Programme of the course «Fundamentals of logistics infrastructure (warehouse) design» for bachelor students (educational direction 080500.62, profile «Logistics and Supply Chain Management»)

Government of the Russian Federation

Federal State Autonomous Educational Institution of the Higher Professional Education
"National Research University
"Higher School of Economics"

Faculty of Business and Management
School of Logistics

Programme of the course

FUNDAMENTALS OF LOGISTICS INFRASTRUCTURE
(WAREHOUSE) DESIGN

For the direction 080500.62 «Management» of the bachelor students education,
profile «Logistics and Supply Chain Management»

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I. Organizational and methodical part

Course «Fundamentals of logistics infrastructure (warehouse) design» was delivered in English to the bachelor students of the Higher School of Economics (HSE) first time in 2014/2015 academic year (1st and 2nd modules). The course accounts for 54 academic hours in total, including 24 contact hours. Significantly, a large amount of contact hours is devoted to the work in small groups including both HSE and exchange students in order to boost intercultural communication, exchange of experience and ideas.

Prerequisites for students

Students attending classes should have taken the following courses: «Foundations of logistics», «Economic support for logistics and supply chain management», «Operations management», «Supply chain management», «Functional areas of logistics», «Inventory management in supply chains».

The main purpose of the course is to establish the students’ competence in setting up and developing a company’s logistics infrastructure in line with the corporate, marketing and logistics strategies of an organization. The major emphasis will be made on warehouses and their kinds (e.g. distribution centres) as a backbone of the contemporary supply chains.

Training objectives

Having taken the course a student must:

- know the requirements for an effective and efficient design of a warehouse site layout;
- master necessary warehouse capacity and area calculations taking into account business development forecasts;
- be skilful in planning a warehouse loading bay and calculating the required number of docks;
- be familiar with loading zone equipment, its types and specifics;
- be able to take decisions on the necessary set of warehouse zones as well as on their optimum sizes;
- be skilled in material flows analysis (both inbound and outbound) in order to compose major technological assortment groups;
- understand how to develop efficient and effective material handling process in a warehouse taking into consideration peculiarities of every single technological assortment group as well as objectives of a warehouse as a whole;
- realize benefits and drawbacks of the different storage modes and racks;
- be aware of the various kinds of material handling machinery;
- be able to take advantage of the right selection of warehouse material handling and storage equipment;
- understand the conditions that make automation of warehouse operations feasible;
- comprehend the specifics of different modes of picking: pallet, cartons and eaches;
- be able to design layouts of major warehouse zones with respect to the elaborated processes of the material handling, evaluate the versions of the layouts and choose the most appropriate one;
- know how to make up the organizational structure of a warehouse.
Methodical novelty of the course

1. Material of the course is based on the real unique consulting projects completed by the experts of the HSE’s International Logistics Training Center and instructors of the School of Logistics. Those real data give students an opportunity to realize the topical issues of the contemporary warehouse logistics in Russia and take into account national specifics.

2. The course reveals specifics of the Russian warehouse market. In course of their analysis students will figure out that the market of warehouses in Russia is at the early stage of its establishment therefore major and most frequent issues are connected with the development of the logistics infrastructure rather than optimization of the existing facilities. However new warehouses in Russia often appear as a result of conversion from the former manufacturing premises, that is why complex reconstruction projects involving a set of restrictions are far more frequent in Russia than in the countries of Western Europe and the USA.

3. The course is based on the flexible and effective combination of different educational methods: lecturing enriched with small assignments for the students and dialogues with the audience, work in small groups consisting of the HSE and foreign exchange students at the selected case studies, individual and group presentations on the project tasks, intergroup discussions, and mini research of the markets (e.g. warehouses, material handling and storage equipment) carried out by the students on their own. To complete each task of the project students will be provided with a chunk of theory in a form of mini lecture that will be followed by teamwork resulting in group and individual presentations. Presentations will involve scenario analysis on every part of the project. All the delivered scenarios along with their strengths and weaknesses will be reviewed in course of all class discussions. This combination of methods allows to reach an active students participation in the classes and take advantage of learning by doing principle. Moreover, the scenario approach lies in a full compliance with case study method assuming that there are different ways of tackling an issue rather than a single right solution of the problem.

4. Unlike the traditional courses, the discipline in question will embrace vast video material, illustrating basic material handling equipment as well as cutting-edge warehouse technologies. Videos will help students to realize principles of warehouse operations and will make educational process more effective due to students’ vivid impressions on the subject.

5. The course might include guided tours to warehouse facilities of the commercial companies as well as logistics service providers (subject to fitting the tours into the students schedule and getting all the necessary permissions from the companies’ management). During the tours students will be able to have a look at different warehouse operations as well as various material handling and storage equipment.

Position of the course in the system of formed innovative qualifications

Course «Fundamentals of logistics infrastructure (warehouse) design» is a part of a cycle of professional disciplines. It is included in the block of subjects that support educational profile «Logistics and Supply Chain Management». This course is elective for the students of specialization «Logistics and Supply Chain Management».

The course is based on the knowledge that students can get from the preceding disciplines:
- «Foundations of logistics»;
- «Economic support for logistics and supply chain management»;
- «Operations management»;
- «Supply chain management»;
- «Functional areas of logistics»;
- «Inventory management in supply chains».
To master the course students should have following knowledge and competencies:
- knowledge of general logistics terms and notions, classification of logistics costs, elements of logistics infrastructure, major supply chain actors along with their functions, specifics of logistics functional spheres, types of inventory and main systems of inventory management, general characteristics of material flows, sorts of loads;
- skills of data mining from different sources (periodicals, special literature, web), data systematization and analysis, teamwork with roles assignment, presentation of analysis outcomes;
- ability to use Microsoft Office or Open Office software to group and analyze data, make necessary calculations, prepare presentations.

The knowledge that students get while studying the discipline will form a base for taking further bachelor’s and master’s courses listed below.
Courses for bachelor students:
- «Distribution logistics»;
- «Operations management in supply chains».

Courses for master students (Master programme «Strategic management of logistics»):
- «Strategic logistics infrastructure management»;
- «Management of logistical operations in supply chain»;
- «Optimization of investments into logistics infrastructure»;
- «Information technologies for logistics infrastructure management»;
- «Strategic development of corporate distribution network»;
- «Strategic planning of logistics infrastructure development».

As a result of studying the course «Fundamentals of logistics infrastructure (warehouse) design» students should gain following competencies.
General competencies:
- skill to apply quantitative and qualitative methods of analysis when taking management decisions as well as construct economic, financial and organizational-management models;
- ability to select mathematical models of organizational systems, analyze their validity, adapt models to complete specific management tasks;
- skill to design business processes and knowledge of methods of their reengineering;
- skill to use information, received in course of marketing research and best practices benchmarking, in an organization’s practical activity;
- ability to carry out analysis of an organization’s operations and use its results to make management decisions.

Professional competencies:
- ability to plan and take actions, both at tactical and operational levels, aimed at logistics strategy realization;
- ability to participate in the design of logistics department’s organizational structure as well as to assign authority and responsibility on the base of their delegation to the linear (operational) units inside a company’s logistics department;
- ability to plan and conduct logistics operations with reference to warehouse facilities;
- ability to choose material handling and storage equipment for a warehouse as well as optimize its logistics process;
- ability to optimize individual operations with the help of economic-mathematical models of logistics business processes, systems and supply chains.
II. Course contents

Novelty of the course

Novelty of the course involves the following elements:
- extensive use of case-studies based on the real life practical situations concerning the development of the logistics infrastructure under the conditions typical for the Russian business environment;
- use of continuous tasks for the students that are generally similar to the actual requirements specification for the logistics design of warehouse facilities;
- both theoretical and practical material of the course corresponds not only to the national educational standards (Federal state educational standard of the higher professional education for the direction 080200.62 «Management») but also complies with the respective provisions of the new generation of the European Qualifications Standards for Logistics Professionals (Level 4: Supervisory/Operational Management, block «Supply Chain and Logistics Execution», module «Warehouse»);
- all the practical assignments assumed in the course will be carried out in small groups including HSE students and exchange students from the partner universities to boost intercultural communication, exchange of knowledge and experience;
- flexible combination of different educational methods that will help students to make use of their creativity.

Thematic plan of the course

<table>
<thead>
<tr>
<th>№</th>
<th>Theme</th>
<th>Hours total</th>
<th>Contact Hours</th>
<th>Self-study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lectures</td>
<td>Seminars</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Design of warehouse premises external layout. Design of warehouse loading bay.</td>
<td>14</td>
<td>6</td>
<td>8</td>
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<tr>
<td>2</td>
<td>Calculation of the required warehouse storage capacity. Distribution and planning of warehouse zones.</td>
<td>11</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Material handling process at a warehouse. Selection of material handling and storage equipment.</td>
<td>14</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Space planning of warehouse zones.</td>
<td>11</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Organizational structure of a warehouse.</td>
<td>4</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>Total:</td>
<td>54</td>
<td>24</td>
<td>30</td>
</tr>
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</table>

Contents of the programme

Examples of the possible scenarios for the group work and discussions on the themes 1-5:
1) Reconstruction of the acquired facilities to establish a distribution centre of the federal retail chain under conditions that a part of the new complex should be used for the provision of the logistics services in the open market
2) Redevelopment of the former production facilities to set up a central warehouse of a trade holding company
3) Enlargement of a wholesaler warehouse facilities to provide additional logistics services for the supply chain counterparts
4) Enlargement of a manufacturer’s finished goods warehouse to handle expanding material flows.
Theme 1. Design of warehouse premises external layout. Design of warehouse loading bay.

**Theme outline:**

**Main references/books/reading:**

**Additional references/books/reading:**

Theme 2. Calculation of the required warehouse storage capacity. Distribution and planning of warehouse zones.

**Theme outline:**
Calculation of the company’s required warehouse storage capacity considering the prospects of the company’s business development. Assessment of the warehouse area in need (at a strategic level). Main, support and auxiliary (service) warehouse premises. Planning of the main warehouse zones. Calculation of the required areas of the receiving, storage and picking zones, receiving and shipping premises.

**Main references/books/reading:**

**Additional references/books/reading:**
Theme 3. Material handling process at a warehouse. Selection of material handling and storage equipment.

Theme outline:
Criteria for the formation of technological groups of goods. Processes and components of warehouse material handling. Factors that influence material handling process. Ways of material handling process description. Types and major characteristics of warehouse storage equipment. Factors influencing the choice of storage equipment. Types and major features of material handling equipment. Selection of the material handling equipment. Interdependence of warehouse material handling and storage equipment.

Main references/books/reading:

Additional references/books/reading:

Theme 4. Space planning of warehouse zones.

Theme outline:
Requirements for warehouse zones space planning. Factors that influence warehouse space planning solutions. Criteria for the assessment of comparative efficiency and effectiveness of the versions of space planning design.

Main references/books/reading:

Additional references/books/reading:

Theme 5. Organizational structure of a warehouse.
Theme outline:

Main references/books/reading:

Additional references/books/reading:

List of sample control and test questions
1. Major particulars and trends of the Russian warehouse property market.
2. Main requirements for the «A+» grade warehouse facilities.
3. Tasks of warehouse premises logistics design and proper sequence of their completion.
4. Requirements for the warehouse premises layout design.
5. Criteria for the assessment of the warehouse premises layout.
7. Requirements for the loading bay of the contemporary warehouse.
8. Types and specifics of loading bay equipment.
9. Identification of the optimum loading bay size.
10. Evaluation of warehouse storage capacity and area that are required to handle the defined material flows.
11. Types of warehouse premises. Assessment of the required area of warehouse zones.
12. Requirements for the material handling process at a warehouse. Major elements of the material handling process.
13. Order picking strategies, their specifics and conditions of choice.
14. Types of storage equipment and factors influencing its choice.
15. Types of warehouse material handling equipment. Criteria for the proper material handling equipment selection.
16. Material handling machines and storage equipment interdependence. Criteria for the selection of the optimal combination of the material handling and storage equipment.
17. Requirements for the warehouse internal layout design and space planning.
18. Assessment of the effectiveness and efficiency of the warehouse space planning options. Selection of the best possible option.
19. Major principles of the warehouse organizational structure design.

**Sample tasks for the self-study**
1. Define the optimum location of loading bay at a warehouse site.
2. Define the optimum location of the check point at the entrance to the warehouse site.
3. Define the place for the trucks’ parking.
4. Outline possible routes for the trucks at the warehouse site. Select the optimal routes.
5. Calculate the length of the loading bay. Locate the loading bay at the warehouse site.
6. Compose technological groups of goods.
7. Evaluate the required storage capacity for each technological group you have composed. Take into account the prospects for the company’s business development.
8. Identify the required set of warehouse zones and assess their areas in need.
9. Plan the internal warehouse layout (at least two variants for every major warehouse zone).
10. Plan the support and auxiliary warehouse premises.
11. Design major material handling operations referring to the specifics of the arranged commodity groups.
12. Formulate the major requirements for the storage and material handling equipment that will be used at the warehouse.
13. Select proper material handling and storage equipment. Calculate the required quantity of the material handling machines as well as the necessary amount of storage locations.
14. Develop several versions of space planning solutions in major warehouse zones. Evaluate the versions and select the best one.
15. Design the organizational structure of the warehouse.

**Sample themes of course projects**
1. Selection of the optimal order picking strategy.
2. Factors that influence feasibility of warehouse operations’ automation.
3. Ways of a warehouse logistics process improvement.
4. Prospects of the Russian warehouse market development.
5. Comparison of the Russian warehouse markets with the similar markets abroad.
6. Role of warehouse management systems in raising efficiency and effectiveness of material handling operations.
8. Influence of a company’s sphere of business on its warehouse operations and layout.
9. Retail distribution centres: specifics, typical issues, and ways of tackling them.
10. Ways of organizing effective and efficient material handling process at an e-tailer’s warehouse.
Forms of control

Current control is conducted during the workshops by questioning students about the issues discussed at previous classes as well as on the base on the assessment of students activity in course of group and individual work.

Intermediate control is carried out in form of the written tests on each of the studied themes. Every test normally contains 5-10 questions. Students are given 10-20 min. to complete the test.

The ultimate control is held in form of written examination assuming that students answer several questions on the subject. The examination takes 1 hour and 20 min.

The final grade on the course is put according to 10-point scale and it is formed on the base of the results of the students work at the seminars, their homework, examination mark and attendance of the classes. The final grade is calculated following the next formula:

\[ G_f = W_s*G_s + W_h*G_h + W_e*G_e + W_a*G_a, \]

where
- \( G_f \) – final (resulting grade)
- \( G_s \) – grade for the student’s work at the seminars
- \( W_s \) – weight of the grade on the seminars (\( W_s=0,2 \))
- \( G_h \) – grade for the homework
- \( W_h \) – weight of the grade on the homework (\( W_c=0,25 \))
- \( G_e \) – examination grade
- \( W_e \) – weight of the examination grade (\( W_e=0,5 \))
- \( G_a \) – grade on the attendance
- \( W_a \) – weight of the attendance grade (\( W_a=0,05 \)).

Grade for the student’s work at the seminars shall be calculated according to the following formula:

\[ G_s = W_a*G_a + W_t*G_t, \]

where
- \( G_a \) – grade for the student’s activity
- \( W_a \) – weight of the grade for the student’s activity (\( W_a=0,8 \))
- \( G_t \) – grade for the current tests (minitests given at the seminars)
- \( W_t \) – weight of the current tests’ grade (\( W_t=0,2 \)).