019

Mapping of Q. Paper

QSNO	Questions	CO		PO	
	Muliple Choice Questions				**Marks : 1X10=10**
1					
2	**Answer any two**				**Marks: 5X2=10**
Q.2.a.	Write short notes on liquid crystals mentioning its types and application	CO2	Demonstrate firm foundations in the fundamentals and application of physico-chemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage forms.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.2.b.	Define diffusion. Discuss different laws of diffusion.	CO1	Describe the properties of solution with different solubility expressions and determine the solubility of drugs.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.2.c	What is critical solution temperature of two immiscible or partially miscible liquids? Discuss with suitable examples.	CO1	Describe the properties of solution with different solubility expressions and determine the solubility of drugs.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.3	**Answer any One**				**Marks : 5X2=10**
Q.3.a	State and derive Roult's law. Describe the deviations from the law with suitable examples.	CO2	Demonstrate firm foundations in the fundamentals and application of physico-chemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services

			forms.		
Q.3.b	Define solvation and association. Briefly discuss factors affecting solubility of drugs.	CO1	Describe the properties of solution with different solubility expressions and determine the solubility of drugs.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services

2nd Sessional Examination 2019
PHYSICAL PHARMACEUTICS I (BP302T)
Aug-Dec 2019

QSNO	Questions	CO		PO	
	Muliple Choice Questions				Marks : 1X10=10
1					
2	Answer any two				Marks: 5X2=10
Q.2.a.	Write a short note on i) Eutectic mixture ii) Spreading Coefficient	CO2	Demonstrate firm foundations in the fundamentals and application of physico-chemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage forms.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.2.b.	Define Refractive index? Write its application and working of Abbes Refractometer.	CO2	Demonstrate firm foundations in the fundamentals and application of physico-chemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage forms.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.2.c	What is sublimation and triple point explain with diagram. Define Dipole moment and write about its	CO2	Demonstrate firm foundations in the fundamentals and application of physico-	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in

	application		chemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage forms.		manufacturing, marketing and healthcare services
Q.3	**Answer any One**				**Marks : 5X2=10**
Q.3.a	What do you mean by CMC. Explain any two methods formeasurement of surface tension.	CO3	Explain the role of surfactant, interfacial phenomenon of solid-gas, solid-liquid & liquid-liquid interfaces and understand the idea of adsorption isotherms	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.3.b	What are the differences between absorption and adsorption. Explain theadsorption in solid surface with the help of suitable isotherms.	CO3	Explain the role of surfactant, interfacial phenomenon of solid-gas, solid-liquid & liquid-liquid interfaces and understand the idea of adsorption isotherms	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services

3rd Sessional Examination 2019
PHYSICAL PHARMACEUTICS I (BP302T)
Aug-Dec 2019

QSNO	Questions	CO		PO	
	Muliple Choice Questions				**Marks : 1X10=10**
1					
2	**Answer any two**				**Marks: 5X2=10**
Q.2.a.	Define protein binding. Briefly discuss the kinetics ofprotein binding.	CO4	Explain methods of tonicity adjustment of biological fluid and suggest buffers for pharmaceutical use and describe detailed ideaof complexation of drug action & drug protein binding.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.2.b.	What are chelates and clathrates? Write down the application of complexation	CO4	Explain methods of tonicity adjustment of biological fluid and	PO1	Demonstrate the knowledge of pharmaceutical and

	in pharmacy.		suggest buffers for pharmaceutical use and describe detailed ideaof complexation of drug action & drug protein binding.		basic sciences in manufacturing, marketing and healthcare services
Q.2.c	Explain the Langmuir adsorption isotherm.	CO3	Explain the role of surfactant, interfacial phenomenon of solid-gas, solid-liquid & liquid-liquid interfaces and understand the idea of adsorption isotherms	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.3	Answer any One				Marks : 5X2=10
Q.3.a	Classify the types of complexes. Explain the pH titration method for analysis of complexes	CO4	Explain methods of tonicity adjustment of biological fluid and suggest buffers for pharmaceutical use and describe detailed ideaof complexation of drug action & drug protein binding.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services
Q.3.b	Write down the applications of pH in pharmacy. Explain any one method of determination of pH?	CO4	Explain methods of tonicity adjustment of biological fluid and suggest buffers for pharmaceutical use and describe detailed ideaof complexation of drug action & drug protein binding.	PO1	Demonstrate the knowledge of pharmaceutical and basic sciences in manufacturing, marketing and healthcare services

Teaching Learning Plan

Name of the Course: **PHYSICAL PHARMACEUTICS- I (Theory)**
Course Code: **BP302T**
Semester: **3rd** Year: **2019**
Name of the Teacher: Ms. Madhuchandra Lahan

Designed Course Outcome:

- **CO1:** Describe the properties of solution with different solubility expressions and determine the solubility of drugs.
- **CO2:** Demonstrate firm foundations in the fundamentals and application of physico-chemical properties of drug molecules and other states of matter relevant to pharmaceutical dosage forms.
- **CO3:** Explain the role of surfactant, interfacial phenomenon of solid-gas, solid-liquid & liquid-liquid interfaces and understand the idea of adsorption isotherms.
- **CO4:** Explain methods of tonicity adjustment of biological fluid and suggest buffers for pharmaceutical use and describe detailed idea of complexation of drug action & drug protein binding.

Tentative Dates	Unit	Syllabus Topics to be Covered	Lecture outcome	Contribution to which CO	Mode of Delivery	Assessment Tools for measuring Outcome
2/8/19 6/8/19 7/8/19	I	**Solubility of drugs:** Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation and association	Outline the application and use of solubility determination in pharmacy and various factors influencing solubility of drugs.	CO1	1.Class room lecture 2. Lecture hand out 3 Power point presentation 4.Class notes	Class room quiz Internal assessment End term Examination Assignment
8/8/19		Diffusion principles in biological systems				
9/8/19		Factors influencing solubility of drugs				
13/8/19 14/8/19 16/8/19 19/8/19		Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions.				
21/8/19 26/8/19		Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications				
27/08/19 28/08/19	II	**States of Matter and properties of matter:** States of matter, changes in the states of matter	Explain the changes in states of matters and demonstra	CO2	1.Class room lecture 2. Lecture hand out 3 Power point presentation 4.Class notes	Class room quiz Internal assessment End term Examination Assignment
30/08/19 02/09/19		Solid state- crystalline, amorphous and polymorphism.				
03/09/19 04/09/19		Latent heats, vapour pressure, sublimation critical point, Eutectic				

		mixtures	te use of physicoch emical properties in the formulatio n developme nt			
06/09/19		liquid complexes, liquid crystals, glassy states				
09/9/19		Gases, aerosols - inhalers, relative humidity				
10/9/19 11/9/19 13/9/19 16/9/19 17/9/19		**Physicochemical properties of drug molecules:** Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.				
20/9/19 23/9/19 24/9/19 27/9/19 30/09/19	III	**Surface and interfacial phenomenon:** Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient	Demonstrat e the use and application of surface active agents and its determinati on methods	CO3	1.Class room lecture 2. Lecture hand out 3 Power point presentation 4.Class notes	Class room quiz Internal assessment End term Examination Assignment
11/10/19 14/10/19 15/10/19		Adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency				
16/10/19 21/10/19		Adsorption at solid interfaces.				
22/10/19 23/10/19 25/10/19 29/10/19	IV	**Complexation and protein binding:** Introduction, Classification of Complex ation, Applications, methods of analysis, Complexation and drug action,	Outline the basic concept of complexati on of drug action and various types of complexati on formation	CO4	1.Class room lecture 2. Lecture hand out 3 Power point presentation 4.Class notes	Class room quiz Internal assessment End term Examination Assignment
30/10/19 01/11/19		Protein binding- Applications, methods of analysis				
04/11/19		Crystalline structures of complexes and thermodynamic treatment of stability constants.				
05/11/19 08/11/19 13/11/19	V	**pH, buffers and Isotonic solutions:** Sorensen's pH scale, pH determination (electrometric and calorimetric),	Outline the importance of buffers and isotonicity in biological system	CO4	1.Class room lecture 2. Lecture hand out 3 Power point presentation 4.Class notes	Class room quiz Internal assessment End term Examination Assignment
15/11/19 18/11/19		Buffers- applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems,				
19/11/19		Isotonicity and buffered isotonic solutions.				

Teaching Learning Plan

Name of the Course: **PHYSICAL PHARMACEUTICS- I (Practical)**
Course Code: **BP307P**
Semester: **3rd** Year: 2019
Name of the Teacher: Ms. Madhuchandra Lahan

Designed Course Outcome:

- **CO1:** Perform record and analyze the results of physicochemical tests to describe property, identity, purity, solubility of substances with the use of modern instrumentation and classical techniques.

Sl. No	Tentative date	Experiment to be conduct	Learning outcome	Contribution to which CO	Mode of Delivery	Assessment Tools (With tentative date of Assessment) for measuring Outcome
1	07/08/19	Determination of molar mass by Rast Camphor method	Determination of molar mass	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis MID TERM END TERM
2	14/08/19	Determination of partition co-efficient of iodine between water and carbon tetra chloride.	Determination of partition co-efficient.	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis MID TERM END TERM
3	21/08/19	Determination of partition co-efficient of benzoic acid between benzene and water	Determination of partition co-efficient	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis MID TERM END TERM
4	28/08/19	Determine the bulk density, true density and porosity of given sample of powder	Determine the bulk density, true density and porosity	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis MID TERM END TERM
5	04/09/19	Determination of solubility of solids at different temperature	Determination of solubility of solids	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis MID TERM END TERM
6	11/09/19	Determine the pKa value of weak acid (acetic acid)	Determination of pKa value	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis END TERM
7	25/09/19	Determine the surface tension of given liquid by drop count and drop weight method using stalagmometer.	Determination of surface tension of given liquid	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis
8	16/10/19	Determination of CMC of a surfactant by surface tension method using stalagmometer	Determination of CMC of a surfactant	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis END TERM

9	23/10/19	Determination of HLB value of a given surfactant	Determination of HLB value of a given surfactant	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis END TERM
10	30/10/19	Determination of required HLB value of for the oil phase to be incorporated in the emulsion	Determination of required HLB value	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis END TERM
11	13/11/19	Analysis of copper glysine complex by pH titration method	Analysis of copper glysine complex	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis END TERM
12	20/11/19	Preparation of acetate buffer (acetic acid and sodium acetate to measure the ph and calculate the pKa	Preparation of acetate buffer	CO1	Lab demonstration and explanation	Lab Performance Viva & Lab record Synopsis END TERM

GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE

PROGRAM :	BACHELOR OF PHARMACY (B. PHARM) [New Curriculum - 2017]			
UNIVERSITY :	Assam Science & Technology University			
NAME OF THE SUBJECT :	Theory:	Physical Pharmaceutics-I	Practical	Physical Pharmaceutics-I
SUBJECT CODE :	Theory:	BP302T	Practical	BP306P
SESSION :	Aug - December 2019			
NAME OF THE TEACHER(S) :	Madhuchandra Lahan			

COURSE OUTCOME ASSESSMENT SHEET

ROLL NO	Theory			Practical			Theory								
							SESSIONAL (30)				CONTINUOUS EVALUATION (20)				ESE
	NO. OF CLASSES	NO. OF CLASSES ATTENDED	ATTENDANCE	NO. OF CLASSES	NO. OF CLASSES	ATTENDANCE	1ST SES	2ND SES	3RD SES	AVG	CE 1	CE 2	CE 3	AVG	
180510011001	44	40	91				14	0	12	13	14	8	16	12.7	D
180510011002	44	36	82				23	27	24	25	10	12	16	12.7	A
180510011003	44	35	80				20	22	26	24	12	13	16	13.7	A
180510011006	44	38	86				22	18	26	24	14	13	16	14.3	B
180510011007	44	34	77				14	15	0	15	8	16	15	13.0	F
180510011008	44	40	91				15	22	25	23	12	8	15	11.7	C
180510011009	44	38	86				5	7	5.5	6	8	12	17	12.3	F
180510011010	44	35	80				15	0	19	17	8	11	16	11.7	D
180510011011	44	37	84				22	0	25	23	12	10	15	12.3	B
180510011012	44	40	91				15	17	17	17	10	12	16	12.7	C
180510011013	44	6	14				17	0	0	9	16	8	17	13.7	
180510011014										0					
180510011015	44	42	95				12	20	20	20	12	16	16	14.7	D
180510011016	44	38	86				10	20	15	18	14	14	16	14.7	C
180510011017	44	38	86				13	19	20	19	12	14	16	14.0	D
180510011018	44	42	95				15	18	22	20	10	14	16	13.3	C
180510011019	44	37	84				13	0	10	12	10		17	13.5	D
180510011020	44	36	82				0	0	10	5	16	16	15	15.7	F
180510011021	44	35	80				16	0	12	14	0	8	17	8.3	
180510011022	44	38	86				20	18	21	21	8	16	15	13.0	C
180510011023	44	38	86				0	19	23	21	10	16	15	13.7	D
180510011024	44	39	89				0	22	21	21	14	14	15	14.3	C

ROLL NO	Practical																											
	CONTINUOUS ASSESSMENT (20)																								SESSIONAL			
	EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	ESE CP
180510011001																											0	
180510011002																											0	
180510011003																											0	
180510011006																											0	
180510011007																											0	
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180510011023																											0	
180510011024																											0	

SIGNATURE OF THE TEACHER

ROLL NO	Theory NO. OF CLASSES HELD	Theory NO. OF CLASSES ATTENDED	Theory ATTENDANCE	Practical NO. OF CLASSES HELD	Practical NO. OF CLASSES ATTENDED	Practical ATTENDANCE	Theory SESSIONAL (30) 1ST SES	2ND SES	3RD SES	AVG	CONTINUOUS EVALUATION (20) CE 1	CE 2	CE 2	AVG	ESE
180510011025	44	43	98				20	23	24	24	12	16	16	14.7	B
180510011026	44	38	86				0	20	12	16	0	14	16	10.0	D
180510011027	44	39	89				17	18	12	17	0	16	16	10.7	C
180510011028	44	44	100				17	21	15	19	12	14	15	13.7	D
180510011029	44	39	89				18	0	21	20	14	13	16	14.3	C
180510011030	44	41	93				16	23	18	20	14	14	16	14.7	C
180510011031	44	35	80				13	8	7.5	11	12	12	17	13.7	F
180510011032	44	41	93				16	22	15	19	10	16	16	14.0	D
180510011033	44	44	100				15	23	26	24	10	0	16	8.7	B
180510011034	44	44	100				13	21	18	19	8	12	14	11.3	C
180510011035	44	38	86				20	0	21	21	0	14	16	10.0	C
180510011036	44	42	95				13	20	19	20	0	14	16	10.0	D
180510011037	44	38	86				21	24	26	25	10	16	16	14.0	A
180510011038	44	35	80				19	15	20	19	14	13	17	14.7	C
180510011039	44	25	57				11	0	16	13	0	14	16	10.0	F
180510011040	44	40	91				17	21	23	22	0	14	16	10.0	C
180510011041	44	35	80				15	0	15	15	12	12	16	13.3	F
180510011042	44	37	84				16	17	0	16	10	13	17	13.3	F
180510011043	44	36	82				13	0	21	17	14	12	17	14.3	D
180510011044	44	40	91				15	20	22	21	0	16	15	10.3	D
180510011045	44	35	80				0	0	20	10	14	0	16	10.0	F
180510011046	44	42	95				16	0	22	19	12	12	16	13.3	D
180510011047	44	42	95				23	21	10	22	12	12	16	13.3	C
180510011048	44	39	89				16	17	13	17	10	12	16	12.7	C
180510011049	44	38	86				17	19	20	19	8	12	17		D
180510011050	44	39	89				20	0	21	21	12	16	16	14.7	C
180510011051	44	36	82				6	5	8.5	7	0	14	16	10.0	F
180510011052	44	35	80				0	0	9.5	5	0	0	16	5.3	
180510011053	44	44	100				17	19	0	18	17	16	17	16.7	D

ROLL NO	Practical CONTINUOUS ASSESSMENT (20) EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	SESSIONAL 1ST SES	2ND SES	AVG	ESE GP
180510011025																											0	
180510011026																											0	
180510011027																											0	
180510011028																											0	
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SIGNATURE OF THE TEACHER

ROLL NO	Theory			Practical			Theory								
	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	SESSIONAL (30) 1ST SES	2ND SES	3RD SES	AVG	CONTINUOUS EVALUATION (20) CE 1	CE 2	CE 2	AVG	ESE
180510011054	44	41	93				23	20	22	22	16	18	16	16.7	B
180510011055	44	44	100				0	16	13	14	15	14	17	15.3	C
180510011056	44	37	84				0	24	24	24	18	17	17	17.3	B
180510011057	44	42	95				25	20	22	23	14	15	16	15.0	B
180510011058	44	44	100				19	24	23	23	16	17	16	16.3	B
180510011059	44	44	100				15	18	14	16	14	15	15	14.7	D
180510011060	44	43	98				22	0	20	21	16	18	16	16.7	B
180510011061	44	42	95				24	0	23	24	16	17	15	16.0	B
180510011062	44	40	91				24	0	20	22	14	17	16	15.7	D
180510011063	44	44	100				21	22	19	21	14	16	16	15.3	B
180510011064	44	40	91				25	14	19	22	16	17	16	16.3	C
180510011065	44	44	100				24	26	16	25	16	17	18	17.0	A
180510011066	44	41	93				21	0	17	19	16	15	15	15.3	B
180510011067	44	44	100				22	23	0	22	14	15	17	15.3	B
180510011068	44	35	80				18	7	14	16	18	15	17	16.7	
180510011069	44	38	86				18	0	15	16	14	15	16	15.0	D
180510011070	44	40	91				0	19	26	22	14	18	16	16.0	A
180510011071	44	44	100				26	19	19	23	16	16	17	16.3	B
180510011072	44	40	91				24	0	20	22	18	17	17	17.3	C
180510011073	44	39	89				20	0	22	21	14	16	17	15.7	C
180510011074	44	44	100				22	25	0	24	18	17	18	17.7	B
180510011075	44	43	98				20	0	21	20	16	15	17	16.0	D
180510011076	44	41	93				0	12	18	15	14		15	14.5	F
180510011077	44	44	100				20	0	18	19	15	14	17	15.3	D
180510011078	44	42	95				25	27	26	26	19	18	18	18.3	A
180510011079	44	38	86				22	0	22	22	15	17	17	16.3	B
180510011080	44	41	93				21	18		11	16	16	17	16.3	C
180510011082	44	43	98				10	12	9	11	12	12	16	13.3	D
180510011083	44	37	84				22	0	27	24	0	12	16	9.3	B

ROLL NO	Practical																											
	CONTINUOUS ASSESSMENT (30)																								SESSIONAL			
	EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	ESE GP
180510011054																											0	
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180510011077																											0	
180510011078																											0	
180510011079																											0	
180510011080																											0	
180510011082																											0	
180510011083																											0	

SIGNATURE OF THE TEACHER

ROLL NO	Theory: NO. OF CLASSES HELD	Theory: NO. OF CLASSES ATTENDED	Theory: ATTENDANCE	Practical: NO. OF CLASSES HELD	Practical: NO. OF CLASSES ATTENDED	Practical: ATTENDANCE	Theory SESSIONAL (30): 1ST SES	2ND SES	3RD SES	AVG	Theory CONTINUOUS EVALUATION (20): CE 1	CE 2	CE 2	AVG	ESE
180510011085	44	44	100				25	25	21	25	18	16	17	17.0	A
180510011086	44	35	80				12	0	0	6	0	10	16	8.7	
180510011087	44	41	93				20	19	16	20	18	16	15	16.3	C
180510011088	44	44	100				27	26	28	27	19	18	18	18.3	O
180510011089	44	44	100				25	21	26	25	14	17	17	16.0	A
180510011090	44	43	98				20	18	24	22	12	13	16	13.7	B
180510011091	44	41	93				18	21	0	20	14	15	15	14.7	C
180510011092	44	44	100				20	9	11	15	16	12	16	14.7	D
180510011094	44	44	100				11	0	10	11	16	10	15	13.7	F
180510011095	44	43	98				13	14	8	14	14	12	15	13.7	B
180510011096	44	44	100				17	19	17	18	12	12	15	13.0	C
180510011097	44	44	100				22	23	25	24	18	17	17	17.3	A
180510011098	44	42	95				15	0	11	13	13	14	17	14.7	D
180510011099	44	41	93				12	17	0	14	12	11	17	13.3	D
180510011100	44	36	82				21	14	19	20	0	12	16	9.3	D
180510011101	44	44	100				22	21	22	22	19	17	17	17.7	A
180510011102	44	36	82				0	3	0	2	0	14	16	10.0	F
190550011001	44	38	86				24	0	23	23	18	16	18	17.3	
190550011002	44	44	100				23	19	20	22	17	17	18	17.3	B
190550011003	44	44	100				16	0	22	19	16	16	17	16.3	D
190550011004	44	43	98				22	19	24	23	15	16	17	16.0	
190550011005	44	42	95				23	0	15	19	0	13	17	10.0	C
190550011006	44	44	100				23	19	24	23	16	16	17	16.3	A
190550011007	44	44	100				15	0	15	15	17	15	17	16.3	D
190550011008	44	43	98				21	0	18	20	15	17	16	16.0	C
190550011009	44	39	89				23	22	0	22	16	17	17	16.7	B
190550011010	44	43	98				21	18	21	21	16	17	17	16.7	B
190550011011	44	44	100				24	24	16	24	16	17	16	16.3	B
190550011012	44	40	91				21	21	20	21	16	16	17	16.3	B

ROLL NO	Practical CONTINUOUS ASSESSMENT (20): EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	SESSIONAL: 1ST SES	2ND SES	AVG	ESE GP
180510011085																											0	
180510011086																											0	
180510011087																											0	
180510011088																											0	
180510011089																											0	
180510011090																											0	
180510011091																											0	
180510011092																											0	
180510011094																											0	
180510011095																											0	
180510011096																											0	
180510011097																											0	
180510011098																											0	
180510011099																											0	
180510011100																											0	
180510011101																											0	
180510011102																											0	
190550011001																											0	
190550011002																											0	
190550011003																											0	
190550011004																											0	
190550011005																											0	
190550011006																											0	
190550011007																											0	
190550011008																											0	
190550011009																											0	
190550011010																											0	
190550011011																											0	
190550011012																											0	

SIGNATURE OF THE TEACHER

ROLL NO	Theory			Practical			Theory								
	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	SESSIONAL (30)				CONTINUOUS EVALUATION (20)				ESE
							1ST SES	2ND SES	3RD SES	AVG	CE 1	CE 2	CE 2	AVG	
190550031013	44	39	[illegible]				17	18	0	17	16	16	15	15.7	C
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					
										0					F
										0					F

ROLL NO	Practical																											
	CONTINUOUS ASSESSMENT (20)																								SESSIONAL			ESE %
	EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	
190550031013																												
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
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																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	
																											0	

>80%
>70%
>60%
>50%
<50%

SIGNATURE OF THE TEACHER

ASSESSMENT REPORT

	GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE		
PROGRAM :	BACHELOR OF PHARMACY (B. PHARM) (New Curriculum - 2017)		
UNIVERSITY :	Assam Science & Technology University		
NAME OF THE SUBJECT :	Theory: Physical Pharmaceutics I	Practical	Physical Pharmaceutics I
SUBJECT CODE :	Theory: BP302T	Practical	BP306P
SESSION :	Aug - December 2019		
NAME OF THE TEACHER(S) :	Madhuchandra Lahan		

ASSESSMENT REPORT	ATTENDANCE	ATTENDANCE	SESSIONAL (30) 1ST SES	2ND SES	3RD SES	AVG	CONTINUOUS EVALUATION (20) CE 1	CE 2	CE 3	AVG	ESE	CONTINUOUS ASSESSMENT EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	SESSIONAL 1ST SES	2ND SES	AVG	ESE
NO. OF STUDENTS SCORED >= 80%	96	0	11	8	17	17	35	46	89	34	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO. OF STUDENTS SCORED >= 70%	107	0	36	28	37	49	61	71	109	63	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO. OF STUDENTS SCORED >= 60%	107	0	54	51	59	73	78	95	109	88	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO. OF STUDENTS SCORED >= 50%	108	0	78	63	73	89	88	100	109	102	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO. OF STUDENTS SCORED 0 - 50%	1	0	31	46	35	43	21	7	0	6	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	0

ASSESSMENT REPORT	ATTENDANCE	ATTENDANCE	SESSIONAL (30) 1ST SES	2ND SES	3RD SES	AVG	CONTINUOUS EVALUATION (20) CE 1	CE 2	CE 3	AVG	ESE	CONTINUOUS ASSESSMENT EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	SESSIONAL 1ST SES	2ND SES	AVG	ESE
% OF STUDENTS SCORED >= 80%	88	0	10	7	16	16	32	42	82	31	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% OF STUDENTS SCORED >= 70%	98	0	33	26	34	45	56	65	100	58	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% OF STUDENTS SCORED >= 60%	98	0	50	47	54	67	72	87	100	81	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% OF STUDENTS SCORED >= 50%	99	0	72	58	67	82	81	92	100	94	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121	0
% OF STUDENTS SCORED < 50%	1	0	28	42	32	39	19	6	0	6	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO. OF STUDENTS APPEARED	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109
80% OF STUDENTS SCORED	>80%	<50%	<50%	<50%	<50%	>50%	>50%	>60%	>80%	>60%	>50%	>70%	>60%	>70%	>50%	>60%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	100	0	0	0	0	60	60	70	100	70	60	80	70	80	60	70	70	60	100	60	60	70	70	70	0	0	0	0	0	0	0	0	0	0	0	60	60	60	30

SIGNATURE OF THE TEACHER

WEIGHTAGE CONTRIBUTION TO RESPECTIVE COURSE OUTCOMES

Weightage	100	20		10			10	10			20	30																												
CO 1		0.2	0	0.1	0	0	0.1	0.1	0	0	0.2	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		20	0	0	0	0	6	6	0	0	14	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weightage	100	20		10			10		10		20	30																												
CO 2		0.2	0	0.1	0	0	0	0	0.1	0	0.2	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		20	0	0	0	0	6	0	7	0	14	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weightage	100	20			10		10			10	20	30																												
CO 3		0.2	0	0	0.1	0	0.1	0	0	0.1	0.2	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		20	0	0	0	0	6	0	0	10	14	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weightage	100	20				10	10			10	20	30																												
CO 4		0.2	0	0	0	0.1	0.1	0	0	0.1	0.2	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		20	0	0	0	0	6	0	0	10	14	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weightage	0																																							
CO 5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weightage	0																																							
CO 6		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ATTAINMENT OF COURSE OUTCOMES

COs	% OF ATTAINMENT	ATTAIMENT LEVEL	REMARKS
CO 1	64	MODERATE	
CO 2	65	MODERATE	
CO 3	68	MODERATE	
CO 4	68	MODERATE	
CO 5	0		
CO 6	0		

SIGNATURE OF THE TEACHER

GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE

PROGRAM :	BACHELOR OF PHARMACY (B. PHARM) (New Curriculum - 2017)		
UNIVERSITY :	Assam Science & Technology University		
NAME OF THE SUBJECT :	Theory: Physical Pharmaceutics-I	Practical	Physical Pharmaceutics-I
SUBJECT CODE :	Theory: BP302T	Practical	BP306P
SESSION :	Aug - December 2019		
NAME OF THE TEACHER(S) :	Madhuchandra Lahon		

COURSE OUTCOME ASSESSMENT SHEET

ROLL NO	Theory: NO. OF CLASSES	Theory: NO. OF CLASSES ATTENDED	Theory: ATTENDANCE	Practical: NO. OF CLASSES	Practical: NO. OF CLASSES	Practical: ATTENDANCE	Theory Sessional (30): 1ST SES	2ND SES	3RD SES	AVG	Continuous Evaluation (20): CE 1	CE 2	CE 2	AVG	ESE
180510011001				13	13	100				0					
180510011002				13	11	85				0					
180510011003				13	11	85				0					
180510011006				13	12	92				0					
180510011007				13	11	85				0					
180510011008				13	12	92				0					
180510011009				13	11	85				0					
180510011010				13	11	85				0					
180510011011				13	11	85				0					
180510011012				13	13	100				0					
180510011013				13	0	0				0					
180510011014										0					
180510011015				13	12	92				0					
180510011016				13	12	92				0					
180510011017				13	12	92				0					
180510011018				13	12	92				0					
180510011019				13	9	69				0					
180510011020				13	11	85				0					
180510011021				13	11	85				0					
180510011022				13	12	92				0					
180510011023				13	12	92				0					
180510011024				13	12	92				0					

ROLL NO	Practical Continuous Assessment (20): EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	Sessional: INT SES	END SES	AVG	[illegible]
180510011001	15	13	15	13	9	12	11	7	8	10	9	12													25	30	28	[illegible]
180510011002	15	14	15	14	16	15	12	9	18	17	9	10													34	35	35	[illegible]
180510011003	15	15	15	10	16	12	13	11	10	11	13	14													28	32	30	[illegible]
180510011006	13	13	15	9	12	15	15	11	9	12	14	15													30	36	33	[illegible]
180510011007	15	15	9	10	15	10	8	14	8	10	9	12													22	25	24	[illegible]
180510011008	14	14	14	14	9	14	11	12	9	9	12	12													26	29	28	[illegible]
180510011009	7	8	14	11	14	10	8	10	7	13	6	9													22	25	24	[illegible]
180510011010	13	13	14	17	8	12	10	12	7	7	10	16													25	27	26	[illegible]
180510011011	17	13	13	15	12	15	16	11	15	10	12	14													23	25	24	[illegible]
180510011012	16	14	16	14	8	12	10	9	9	9	12	12													26	32	29	[illegible]
180510011013	14	14	8	14	11	9	12	10	9	8	10	10															0	
180510011014																											0	
180510011015	14	14	14	14	8	12	10	13	9	9	11	12													27	30	29	[illegible]
180510011016	14	14	14	14	8	16	10	12	12	12	12	14													27	30	28	[illegible]
180510011017	14	14	14	13	15	12	11	14	9	9	12	14													28	30	29	[illegible]
180510011018	14	14	15	14	8	12	12	15	16	8	14	14													27	30	29	[illegible]
180510011019	14	15	12	15	12	8	9	12	10	12	11	12													28	25	26	[illegible]
180510011020	10	14	14	14	8	11	11	9	12	9	11	9													22	26	24	[illegible]
180510011021	14	15	14	13	16	12	12	11	11	11	12	14													25	28	27	[illegible]
180510011022	12	12	12	15	13	12	10	11	11	11	12	14													28	31	29	[illegible]
180510011023	14	14	14	13	10	12	12	7	9	17	15	16													31	34	33	[illegible]
180510011024	15	15	15	16	10	11	11	12	12	12	11	12													20	25	23	[illegible]

SIGNATURE OF THE TEACHER

ROLL NO	Theory: NO. OF CLASSES HELD	Theory: NO. OF CLASSES ATTENDED	Theory: ATTENDANCE	Practical: NO. OF CLASSES HELD	Practical: NO. OF CLASSES ATTENDED	Practical: ATTENDANCE	Theory Sessional (30): 1ST SES	2ND SES	3RD SES	AVG	Theory Continuous Evaluation (20): CE 1	CE 2	CE 2	AVG	ESE
180510011025				13	12	92				0					
180510011026				13	10	77				0					
180510011027				13	12	92				0					
180510011028				13	12	92				0					
180510011029				13	12	92				0					
180510011030				13	12	92				0					
180510011031				13	12	92				0					
180510011032				13	11	85				0					
180510011033				13	12	92				0					
180510011034				13	12	92				0					
180510011035				13	9	69				0					
180510011036				13	11	85				0					
180510011037				13	11	85				0					
180510011038				13	12	92				0					
180510011039				13	8	62				0					
180510011040				13	11	85				0					
180510011041				13	11	85				0					
180510011042				13	12	92				0					
180510011043				13	11	85				0					
180510011044				13	9	69				0					
180510011045				13	8	62				0					
180510011046				13	12	92				0					
180510011047				13	12	92				0					
180510011048				13	12	92				0					
180510011049				13	11	85				0					
180510011050				13	11	85				0					
180510011051				13	11	85				0					
180510011052				13	10	77				0					
180510011053				13	13	100				0					

ROLL NO	Practical: Continuous Assessment (20): ESPT 1	ESPT 2	ESPT 3	ESPT 4	ESPT 5	ESPT 6	ESPT 7	ESPT 8	ESPT 9	ESPT 10	ESPT 11	ESPT 12	ESPT 13	ESPT 14	ESPT 15	ESPT 16	ESPT 17	ESPT 18	ESPT 19	ESPT 20	ESPT 21	ESPT 22	ESPT 23	ESPT 24	Sessional: 1ST SES	2ND SES	AVG	ESE GP
180510011025	15	14	15	14	14	16	11	11	11	9	14	14													30	32	31	O
180510011026	14	13	13	14	8	14	8	12	16	9	11	12													22	21	22	C
180510011027	14	14	14	13	11	11	14	11	9	9	12	12													24	27	26	C
180510011028	16	16	16	16	16	15	18	17	17	15	10	15													26	25	26	B
180510011029	15	16	16	15	17	15	17	15	16	15	10	15													24	23	24	C
180510011030	17	18	16	17	16	15	16	16	15	17	15	13													38	38	38	O
180510011031	15	14	16	16	14	15	19	17	16	16	15	13													20	21	21	B
180510011032	17	16	17	16	18	15	15	17	15	19	15	13													37	37	37	O
180510011033	16	16	16	16	18	16	17	17	15	19	15	13													35	34	35	A
180510011034	14	14	14	14	18	18	18	18	19	19	15	13													21	23	22	B
180510011035	14	12	13	11	9	16	7	19	14	18	15	13													18	18	18	C
180510011036	15	14	16	16	9	16	16	17	19	17	15	13													23	25	24	C
180510011037	17	16	17	16	16	16	18	17	13	18	15	13													27	25	26	B
180510011038	14	13	16	16	16	16	17	17	18	17	15	13													18	19	18	B
180510011039	15	12	13	14	14	8	18	18	17	8	15	13													18	17	18	C
180510011040	18	8	17	14	16	18	17	13	15	17	15	13													36	37	36	A
180510011041	16	15	17	16	17	18	12	13	17	8	14	15													31	29	30	B
180510011042	13	12	13	16	17	18	17	12	18	13	14	14													20	18	19	C
180510011043	9	9	10	12	12	16	12	11	10	15	14	14													20	16	18	D
180510011044	5	16	16	13	9	17	7	16	18	18	14	14													29	25	24	C
180510011045	13	12	10	9	9	14	11	9	9	15	11	11													16	17	17	D
180510011046	14	16	16	15	17	18	16	18	16	18	14	14													20	25	26	B
180510011047	15	16	16	15	17	18	16	18	16	17	15	16													28	32	29	A
180510011048	15	18	17	18	18	18	16	18	16	18	15	16													36	35	36	A
180510011049	16	18	16	18	17	18	16	18	16	17	15	16													34	36	35	A
180510011050	17	18	17	18	14	12	15	15	14	15	15	16													38	36	37	A
180510011051	13	13	13	15	14	15	15	10	15	13	15	10													18	19	18	D
180510011052	13	9	12	13	14	14	8	10	14	8	10	10													13	16	16	
180510011053	18	18	17	18	18	19	18	19	17	19	15	16													23	25	24	C

SIGNATURE OF THE TEACHER

ROLL NO	Theory: NO. OF CLASSES HELD	Theory: NO. OF CLASSES ATTENDED	Theory: ATTENDANCE	Practical: NO. OF CLASSES HELD	Practical: NO. OF CLASSES ATTENDED	Practical: ATTENDANCE
180510011054				13	13	100
180510011055				13	11	85
180510011056				13	10	77
180510011057				13	10	77
180510011058				13	11	85
180510011059				13	11	85
180510011060				13	12	92
180510011061				13	11	85
180510011062				13	11	85
180510011063				13	11	85
180510011064				13	10	77
180510011065				13	11	85
180510011066				13	10	77
180510011067				13	10	77
180510011068				13	10	77
180510011069				13	11	85
180510011070				13	10	77
180510011071				13	12	92
180510011072				13	12	92
180510011073				13	10	77
180510011074				13	12	92
180510011075				13	11	85
180510011076				13	9	69
180510011077				13	10	77
180510011078				13	11	85
180510011079				13	13	100
180510011080				13	13	100
180510011082				13	13	100
180510011083				13	9	69

ROLL NO	Theory: SESSIONAL (30) 1ST SES	2ND SES	3RD SES	AVG	CONTINUOUS EVALUATION (20) CE 1	CE 2	CE 3	AVG	ESE
180510011054				0					
180510011055				0					
180510011056				0					
180510011057				0					
180510011058				0					
180510011059				0					
180510011060				0					
180510011061				0					
180510011062				0					
180510011063				0					
180510011064				0					
180510011065				0					
180510011066				0					
180510011067				0					
180510011068				0					
180510011069				0					
180510011070				0					
180510011071				0					
180510011072				0					
180510011073				0					
180510011074				0					
180510011075				0					
180510011076				0					
180510011077				0					
180510011078				0					
180510011079				0					
180510011080				0					
180510011082				0					
180510011083				0					

ROLL NO	Practical: CONTINUOUS ASSESSMENT (20) EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24
180510011054	18	17	19	19	19	17	18	17	17	17	14	17												
180510011055	16	18	19	17	18	18	10	17	8	15	14	17												
180510011056	16	17	18	8	8	8	17	16	17	15	14	8												
180510011057	16	18	17	17	18	18	19	17	8	18	14	17												
180510011058	16	8	18	18	17	19	19	17	18	8	14	17												
180510011059	17	19	17	19	18	17	19	17	8	8	17	12												
180510011060	18	8	18	19	17	17	15	9	19	12	17	12												
180510011061	17	18	17	19	18	17	18	19	19	9	17	12												
180510011062	18	17	18	9	17	18	17	19	17	12	17	12												
180510011063	19	18	19	18	19	19	18	18	17	8	17	12												
180510011064	18	17	19	19	19	19	17	17	8	18	16	15												
180510011065	19	18	19	17	15	19	18	18	18	17	17	16												
180510011066	19	17	18	9	19	16	8	17	19	18	17	16												
180510011067	19	18	17	17	19	12	8	18	19	17	15	13												
180510011068	18	8	15	7	14	8	14	17	9	14	12	14												
180510011069	19	8	15	17	15	14	8	18	8	17	12	13												
180510011070	19	17	18	17	19	18	19	19	17	19	13	14												
180510011071	18	18	17	17	18	19	19	18	8	19	13	14												
180510011072	19	17	18	18	17	17	19	17	17	9	13	14												
180510011073	17	19	17	19	18	8	19	18	18	17	13	14												
180510011074	16	19	18	19	17	17	18	17	19	18	13	14												
180510011075	17	18	17	19	18	8	17	18	8	17	12	13												
180510011076	15	10	14	12	9	8	9	16	14	13	12	13												
180510011077	16	16	15	8	16	16	17	14	17	17	12	13												
180510011078	18	17	19	19	19	17	18	19	19	19	12	13												
180510011079	19	18	19	17	18	19	16	19	17	18	12	13												
180510011080	19	17	18	15	19	17	17	19	17	19	12	13												
180510011082	14	14	14	12	13	8	13	13	17	12	12	13												
180510011083	17	17	18	17	19	8	8	19	17	18	12	13												

ROLL NO	Practical: SESSIONAL 1ST SES	2ND SES	AVG	ESE GP
180510011054	[illegible]	[illegible]	35	A
180510011055	[illegible]	[illegible]	25	C
180510011056	[illegible]	[illegible]	27	B
180510011057	[illegible]	[illegible]	27	A
180510011058	[illegible]	[illegible]	35	B
180510011059	[illegible]	[illegible]	27	B
180510011060	[illegible]	[illegible]	36	A
180510011061	[illegible]	[illegible]	36	A
180510011062	[illegible]	[illegible]	31	B
180510011063	[illegible]	[illegible]	29	B
180510011064	[illegible]	[illegible]	29	B
180510011065	[illegible]	[illegible]	37	O
180510011066	[illegible]	[illegible]	36	O
180510011067	[illegible]	[illegible]	31	B
180510011068	[illegible]	[illegible]	19	D
180510011069	[illegible]	[illegible]	19	D
180510011070	[illegible]	[illegible]	32	A
180510011071	[illegible]	[illegible]	28	B
180510011072	[illegible]	[illegible]	29	A
180510011073	[illegible]	[illegible]	26	B
180510011074	[illegible]	[illegible]	36	A
180510011075	[illegible]	[illegible]	23	C
180510011076	[illegible]	[illegible]	19	C
180510011077	[illegible]	[illegible]	26	[illegible]
180510011078	[illegible]	[illegible]	33	[illegible]
180510011079	[illegible]	[illegible]	30	[illegible]
180510011080	[illegible]	[illegible]	30	[illegible]
180510011082	[illegible]	[illegible]	21	C
180510011083	[illegible]	[illegible]	27	B

SIGNATURE OF THE TEACHER

ROLL NO	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	SESSIONAL (30)				CONTINUOUS EVALUATION (20)				ESE	CONTINUOUS ASSESSMENT (50)																						SESSIONAL			END SEM
							1ST SES	2ND SES	3RD SES	AVG	CE 1	CE 2	CE 3	AVG		EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	
180510011085				13	11	85				0						8	17	19	19	19	9	18	17	17	18	14	13													17	15	16	A
180510011086				13	10	77				0						10	14	14	13	15	12	9	13	12	15	14	13													16	17	17	
180510011087				13	13	100				0						19	17	18	17	19	19	18	16	17	18	14	13													18	17	35	B
180510011088				13	13	100				0						19	18	17	17	18	18	19	17	19	17	17	16													18	18	36	O
180510011089				13	13	100				0						19	17	18	18	17	18	19	17	19	16	14	13													15	14	29	B
180510011090				13	13	100				0						17	19	17	8	18	17	19	16	19	17	16	14													12	11	23	C
180510011091				13	13	100				0						17	19	18	19	17	18	19	17	19	16	16	14													12	11	23	B
180510011092				13	13	100				0						17	18	17	19	18	18	19	17	19	14	16	14													11	11	22	D
180510011094				13	9	69				0						10	17	13	8	17	12	8	17	12	13	16	14													11	9	20	D
180510011095				13	13	100				0						19	18	19	18	8	18	19	17	19	18	16	14													10	9	19	C
180510011096				13	13	100				0						16	15	15	9	14	12	13	18	17	17	16	14													14	14	28	A
180510011097				13	13	100				0						16	14	13	9	16	14	12	15	12	14	16	14													17	17	37	O
180510011098				13	11	85				0						8	12	12	13	14	15	8	17	14	13	15	13													14	15	29	C
180510011099				13	13	100				0						19	18	17	17	18	16	18	17	19	18	15	13													11	10	21	C
180510011100				13	10	77				0						19	17	16	18	17	12	9	17	18	17	15	13													10	9	19	C
180510011101				13	13	100				0						17	19	17	19	18	16	18	18	17	18	15	13													18	20	38	O
180510011102				13	7	54				0						10	12	10	11	13	9	9	12	11	10	14	10													7	10	17	
190550011001				13	12	92				0						17	10	12	12	13	17	14	10	17	12	17	13													14	13	27	
190550011002				13	13	100				0						8	17	18	19	17	16	17	19	18	19	17	16													18	18	36	A
190550011003				13	12	92				0						17	18	16	18	14	16	18	13	17	13	15	16													12	11	23	C
190550011004				13	12	92				0						15	17	14	14	17	15	17	15	14	17	17	16													13	15	28	
190550011005				13	11	85				0						19	18	19	18	19	18	17	18	19	18	17	16													11	11	22	C
190550011006				13	12	92				0						18	17	18	19	17	18	9	18	19	17	17	16													13	12	25	C
190550011007				13	11	85				0						16	18	17	18	19	17	9	18	19	17	13	14													11	11	22	C
190550011008				13	13	100				0						14	16	12	13	14	15	14	14	15	14	13	14													11	10	21	C
190550011009				13	11	85				0						18	17	18	8	17	18	17	18	19	17	13	14													13	12	25	B
190550011010				13	13	100				0						18	17	18	19	17	18	17	18	19	17	15	14													14	13	27	A
190550011011				13	11	85				0						12	18	19	17	18	15	10	16	14	15	13	14													14	13	27	B
190550011012				13	12	92				0						16	18	19	9	18	18	17	18	19	17	13	14													14	13	27	B
	Theory			Practical			Theory									Practical																										

ROLL NO	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	SESSIONAL (30)				CONTINUOUS EVALUATION (20)				ESE	CONTINUOUS ASSESSMENT (20)																								SESSIONAL			ESE GP
							1ST SES	2ND SES	3RD SES	AVG	CE 1	CE 2	CE 2	AVG.		EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	
190550011013				13	11	85				0					C	14	16	18	17	18	15	9	16	14	17	15	15													24	22	23	C
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<50%

SIGNATURE OF THE TEACH

							SESSIONAL (30)				CONTINUOUS EVALUATION (20)					CONTINUOUS ASSESSMENT (20)																								SESSIONAL			
ROLL NO	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	NO. OF CLASSES HELD	NO. OF CLASSES ATTENDED	ATTENDANCE	1ST SES	2ND SES	3RD SES	AVG	CE 1	CE 2	CE 2	AVG	ESE	EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	ESE GP
1505SS0011013				13	11	85				0					C	14	16	18	17	18	15	9	16	14	17	15	15													24	22	23	C
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SIGNATURE OF THE TEACHER

ASSESSMENT REPORT

PROGRAM :	GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE			
UNIVERSITY :	BACHELOR OF PHARMACY (B. PHARM) (New Curriculum - 2017)			
NAME OF THE SUBJECT :	Assam Science & Technology University			
SUBJECT CODE :	Theory:	Physical Pharmaceutics-I	Practical	Physical Pharmaceutics-I
SESSION :	Theory:	BP302T	Practical	BP302P
NAME OF THE TEACHER(S) :	Aug - December 2019			
	Madhuchandra Lahan			

ASSESSMENT REPORT	ATTENDANCE	ATTENDANCE	SESSIONAL (30)				CONTINUOUS EVALUATION (20)				ESE	CONTINUOUS ASSESSMENT																							SESSIONAL			
			1ST SES	2ND SES	3RD SES	AVG	CE 1	CE 2	CE 3	AVG		EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	ESE
NO. OF STUDENTS SCORED >= 80%	0	86	0	0	0	0	0	0	0	0	0	59	60	65	55	64	56	56	66	59	55	21	19	0	0	0	0	0	0	0	0	0	0	0	23	28	26	28
NO. OF STUDENTS SCORED >= 70%	0	99	0	0	0	0	0	0	0	0	0	91	85	91	77	88	76	64	75	74	67	65	56	0	0	0	0	0	0	0	0	0	0	0	47	51	45	67
NO. OF STUDENTS SCORED >= 60%	0	107	0	0	0	0	0	0	0	0	1	99	98	104	91	89	82	75	89	81	83	94	100	0	0	0	0	0	0	0	0	0	0	0	73	76	72	96
NO. OF STUDENTS SCORED >= 50%	0	108	0	0	0	0	0	0	0	0	1	103	101	107	96	98	97	89	102	88	90	105	106	0	0	0	0	0	0	0	0	0	0	0	98	93	92	103
NO. OF STUDENTS SCORED 0 - 50%	0	1	0	0	0	132	0	0	0	0	2	6	8	2	13	16	12	20	7	21	19	4	3	0	0	0	0	0	0	0	0	0	0	0	10	15	40	0

ASSESSMENT REPORT	ATTENDANCE	ATTENDANCE	SESSIONAL (30)				CONTINUOUS EVALUATION (20)				ESE	CONTINUOUS ASSESSMENT																							SESSIONAL			
			1ST SES	2ND SES	3RD SES	AVG	CE 1	CE 2	CE 3	AVG		EXPT 1	EXPT 2	EXPT 3	EXPT 4	EXPT 5	EXPT 6	EXPT 7	EXPT 8	EXPT 9	EXPT 10	EXPT 11	EXPT 12	EXPT 13	EXPT 14	EXPT 15	EXPT 16	EXPT 17	EXPT 18	EXPT 19	EXPT 20	EXPT 21	EXPT 22	EXPT 23	EXPT 24	1ST SES	2ND SES	AVG	ESE
% OF STUDENTS SCORED >= 80%	0	79	0	0	0	0	0	0	0	0	0	54	55	60	50	59	51	51	61	54	50	19	17	0	0	0	0	0	0	0	0	0	0	0	21	26	23	26
% OF STUDENTS SCORED >= 70%	0	91	0	0	0	0	0	0	0	0	0	83	78	83	71	74	70	59	69	68	61	60	51	0	0	0	0	0	0	0	0	0	0	0	43	47	41	61
% OF STUDENTS SCORED >= 60%	0	98	0	0	0	0	0	0	0	0	1	91	90	95	83	82	84	69	82	74	76	86	92	0	0	0	0	0	0	0	0	0	0	0	67	70	66	86
% OF STUDENTS SCORED >= 50%	0	99	0	0	0	0	0	0	0	0	1	94	93	98	88	85	89	82	94	81	83	96	97	0	0	0	0	0	0	0	0	0	0	0	90	85	84	94
% OF STUDENTS SCORED < 50%	0	1	0	0	0	121	0	0	0	0	2	6	7	2	12	15	11	18	6	19	17	4	3	0	0	0	0	0	0	0	0	0	0	0	9	14	37	0
NO. OF STUDENTS APPEARED	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109
80% OF STUDENTS SCORED	>60%	>80%	<50%	<50%	<50%	>50%	>50%	>60%	>80%	>60%	>50%	>70%	>60%	>70%	>60%	>60%	>60%	>50%	>70%	>50%	>50%	>60%	>60%	>50%	>50%	>60%	>60%	>50%	<50%	<50%	<50%	<50%	<50%	<50%	>50%	>50%	>60%	>60%
	100	80	0	0	0	60	60	70	100	70	60	80	70	80	70	70	70	60	70	60	60	70	70	70	0	0	0	0	0	0	0	0	0	0	60	60	80	70

SIGNATURE OF THE TEACHER

WEIGHTAGE CONTRIBUTION TO RESPECTIVE COURSE OUTCOMES

Weightage	100		20																																								
														3	2	2	2	2	2	1	1	1	1	1	2															10	10	10	30
CO 1		0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0.3
		0	16	0	0	0	0	0	0	0	0	0	0	2.4	1.8	1.6	1.4	1.4	1.4	0.6	0.7	0.6	0.6	0.7	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	6	21
Weightage	100		20																																								
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CO 2		0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0.3
		0	16	0	0	0	0	0	0	0	0	0	0	1.6	0.7	0.8	0.7	2.1	2.1	0.6	0.7	1.8	1.8	2.1	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	6	18
Weightage	100		20																																								
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CO 3		0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.2	0.3
		0	16	0	0	0	0	0	0	0	0	0	0	1.6	1.4	1.6	0.7	0.7	0.7	1.2	1.4	1.8	1.8	2.1	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6	9	18
Weightage	0																																										
CO 4		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weightage	0																																										
CO 5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weightage	0																																										
CO 6		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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ATTAINMENT OF COURSE OUTCOMES

COs	% OF ATTAINMENT	ATTAIMENT LEVEL	REMARKS
CO 1	69.2	MODERATE	
CO 2	66.6	MODERATE	
CO 3	66.6	MODERATE	
CO 4	0		
CO 5	0		
CO 6	0		

SIGNATURE OF THE TEAC

10-09-19

203

Girijananda Chowdhury Institute of Pharmaceutical Science
B.Pharm 3rd sem, 1st Sessional Examination, September 2019
Subject: Physical Pharmaceutics
Subject Code: BP302T

Full Marks-30 **Time-1hr**

1. Answer the Following Questions (Multiple Choice) **1×10=10**

i) Solubility of most gases usually decreases with increasing in temperature.
a) Decreases b) Increases
c) Does not change d) First increases and then decreases.

ii) Increase in solubility of a drug in water in the presence of additive is known as:
a) Dissolution b) Cosolvency
c) Solubilization d) Hydrotropy.

iii) Hildebrand-Scatchard equation is applicable to one of the following type of solutions-
a) Equilibrium b) Ideal
c) Non-ideal d) Regular

iv) According to IP, sparingly soluble means:
a) 1 to 10 parts b) 10 to 30 parts
c) 30 to 100 parts d) 100 to 1000 part

v) Which of the following is not a real gas?
a) Oxygen b) Nitrogen
c) Carbon-di-oxide d)Hydrogen

vi) A phenomenon having physical properties in different directions are called:
a) Polymorphic b) Isomorphic
c) Isotropic d) Anisotropic

vii) Which is NOT a limitation of distribution law
a) Dilute solution b) Mixing Time
c) Same molecular State d) Non miscibility of liquid

viii) Amorphous form of a drug dissolves _____ than the crystalline form.

a) Slower b) Faster
c) Equal d) Does not dissolve

ix) What kind of liquid crystal consists of parallel molecules in layers?

a) Cholesteric b) Nematic
c) Smetic d) All of the above

x) The energy supplied to convert a unit mass of substance from solid to liquid state at its melting point is called-

a) Evaporation b) Latent heat of fusion
c) Latent heat of vaporization d) Solidification.

2. Answer the following questions (Any two) 2×5=10

a) Write a short note on liquid crystals mentioning its types and application.

b) Define Diffusion. Discuss different laws of diffusion.

c) What is critical solution temperature of two immiscible or partially miscible liquids? Discuss with suitable examples.

3. Answer the following Questions (Any One) 1×10=10

a) State and derive Raoult's law. Describe the deviation from the law with suitable examples.

b) Define solvation and Association. Briefly discuss factors affecting solubility of drugs.

10-10-19

Girijananda Chowdhury Institute of Pharmaceutical Science
B.Pharm 3rd semester, 2nd Sessional Examination, Oct 2019
Subject: Physical Pharmaceutics-I (Sub Code: BP302T)

Full Marks-30 **Time-1hr**

1. Answer the Following Questions (Multiple choice) **1×10=10**

i) Wetting agents generally have a HLB value in the range of:
a) 0-3 b) 6-9 c) 9-12 d) 13-16

ii) Chemically spans are called as:
a) Alcohol-polyethylene glycol esters b) Polyoxyethylenesorbitan esters c) Fatty acid-polyethylene glycol esters d) Sorbitan esters of fatty acids

iii) _____ is a Zwitterionic surfactant.
a) SLS b) Lecithin c) Tween d) Benzalkonium chloride

iv) The Du-Nouy ring method determins _____
a) Surface tension b) Interfacial tension c) Both (a) and (b)
d) None of the above

v) Which of the following surfactant also possess anti-bacterial activity?
a) Quaternary ammonium compound b) Glyceryl monostearate
c) Sodium oleate d) SLS

vi) dielectric constant is a property applied for:
a) Percent composition b) Polarity scale
c) Qualitative analysis d) Structural elucidation

vii) Calculate the HLB value Span 80, if the saponification value is 25.7 and the acid value is 190.
a) 8.5 b) 12.7 b) 17.2 c) 22.4

viii) The instrument used to measure the optical activity is _____.

ix) If angle of incident is equal to angle of reflection then the phenomenon it is called as _____.

x) Refractive index _____ with decrease in temperature.

2. Answer the following questions (Any two) **2×5=10**

a) Write a short note on: (2.5+2.5)
i) Eutectic mixture ii) Spreading Coefficient

b) Define Refractive index? Write its application and working of Abbes Refractometer. (1+4)

c) What is sublimation and triple point explain with diagram. Define Dipole moment and write about its application. (2.5+2.5)

3. Answer the following Questions (Any One) **1×10=10**

a) What do you mean by CMC. Explain any two methods for measurement of surface tension. (2+8)

b) What are the differences between absorption and adsorption" Explain the adsorption in solid surface with the help of suitable isotherms. (2+8)

Nov, 2019

Girijananda Chowdhury Institute of Pharmaceutical Science
B Pharm 3rd Semester, 3rd Sessional Examination, Nov- 2019
Sub: Physical Pharmaceutics I
Paper Code: BP302T

Time: 1 hr **FM: 30**

1 x 10= 10

I. Answer the following questions

a. Ligands which can form 2 co-ordinate bond from each ion or molecules to transition metal ions are known as:
   I. Ligand ions
   II. Dentate ligands
   III. Monodentate ligands
   IV. Bidentate ligands

b. What are the two important parameters of protein binding?
   I. Shape and size
   II. Carboplatin
   III. Affinity and capacity
   IV. Molecular complex

c. Highly protein-bound drugs tend to remain mainly in the _____ as opposed to binding with _____ tissue, and have a relatively _____ volume of distribution.
   I. Carboplatin, Adipose tissue, systemic circulation
   II. Protein binding, carboplatin, adipose tissue
   III. Systemic circulation, adipose tissue, lower
   IV. None of the above

d. What will be the litmus test if the solution is basic?
   I. No change in colour
   II. Red litmus will turn to blue
   III. Blue litmus will turn to red
   IV. None of the above

e. Who had invented the pH scale?
   I. Heney Moseley
   II. Benzamin Franklin
   III. S.P.L. Sorenson
   IV. Wilhelm Rontgen

f. As the pKa of an acid increases the acid will be:
   I. More weaker
   II. More stronger
   III. Neutral
   IV. None

g. β-cyclodextrin increases the solubility of poorly soluble drugs by
   I. Cosolvency
   II. Solubilization
   III. Inclusion complexation
   IV. Chemical modification

h. Pure water is known to be
   I. Weak electrolyte
   II. Strong electrolyte
   III. Note an electrolyte
   IV. Neighter weak nor strong electrolyte

i. EDTA is an example of:
   I. Unidentate ligand
   II. Bidentate ligand
   III. Tetradentate ligand
   IV. Hexadentate ligand

j. Calculate the pH of a solution that has a $[OH^-] = 1X10^{-6}$?

2 x 5=10

2. Answer any two questions
   a. Define protein binding. Briefly discuss the kinetics of protein binding.
   b. What are chelates and clathrates? Write down the application of complexation in pharmacy.
   c. Explain the Langmuir adsorption isotherm.

1x10=10

3. Answer any one questions
   a. Classify the types of complexes. Explain the pH titration method for analysis of complexes. [5+5=10]
   b. Write down the applications of pH in pharmacy. Explain any one method of determination of pH? [5+5=10]

GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE

(GIPS)

1st Sessional Practical Examination, 2019

Semester: B Pharm 3rd Semester

Sub: Physical Pharmaceutics I (Code: BP306P)

Full Marks: 20

1. Write Synopsis on: (Any one) (5)
   a) Partition co-efficient of iodine between carbon tetrachloride and water.
   b) Factors affecting solubility of drugs.

2. Perform the experiment as given. (10)

3. Viva; (5)

GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE

(GIPS)

2nd Sessional Practical Examination, 2019

Semester: B Pharm 3rd Semester

Sub: Physical Pharmaceutics I (Code: BP306P)

Full Marks: 20

1. Write Synopsis on: (Any one) (5)
   a) Surface tension and its determination by drop count method.
   b) HLB and its different determination methods.

2. Perform the experiment as given. (10)

3. Viva: (5)

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

B. PHARM 3rd SEMESTER END-TERM PRACTICAL EXAMINATION, 2019

PHYSICAL PHARMACEUTICS-I

BP306P

Full Marks: 35 **Time: 3 Hours**

GROUP A

1. **Write Synopsis on:** (5)

2. **Major Experiment:** (15)
   Determine the partition co-efficient of benzoic acid between benzene and water.

3. **Minor Experiment:** (10)
   Determine the surface tension of given liquid by drop count method.

4. **Viva voce** (5)

Internal Examiner External Examiner

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

B. PHARM 3rd SEMESTER END-TERM PRACTICAL EXAMINATION, 2019

PHYSICAL PHARMACEUTICS-I

BP306P

Full Marks: 35 **Time: 3 Hours**

GROUP B

1. **Write Synopsis on:** **(5)**

2. **Major Experiment:** **(15)**
   Determine the solubility of solids at different temperatures using benzoic acid as solid sample.

3. **Minor Experiment:** **(10)**
   Determine the pKa value of given weak acid (acetic acid) by using pH meter.

4. **Viva voce** **(5)**

Internal Examiner External Examiner

Dec, 2019

Total No. of printed pages = 7

BP 302 T

Roll No. of candidate | | | | | | | | | | |

2019

B.Pharm 3rd Semester End-Term Examination

PHYSICAL PHARMACEUTICS — I (Theory)

(New Regulations)

(w.e.f. 2017–2018)

Full Marks – 75

Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : (MCQ) (20 × 1 = 20)

(i) The result of allowing a gas to pass from a high pressure zone to a low pressure zone

(a) The gas become liquid

(b) Gives heating effect

(c) Gives cooling effect

(d) None of the above

[Turn over

Dec, 2019

Total No. of printed pages = 7

BP 302 T

Roll No. of candidate | | | | | | | | | | |

2019

B.Pharm 3rd Semester End-Term Examination

PHYSICAL PHARMACEUTICS — I (Theory)

(New Regulations)

(w.e.f. 2017–2018)

Full Marks – 75 Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : (MCQ) (20 × 1 = 20)

(i) The result of allowing a gas to pass from a high pressure zone to a low pressure zone

(a) The gas become liquid

(b) Gives heating effect

(c) Gives cooling effect

(d) None of the above

(ii) Heat absorbed or liberated at the time of change of state of matter is

(a) Sensible heat

(b) Critical heat

(c) Transition heat

(d) Latent heat

(iii) The phenomenon of having same physical properties in all direction is known as

(a) Isotropy

(b) Crystallinity

(c) Anisotropy

(d) Isomerism

(iv) Which one of the following is not true for order of solubility

(a) Amorphous>crystalline

(b) Solvates>hydrates

(c) Hydrates>Anhydrous

(d) Metastable>Stable polymorph

(v) The ratio of partial pressure of water vapour to the equilibrium vapour pressure of water is known as

(a) Critical pressure

(b) Relative humidity

(c) Eutectic point

(d) Atmospheric pressure

(vi) The outer appearance of a crystal is called

(a) Metastable form

(b) Crystal habbit

(c) Pseudomorphism

(d) Apomorphism

(vii) The relationship between vapor pressure and absolute temperature of a liquid is expressed by

(a) Clausius Clapeyron equation

(b) Joule Thompson equation

(c) Gibbs equation

(d) Vant Hoff s equation

(viii) A viscous mixture of macromolecules (polymer) with a liquid likely to give

(a) Liquid crystal

(b) Eutectic mixture

(c) Liquid complex

(d) Compressed liquid

(ix) The surface tension of a liquid is _____ at critical temperature.

(a) Zero

(b) One

(c) Maximum

(d) Minimum

(x) Glycine forms complex with cupric ions only at pH range:

(a) About neutral

(b) Acidic

(c) Alkaline

(d) Both acidic and alkaline

(xi) Positive adsorption means

(a) When the added molecules move to the interface

(b) Added molecules distribute uniformly

(c) When added molecules moves to the bulk

(d) None of the above

(xii) Which one of the following is not an isotonic solution-

(a) 0.9% w/v normal saline

(b) 5.0% w/v dextrose solution

(c) 1.8% w/v urea solution

(d) 2% w/v boric acid solution

(xiii) Van Slykes's equation can be used for calculating-

(a) Osmotic pressure

(b) pH

(c) Ratio of salt to acid

(d) Buffer capacity

(xiv) Surface tension is

(a) Capacity factor

(b) Extensive property

(c) Intensive property

(d) Tolerance factor

(xv) Buffer capacity is maximum when:

(a) pH = pKa

(b) pH > pKa

(c) pH < pKa

(d) None of the above

(xvi) The vappur pressure of solution can be measured by:

(a) Barrometers

(b) Manometers

(c) Siesmometer

(d) None of the above

(xvii) In coordinated complex, the function of a ligand is to:

(a) Accept a pair of electrons

(b) Accept one electron and share it

(c) Donate one electron and share it

(d) Donate a pair of electrons

(xviii) The reverse of melting phenomena is known as:

(a) Fusion

(b) Sublimation

(c) Freezing

(d) Condensation

(xix) Dielectric constant is a property related to

(a) Percent composition

(b) Polarity scale

(c) Qualitative analysis

(d) Structural elucidation

(xx) Dipolar molecule means:

(a) Even distribution of charges

(b) Uneven distribution of charges

(c) Both

(d) None of the above

2. Answer any seven $(7 \times 5 = 35)$

(a) Explain the principle of diffusion in biological system.

(b) Describe the positive and negative deviations from the Raoult's law.

(c) What is spreading coefficient? Derive an equation for calculating spreading coefficient.

(d) Define refractive index and optical rotation with their applications.

(e) State the 'Distribution law'. Write its limitations and applications.

(f) Define-buffer, buffer capacity, hypotonic solution, isotonic solution, iso-osmotic solution.

(g) Draw the phase solubility diagram of phenol-Water system and explain its behavior.

(h) How temperature and pressure affect solubility of gases in liquids.

(i) What are the buffers available in human body? Describe the preparation of pharmaceutical buffer.

3. Answer any two questions: (2 × 10 = 20)

(a) What do you mean by surface tension and interfacial tension? Explain the method of measurement of surface tension by capillary rise method. Write the various applications of surface active agents with examples. (2+4+4)

(b) Classify the type of complexes. Briefly explain about inclusion complexes. Explain any one method of analysis of complexes. (2+4+4)

(c) Write shod notes: (Any four) (4 × 2.5 = 10)

(i) Inhalers

(ii) Absolute and relative humidity

(iii) Amorphous and crystalline

(iv) Glassy state

(v) Super Critical Fluids (SCF).

CLASS TEST 1

SUBJECT: PHYSICAL PHARMACEUTICS-I

3RD SEMESTER **TOTAL MARKS: 10**

1. If the concentration of solid in liquid is higher than the equilibrium solubility, such a solution is known as:
   a) Saturated solution
   b) Unsaturated solution
   c) Supersaturated solution
   d) Equilibrium solution

CLASS

2. In micellar solubilization, which of the following agents is used?
   a) Acetone
   b) Ethyl oleate
   c) Polyethylene Glycol
   d) Tween 80
3. Which of the following **does not** affect the solubility of drug?
   a) Nature of the solvent
   b) Size of particle
   c) Pressure
   d) Temperature
4. The process of transferring a solute between two immiscible phases is known as:
   a) Diffusion
   b) Distribution
   c) Dissolution
   d) Dissociation
5. Sparingly soluble means _____ parts of solvent required to dissolve one part of solute:
   a) 10 to 30 parts
   b) 30 to 100 parts
   c) 100 to 1000 parts
   d) None of the above
6. Which of the following is **not** a limitation of distribution law?
   a) Mixing time
   b) Dilute solution
   c) Same molecular state
   d) Non-miscibility of liquid phases
7. The greater the Log P value, the higher is the _____solubility of the solute.
8. If the added material is soluble in both of the liquids of partially miscible solution to about the same extent, then the solubility of the liquid pair is _____ (increased/ decreased) and the phenomenon is called as _____.
9. How solubility of a drug is affected by the common-ion effect?
10. Why **ammonia bottles** are kept in ice or cold water?

GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE

Class test 2

B.Pharm 3rd semester

Subject: Physical Pharmaceutics-I

Subject Code: BP302T

Full Marks-20 **Time-1hr**

1. **Answer the Following Questions (Multiple choice)** 1×5=5

i. If the concentration of solid in liquid is higher than the equilibrium solubility, such a solution is known as;
   a) Saturated solution
   b) Unsaturated solution
   c) Suppersaturated solution
   d) Equilibrium solution

ii. In micellar solubilization, which of the following agents is used?
   a) Acetone
   b) Ethyl oleate
   c) Polyethylene Glycol
   d) Tween 80

iii. Which of the following **does not** affect the solubility of drug?
   a) Nature of the solvent
   b) Size of particle
   c) Pressure
   d) Temperature

iv. The process of transferring a solute between two immiscible phases is known as:
   a) Diffusion
   b) Distribution
   c) Dissolution
   d) Dissociation

v. Which of the following is **not** a limitation of distribution law?
   a) Mixing time
   b) Dilute solution
   c) Same molecular state
   d) Non-miscibility of liquid phases

2. Briefly discuss factors affecting solubility of drugs. (5)
3. State Nernst's distribution law. Write the limitations ofNernst's distribution law. (5)
4. State and derive Roult's law. Describe the deviations from the law with suitable examples. (5)

SURFACE AND INTERFACES

The term *surface* is used when referring to either a gas–solid or a gas–liquid interface.

When two phases are in contact with each other, the boundary between them is known as an *interface.*

It may be solid-solid, liquid-liquid or solid-liquid.

The properties of the molecules forming the interface are often sufficiently different from those in the bulk of each phase.

DEFINITION

Surface tension: Surface tension can be defined as the force acting at right angles to the surface of a liquid along per length of the surface.

S.I. unit : Newton/ meter

CGS unit: dynes/ cm

Interfacial tension: force per unit length existing at the interface between two immiscible liquid phases.

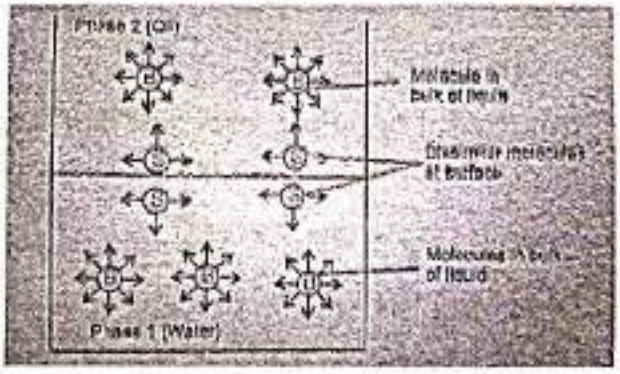
S.I. unit : Newton/ meter

CGS unit: dynes/ cm

Importance Of Interfacial Phenomena In Pharmacy:

- Adsorption of drugs onto solid adjuncts in dosage forms
- Penetration of molecules through biological membranes
- Formulation and stability of Emulsion
- The dispersion of insoluble particles in liquid media to form suspensions.
- Coating of solid dosage forms.
- Changes in physical characteristics of solid particles.

COHESIVE AND ADHESIVE FORCES



COHESIVE AND ADHESIVE FORCES

Cohesive Forces:

The intermolecular attraction between the like molecules or the similar molecules is called as cohesive force. E.g. molecules of water in bulk.

Adhesive Forces:

The force between the unlike molecules is called as adhesive force. E.g. molecules of water at the surface.

- If cohesive force is stronger, it keeps the phases separate.
- If adhesive force is stronger, miscibility will take place.

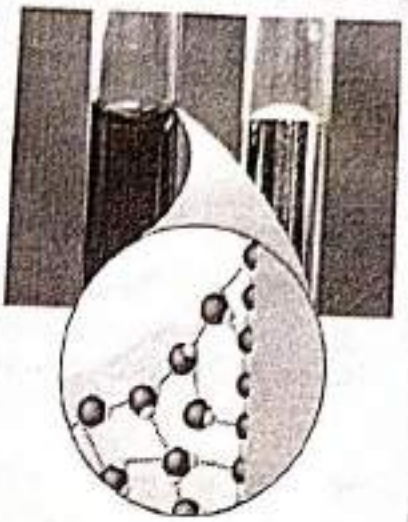
- The cohesive forces among liquid molecules are responsible for the phenomenon of surface tension.
- In the bulk of the liquid, each molecule is pulled equally in every direction by neighbouring liquid molecules, resulting in a net force of zero.
- The molecules at the surface do not have other molecules on all sides of them and therefore are pulled inwards.
- This creates some internal pressure and forces to the liquid surfaces to contract to the minimal area. Surface tension is responsible for the shape of liquid droplets.
- Droplets of water tend to be pulled into a spherical shape by the cohesive forces of the surface layer.
- The spherical shape minimizes the necessary "wall tension" of the surface layer according to Laplace's law.

❑When the adhesive force of the liquid to the wall is stronger than the cohesive force of the liquid, the liquid is more attracted to the wall than its neighbours, causing the upward concavity.

e.g. Water in the glass tube.

❑When the cohesive force of the liquid is stronger than the adhesive force of the liquid to the wall, the liquid concaves down in order to reduce contact with the surface of the all.

e.g. Mercury in the glass tube



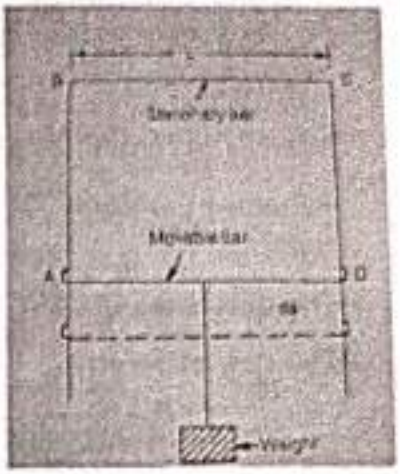
SURFACE FREE ENERGY

Definition: The work done or energy required to increase the area of the surface by unit value.

The work which has to be expended in order to increase the size of the surface of a phase is referred to as the *surface free energy*.

➢ Let us consider a 3- sided wire framed fitted with a movable bar. If the wire frame is dipped into a soap solution and taken out, a soap film formed ABCD.

➢ The soap film tends to reduce the surface area and pulls the movable bar towards the movable bar. A weight is applied to counterbalance the contraction.



The applied force = surface tension x twice of the length of the movable bar

Thus, $F = \gamma \times 2L$

Or, $\gamma = F / 2L$

Work done, W = force x distance

$= f \times d$

$= \gamma 2L \times d$

$= \gamma \Delta A$ (2Ld- change in area)

❑ Units are same as Surface tension.

Methods For Measuring Surface And Interfacial Tension

3 methods are there:

1. Capillary rise method
2. Drop weight and Drop count method (Stalagmometer)
3. Ring Detachment method (Du Nouy tensiometer)
4. Wilhelmy Plate method

The choice of the method for measuring surface and interfacial tension depend on:

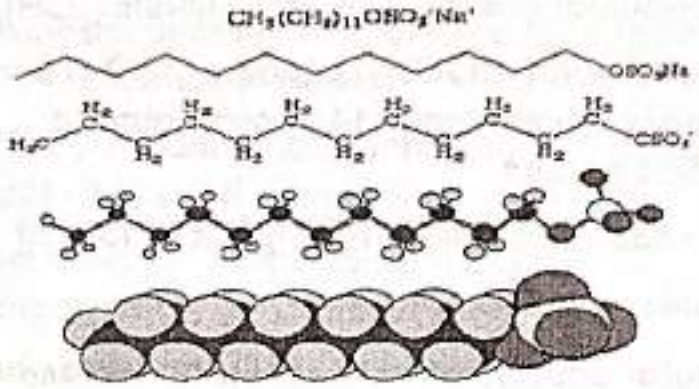
- Whether surface or interfacial tension is to be determined.
- The accuracy desired
- The size of sample.

ADSORPTION AT LIQUID INTERFACES

Certain molecules and ions, when dispersed in the liquid, move of their own accord to the interface, the surface free energy and the surface tension of the system are automatically reduced.

Molecules and ions that are adsorbed at interfaces are termed *surface-active agents* or *surfactants*. An alternative term is *amphiphile*.

Surface Active Agents



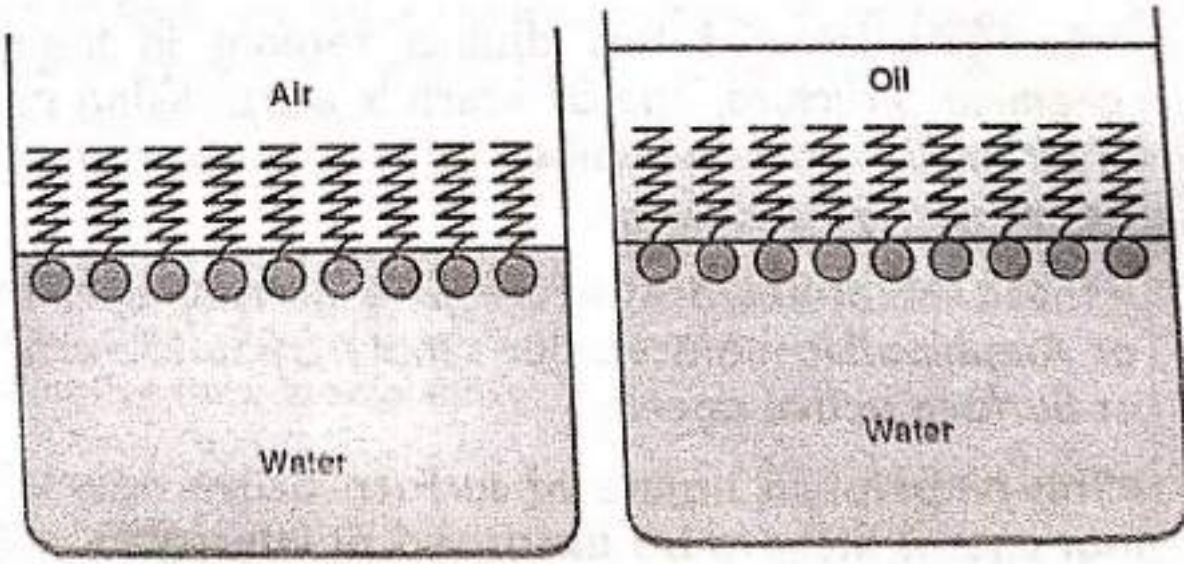
Sodium Lauryl
Sulfate molecule

SURFACE-ACTIVE AGENTS

- Molecules and ions that are absorbed at the interface is termed as ***Surfactants***
- Surfactants have two distinct regions in their chemical structure, one of which is water-liking or ***Hydrophilic*** and the other of which is water-hating or ***Hydrophobic.***
- These molecules are referred to as ***Amphiphilic*** or ***Amphipathic*** molecules or simply as ***Surfactants*** or ***Surface active agents.***
- This amphiphilic nature of surface-active agents that causes them to be absorbed at interfaces.

SURFACE-ACTIVE AGENTS

- The functional groups such as alcoholic (-OH), carboxylic acid (-COOH), sulphate (-SO4) & quaternary ammonium(NH4+) contribute to ***hydrophilic portion.***
- Alkyl chains contribute to ***lipophilic nature*** of Molecules.
- The polar end oriented towards the water as well as the non polar end projected upwards to space.



TYPES OF SURFACE-ACTIVE AGENTS

a) Anionic: Sodium dodecyl /lauryl sulphate (SLS), Potassium stearate.

b) Cationic: Cetrimide, benzalkonium chloride, Dodecyltrimethyl ammonium bromide (DTAB)

c) Ampholytic (Zwitterionic): Lecithin (Phospholipids), N-dodecyl alanine.

d) Nonionic: Glycerol, Tweens, Spans

Anionic surfactants

- Consists of soaps of Alkali, Amines and metals, sulphated alcohols and sulphonates.
- The chief of which is sodium dodecyl sulfate, $C_{12}H_{25}SO_4 - Na^+$
- It is very soluble in water at room temperature.
- It is not suitable for internal use.
- It is used pharmaceutically as a preoperative skin cleaner, having Bacteriostatic action against gram-positive bacteria, and also in medicated shampoos.

Cationic surfactants

- In aqueous solutions, these dissociates to form positively charged cations which provide the emulsifying properties.
- Cationic surfactants are important pharmaceutically because of their bactericidal activity against a wide range of gram-positive and some gram-negative organisms.
- Also used as secondary emulsifying agents for external application, especially in the cleaning of wounds.
- Unstable at high pH.

Ampholytic surfactants

- The ionic characteristics dependent on pH.
- Below a certain pH, these are cationic and above a certain pH, these are anionic.
- At intermediate pH, they behave as Zwitterions.

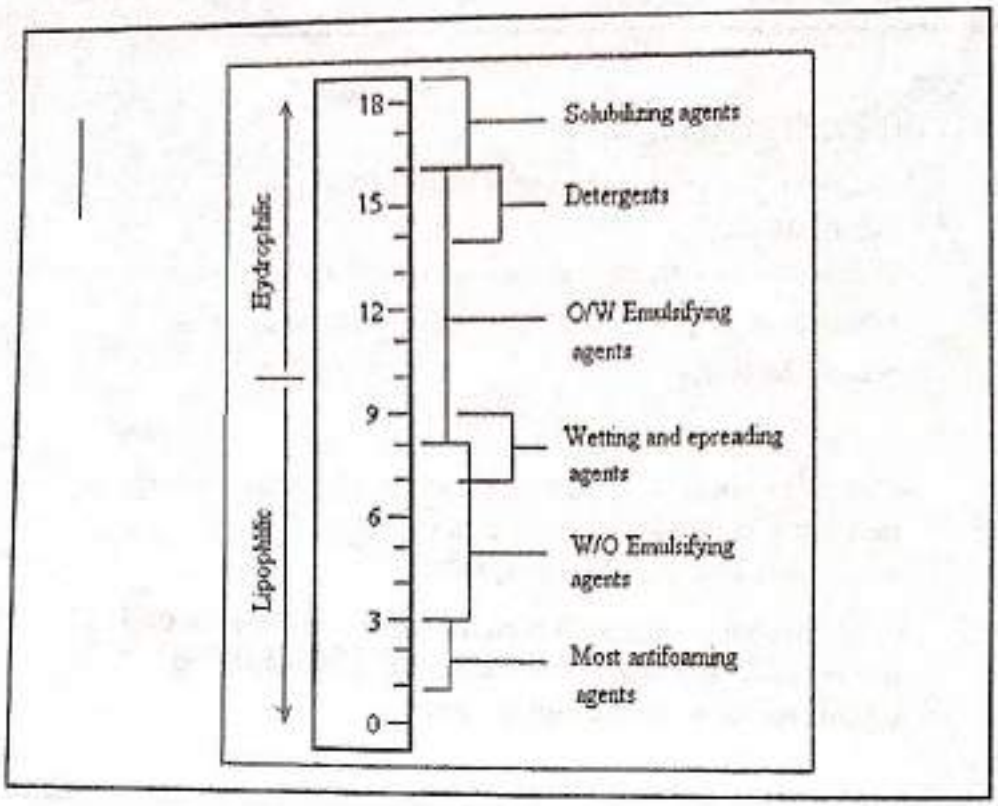
Non-ionic surfactants

- Largest group of surfactants because of the advantages:
  - •Compatible with both anionic and cationic surfactants.
  - •Resistance to pH change and effects of electrolytes
  - •Lower irritancy

- *Sorbitan esters are supplied commercially as* ***Spans*** *and* generally insoluble in water and are used as w/o emulsifiers and as wetting agents.
- *Polysorbates are* supplied commercially as ***Tweens*** and *are miscible* with water, and are used as emulsifying agents for o/w type of emulsions.

HYDROPHILIC–LIPOPHILIC SYSTEMS (HLB):

- Surfactants contain both hydrophilic groups and lipophilic groups with one or the other being more predominant.
- The hydrophile-lipophile balance (HLB) number is used as a measure of the ratio of these groups.
- It is a value between 0-20 defining the affinity of a surfactant for water or oil.
- The higher the HLB of an agent, the more hydrophilic it is.



HLB CALCULATION:

- HLB for polyhydric alcohol fatty acid esters:

HLB = 20 (1-S/A)

Where, S- Saponification no.

A- Acid no.

- HLB for Beeswax and Lenolin derivatives:

HLB = (E+P)/5

Where, E- % w/w of oxyethylene chain

P- % w/w of polyhydric alcohol group

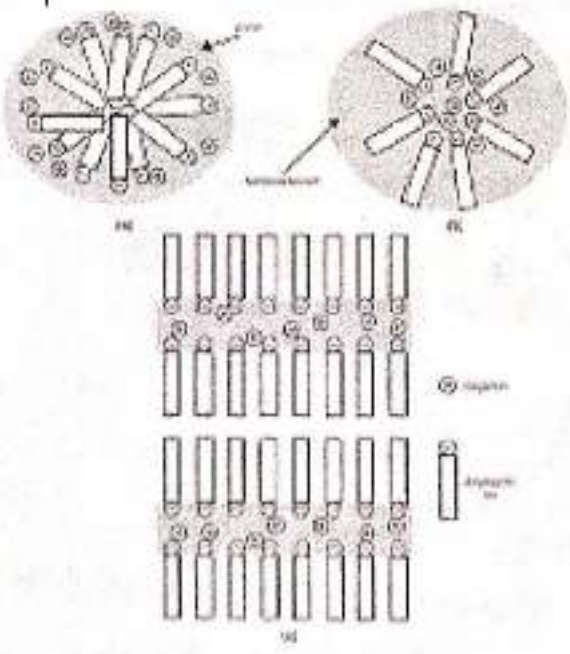
- The HLB values of the surfactant mixtures:

$$HLBmix = \frac{(C_1 \times HLB_1) + (C_2 \times HLB_2) + (C_3 \times HLB_3) \ldots}{C_{Total}}$$

where C1,C2,C3 are the percent of component proportion and HLB1,HLB2,HLB3 are the HLB values for the each component.

MICELLES & CMC

- When present in a liquid medium at low concentrations, the amphiphiles exist separately. As the concentration is increased, aggregation occurs. These aggregates, which may contain 50 or more monomers, are called *micelles*.
- The concentration of monomer at which micelles form is termed the *critical micelle concentration*(CMC).
- In a micelle, the hydrophobic tails flock to the interior in order to minimize their contact with water, and the hydrophilic heads remain on the outer surface in order to maximize their contact with water.



(a) spherical micelle in aqueous media,

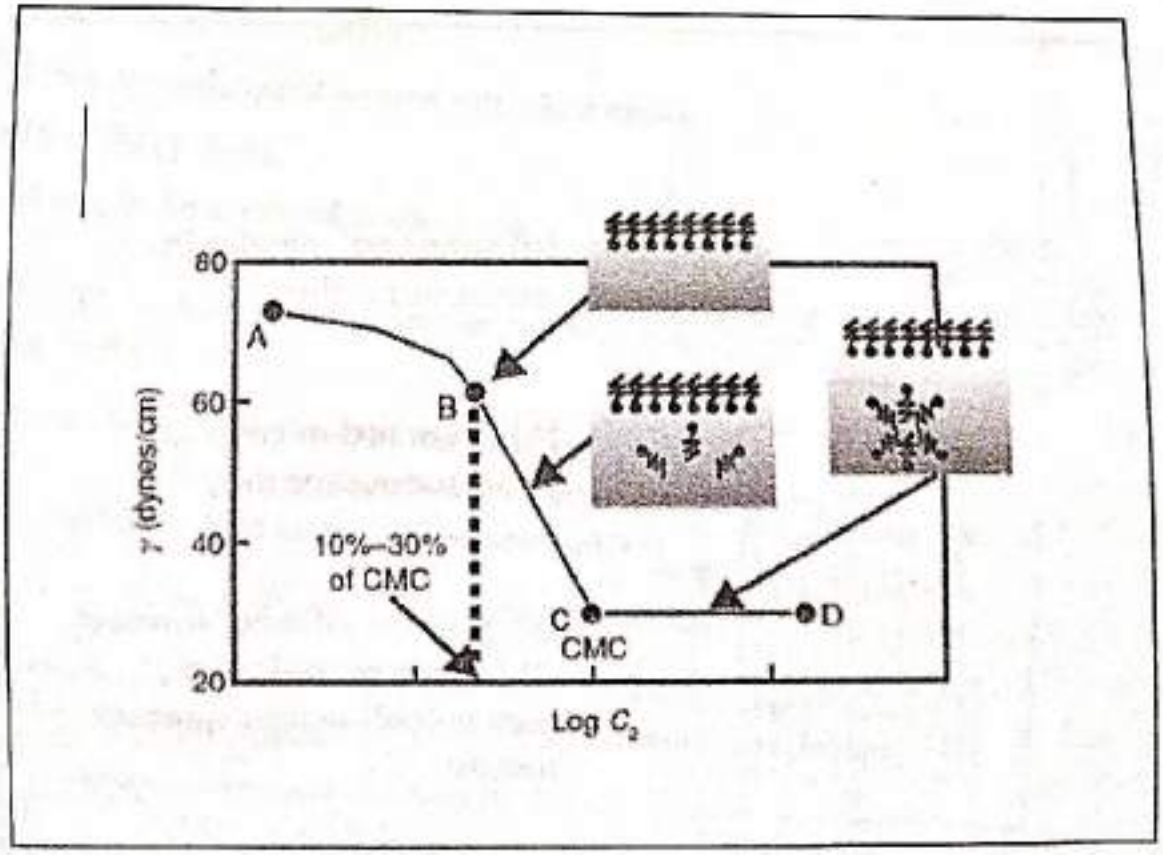
(b) reversed micelle in nonaqueous media,

(c) laminar micelle, formed at higher amphiphile concentration, in aqueous media.

- Diluting the surfactant solution to below the CMC causes the micelles to disperse or break up into single or non associated surfactant molecules.
- Micelles are not static aggregates but dissociate, regroup and reassociate rapidly.
- There is a dynamic equilibrium between single surfactant

molecules and micelles.

- The shape of micelles in dilute surfactant solutions is approximately spherical.
- The surface tension decreases up to the CMC. Above CMC the surface tension becomes constant.



When the surface tension, γ, of a surfactant is plotted against the logarithm of the surfactant activity or concentration, log c_2, the plot takes on the shape shown in Figure.

- Initially there is a sharp decrease in surface tension as log c_2 increases.
- The point C corresponds to the critical micelle concentration (CMC), the concentration at which micelles form in the solution.
- Beyond the CMC, the line becomes horizontal because further additions of surfactant are no longer being accompanied by a decrease in surface tension.

FACTORS AFFECTING CMC:

1. Molecular structure of the surface active agent:

A) The hydrocarbon chain (HC):

- HC length ↑: CMC ↓
- Branching of HC : CMC ↑
- Unsaturation of HC : CMC ↑

B) The hydrophilic group:

- Type
  - -Ionic: little effect at equal valence
  - -Nonionic: lower CMC Number CMC
- Position: Middle HC > terminal HC
- Number: ↑ Number: CMC ↑

FACTORS AFFECTING CMC:

2. Effect of additives:

a) Simple electrolytes:

- Addition of salt: CMC ↓

b) Alcohol: CMC

- HC chain length of the alcohol
- HC chain length of the SAA
- Concentration of the alcohol

} CMC ↓

c) Hydrocarbons:

Solubilization →↓ Repulsion → CMC ↓

3. Temperature:

- Nonionic SAA, ↑ temperature → ↑Micellar size → CMC ↓

APPLICATIONS OF SURFACTANTS

I. MEDICINAL APPLICATIONS:

1. ANTIBACTERIAL ACTIVITY

- Quaternary ammonium compounds like cetrimide, benzalkonium chloride etc. have useful antibacterial properties.
- Can be used as disinfectants for instruments and skins.
- As antibacterial creams and throat lozenges.

2. EXPECTORANT ACTIVITY:

- In acute or chronic upper respiratory tract infections (e.g. TB, Asthma), the surfactants in the form of mists or sprays loosens the mucus and provide its easy removal and relief.

3. CLEANSING ACTIVITY:

- Surfactants have detergent properties, so also can be used as cleansing agent.

II. PHARMACEUTICAL APPILCATIONS:

1. As Solubilizing Agents:

Used for poorly soluble drugs such as oil soluble vitamins, volatile oils, hormones etc.

Also can be used to solubillze many disinfectant compounds such as cresol and chloroxylenol. Surfactants increases the disinfectant properties by altering the permeability of the cell membrane of the microorganisms.

2. As Wetting Agents:

Surfactants get adsorbed at the solid/ liquid interface and increase the affinity of hydrophobic powder for water and reduce the attractive forces between the particles of the solid.

3. As Flocculating agents:

Surfactants coupled with precipitation can brings about controlled flocculation in suspension, which is desirable. Surfactants also avoid formation of caking.

4. As Emulsifying agents:

Emulsifying agents act by reducing interfacial tension between the oil phase and the water phase by forming a stable interfacial film between the two. E.g. tweens, spans etc.

5. As Additives in Semi-solid preparations:

Surfactants are use in creams or ointments to increase the release characteristics of the drug. This is due to absorption of water from the surrounding and formation of an emulsion at the interface. Such emulsification result in increase the interfacial area and release of medicament.

DIFFUSION

Prepared by:
Madhuchandra Lahan
Assistant Professor
GIPS

INTRODUCTION

Diffusion:

- "The movement of particles in a solid from an area of high concentration to an area of low concentration, resulting in the uniform distribution of the substance."
- During diffusion molecules move from an area of high concentration to an area of low concentration.
- They are said to move down a concentration gradient.
- The material that undergoes the transport is known as diffusant or permeant or penetrant.

- Diffusion is a passive process which means that no energy is needed.
- Molecules diffuse until they are evenly spaced apart and equilibrium is reached.

Steady state diffusion

- **Steady State:** A system is said to be steady state if conditions do not vary with time. The mass transfer remains constant with time.
- The concentration of solute in donor and receptor compartment must be maintained constant. To achieve this both the compartments are connected to reservoirs of solutions (maintained at respective concentration) and recirculated. Concentration gradient remains constant.

Sink condition

- Concentration in receptor compartment is maintained at lower level compare to concentration in the donor compartment.
- Donor compartment act as source and receptor compartment act as sink.
- Receptor compartment is connected to large reservoir and solution is recirculated.

STEADY-STATE DIFFUSION

Fick's 1st law:

- Mass get transported from 1 compartment to another over period of time is Flux.
- Flux (J) = Rate of mass transfer across unit surface area of barrier.

$$J = 1/S\ (dm/dt) \quad \text{---------- (1)}$$

Where,

dm = change in mass of material.

S = barrier surface area.

dt = change in time.

Acc.to Fick's law, flux is directly proportional to conc.gradient.

$$J = -D\frac{dC}{dx} \quad \text{---------- 2)}$$

D=diffusion coefficient of penetrant.

dx=change in distance.

Combine equation 1) & 2) gives,

$$dm/dt = -DS\,(dC/dx)$$

This equation represent rate of mass transfer as per fick's law.

Fick's Second Law

- States that the change in concentration with time in a particular region is proportional to the change in concentration gradient at that point of time.

$$dC/dt = -dJ/dx \quad \text{---------- (4)}$$

From Fick's first law

$$J = -D \cdot dC/dx$$

Differentiating wrt x

$$dJ/dx = -D\,d^2C/dx^2 \quad \text{---------- (5)}$$

As we know, $-dJ/dx = dC/dt$

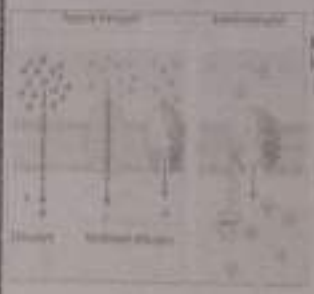
Eq. $dC/dt = D\,d^2C/dx^2$ ---------- (6)

- Above equation represent diffusion in x direction only. Extending this to 3 coordinates x, y and z.

$$dC/dt = D\,[d^2C/dx^2 + d^2C/dy^2 + d^2C/dz^2]$$

DIFFUSION ACROSS MEMBRANE

Diffusion across membrane:



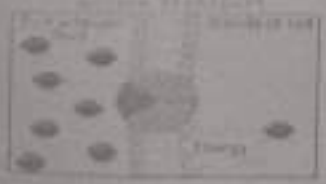
There are two ways in which substances can enter or leave a cell:

1) Passive
   a) Simple Diffusion
   b) Facilitated Diffusion
   c) Osmosis
2) Active
   a) Pinocytosis
   b) Phagocytosis

DIFFUSION ACROSS MEMBRANE

Active Transport:

- Active transport is the energy-demanding transfer of a substance across a cell membrane against its concentration gradient, i.e. from lower concentration to higher concentration.
- Special proteins within the cell membrane act as specific protein carriers. The energy for active transport comes from ATP.



Passive Transport:

- Passive diffusion is the process by which molecules spontaneously diffuse from a region of higher concentration to a region of lower concentration.
- Lipid-soluble drugs penetrate the lipid cell membrane and can pass the cell membrane by passive diffusion.
- Also, large molecules, such as proteins and protein-bound drugs, cannot diffuse through the cell membrane.

Acc.to Fick's law, flux is directly proportional to conc.gradient,

$$J = -D\frac{dC}{dx} \qquad \text{2)}$$

D=diffusion coefficient of penetrant.

dx=change in distance.

Combine equation 1) & 2) gives,

$$dm/dt = -DS\,(dc/dx)$$

This equation represent rate of mass transfer as per fick's 1st law.

Fick's Second Law

- States that the change in concentration with time in a particular region is proportional to the change in concentration gradient at that point of time.

dC/dt = - dJ/dx ---------- (4)

From Ficks first law

$$J = -D \cdot dC/dx$$

Differentiating wrt x

$$dJ/dx = -D\,d^2C/dx^2 \text{ ---------- (5)}$$

As we know: $-dJ/dx = dC/dt$

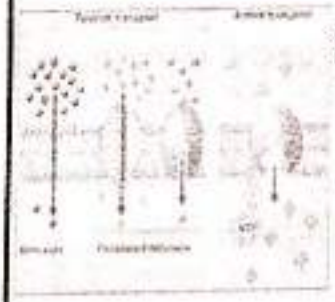
So, $dC/dt = D\,d^2C/dx^2$ ---------- (6)

- Above equation represent diffusion in x direction only. Extending this to 3 coordinates x, y and z

$$dC/dt = D\,[d^2C/dx^2 + d^2C/dy^2 + d^2C/dz^2]$$

DIFFUSION ACROSS MEMBRANE

Diffusion across membrane:



There are two ways in which substances can enter or leave a cell.

1) Passive
   a) Simple Diffusion
   b) Facilitated Diffusion
   c) Osmosis
2) Active
   a) Molecules
   b) Particles

DIFFUSION ACROSS MEMBRANE

Active Transport:

- Active transport is the energy-demanding transfer of a substance across a cell membrane against its concentration gradient i.e. from lower concentration to higher concentration.
- Special proteins within the cell membrane act as specific protein 'carriers'. The energy for active transport comes from ATP.

Passive Transport:

- Passive diffusion is the process by which molecules spontaneously diffuse from a region of higher concentration to a region of lower concentration.
- Lipid-soluble drugs penetrate the lipid cell membrane and can pass the cell membrane by passive diffusion.
- Also, large molecules, such as proteins and protein-bound drugs, cannot diffuse through the cell membrane.

METHODS & PROCEDURES

Two types:

- A) horizontal transport cell:
  - a. wurester cell
  - b. Viles chein permeation cell
- B) vertical transport cell:
  - a) Aquair and weiner diffusion cell
  - b) biber and rhodes cell
  - c) franz diffusion cell

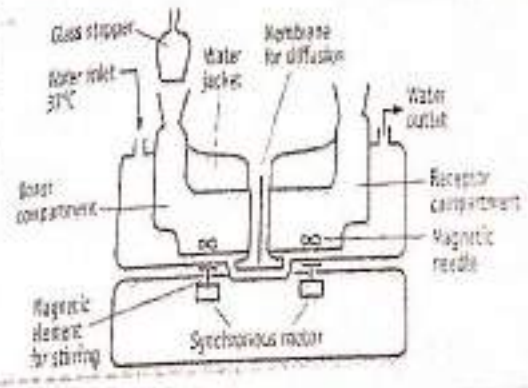
Barriers used to separate the compartments

- **Natural origin:**
  - **Stratum corneum** (stripped skin of the forearm) is used to study percutaneous absorption study
  - **Buccal mucosa** (obtained from calf buccal cavity) is used to buccal absorption from the oral cavity
  - **Human skin** (obtained from autopsy) and cadaver skin (obtained from dead bodies) are used to study transdermal drug absorption
- **Synthetic origin:** These are used in the study of transport as in vitro models.
  - **Visking dialysis** membrane is used to study protein binding and determination of molecular weight.
  - **Polyvinyl chloride.** Polyvinyl acetate are used in controlling the diffusion of drugs from controlled release systems.

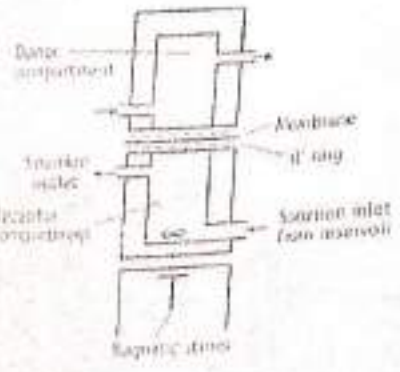
General method:

- Receptor and donor compartment made of **pyrex** glass material
- Animal or human skin acts as semi permeable cell and barrier may be supported on a perforated plate.
- Drug sample solution taken in donor compartment and solvent in the receptor compartment.
- Whole set up placed in constant temperature bath to maintain the temp of 37±0.2°C.
- The liquid in receptor stirred by using magnetic beads to obtain uniform distribution
- Samples are withdrawn from the receptor compartment and the concentration of diffusant is analyzed. Data obtained are plotted (y axis) against time (x axis).

Horizontal Transport Cell



Vertical Transport Cell



Application

- Release of drug from dosage form in diffusion controlled system, SR and CR dosage forms.
- Molecular wt. of polymer can be estimated.
- Transport of drug (absorption) from GIT, skin etc
- Diffusion of drug in tissues (distribution) and excretion through kidneys
- Dialysis/ Microfiltration/ultrafiltration
- Dissolution of drug from
  - Tablet
  - Powder
  - Granules
  - Ointment
  - Suppositories

DIPOLE MOMENT

*Dipolar molecule*is defined as one in which the regions of positive and negative charges are well separated due to uneven distribution of electrons in the molecules.

What is Dipole Moment?

A dipole moment arises in any system in which there is a separation of charge. They can, therefore, arise in ionic bonds as well as in covalent bonds. Dipole moments occur due to the difference in electronegativity between two chemically bonded atoms.

The product of magnitude of negative or positive charge(q) and the distance between the centres of the positive and negative charges is called **dipole moment**. It is usually donated by μ.

The bonddipole moment is a vector quantity since it has both magnitude and direction. An illustration describing the dipole moment that arises in an HCl (hydrochloric acid) molecule is provided below.

Dipole Moment has a Magnitude and a Direction

It can be noted that the symbols δ^+ and δ^- represent the two electric charges that arise in a molecule which are equal in magnitude but are of opposite signs. They are separated by a set distance, which is commonly denoted by 'd'.

Important Points

- The dipole moment of a single bond in a polyatomic molecule is known as the bond dipole moment and it is different from the dipole moment of the molecule as a whole.
- It is a vector quantity, i.e. it has magnitude as well as definite directions.
- Being a vector quantity, it can also be zero as the two oppositely acting bond dipoles can cancel each other.
- By convention, it is denoted by a small arrow with its tail on the positive center and its head on the negative center.

Dipole Moment Formula

A dipole moment is the product of the magnitude of the charge and the distance between the centers of the positive and negative charges. It is denoted by the Greek letter 'μ'.

Mathematically,

Dipole Moment (μ) = Charge (Q) X distance of separation (r)

It is measured in Debye units denoted by 'Debye' (D)

1 D = 3.33564×10^{-30} C.m, where C is Coulomb and m denotes a meter.

The bond dipole moment that arises in a chemical bond between two atoms of different electronegativities can be expressed as follows:

$$\mu = \delta.d$$

Where: μ is the bond dipole moment,

δ is the magnitude of the partial charges δ^+ and δ^-,

And d is the distance between δ^+ and δ^-.

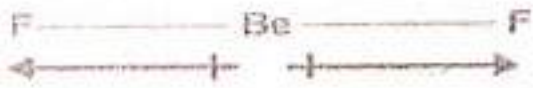
The bond dipole moment (μ) is also a vector quantity, whose direction is parallel to the bond axis. In chemistry, the arrows that are drawn in order to represent dipole moments begin at the positive charge and end at the negative charge.

When two atoms of varying electronegativities interact, the electrons tend to move from their initial positions to come closer to the more electronegative atom. This movement of electrons can be represented via the bond dipole moment.

Examples:

Dipole moment of BeF_2

In a beryllium fluoride molecule, the bond angle between the two beryllium-fluorine bonds is 180°. Fluorine, being the more electronegative atom, shifts the electron density towards itself. The individual bond dipole moments in a BeF_2 molecule are illustrated below.



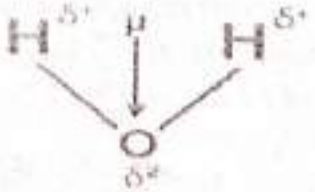
Bond dipoles in BeF_2

Total bond moment in BeF_2

From the illustration provided above, it can be understood that the two individual bond dipole moments cancel each other out in a BeF_2 molecule because they are equal in magnitude but are opposite in direction. Therefore, the net dipole moment of a BeF_2 molecule is zero.

Dipole moment of H_2O (Water)

In a water molecule, the electrons are localized around the oxygen atom since it is much more electronegative than the hydrogen atom. However, the presence of a lone pair of electrons in the oxygen atom causes the water molecule to have a bent shape. Therefore, the individual bond dipole moments do not cancel each other out as is the case in the BeF_2 molecule. An illustration describing the dipole moment in a water molecule is provided below.



The bond angle in a water molecule is 104.5°. The individual bond moment of an oxygen-hydrogen bond is 1.5 D. The net dipole moment in a water molecule is found to be 1.84D.

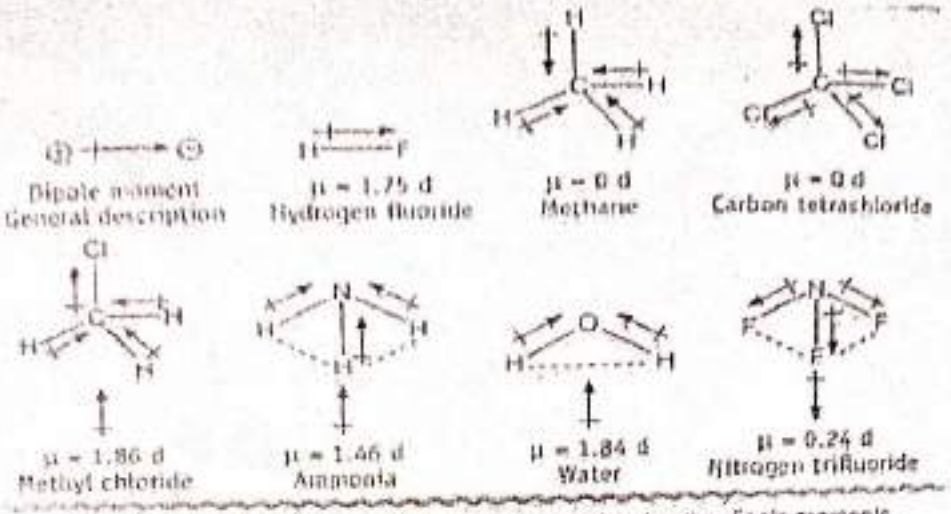


Figure 12-2 ▯ Chemical structures of molecules showing the dipole moments.

TABLE 12-5
Dipole Moments of Some Compounds

Solvents	*Dipole moment (debye units)*	*Drugs*	*Dipole moment (debye units)*
Benzene	0	Phenobarbitone	1.16
1-4 Dioxane	0	Cholesterol	1.99
Acetic acid	1.4	Aspirin	2.07
Ammonia	1.46	Testosterone	4.32
Ethanol	1.69	Sulphanilamide	5.37
Methanol	1.70	Androsterone	3.70
Water	1.84		
Chloroform	1.86		
Acetone	2.88		

Application:

1. **Solubilisation of Drugs:**

Solubilisation of drugs : When a solute is added to a solvent such as water, the permanent dipoles of water strongly interact with the solute. This type of interaction enhances the solubility of solute in a variety of ways.

(a) By hydrating the solute molecules and ions.

(b) By inducing dipoles in nonpolar molecules.

Some solutes are symmetric and planar. Their dipole moments are zero. If such molecules are present in the vicinity of dipolar molecules, the solutes get polarized. Then the dipoles (of solvent) and induced dipoles (of solutes) have greater attractions. This is responsible for enhanced solubility. Ion-induced dipole interactions are also responsible for the solubility.

2. **In determining the polarity of bonds:**

Greater is the magnitude of dipole moment, higher will be the polarity of the bond. This is applicable to molecules containing only one polar bond. In case of non-polar molecules like H2, O2, N2 etc, the dipole moment is found to be zero. This is because there is no charge separation in these molecules.

3. Therapeutic activity of drugs:

Therapeutic activity of drugs : Permanent dipole moments can be correlated with the biological activity. For example, the insecticidal activity of DDT can be correlated with the structural requirements. DDT is available in three isomers. The structures of these isomers along with their dipole moments and activities are given in Figure 12-4.

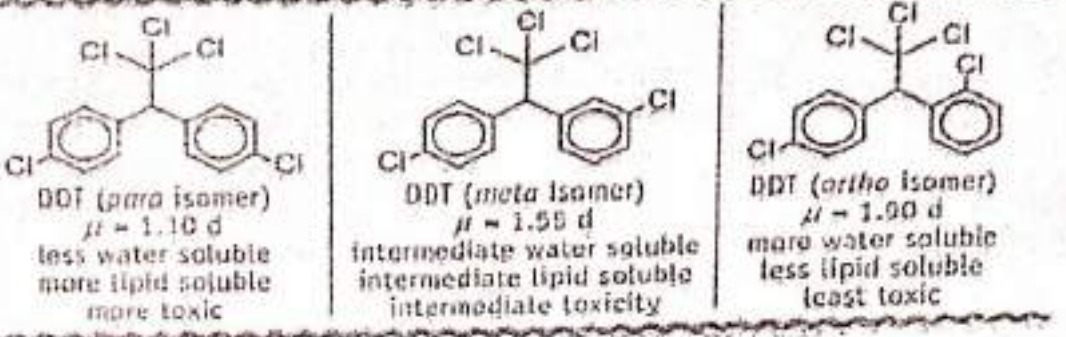


Figure 12-4 ▮ Dipole moments correlations with insecticidal activities of different isomers of DDT.

Among the isomers, the p-isomer of DDT is highly toxic and has least dipole moment and hence greater solubility in non-polar solvents. The membrane of the insects is lipoidal in nature. The p-isomer, being soluble in non-polar solvents, can easily penetrate through the lipoidal membranes of the insects.

4. Chemical Structure of compounds:

(i) *Deciding ionic nature of a bond* : For example, experimental dipole moment value of hydrochloric acid is 1.303 d. If the molecule is completely ionized (H^+Cl^-), the dipole moment from equation (4) is supposed to be:

$$\mu = \text{distance} \times \text{charge} = r \times e = 1.26 \times 4.80 = 6.05 \text{ d}$$

The experimental value is less than the theoretical value (100 % ionized). Hence, hydrochloric acid is not 100 % ionized. The ionic character of the bond in hydrochloric acid is equivalent to a separation of charge of about 1/6 e.

(ii) *Identifying the shape of molecules* : Linear structure of the molecules can be decided. Examples are carbon dioxide and oxygen. (Figure 12-5). Though the differences in the electronegativity between carbon and oxygen exist, the dipole moment of carbon dioxide is zero. This is possible only in a linear structure, since dipole moments of bonds get cancelled. Similarly, symmetric molecules such as H_2, O_2, N_2 and Cl_2 are nonpolar. Their dipole moments are zero.

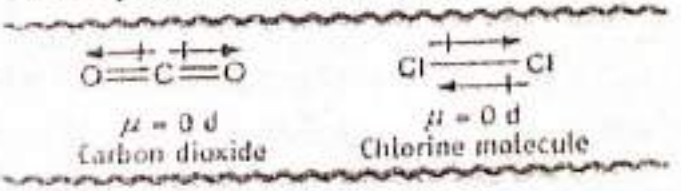
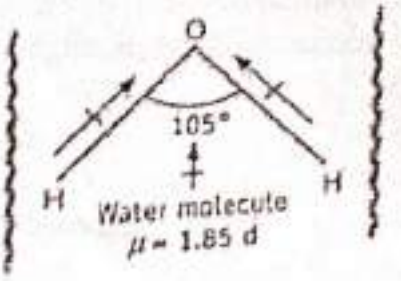


Figure 12-5 ▮ Dipole moments of symmetric small molecules.

Even in case of molecules such as carbon tetrachloride, the individual dipole moments get cancelled. Hence dipole moment is zero, though it contains electronegative and electropositive atoms.

(iii) *Identifying the shape and bond angle* : The dipole moment helps in deciding the shape of the molecule and bond angle. For example, the dipole moment of water is 1.85 d. Hence, water is not a linear molecule. It has been estimated that each O–H bond has a moment of 1.60 d. Hence, the bond angle is about 105°.



Molecules containing large electronegative and electropositive atoms possess high dipole moments. For example, hydrogen fluoride (HF) has the dipole moment of 1.75 d.

(iv) Deciding the arrangement of groups:

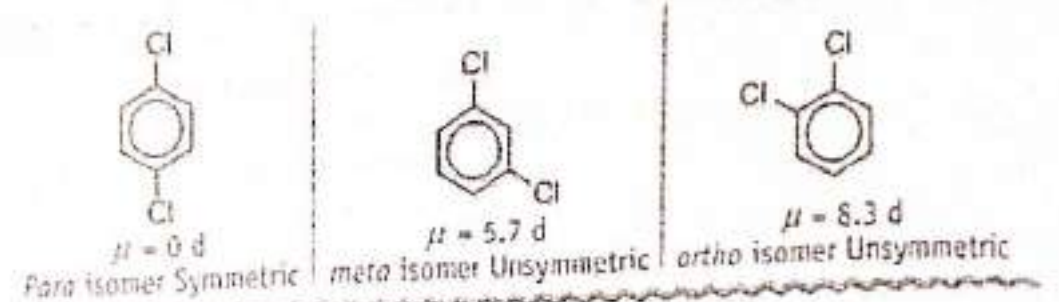


Figure 12-6 ▯ Arrangement of groups and dipole moments.

p-Dichlorobenzene has dipole moment of zero due to symmetric structure. *m*-Dichlorobenzene has 5.7 d, while *o*-dichlorobenzene has 8.3 d.

(v) *Identifying geometric isomers* : For example, dichloroethylene is available as cis and trans isomers. Normally, cis isomer has a higher dipole moment than the trans isomer (Figure 12-7).

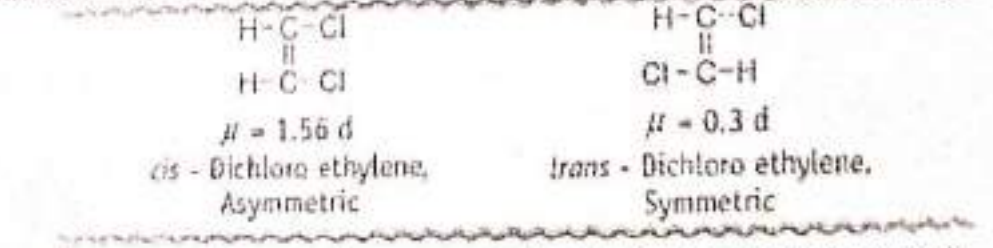


Figure 12-7 ▯ Structural arrangement of geometric isomers-Dipole moments.

Dipole moments are not measured, but can be predicted from polarity of the structure, electronegativity of the atoms, polarity of bonds and bond energies.

Induced Polarization of nonpolar molecules:

Whennonpolarmoleculesareplacedinanelectricalfield,theelectroncloudsoftheirmolecul esbecomedistortedsothatatemporarychargeseparationoccursthatistheybecomepolarized .Thiseffectistermedinducedpolarization.
Onremovaloftheelectricfield,themoleculesreverttotheiroriginalstate.
So,themoleculesacquireaninducedtemporarydipolemoment,themagnitudeofwhichispro portionaltotheappliedfieldstrength(E)andtheinducedmolecularpolarizability(αp)

$$\mu_{ind} = E\,\alpha$$

The induced molar polarization Pi represents the induced dipole moment per mole of non polar substance when the electric field strength of the condenser is 1 V/m.
Pi can be definedbytheClausius-Mossottiequationas:

$$P_i = \frac{\varepsilon - 1}{\varepsilon + 2}\frac{M}{\rho}$$

- Where:
  - ε is the dielectric constant.
  - M is the molar mass (molecular weight) (g mol^{-1})
  - ρ is the density (g cm^{-3}).

GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE

A

Assignment-II

On

Physical Pharmaceutics-II

Topic :- Factors affecting adsorption, Electrical Double layer, Nernst and Zeta potential and Nernst equation

Submitted by -

Name :- Sanjana Chowdhury

Class :- B. Pharm 3rd Sem

Sec :- 'B'

Roll no :- 88

Date of assignment :- 23rd Oct, 2019

Date of submission :- 29th Oct, 2019

9.5

Factors affecting Adsorption

The adsorption of solute molecules from the solution may be influenced by the following factors

1. Solute concentration → There is an increase in the amount of adsorption with an increase in the concentration of solute at equilibrium until it reaches a limiting value. However, the relative amount of solute removed from solution is greater in dilute solutions.

2. Surface area of the adsorbent → The adsorption being a surface phenomenon, the amount of solute adsorbed depends on the surface area available. The reduction of the particle size of adsorbent will result in increase in the surface area and hence an increase in the adsorption.

3. Temperature → Most of the adsorption processes being exothermic an increase in temperature will decrease the amount of adsorption.

4. Removal of Adsorbed Impurities → Adsorbed impurities such as gases or moisture on the surface of solid adsorbent decreases the efficiency of these adsorbents. Heating at high temperature (at 110°C for 1 hr) removes these impurities to activate the adsorbent and the efficiency is increased.

5. Adsorbent – Solute Interaction → The adsorption of a solute from a dilute solution

involves the breaking of bonds between the solute and solvent molecules as well as adsorbent and solvent molecules and the formation of bonds between the solute and adsorbent molecules. The strength of these interactions generally depends on the mechanism of interaction which in turn depends upon the structure of the components.

6. Solvent Competition → Solutes are generally readily adsorbed when they are sparingly soluble in the solvent and also when the solvent has a low affinity for the adsorbent. In general, this depends on the relative affinities existing among the solute, the solvent and the adsorbent.

7. pH of the medium → Since pH affects the dissociation of an electrolyte, depending upon whether the ionized or unionized species are more strongly adsorbed, the adsorption would increase or decrease with a change in pH. Amphoteric solutes such as proteins are usually best adsorbed in the region of their isoelectric point.

Electrical Double Layer

Electrical Double layer is a region of molecular dimension boundary of two substances across which an electrical field The substances must contain electrically charged particles, ions, electrons, ions or molecules with a separation of electrical charge In EDL, oppositely charged particles attract each other and tend to collect at the surface of each substance but remain separated from one another by the finite size of each particle or by neutral molecules that surround the charged particles. The electrostatic attraction between the two opposite and separated charge causes an electrical field to be established across the interface

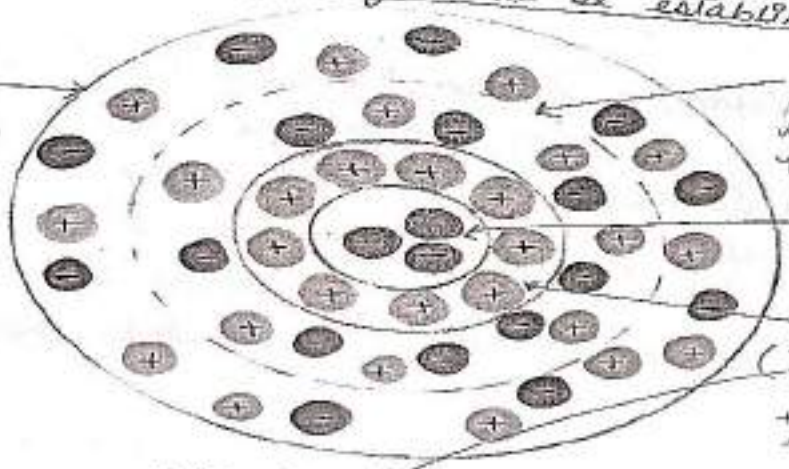


Fig:- Electrical double layer

Let us consider a suspension in which the surface of each solid particle preferentially adsorbs positive charges in contact with an aqueous solution containing positive and negative ions due to dissolved salts. The positive charges on the particle influences the distribution of the ions in the immediate vicinity of the solution surrounding the particle.

GIRIJANANDA CHOWDHURY INSTITUTE OF PHARMACEUTICAL SCIENCE (GIPS)

(A Unit of Shrimanta Shankar Academy)
N. H. 37, Hatkhowapara, Azara, Guwahati - 17

ESTD. - 2007

PRACTICAL NOTE BOOK

Subject Physical Pharmaceutics - I

Name Mominul Islam

Class B. Pharm 3rd Sem (B) Roll No. 180510011060

Regn. No. 196105118

Bk. No. — G 1696

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