

Syllabus
BAE5320 Elective Focus Business Engineering
Prof. Karl R. van der Merve
Winter Semester 2024/2025

Level	Master	
Credits	2	
Student Contact Hours	3	
Workload	90 hours	
Prerequisites		
Time	s. LSF	
Room	s. LSF	
Start Date	s. LSF	
Lecturer(s)	Name	Prof Karl van der Merwe
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1. PURPOSE STATEMENT

The purpose of this Lean Manufacturing course is to equip participants with the knowledge and skills necessary to implement Lean principles and practices in their organizations. By focusing on waste reduction, process optimization, and continuous improvement, this course aims to enhance operational efficiency, improve product quality, and increase customer satisfaction. Participants will learn to identify and eliminate non-value-added activities, streamline workflows, and foster a culture of continuous improvement, ultimately driving sustainable growth and competitive advantage.

2. MODULE OBJECTIVES

The students will be able to:

- Describe the lean philosophy and its origins
- Minimise operational waste
- Apply continuous improvement tools and techniques
- Create and analyse current state value stream maps
- Develop future state value stream maps
- Design work cells and explain associated advantages
- Design and implement Kanban systems
- Conduct setup reduction exercises
- Develop mistake proofing interventions
- Contrast pull and push production systems
- Develop lean solutions in service operations including healthcare and laboratories.
- Conduct lean audits

3. CORE CONTENT

Within a manufacturing or technical or operations environment:

- Lean origins
- Lean principles
- Continuous improvement tools
- Value stream mapping
- Work cells and cellular manufacturing
- Kanban systems
- Setup reduction
- Mistake proofing
- Pull systems
- Lean service applications
- Lean audits

4. SYLLABUS / SCOPE OF WORK

The following syllabus outline describes the scope of the work to be covered in this module.

Unit of Learning Content	Related Topics Considered	Learning outcomes. After completing this unit, learners will be able to:
1.0 Lean Overview	1.1 History of operations 1.2 Evolution of lean thinking 1.3 Lean principles 1.4 Lean concepts 1.5 Benefits of lean operations 1.6 Manufacturing vs. Services 1.7 Role of lean culture 1.8 Lean implementation	<ul style="list-style-type: none"> • Identify and distinguish between the two systems the preceded lean. • Trace the roots of lean thinking, highlighting milestones. • Identify lean principles and concepts. • Build a case for implementing lean. • Discuss reasons for lean applicability to services. • Explain the role of organisational culture in lean. • Discuss lean implementation.
2.0 Lean Principles	2.1 Introduction to waste elimination 2.2 The original seven wastes 2.3 New wastes 2.4 Variation and overload 2.5 Techniques for exposing waste 2.6 Value added	<ul style="list-style-type: none"> • Identify and explain the original 7 Wastes as described in the Toyota Production System. • Use the 7 Wastes to uncover waste in a working environment. • Discuss the merits of the “new” waste categories. • Explain how variation, overload and waste are related. • Conduct a 5S exercise in a working environment. • Calculate a takt time and explain its significance. • Contrast value adding and non-value adding activities.
3.0 Continuous Improvement	3.1 Introduction 3.2 Continuous improvement features 3.3 Tiered approach 3.4 Continuous improvement techniques 3.5 Continuous improvement framework 3.6 Mapping 3.7 A3 Problem solving - 3.8 Benefits of continuous improvement	<ul style="list-style-type: none"> • Explain the importance of continuously improving operations from a lean point of view. • Identify key features of continuous improvement actions. • Explain the tiered approach and relate the levels to real operational situations. • Use the continuous improvement tools to solve operational problems. • Describe and use mapping and A3 techniques for operational problem solving. -
4.0 Engaging People	4.1 Introduction 4.2 Organisational culture 4.3 Implications for lean implementation 4.4 Achieving lean culture 4.5 Engagement embedded in respect	<ul style="list-style-type: none"> • Explain why employee engagement is so critical for the success of lean. • Define the meaning of the term “organisational culture”. • Identify the characteristics that make organisational culture so difficult to change. • Discuss the concept of a lean culture.
5.0 Lean Planning and Control	5.1 Introduction 5.2 Level loading 5.3 Pull systems 5.4 Integrating lean and MRP	<ul style="list-style-type: none"> • Explain the importance of level loading and give examples of how it can be achieved.

Unit of Learning Content	Related Topics Considered	Learning outcomes. After completing this unit, learners will be able to:
		<ul style="list-style-type: none"> • Identify reasons preventing organisations from implementing level loading. • Explain the meaning of the term “pull system” and why it is so important to lean. • Calculate bin requirement in a typical Kanban system. <ul style="list-style-type: none"> • Explain the meaning of the term CONWIP.
6.0 Robust Processes	6.1 Introduction 6.2 Standard operating procedures 6.3 Total productive maintenance (TPM) 6.4 Mistake proofing 6.5 Healthcare case study of mistake proofing	<ul style="list-style-type: none"> • Describe the purpose of inferential Explain the term robust process. • Identify the reasons for variation. • Draw up a standard operating procedure. • Explain the meaning of total productive maintenance (TPM). • Identify and design mistake proofing devices.
7.0 Cellular Operations	7.1 Introduction 7.2 Factors influencing batch size 7.3 Work cells 7.4 System balance	<ul style="list-style-type: none"> • Explain the meaning of small batch operations • Elaborate on why it is necessary in a lean system • Identify the factors that influence batch size • Explain how work cells can reduce batch sizes • Conduct capacity calculations on work cell variations
8.0 Quick Changeover	8.1 Introduction 8.2 Traditional approaches 8.3 long setup impact on batches 8.4 Reducing set-ups (SMED) 8.5 Benefits of simplified set-ups 8.6 Accelerate progress	<ul style="list-style-type: none"> • Explain the factors that promote large batches • Explain how long changeovers negatively impact upon batch size and flexibility • Utilise the SMED methodology for reducing changeover duration • Identify the benefits of reduced changeovers
9.0 Lean Supply Chains	9.1 Introduction 9.2 Produce or buy? 9.3 Supply chain management 9.4 Waste in the supply chain 9.5 Bullwhip effect 9.6 Customer-supplier relationships 9.7 Supplier selection 9.8 Supplier kanban 9.9 Lean supply chain benefits	<ul style="list-style-type: none"> • Identify factors influencing the make-or-buy decision • Describe the concept of supply chain management • Identify waste in a supply chain • Describe the bullwhip effect • Identify practices that characterise a lean supply chain • Describe lean supplier selection • Develop supplier Kanban • Identify the benefits of lean supply chains

Course Intended Learning Outcomes and their Contribution to Program Intended Learning Outcomes / Program Goals

Program Intended Learning Outcomes	Course Intended Learning Outcomes
After completion of the program the students will be able...	After completion of the course the students will be able...
1 Responsible leadership in organizational contexts	
1.1 ...to demonstrate their solid knowledge of numerous relevant management principles. They are able to explain and discuss them discerningly.	<ul style="list-style-type: none"> Describe the lean philosophy and its origins
1.2 ...to apply management principles within an organizational context.	<ul style="list-style-type: none"> Apply continuous improvement tools and techniques Conduct lean audits
1.3 ...to reflect discerningly and critically on diverse management principles within an organizational context.	<ul style="list-style-type: none"> Create and analyse current state value stream maps
1.4 ... to understand and deal with the challenges of ethics and sustainability for responsible business operations and are able to deal with them.	
2 Creative problem solving skills in a complex business environment	
2.1 ...to recognize and define problems as well as assess their importance.	
2.2 ...to analyse complex in-company and inter-company problems and challenges from different perspectives and/or within an international context.	<ul style="list-style-type: none"> Contrast pull and push production systems
2.3 ...to independently develop creative solutions to complex in-company and inter-company problems and challenges.	<ul style="list-style-type: none"> Develop future state value stream maps Design work cells and explain associated advantages Design and implement Kanban systems
2.4 ...to clarify successfully complex problems and solutions to both experts and laymen.	<ul style="list-style-type: none"> Develop lean solutions in service operations including healthcare and laboratories.
3 Creative problem solving skills in a complex business environment	
3.1 ...to demonstrate their knowledge of research methods relevant to engineering and management as well as their advantages and disadvantages.	
3.2 ...to successfully apply research methods relevant to engineering and management.	
3.3 ...to implement relevant research methods in such a way as to deliver reliable and innovative results.	
4 Interface expertise in the technical-economic field	
4.1 ... to utilise well-founded knowledge in the technical and economic fields for the integrative solution of complex tasks.	<ul style="list-style-type: none"> Minimise operational waste
4.2 ... to apply the methods of project management and successfully organise, implement and manage projects.	
4.3 ... to develop and evaluate alternative solutions, taking into account various specialist disciplines, and to implement them in integrated overall solutions.	

Teaching and Learning Approach

Literature and Course Materials

Prescribed references:

Van der Merwe, K.R. 2018. Lean Operations. CIRG Publishing. PE.

Van der Merwe, K.R. Value Stream Mapping. CIRG Publishing. PE.

Assessment

FORMATIVE ASSESSMENT

Formative assessment shall take place in the classroom environment by means of the students' ability to answer questions posed in the lectures (mostly verbally), and from feedback asked of them to indicate whether they feel comfortable with a particular section of work. This assessment shall only be used to gauge whether the learners are keeping pace with the lecturer, and for feedback purposes, and such that the lecturer can make adjustments to his presentations to guide students more effectively in areas where they appear to be less competent, or allocate more lecture/tutorial time to those areas.

SUMMATIVE ASSESSMENT

Summative assessment shall take place in various environments by means of the following (not all necessarily apply):

- Theory tests
- Assignments
- Tutorials
- Practical tests
- Examination

WEIGHT OF ASSESSMENTS

The various assessments will contribute as follows toward the final summative mark.

Class Tests	Assignments	Practical Tests	Project Work	Examination	Total
30	30	0	0	40	100%

Schedule

N/A

Academic Integrity and Student Responsibility

Students play a critical role in maintaining academic integrity and are expected to adhere to the following responsibilities:

- Understanding Institutional Policies:** Familiarize yourself with your institution's academic integrity policies and procedures, including definitions of academic dishonesty (plagiarism, cheating, fabrication, etc.).
- Submitting Original Work:** Ensure that all assignments, projects, and examinations represent your own efforts. Avoid copying others' work or using unauthorized resources.
- Proper Attribution:** When using the ideas, words, or creations of others, always provide appropriate citations and attribution according to the required referencing style (APA, MLA, Chicago, etc.).

- iv. **Seeking Clarification:** If unsure about what constitutes academic dishonesty or how to properly acknowledge sources, ask instructors or academic advisors for guidance.
- v. **Reporting Violations:** Should you witness or suspect academic dishonesty, report it to the appropriate authority within your institution. This helps maintain a fair academic environment.
- vi. **Collaboration within Limits:** Understand the guidelines for collaboration on group projects and discussion assignments, knowing when it is appropriate to work with others and when you should work independently.
- vii. **Practice Ethical Conduct:** Develop and maintain ethical study practices, including time management and preparation for examinations, to minimize the temptation to engage in dishonest behavior.
- viii. **Respect for Intellectual Property:** Acknowledge and respect the intellectual property rights of others, both in your work and in your interactions with fellow students.

Code of Conduct for Students

[Link to the Code of Conduct for online Teaching](#)

Teaching and Learning Approach

The role of the lecturer will only be that of a facilitator. It is expected of students to prepare thoroughly and to participate actively during classes. It is expected of students to be able to access the Internet because management related articles and other support material from the Internet would be discussed during classes.

Please note

- Class attendance is critical to your success in this course.
- You are encouraged to participate in class discussions – this is your opportunity to learn as much as possible.
- Arriving late at classes will not be accepted.
- To avoid disruption, no student will be admitted to the lecture room after 5 minutes have elapsed.
- Please contact the Faculty Officer should you have any administration related problems
- If you miss a test, due to illness or exceptional circumstances, you will be able to re write the test.
- Please refer to the faculty prospectus for the institutions' rules and regulations.
- Cell phone use is not allowed during class time
- PowerPoint presentations of work lectured in class will not be provided to students

General

- Students are expected to prepare specific work for each lecture according to the given schedule.
- Ensure that you are registered for the correct modules.
- Students must display their student cards when using the computer labs.
- Computer lab rules will be strictly enforced; lab rules are displayed in the various labs.
- It is the students' responsibility to ensure that they have the correct exam dates. The first exam timetable is a provisional timetable only; it will change. Students must read e-mail notifications.

Projects and Assignments

- Projects and assignments must be typed.
- Deadlines must be met or a nil mark will be allocated.
- Projects and assignments must be completed in the accepted format
- No projects, assignments etc may be e-mailed.
- No work may be copied directly from the internet, students who previously completed the subject, or any other source.
- All sources must be referenced according to the prescribed method.

Additional Information

Course Intended Learning Outcomes and their Contribution to Program Intended Learning Outcomes / Program Goals

Dear Karl, please add learning outcomes of the course on the right side where applicable. According to the alignment matrix, there are probably contributions to goals 1, 2, and 4. Not all fields need to be filled in!

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Teaching and Learning Approach

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Assessment

Schedule

N/A

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Teaching Philosophy

Additional Information