

No	Subject Details					
1	Name of Course/Module		PHARMACEUTICAL ENGINEERING I			
2	Course Code		BPS 2153			
3	Name of academic staff		Dr Long Ming			
4	Rationale for the inclusion of the course/module in the programme <ul style="list-style-type: none"> <li>▪ To enable the learner to develop an understanding of the basic knowledge in unit operation of pharmaceutical processing</li> </ul>					
5	Semester and Year offered		Year 2, Semester 2			
6	Total Student Learning Time (SLT)	Face to Face				Total Guided and Independent Learning
		Lecture	Tutorial	Practicals	Others	
		22	9	15	Test-3 Hrs Assignment- 6 Hrs Quiz- 3 Hrs	L-22+44=66 T-9+9=18 Pr-15+10=25 Others-12 <b>Total Hours=121</b>
7	Credit Value		3			
8	Prerequisite (if any)		Physical Pharmacy [BPS 1103]			
9	Learning Outcomes:  At the completion of this unit students should be able to <ul style="list-style-type: none"> <li>• Describe the fundamental process of extraction and drying in pharmaceuticals.(C1,C2,P1,A1)</li> <li>• Demonstrate the process of size reduction and size separation.(C3,P5,A3)</li> <li>• Perform the filtration and centrifugation process.(C2,A2,A5)</li> <li>• Outline the plant location and to understand the hazards in Pharmaceutical industries.(C1,C4)</li> <li>• Perform the distillation, drying and mixing process.(C2,A2,A5)</li> </ul>					

10	<p>Transferable Skills:</p> <p>On completion of the course the student will be able to:</p> <ol style="list-style-type: none"> <li>1. undertake independent and self-directed study and learning;</li> <li>2. recognize and work within the limitations of their own personal and professional skills</li> <li>3. develops basic knowledge on engineering principles in the design of pharmaceutical plants with an optimized output</li> </ol>								
11	<p>Teaching-learning and assessment strategy</p> <table border="1"> <tr> <td>Test</td> <td>20 %</td> </tr> <tr> <td>Practical assessment / Report</td> <td>20 %</td> </tr> <tr> <td>Final Exam</td> <td>60 %</td> </tr> <tr> <td><b>Grand Total</b></td> <td><b>100 %</b></td> </tr> </table>	Test	20 %	Practical assessment / Report	20 %	Final Exam	60 %	<b>Grand Total</b>	<b>100 %</b>
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Final Exam	60 %								
<b>Grand Total</b>	<b>100 %</b>								
12	<p>Synopsis:</p> <p>The topics covered in lectures include basic principles, construction and working of machineries or equipments required for various pharmaceutical processes like size reduction, distillation, mixing, filtration, etc.</p>								
13	<p>Mode of Delivery</p> <p>Lecture, tutorial, Practical, Self-Directed/Student led/Viva Voce/Assignment/Exam/Quiz/Test</p>								
14	<p>Assessment Methods and Types</p> <p><b>Test : 20%,</b> (Short Answer Questions : 1 hour and Assignment: minimum 1000 words)</p> <p><b>Practical Assessment: 20%</b> (Practical report, Viva-Voce, practical Exam and Presentation)</p> <p><b>Final Exam: 60%</b> (MCQ – 40 questions, 6 Essays)</p>								

15	Mapping of the course/module to the Programme Aims								
	Course/Module	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6		
	<b>Pharmaceutical Technology I</b>	X	X	X					
16	Mapping of the course/module to the Programme Learning Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
	X	X							
17	Content outline of the course/module and the SLT per topic								
	<b>Topics</b>				<b>Hours</b>				
					<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
<b>UNIT 1</b> <b>HEAT TRANSFER</b> <ul style="list-style-type: none"> <li>• Concept of heat flow by conduction, convection and radiation</li> <li>• Black body, Stefan-Boltzmann equation, Kirchhoff's law</li> </ul>				1	1	-	-		
<b>UNIT 2</b> <b>EXTRACTION AND EVAPORATION</b> <ul style="list-style-type: none"> <li>• Definition of extraction</li> <li>• Extraction process</li> <li>• Types of extraction</li> <li>• Liquid-liquid extraction</li> <li>• Solid-liquid extraction</li> <li>• Supercritical gas extraction</li> <li>• Basic concept of phase equilibrium, factors affecting evaporation.</li> <li>• Evaporators - film evaporators, single effect and multiple effect evaporators.</li> </ul>				3	1	3	-		

<p><b>UNIT 3</b></p> <p><b>DISTILLATION</b></p> <ul style="list-style-type: none"> <li>• Raoult's law, Volatility, simple, steam and flash distillations</li> <li>• Principles of rectification, azeotropic, molecular and extractive distillation</li> </ul>	2	1	2	-
<p><b>UNIT 4</b></p> <p><b>DRYING</b></p> <ul style="list-style-type: none"> <li>• Moisture content and mechanism of drying, factors affecting drying</li> <li>• Classification and types of dryers, dryers used in pharmaceutical industries</li> <li>• Construction and working of tray dryer, fluidized bed dryer, drum dryer, vacuum Dryer, Freeze dryer and Spray dryer</li> </ul>	3	1	2	-
<p><b>UNIT 5</b></p> <p><b>SIZE REDUCTION AND SIZE SEPARATION</b></p> <ul style="list-style-type: none"> <li>• Definition, objectives of size reduction,</li> <li>• Factors affecting size reduction,</li> <li>• Laws governing energy and power requirements of a mill, types of mills,</li> <li>• Construction and working of ball mill, hammer mill, fluid energy mill</li> <li>• Different techniques of size separation- sieves, sieve shakers, sedimentation tanks, Mechanical classifiers, Cyclone separators, Air separators</li> </ul>	3	1	2	-

	<p><b>UNIT 6</b></p> <p><b>MIXING</b></p> <ul style="list-style-type: none"> <li>• Theory of mixing, solid-solid, solid-liquid and liquid – liquid mixing</li> <li>• Equipments-tumbler, -double cone, ribbon blenders, Sigma blade and planetary, zig-zag mixers</li> <li>• Mixing devices, - Propellers, turbines, paddles, and baffles. Vortex formation and prevention. Homogenisation, and homogenizers</li> </ul>	3	1	2	-
	<p><b>UNIT 7</b></p> <p><b>FILTRATION AND CENTRIFUGATION</b></p> <ul style="list-style-type: none"> <li>• Theory of filtration</li> <li>• classification of industrial filters,</li> <li>• Construction and working of filter press, filter leaf, Meta filter, and candle filter.</li> <li>• Filter aids</li> <li>• Theory and principle of centrifugation, classification of industrial centrifuges. Centrifuges, - basket, tubular bowl, conical disc, semi continuous and continuous horizontal centrifuges</li> </ul>	3	1	2	-

	<p><b>UNIT 8</b></p> <p><b>CRYSTALLIZATION</b></p> <ul style="list-style-type: none"> <li>• Crystal habits, solubility curves, Mier's theory</li> <li>• Construction and working of agitated batch crystalliser,</li> <li>• Swenson-walker, Krystal and Vacuum crystallisers. Caking of crystals.</li> </ul>	2	1	2	-
	<p><b>UNIT 9</b></p> <p><b>PLANT LOCATION</b></p> <ul style="list-style-type: none"> <li>• Layout, utilities and services. Industrial hazards and safety measures</li> </ul>	2	1	-	-
	<b>Total</b>	<b>22</b>	<b>9</b>	<b>15</b>	<b>12</b>
	<b>Total credit hours</b>	<b>3</b>			
18	<p>Main Reference:</p> <ul style="list-style-type: none"> <li>▪ Bentley's (2015). <b>Textbook of Pharmaceutics</b>. A.I.T.B.S. Publishers &amp; Distributors.</li> <li>▪ Aulton, M.E. (2014). <b>Pharmaceutics</b>. Churchill Livingstone.</li> </ul> <p>Additional references:</p> <ul style="list-style-type: none"> <li>▪ Banker G.S., Rhodes, C.T. (2015). <b>Modern Pharmaceutics</b>. Marcel Dekker Inc.</li> <li>▪ Watson, D. (2015). <b>Pharmaceutical Analysis</b>. Churchill Livingstone. Hopper, T., McBride L., Snipe, K. (2012). <b>Mosby's Pharmacy technician-text and workbook package</b>. W.B Saunders.al</li> </ul>				

19 Practical training

List of practicals

1. Drying of wet granules and to plot the rate of drying curves
2. Operation of sieve shaker and sieve analysis
3. Determination of mixing index of blenders
4. Rate of filtration studies
5. Experiment to determine the leaching of contents from packaging material
6. Methods of crystallization, study of crystal habit.
7. Steam distillation: collection of volatile oil (Demonstration)
8. Evaporation: factors affecting the rate of evaporation.