

**SATUAN ACARA PERKULIAHAN**  
**TATA LETAK DAN PENANGANAN BAHAN**

Oleh :

**Prof. Dr. Ir. Machfud, MS**

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**Dr. Andes Ismayana, STP MT**

**Muhammad Arif Darmawan, STP, MT**



**DEPARTEMEN TEKNOLOGI INDUSTRI PERTANIAN**

**FAKULTAS TEKNOLOGI PERTANIAN**

**INSTITUT PERTANIAN BOGOR**

**2016**

## Course Syllabus

### Plant Layout and Material Handling

Course title	Plant Layout and Material Handling		
Course code: TIN310	Credits: 3(2-3)	Semester: 5	Compulsory/optional: Compulsory
Coordinator's name	Prof. Dr. Ir. Machfud, MS	Instructor's name	Dr. Ir. Hartrisari Hardjoamidjodjo Dr. Andes Ismayana, STP, MT Muhammad Arif Darmawan, STP, MT
Main reference (Title, author, year) (maximum 3 references)	<ol style="list-style-type: none"> <li>1. Tompkins A James, White A John, Bozer A Yavuz, and Tangchoco A M J. 2010. Facilities Planning: Fourth Edition. John Wiley &amp; Sons, Inc.</li> <li>2. Meyers FE and MP Stephens. 2005. Manufacturing Facilities Design and Material Handling. Third Edition. Prentice-Hall, Inc.</li> <li>3. Hanna, S.R. and Konz, S. 2004. Facility Design &amp; Engineering. Hathaway Publishers.</li> </ol>		
Additional reference (Supplemental materials)	<ol style="list-style-type: none"> <li>1. Birchfield, J.C. 1988. Design and Layout of Food Service Facilities. Van Nostrand Reinhold.</li> <li>2. Plant Layout and Flow Improvement. Bluecreek Publ., 1992.</li> <li>3. Askin, R.G. and C.R. 1993. Standridge. Modelling and Analysis of Manufacturing Systems John Wiley and Sons, Inc.</li> </ol>		
Brief description	This course is designed to give the students a comprehensive understanding and skill in the design and integration of plant layout and material handling. It will cover the factors, method and techniques in facility location, selection and managing of material handling equipment.		
Prerequisite			
Course outcome	<ol style="list-style-type: none"> <li>A. Understand the methodologies of developing efficient layouts for production system and material handling system, and material handling equipment selection</li> <li>B. Understand the importance of interrelationship with management planning, product and process engineering, methods engineering and production control.</li> <li>C. Able to apply quantitative approaches and model in developing alternatives of facilities planning and material handling problems</li> <li>D. Able to apply in using computer software in computer aided layout</li> <li>E. Able to work with a team to design and evaluate plant layout and to develop a written project report.</li> </ol>		
Relationship between course outcomes and program outcomes	<ol style="list-style-type: none"> <li>1. Course outcome A and B supports student outcomes 1, 2, 4, 6, 7, and 12.</li> <li>2. Course outcome C and D supports student outcomes 1, 2, 4, 5, 6, 7, and 12.</li> <li>3. Course outcome E supports student outcomes 4, 5, 6, 7, 9 and 14.</li> </ol>		
Offered to	Study Program of Agroindustrial Technology-IPB and other study programs as elective course		

Topics to be covered	<ol style="list-style-type: none"> <li>1. Introduction to facilities layout design and material handling.</li> <li>2. Source of information for facilities layout design and basic type of layout</li> <li>3. Layout construction technique: production, activity and materials flow analysis, space requirements and personnel services design, activity relationship analysis, space relationship diagram).</li> <li>4. Quantitative model and analytical method: single and multi-facilities location problem, line balancing model, waiting line model.</li> <li>5. Computerized layout: ALDEP, CORELAP, CRAFT, etc.</li> <li>6. Assessment and evaluation of layout alternative.</li> <li>7. Material handling: material handling system and principles; material handling equipment.</li> <li>8. Fixed and random scheduling system.</li> <li>9. Conveyor model in transportation system.</li> </ol>				
ATSP Student Outcomes	<ol style="list-style-type: none"> <li>1. An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities</li> <li>2. An ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies</li> <li>4. An ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives</li> <li>5. An ability to function effectively as a member or leader on a technical team</li> <li>6. An ability to identify, analyze, and solve broadly-defined engineering technology problems</li> <li>7. An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature</li> <li>12. An ability to accomplish the integration of system using appropriate analytical, computational, and application practices and procedures</li> </ol>				
Percentage	Knowledge	40 %	Facility/media	x	White board
	Skill	40 %		x	LCD projector
	Attitude	20 %		x	Computer
Activity, contact hours (hour/week)	Lecture	2 hours/week		x	Wi-Fi
	Lab work	3 hours/week	x	Sound system	
	Tutorial	-		Courseware	
	Others	-		Other: ....	
	Assessment	Assignment	30 % (paper)		
	Examination	70 % (mid and final exams)			
	Quiz	-			

## JADWAL DAN MATERI PERKULIAHAN

Week	Learning Outcomes	Topics	Reference	Lecturer
1.	<p>Know:</p> <ul style="list-style-type: none"> <li>• The scope of location and layout, the importance of plant layout and location planning</li> <li>• Various applications of plant location and layout planning in agroindustry</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>• Identify the importance of location and layout design in production systems</li> <li>• Identify a project in agroindustrial layout and location planning</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>• The location and layout planning in relations to effectiveness and efficiency</li> <li>• Considerations in defining value chain in product versus service industry</li> </ul>	<p>✓ Introduction to Location and Layout</p>	1,2	Machfud
2.	<p>Know:</p> <ul style="list-style-type: none"> <li>• Different types of factors: <ul style="list-style-type: none"> <li>- Critical factor</li> <li>- Subjective</li> <li>- Objective</li> </ul> </li> <li>• Different methods in location planning: <ul style="list-style-type: none"> <li>- Bayes, MPE, CPI</li> <li>- Break Even Analysis</li> <li>- Mean, Median Gravitational Method</li> <li>- Hybrid Method</li> </ul> </li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>• Identify appropriateness of methods in light of various different factors pertinent to location planning</li> <li>• Apply methods to a project in agroindustry</li> </ul>	<p>✓ Location</p>	2,3	Machfud

	<p>location planning</p> <ul style="list-style-type: none"> <li>Identify factors in the project</li> <li>Work as a team in the project</li> </ul> <p>Aware of: Differences in factor characteristics needs different methods and different types of measures</p>			
3.	<p>Know:</p> <ul style="list-style-type: none"> <li>Different layout types in production systems</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Identify appropriateness of layout types in light of a firm's manufacturing strategy</li> <li>Identify layout type in the selected project</li> </ul>	✓ Layout types	1	Machfud
4.	<p>Know:</p> <ul style="list-style-type: none"> <li>Steps in layout design</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Apply layout design procedure to students' project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Necessary data and information needed in the project</li> </ul>	✓ Layout Design Procedure	1	Machfud
5.	<p>Know:</p> <ul style="list-style-type: none"> <li>Types of material flow based on type of factories</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Identify type of material flow in students' project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Necessary data and information needed in the project</li> </ul>	✓ Material flow planning and analysis	1	Machfud
6.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand the mechanism of Activity Relationship Chart</li> <li>Know and understand the mechanism of Activity Relationship Diagram and String Diagram</li> </ul> <p>Be able to:</p>	✓ Activity relationship analysis and engineering	1	Machfud

	<ul style="list-style-type: none"> <li>Apply ARC, ARD and String Diagram in students' project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Aware of necessary data and information</li> </ul>			
7.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand space requirement planning</li> <li>Know and understand space requirement diagram</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Identify activities needed to create value in the production process</li> <li>Identify space requirement for activities identified</li> <li>Apply and create space requirement diagram for the project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Data and information of measures and dimension of machinery and auxiliary tools</li> </ul>	✓ Space requirement planning	2,3	Machfud
<i>Midterm Exam</i>				
8.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand workstation analysis in line as well as job shop</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Identify workstation needed to create value in the production process</li> <li>Apply and create workstation simulation for the project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Data and information needed</li> </ul>	✓ Workstation analysis and design	1	Arif
9.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand material handling system and its importance</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Describe material handling system needed in</li> </ul>	✓ Introduction to material handling system	1,2	Arif

	<p>project</p> <ul style="list-style-type: none"> <li>Analyze material handling system needed in project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Types of material handling system</li> </ul>			
10.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand material handling equipment</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Identify material handling equipment</li> <li>Analyze material handling equipment needed in students' project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Data and information of material handling equipment</li> </ul>	✓ Material handling equipment	2,3	Arif
11.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand the importance of scheduling system</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Analyze given problems</li> </ul> <p>Aware of :</p> <ul style="list-style-type: none"> <li>Mathematical formula</li> </ul>	✓ Fixed and random schedule system	1	Hartrisari
12.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand the importance of scheduling system</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Analyze given problems</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Mathematical formula</li> </ul>	✓ Conveyor model and management	1	Arif
13.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand queue theory and technique in material handling</li> </ul>	✓ Queu technique in material handling management	1	Hartrisari

	Be able to: <ul style="list-style-type: none"> <li>• Calculate and Analyze given problems</li> </ul> Aware of: <ul style="list-style-type: none"> <li>• Mathematical formula and assumptions</li> </ul>			
14.	Know: <ul style="list-style-type: none"> <li>• How to communicate project result</li> </ul> Be able to: <ul style="list-style-type: none"> <li>• Communicate and motivate group and inter-group discussion</li> </ul>	✓ Presentation of Student's project	-	Hartrisari
<i>Final Exams</i>				

MAIN REFERENCE:

1. Tompkins A James, White A John, Bozer A Yavuz, and Tangchoco A M J. 2010. Facilities Planning: Fourth Edition. John Wiley & Sons, Inc.
2. Meyers FE and MP Stephens. 2005. Manufacturing Facilities Design and Material Handling. Third Edition. Prentice-Hall, Inc.
3. Hanna, S.R. and Konz, S. 2004. Facility Design & Engineering. Hathaway Publishers.

**JADWAL DAN MATERI RESPONSI**

Week	Learning Outcomes	Topics	Reference	Lecturer
1.	Know: <ul style="list-style-type: none"> <li>• The scope of location and layout, the importance of plant layout and location planning</li> <li>• Various applications of plant location and layout planning in agroindustry</li> </ul> Be able to: <ul style="list-style-type: none"> <li>• Identify the importance of location and layout design in production systems</li> <li>• Identify a project in agroindustrial layout and location planning</li> </ul>	✓ Introduction to Location and Layout	1,2	Machfud



	<p>Aware of:</p> <ul style="list-style-type: none"> <li>• The location and layout planning in relations to effectiveness and efficiency</li> <li>• Considerations in defining value chain in product versus service industry</li> </ul>			
2.	<p>Know:</p> <ul style="list-style-type: none"> <li>• Different types of factors: <ul style="list-style-type: none"> <li>- Critical factor</li> <li>- Subjective</li> <li>- Objective</li> </ul> </li> <li>• Different methods in location planning: <ul style="list-style-type: none"> <li>- Bayes, MPE, CPI</li> <li>- Break Even Analysis</li> <li>- Mean, Median Gravitational Method</li> <li>- Hybrid Method</li> </ul> </li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>• Identify appropriateness of methods in light of various different factors pertinent to location planning</li> <li>• Apply methods to a project in agroindustry location planning</li> <li>• Identify factors in the project</li> <li>• Work as a team in the project</li> </ul> <p>Aware of: Differences in factor characteristics needs different methods and different types of measures</p>	✓ Location	2,3	Machfud
3.	<p>Know:</p> <ul style="list-style-type: none"> <li>• Different layout types in production systems</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>• Identify appropriateness of layout types in light of a firm's manufacturing strategy</li> <li>• Identify layout type in the selected project</li> </ul>	✓ Layout types	1	Machfud
4.	<p>Know:</p>	✓ Layout Design Procedure	1	Machfud

	<ul style="list-style-type: none"> <li>• Steps in layout design</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>• Apply layout design procedure to students' project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>• Necessary data and information needed in the project</li> </ul>			
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6.	<p>Know:</p> <ul style="list-style-type: none"> <li>• Know and understand the mechanism of Activity Relationship Chart</li> <li>• Know and understand the mechanism of Activity Relationship Diagram and String Diagram</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>• Apply ARC, ARD and String Diagram in students' project</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>• Aware of necessary data and information</li> </ul>	✓ Activity relationship analysis and engineering	1	Machfud
7.	<p>Know:</p> <ul style="list-style-type: none"> <li>• Know and understand space requirement planning</li> <li>• Know and understand space requirement diagram</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>• Identify activities needed to create value in the production process</li> <li>• Identify space requirement for activities identified</li> <li>• Apply and create space requirement diagram for the project</li> </ul>	✓ Space requirement planning	2,3	Machfud

	Aware of: <ul style="list-style-type: none"> <li>Data and information of measures and dimension of machinery and auxiliary tools</li> </ul>			
<i>Midterm Exam</i>				
8.	Know: <ul style="list-style-type: none"> <li>Know and understand workstation analysis in line as well as job shop</li> </ul> Be able to: <ul style="list-style-type: none"> <li>Identify workstation needed to create value in the production process</li> <li>Apply and create workstation simulation for the project</li> </ul> Aware of: <ul style="list-style-type: none"> <li>Data and information needed</li> </ul>	✓ Workstation analysis and design	1	Arif
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	<ul style="list-style-type: none"> <li>Data and information of material handling equipment</li> </ul>			
11.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand the importance of scheduling system</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Analyze given problems</li> </ul> <p>Aware of :</p> <ul style="list-style-type: none"> <li>Mathematical formula</li> </ul>	✓ Fixed and random schedule system	1	Hartrisari
12.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand the importance of scheduling system</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Analyze given problems</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Mathematical formula</li> </ul>	✓ Conveyor model and management	1	Arif
13.	<p>Know:</p> <ul style="list-style-type: none"> <li>Know and understand queue theory and technique in material handling</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Calculate and Analyze given problems</li> </ul> <p>Aware of:</p> <ul style="list-style-type: none"> <li>Mathematical formula and assumptions</li> </ul>	✓ Queu technique in material handling management	1	Hartrisari
14.	<p>Know:</p> <ul style="list-style-type: none"> <li>How to communicate project result</li> </ul> <p>Be able to:</p> <ul style="list-style-type: none"> <li>Communicate and motivate group and inter-group discussion</li> </ul>	✓ Presentation of Student's project	-	Hartrisari
<i>Final Exams</i>				