



Warehouse Automation

Course duration: 30 hrs (20 sessions)

Course Description: The course provides structured explanation and details the warehouse operations. It will be beneficial for middle level executives, seeking an advancement in their career to the managerial levels. The course also imparts the hands-on tools and techniques for improving warehouse management.

Course Objective

The objectives of this course are:

- Explain the basic functions of a warehouse and a warehouse manager
- Describe the basic operations in a warehouse (picking, placing, packing, kitting)
- Demonstrate and discuss the different automation levels used in warehouses
- Discuss the importance of warehouse layouts, storage & handling equipment and other resources required in Warehouse operations
- Assess the health and safety aspects in a warehouse
- Compare the different order picking methods and optimization analysis in warehouse
- Recommend proper metrics for assessment of warehouse performance as per organizational needs
- Evaluate the different enhancement options available using the Geospatial technology like - global positioning systems (GPS), remote sensing (RS), and geographical information systems (GIS) – for applications like drones in warehouse management
- Assess the future needs of the organization and the appropriate technology to be adapted.

Target Audience – Mid level and Senior Level managers

Relevant Industry: Logistics industry, Managers from Rail/Road/ Waterways/Airways/ Bulk transport/ Cargo/ Multimodal/ Port/ Warehouses Sectors

Pedagogy/Teaching Method: Lectures, Case Studies, Demonstration of Tools and Techniques

Course Textbook:

- Richards, G. (2017). Warehouse management: a complete guide to improving efficiency and minimizing costs in the modern warehouse. Kogan Page Publishers.

Additional References:

- Keller, S., & Keller, B. C. (2014). The definitive guide to warehousing: managing the storage and handling of materials and products in the supply chain. Pearson Education.
- Smith, J. D. (1998). The warehouse management handbook. Tompkins press.

Module No.	Session No.	Topics	Readings / Case Study / Videos
Module 1: Understanding Warehouse Management Function and Operations (6 hours)	1-4	Role of a Warehouse and a Warehouse Manager (1 session) Major warehouse processes and End-to-End Warehouse Operations (2 sessions) Automation in warehouses (1 session)	Boots UK – High volume efficiency warehouse automation that scales to meet demand (https://www.youtube.com/watch?v=lsfHtagwsNE) Amazon Fulfillment Center Tour with AWS (https://www.youtube.com/watch?v=8nKPC-WmLjU)
Module 2: Warehouse Layout and Material Handling (6 Hours)	5-8	Order picking methods (1 session) Warehouse Layout (1.5 session) Material Handling Systems in a Warehouse and Other resources (1.5 session)	Inside Amazon's Smart Warehouse (https://www.youtube.com/watch?v=IMPbKVb8y8s) Cardona, L. F., & Gue, K. R. (2020). Layouts of unit-load warehouses with multiple slot heights. <i>Transportation Science</i> , 54(5), 1332-1350.
Module 3: People Aspects in a Warehouse and Warehouse Safety (3 Hours)	9-10	People management in Warehouse (1 sessions) Health and Safety issues in a Warehouse (1 sessions)	Roels, G., & Staats, B. R. (2021). OM Forum—People-Centric Operations: Achievements and Future Research Directions. <i>Manufacturing & Service Operations Management</i> , 23(4), 745-757. Hofstra, N., Petkova, B., Dullaert, W., Reniers, G., & De Leeuw, S. (2018). Assessing and facilitating warehouse safety. <i>Safety Science</i> , 105, 134-148.

Module 4: Cost Analysis and Performance Management (4.5 Hours)	11-13	Inventory Accounting and Cost analysis (2 sessions) Key Performance Indicators (1 sessions)	Conley, K., Natarajarathinam, M., Lu, W., & Rangan, S. (2019). Effect of accounting policies on effectiveness of inventory management strategies. <i>Engineering Management Journal</i> , 31(4), 246-256. Laosirihongthong, T., Adebajo, D., Samaranayake, P., Subramanian, N., & Boon-itt, S. (2018). Prioritizing warehouse performance measures in contemporary supply chains. <i>International Journal of Productivity and Performance Management</i> .
Module 5: Warehouse Automation (4.5 Hours)	14-16	Warehouse Automation Analysis Application areas and technological advancements in Warehouse automation Latest trends in Warehouse Automation	Cai, K. (2020). Warehouse automation by logistic robotic networks: a cyber-physical control approach. <i>Frontiers of Information Technology & Electronic Engineering</i> , 21(5), 693-704. Tatsumoto, Y., Shiraishi, M., Cai, K., & Lin, Z. (2018). Application of online supervisory control of discrete-event systems to multi-robot warehouse automation. <i>Control Engineering Practice</i> , 81, 97-104.
Module 6: Use of Analytics and Optimization in Warehouse Management (6 Hours)	17-20	Optimizing order picking (2 sessions) Data Analytics in different functions – Inventory, Order fulfilment, Procurement and storage (2 sessions)	Haoyuan Hu, Ying Zhang, Jiangwen Wei, Yang Zhan, Xinhui Zhang, Shaojian Huang, Guangrui Ma, Yuming Deng, Siwei Jiang (2022) Alibaba Vehicle Routing Algorithms Enable Rapid Pick and Delivery. <i>INFORMS Journal on Applied Analytics</i> 52(1):27-41. Qin, H., Xiao, J., Ge, D., Xin, L., Gao, J., He, S., ... & Carlsson, J. G. (2022). JD. com: Operations Research Algorithms Drive Intelligent Warehouse Robots to Work. <i>INFORMS Journal on Applied Analytics</i> , 52(1), 42-55.

Learning Outcomes

After completion of the course, participants would be able to:

- Understand the Warehouse Management at different levels – operational, tactical, and strategic
- Apply tools and techniques to improve the warehouse operations.
- Understand the application of state-of-the-art technologies in Warehouse Management including the emerging Geospatial technology.