**MINISTRY OF EDUCATION AND SCIENCE,
YOUTH AND SPORTS OF UKRAINE**

KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

Guidelines to practical tasks of the educational discipline "OPERATIONAL MANAGEMENT"

**for full-time students
of the training direction
6.030601 "Management"**

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Затверджено на засіданні кафедри економіки, організації та планування діяльності підприємств.

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The content of workshops (seminars), methodical recommendations for their implementation and questions for students' knowledge consolidation are given.

It is recommended for full-time students of the training direction 6.030601 "Management".

Вміщено зміст практичних (семінарських) занять, методичні рекомендації до їх проведення і питання для закріплення знань.

Рекомендовано для студентів напряму підготовки 6.030601 "Менеджмент" денної форми навчання.

Introduction

Operational Management is a key element in the improvement of productivity of businesses around the world. Creating a competitive advantage through operations requires an understanding of how the operations function contributes to the growth of productivity.

The organization of the enterprise represents any productive process both in production and in service areas. Operational Management aims at providing an efficient and rational organization of this activity. If the operational functions are not carried out efficiently, the organization can never succeed. The qualitative development of operational management can improve the balance of the enterprise (organization) and its flexibility in order to be consistently competitive. Therefore, the study of theory and practice of operations management is always relevant in Ukraine both for industrial enterprises and enterprises that provide services.

Training course "Operational Management" refers to the normative disciplines' training for the students of the program "Management". It is a cycle of management disciplines required by managers of organizations regardless of ownership and legal form of management.

The purpose of the educational discipline "Operational management" is the formation of skills of operational strategies' development, establishment and use of operating systems as the basis for the attainment of the mission.

The object of the educational discipline is the operating system of the enterprise, its functions and purposes.

The subject is planning, development and effective utilization of the operating system's resources in the market conditions.

The task is mastering the knowledge of the theory of operating systems and planning skills as well as monitoring their activities to ensure effective management of the enterprise (organization).

The importance of the issues dealt with in the discipline is the need to understand basic principles, methods, the essence of effective operations, methods of operational management and the impact of operational management on the performance and competitiveness of enterprises (organizations).

1. Qualification requirements for students

The educational discipline "Operational Management" is referred to as a normative discipline that ensures the formation of skills provided by educational qualification characteristics.

The discipline provides the basic and overall legal training of students and is based on the subjects such as "Systems Technology", "Information and computer technology", "Operations Research", "Economy."

The discipline lays the foundation for further research of the disciplines related to industry specifics of each profession and specialization.

The knowledge of this discipline will help to successfully explore such subjects as "Strategic Management", "Innovation Management", "Personnel Management", take courses, and write a final thesis.

During the course students receive the necessary knowledge. The great importance in the study and consolidation of knowledge is the students' self-study training.

Competences of "Operational Management"

As a result of studying the discipline, students must

know:

essence of operational management and its components as one of the main functions of effective management of the organization;

fundamentals and categorical devices of operational management;

structure of operating systems, their classification;

essence and basic principles of operational processes;

basis of operational processes in space and time;

characteristics of the company's (organization's) infrastructure;

forms of organization of the production process;

essence, stages and phases of technical training;

composition and characteristics of business units for the production stage;

basis of comprehensive services in the operating system;

problems of the organization's operating strategy;

Basics of operating systems;

content and objectives for the operational planning and its role in increasing the operating system's efficiency;

elements of the operational planning and operational activities of the various types of operating systems;

methods of the current functioning of the operating system;

bases of quality management and performance management operations;

be able to:

create the operating strategy of the organization;

develop a specific operating system of the organization;

evaluate the effectiveness of the operating system;

determine the type of operating system;

justify the enterprise's production;

efficiently organize the production process according to scientific principles;

economically justify the feasibility of implementing new techniques and technologies in the enterprise;

use the tools of creation and reconstruction of production units;

choose a system of the operational planning of the specific operating system;

count calendar and plan specifications for different types of operating systems;

use project management techniques in specific contexts;

evaluate and plan quality in the operating system;

count the efficiency rates of operating systems.

2. Plans of workshops

A workshop is a form of instruction where a lecturer organizes students to review some theoretical disciplines and forms skills and experience of their practical application by individual student's performance of various tasks. Workshops include a preliminary control of knowledge, skills and abilities of students; teachers present a common problem and discuss it with students, solve problems with their discussion, solve control tasks, check and test.

Module 1. Operational strategy and managing change

Topic 1. Introduction to the field

1. Differences between services and goods.
2. Historical development of OM.

3. Current Issues in operational management.
***References*:** [1; 3; 7; 11; 13; 15; 18; 20].

Topic 2. Operational strategy and competitiveness

1. Competitive dimensions.
2. Manufacturing.
3. Developing a manufacturing in services.

***References*:** [1; 3; 4; 6; 7; 20; 23].

Topic 3. Project management

1. Pure project.
2. Financial project.
3. Matrix project.

***References*:** [1 ─ 3; 7; 13 ─ 16; 20; 23].

Topic 4. Product design

1. Quality function deployment.
2. Value analysis.
3. Value engineering.

***References*:** [2 – 5; 11; 16; 21].

Module 2. Process selection and design

Topic 5. Process analysis

1. Process analysis.
2. Process of throughput time reduction.

***References*:** [2 – 5; 11; 16; 21].

Topic 6. Manufacturing process selection and design

1. Types of selection.
2. Process flow structures.
3. Product process-matrix.

***References*:** [1 – 3; 7; 12 – 15; 19; 22].

Topic 7. Service process selection and design

1. Global product design strategy.
2. The global joint venture.

***References*:** [1; 7; 19; 22].

Topic 8. Quality management

1. The ISO 9000 series.
2. ISO 9000 certification.
3. Continuous improvement.

***References*:** [2; 3; 5; 8; 14; 17; 21].

Module 3. Supply chain design

Topic 1. Supply chain strategy

1. Outsourcing.
2. Value density.

***References*:** [1 – 6; 9; 17; 21].

Topic 2. Strategic capacity management

1. The rhythm.

***References*:** [1 – 3; 5; 7; 14; 19].

Topic 3. Lean production

1. Decisions tree.

***References*:** [1; 4; 8; 10; 12].

Topic 4. Operations consulting and reengineering

1. Aggregative planning.

***References*:** [1; 3; 4; 11].

Module 4. Planning and controlling the supply chain

Topic 5. Aggregate sales and operations planning

1. Planning of the one subject production line.
***References*:** [2; 5; 11; 16].

Topic 6. Inventory control

1. Planning of the multidisciplinary production line.
***References*:** [1; 3; 6; 8; 15].

Topic 7. Material requirements planning

1. Standard construction plan of the closed subject-area.
***References*:** [1; 2; 5; 6; 23].

Module 1. Operational strategy and managing change

Study guide to practical tasks on the topic "Manufacturing"

The aim of the exercise is to acquire skills of calculating economic efficiency of projected and introduced machines.

Conditions of the exercise are to determine comparative economic efficiency from the introduction of automatic line AL2, production of linear form by "green sand molding" (dimensions: 700x800x300mm) for manufacturing iron and steel casts. The line AL2 consists of three bloc-lines and ensures increase of productivity by matching series of transport and technological operations and by decreasing time of half-mold compaction. The line AL2, consisting of four bloc-lines, is taken as a base for comparison.

The terms of development and introduction are the same. Basic data and accepted designations are adduced in Table 1.

Table 1

Basic data

No.	Host data for the solution	Designations	Basic model	Projected for introduction model AL2
1	2	3	4	5
1	Inputs for projecting, UAH	K project	–	see table 2
2	Hourly capacity of one bloc-line		see table 2	
3	One bloc-line cost	C ol	see table 2	
4	Coefficient inputs for delivery, mounting and adjustment	K m	1.1	1.1
5	Equipment use factor timed	K ut	0.65	0.65
6	Installed capacity, kW		26	30
7	Electric motor use factor: - timed	K utm	0.7	0.7
	- by capacity	K uc	0.6	0.6
	- loss in system factor	K us	1.06	1.06
8	Electric motor’s performance factor		0.85	0.85
9	Cost of 1K.W.H. electricity	Ce	0.25	0.25
10	Consumption of compressed air, mi/f	Cca	1.8	1.8
11	Cost of 1 mi of compressed air, UAH	Cco	0.02	0.02
12	Number of workers, attending bloc in shift and their grade	R (human/ grade)	2/3	2/3
13	Annual valid time fund, hrs	Fv	3.645	3.645

Table 1. Cont.

1	2	3	4	5
14	Supplementary salary	K ss	8	8
15	Assignments for the social arrangements	K social	39.5	39.5
16	Realization of rate of output factor	K rr	1.11	1.11
17	Depreciation charges of standard	Sd	6	6
18	Annual repair outlay	Sr	see table 3	
19	Number of bloc-lines	n bl	4	3
20	Basic rate of the worker with the third grade per hour, UAH	R bh	1.8	1.8

The structures of bloc-lines by the number of equipment units, mechanisms, transport arrangement and metal constructions are the same, that is for three bloc-lines – three units of each mechanism, there are 4 units for four bloc-lines. Connected capital investments (communications, areas, etc.) don't change appreciably.

After determining the comparative economic efficiency from the introduction of automatic line AL2, calculate the next supplementary factors of a new form line:

1. Laboriousness of production per unit of produce (form)
2. Decreasing laboriousness
3. Number of conditionally released jobsites

Versions of tasks are adduced in Table 2.

Table 2

Versions of the tasks

Number of variant	K project, UAH	Hourly capacity of 1 bloc-line Form/hour, AL1/ AL2	C ol		Sr	
			AL1	AL2	AL1	AL2
1	2	3	4	5	6	7
1	36500	35/58	156 000	184 000	63 000	39 000

Table 2. Cont.

1	2	3	4	5	6	7
2	38000	38/62	162 000	190 000	63 500	39 500
3	36000	34/56	154 000	182 000	62 000	38 800
4	35800	32/54	152 000	180 000	61 000	38 000
5	37000	38/60	159 000	187 000	63 200	39 200
6	37500	36/60	161 000	189 000	64 100	40 200
7	37800	38/62	160 500	185 600	64 200	40 300
8	37400	40/64	162 500	188 500	64 100	40 200
9	38200	42/66	164 000	192 000	65 000	41 000
10	36000	36/58	158 000	186 000	61 400	38 600
11	36500	34/56	157 500	185 000	62 100	39 200
12	37000	36/58	159 000	187 000	63 300	39 400
13	36800	36/58	158 800	187 400	63 000	39 200
14	37400	38/62	162 400	188 400	64 100	40 300
15	37200	36/60	158 800	187 600	63 900	39 500
16	36400	34/58	158 600	187 400	62 100	39 100
17	36200	36/60	157 800	186 600	62 000	38 600
18	36000	34/56	159 000	186 000	61 000	38 000
19	36500	34/54	156 000	184 400	60 000	37 000
20	37300	36/60	160 000	188 000	64 000	40 000

Guidelines for doing the exercise

It’s necessary to use the following regulations during the exercise:

1. Annual economic effect from the introduction of new line AL2:

$$Ea = [(Ss1 + En\ Cis1) – (Ss2 + En\ Cis2)] \times Na_{AL2}, \quad (1)$$

where Cis1, Cis2 are capital investments for the 1 form production (specific), including inputs for purchase, mounting and adjustment of equipment by comparing versions AL1 and AL2;

Ss1, Ss2 are costs of manufacture of the 1 form production on AL1 and AL2;

En is capital investment’s efficient factor (0.1);

Na AL2 is annual productivity of line AL2.

2. Costs of manufacture for the 1 form production is calculated by the following formula:

$$Ss = Saoi : Na, \quad (2)$$

where Saoi is annual operational inputs.

3. Laboriousness of production per unit of produce (form) is calculated by the following formula:

$$L = (Fv \times nbl \times R) : Na, \quad (3)$$

where Fv is annual valid time fund

Nbl is the number of bloc-lines

R is the number of workers, attending bloc-line.

4. Decreasing laboriousness in percents:

$$\Delta L = \frac{L\ AL1 - L\ AL2}{L\ AL1} \times 100. \quad (4)$$

5. Number of conditionally released jobsites is calculated by the following formula:

$$\Delta R = \frac{\Delta L \cdot Na}{Fv}, \quad (5)$$

where ΔL is decreasing laboriousness in hours.

Payback period of the supplementary capital investments is not calculated because supplementary investments are not needed.

For the determination of comparative economic efficiency from the introduction of line AL2, it's necessary to calculate basic economic indicators for AL1 and AL2.

The calculation of the basic economic indicators for AL1 and AL2 is realized in the following way:

1. Annual productivity of line Na (unit) is the product of hourly capacity of 1 bloc-line, the number of bloc-lines, annual valid time fund Fv and equipment use factor timed K ut.

2. Capital investments:

2.1. For projecting, purchase, mounting and adjustment of equipment

$$Ci1 = Col \times Km \times nbl$$

$$Ci2 = Col \times Km \times nbl \times Kproject \quad (6)$$

2.2. For the 1 form production

$$Cis = \frac{Ci}{Na} \quad (7)$$

3. Operational inputs are calculated only for the variable items.

3.1. Annual depreciation charges:

$$Da = Ci \times Sd \quad (8)$$

3.2. Annual inputs on technological energy:

$$Ea = (N \times Fv \times Kut \times Km \times Kpc \times Ce \times nbl) \text{ : performance factor} \quad (9)$$

3.3. Annual salary fund for workers, attending bloc-line:

$$Fsa = Rbh \times Fv \times Kss \times Ksocial \times R \times nbl \times Krr \quad (10)$$

3.4. Annual inputs on consumable compressed *air:*

$$IAcc : Cca \times Cco \times N \quad (11)$$

3.5. Annual repair outlay Sr (look table 2)

Module 2. Process Selection and Design

Study guide to practical tasks on the topic "Process flow structures"

The aim of the exercise: Decision – making process is considered by a manager as a method to enable the achievement of strategic and operative purposes. The decision tree is applied in decision making under the conditions of risk or uncertainty in designing an operating system

$$EV = \sum_{1}^{n} Pj \times V_{ij}, \quad (1)$$

where EV is expected value;

P_j is probability of decision event;

V_{ij} is the received result.

Conditions of the exercise: The enterprise has decided to carry out capital or current reconstruction of the enterprise. There is an option – not to carry out reconstruction in general. If market reconstruction is successful it will bring profit of 80,000 UAH. If it's not the costs will be -40,000 UAH. If current reconstruction is successful it will bring 60,000 UAH of net profits and 30,000 UAH of losses if it's not. Probability of decision making totals 0.5.

Guidelines for doing the exercise

$EV_{CAPITAL\ RECONSTRUCTION} = 80,000 \times 0.5 – 40,000 \times 0.5 = 20,000$ UAH

$EV_{CURRENT\ RECONSTRUCTION} = 60,000 \times 0.5 – 30,000 \times 0.5 = 15,000$ UAH

$EV_{Without\ RECONSTRUCTION} = 0$ UAH

Conclusion: It is necessary to conduct capital reconstruction.

Task 1 (Example)

Before making a decision on the reconstruction, the manager decided to conduct market research, which will cost 5,000 UAH. The probability of successful research totals 0.6, unsuccessful research totals 0.4. The probability of favorable market for successful research amounts 0.67, unfavorable market totals 0.33. The probability of the favorable market for unsuccessful research totals 0.25, for unfavorable market totals 0.75. Without market research the probability of the favorable market equals the probability of adverse.

Build the decision tree. Choose the best variant.

Task 3 (Example)

The enterprise introduced a new line of details. The sale volume will be 100.000 units. The management considers 2 variants.

Variant A. For the production of 59 qualitative details per 100 probability totals 0,9 and for the production of 64 qualitative details per 100 probability totals 0,1. Solution **A** will cost 1,000,000 UAH.

Variant B. For the production of 64 qualitative details per 100 probability totals 0,8 and for the production of 59 qualitative details per 100 probability totals 0.2. Solution **B** will cost 1,350,000 UAH.

The cost price of a detail – 75 UAH, price of a detail – 150 UAH.

Task 4 (Example)

Before making a decision on the reconstruction, the management decided to conduct market research at the cost of 5,000 UAH. The probability of successful research – 0.6, unsuccessful – 0.4. The probability of favorable market for successful research – 0.67, unfavorable – 0.33. The probability of favorable market in the unsuccessful research – 0.25, unfavorable – 0.75. Without market research the probability of a favorable market equals the probability of adverse.

Build a decision tree. Choose the best variant.

Task 5 (Example)

The engineer decides to create or not to create a new line. If this line starts working he will receive profit – 20,000 UAH. If it doesn't the loss will constitute – 150,000 UAH. Probability of failure – 60 %. It is possible to conduct marketing research which costs – 100,000 UAH. The probability of successful research constitutes 50:50. If research is successful, the probability that new equipment will work – 90 %. If research is unsuccessful, the probability that new equipment will work – 20 %.

Module 3. Process Selection and Design

Study guide to practical tasks on the topic "Aggregate planning"

The aim of the exercise: Cumulative planning is used for determining quantity and time of production according to demand. For the best satisfaction of demand it is possible to use: regulation of speed of product output, change of level of necessary labor force, creation of stocks of necessary level, prediction of overtime, using an additional contract. The goal of such planning is to minimize the cost.

Cumulative planning provides the formation of strategic plan of the enterprise for the certain period.

Conditions of the exercise: According to marketing research about demand for electro pumps the businessman has decided to consider a new strategy of planning. It is based on using of 8 workers and overtime in all cases when the growing demand needs it. The initial data for calculations is presented in Table 1.

Table 1

Demand for months

Month	Demand	Quantity of the working days in a month
1	900	22
2	700	18
3	800	21
4	1,200	21
5	1,500	22
6	1,100	20

Every day 40 pieces of electro pumps are produced. Costs on storage for 1 unit per month – 5 UAH. For the production of 1 unit the businessman spends 1,6 hours overtime. Cost of one hour overtime – 7 UAH / year. The salary of workers – 40 UAH / day.

Guidelines for doing the exercise

1. Cost for salary = 40 UAH x 124 days x 8 workers = 39,680 UAH
2. Cost for overtime = 1,240 units x 1.6 UAH x 7 UAH = 13,888 UAH
3. Cost for storage = 80 units x 5 UAH = 400 UAH

Task 2 (Example)

The marketing department has presented the project of expectation of demand for 8 months (Table 2).

Table 2

Expectation of demand

Month	1	2	3	4	5	6	7	8
Demand	1,400	1,600	1,800	1,800	2,200	2,200	1,800	1,400

The operations manager considers 5 variants of the plan. Every plan begins with stock 200 pieces (units).The costs for storage – 20 UAH. The costs connected with losses of working hours aren't considered.

Plan A – change the number of workers according to demand. In January there were produced 1,600 pieces. The costs connected with hiring of additional workers – 5,000 UAH for 100 units. The costs connected with discharging of workers – 7,500 UAH for 100 units.

Plan B – production conforms to minimum demand (1,400 pieces). It is necessary to have an additional contract with payment for unit – 75 UAH.

Plan C – keep constant number of workers and the constant production volume equal to monthly average demand and change an inventory level.

Plan D – keep the number of workers who produce 1,600 units per month. The minimum level overtime – 20 % (from monthly production), with additional costs 50 UAH. for units. The maximum stock = 400 units.

Plan E – keep the number of workers who produce 1,600 units per month, using a subcontract.

Task

It is necessary to develop the plan of production for 5 months. The initial data is resulted in Table 3.

Table 3

Initial data

	Month				
	1	2	3	4	5
Demand	300	320	260	400	420
Capacity					
Work time	300	300	300	300	300
Overtime	40	40	20	20	20

The subcontract is possible for 200 units throughout 5 months. Starting stock – 0. In the end of the period the stock – 20 units. Costs per unit during

the work – 100 UAH is recommended. Costs per unit during the overtime – 125 UAH. Costs for the additional contract – 135 UAH. Storage costs for unit per month – 3 UAH.

Study guide to practical tasks on the topic "The rhythm"

The aim of the exercise: Rhythm is a strict accomplishment (realization) of the plan by quantity, quality, terms and nomenclature.

Conditions of the exercise: The mechanic shop should deliver 120 units of equipment a day. Actual (real) production per each day is presented in the table. Draw a conclusion after each method.

Table 1

Actual production per day

Decade	Working days	Actual production	Decade	Working days	Actual production	Decade	Working days	Actual production
1	1	110	2	11	130	3	21	135
	2	100		12	120		22	130
	3	140		13	120		23	110
	4	130		14	130		24	100
	5	110		15	125		25	100
	6	120		16	140		26	130
	7	130		17	110		27	120
	8	100		18	135		28	140
	9	115		19	110		29	140
	10	110		20	120		30	140

Table 2

Variant	exclude the working day from
0	1, 2, 8, 9, 15, 16, 22, 23, 29
1	2, 3, 9, 10, 16, 17, 23, 24, 30
2	3, 4, 10, 11, 17, 18, 24, 25
3	4, 5, 11, 12, 18, 19, 25, 26, 27
4	5, 6, 12, 13, 19, 20, 26, 27, 28,
5	6, 7, 13, 14, 20, 21, 22, 27, 28, 29
6	1, 7, 8, 14, 15, 21, 22, 28, 29
7	2, 8, 9, 15, 16, 22, 23, 30
8	3, 9, 10, 16, 17, 23, 29, 30
9	4, 10, 16, 17, 18, 22, 23, 27, 28

Method 1 (every ten days or decadal)

The planned coefficient of rhythm – the ratio between the quantity of working days in a decade and the quantity of the working days per month

The actual or real coefficient of rhythm – the ratio between actual production in a decade and actual production per month.

Method 2

Table 3

Calculation of daily average production percent

Quantity of working days				daily average production percent			
for a month	for a decade			planned	Actual for a decade		
	1	2	3		1	2	3

Planned average daily output is calculated in the following way: division of 100 % into quantity of working days per month.

Method 3

Table 4

Coefficient of rhythm of the program (implementation)

Working days	Production						The coefficient of rhythm of accomplishment of the program	
	planned		actual				For days	from the beginning of the month
	For days	from the beginning of the month	all		For rhythm calculation			
			For days	from the beginning of month	For days	from the beginning of month		

Method 4

Calculation of coefficient of rhythm by the variation coefficient

$$K_r = 100 - V$$

Method 5

The schedule of actual and planned production

Guidelines for doing the exercise

Method 1 (every ten days or decadal)

Table 1

Actual production per day

Decade	Working days	Actual production	Decade	Working days	Actual production	Decade	Working days	Actual production
1	1	110	2	11	130	3	21	135
	2	100		12	120		22	130
				13	120			
	4	130		14	130		24	100
	5	110		15	125		25	100
	6	120					26	130
	7	130					27	120
	8	100		18	135		28	140
				19	110			
				20	120			
∑	7	800		8	990		7	855

1. Planned coefficient of rhythm $_{\text{decade 1}}$ = 7 / 22×100 % = 31.8 %
2. Planned coefficient of rhythm $_{\text{decade 2}}$ = 8 / 22×100 % = 36.3 %
3. Planned coefficient of rhythm $_{\text{decade 3}}$ = 7 / 22×100 % = 31.8 %

1. Actual or real coefficient of rhythm $_{\text{decade 1}}$ = 800 / 2645 = 30.2 %
2. Actual or real coefficient of rhythm $_{\text{decade 2}}$ = 960 / 2645 = 37.4 %
3. Actual or real coefficient of rhythm $_{\text{decade 3}}$ = 800 / 2645 = 30.2 %

Method 2

Table 3

Calculation of daily average production percent

Quantity of working days				daily average production percent			
for a month	for a decade			planned	Actual for a decade		
	1	2	3		1	2	3
22	7	8	7	100 % / 22 = 4.5	30.2 / 7 = 4.3	37.4 / 8 = 4.6	32.3 / 7 = 4.6

Method 3

Table 4

Coefficient of rhythm of the program (implementation)

Production						The coefficient of rhythm of accomplishment of the program	
planned		actual				For days	from the beginning of the month
For days	from the beginning of the month	all		For rhythm calculation			
		For days	from the beginning of month	For days	from the beginning of month		
120	120	110	110	110	110	0.1	0.91
120	240	100	210	100	210	0.83	0.875
120	360	130	340	120	330	1	0.91
120	480	110	450	110	440	0.91	0.91
120	600	120	570	120	560	1	0.93
120	720	130	700	120	680	1	0.94
120	840	100	800	100	780	0.83	0.92
120	960	130	930	120	900	1	0.93

Module 4. Planning and controlling the supply Chain

Study guide to practical tasks on the topic "Planning of the one-subject line"

The aim of the exercise: Subjects of one name are produced on the one – subject lines and each workplace specializes in the production of one detail.

Conditions of the exercise: In the mechanical shop of the mass production type it has been proposed to organize a production line. The initial data is in the Table 1.

It is necessary:

to calculate a tact of the line;

to calculate the amount of workplaces and their loading.

to choose the period of the operation;

the graph (standard-plan) of the line's operation;

to calculate technological, transport, reserve and turnaround stocks.

Table 1

Initial data

	Rate of time for operation, min								Daily require-ment	Shifts	The detail characte-ristic
	01	02	03	04	05	06	07	08			
1	2	3	4	5	6	7	8	9	10	11	12
1	10.0	5.0	20.0	15.0	11.0	18.0	13.0	9.0	150	2	big
2	5.0	2.5	10.0	7.5	5.5	9.0	6.5	4.5	350	2	average
3	1.3	2.1	3.4	4.3	3.5	3.6	2.7	2.8	450	2	small
4	2.6	4.2	6.8	8.6	7.0	7.2	5.4	5.6	800	3	average
5	2.2	3.1	1.3	4.0	4.5	5.6	2.7	1.8	480	2	average

1. The tact of the line

$$r = \frac{Fef - T}{N}, \quad (1)$$

where F effective is effective time;

T is time of breaks = 0 min;

N is the start program of the line = daily requirement.

2. Amount of work places for each operation

$$C1 = \frac{T}{r}, \quad (2)$$

where T is rate of time for operation.

3. Load factor

$$K = \frac{C1}{C2}, \quad (3)$$

where C1 is calculated amount of work places;

C2 is accepted amount of work places (1,01=1, 1,1=2).

The coefficient of partial loading of a working place – it is a number which follows comma in C1

For determining the operating time of the line it is necessary to choose the period of the line's operation:

for a big detail – 60 min.

for an average detail – 120 min

for a small detail – 480 min

Table 2

Initial data

Operation No.	Rate of time for operation, min	C1	C2	K1	operating time of the line

Table 1

Guidelines for doing the exercise

Operation No.	Rate of time for operation, min	C1	C2	K1	operating time of the line
1	4	1.66	2	0.66	80.4
2	4.8	2	2	–	–
3	7.2	3	3	–	–
4	6.4	2.66	3	0.66	80.4
5	6.8	2.83	3	0.83	99.6
6	5.2	2.16	3	0.16	20.4
7	4.8	2	2	–	–
8	6.0	2.5	3	0.5	60

1. Technological stock.

$$Z = (C1 \times n\ w.p.) + n.c., \quad (1)$$

where n.w.p. – quantity of processed details on a workplace;

n.c. – quantity of details at the controller ;

m – quantity of operations.

2. Transport stock.

$$Z = p \times (m - 1), \quad (2)$$

where p – transfer detail.

3. Insurance stock

$$Z = Tf / r, \quad (3)$$

where Tf – time of faults on operations (10 – 15 min.).

4. Turnaround stock

$$Z = t \times (C2/\text{rate of time} - C2+1/\text{rate of time}+1). \quad (4)$$

Study guide to practical tasks on the topic "Planning of the multidisciplinary production line"

Conditions of the exercise: On the production line there were treated 5 details. The line works 20 days, 2 shifts lasting 8 hours. Time spent on the retooling of equipment – 5 %. The laboriousness and the program of production is in the Tab. 1.

Table 1

Initial data

Va-riant	Detail									
	A		B		C		D		F	
	N_i	T_i	N_i	T_i	N_i	T_i	N_i	T_i	N_i	T_i
1	2	3	4	5	6	7	8	9	10	11
1	1,000	80	1,500	60	200	30	200	25	300	20
2	4,000	18	5,000	16	4,000	12	6,000	8	5,000	14
3	2,000	40	3,000	30	4,000	15	4,500	12	6,000	10
4	1,200	35	1,800	25	2,500	6	6,800	12	3,600	8
5	2,600	11	4,800	24	3,600	8	2,500	12	3,800	17
6	3,600	12	2,400	18	3,800	34	5,600	24	2,800	32
7	6,800	8	6,200	4	4,600	11	5,300	18	4,200	9
8	500	24	950	18	670	65	340	75	770	52
9	900	29	1,200	48	680	55	590	48	370	64
10	2,400	25	2,800	18	4,200	34	8,600	12	7,700	12
11	1,100	65	1,580	50	2,300	20	2,100	15	2,900	15
12	3,500	20	4,500	18	3,500	14	6,500	10	4,000	16
13	2200	35	3300	25	4400	12	5100	8	7000	9
14	1500	30	1600	32	2800	12	7000	10	3200	6
15	2240	12	4500	26	3400	11	2200	11	3500	18
16	3370	11	2800	15	3200	32	5400	26	2600	33
17	6400	9	6400	3	4500	12	5100	19	4000	9
18	600	20	840	19	630	69	380	71	790	49
19	850	30	1400	42	580	62	610	44	450	56
20	2100	26	3200	14	4400	14	8500	11	7200	12
21	2400	22	1600	24	2880	32	5200	52	3990	19
22	6400	43	7400	69	1500	18	1300	25	2400	28
23	3350	24	6450	35	7800	54	3000	35	5000	25
24	870	18	960	12	780	22	930	9	480	8
25	560	8	490	9	780	8	1240	11	1400	12

Table 1. Cont.

1	2	3	4	5	6	7	8	9	10	11
26	2280	12	1600	12	3200	21	3350	29	2800	17
27	5300	24	3580	33	2840	32	6480	35	8200	38
28	850	8	970	11	780	8	880	9	780	7
29	2100	21	3100	22	4200	23	5300	24	6400	25
30	3200	65	4300	54	5400	43	6500	43	7600	53

Table 2

De-tail	N_i, unit.	T_i, min.	$N_i \times T_{дi}$	Δ_i	F_i		r_i, min./ unit.	C_1	C_2	K	n_i, unit.	R_1	R_2	Kl
					min.	Shift								
A														
B														
C														
D														
F														

1. N – program of production, unit
2. T– laboriousness, min
3. Fi (min.) – 20 working days × 2 shifts × 8 hours × 60 min. × (1 – 5 %)
4. Fi (shift) = Fi(min) / 60min. × 8 hours
5. ri = Fi(min) / N

Table 1

Guidelines for doing the exercise

De-tail	N_i, unit.	T_i, min.	$N_i \times T_{дi}$	Δ_i	F_i		r_i, min./ unit.	C_1	C_2	K	n_i, unit.	R_1	R_2	Kl
					min.	Shift								
A	600	20	12,000	0.0875	1596	3.325	2.66	7.51	8	0.93	1732	4.9	5	4
B	840	19	15,960	0.116	2116	4.408	2.51	7.56	8	0.94	1835.8	4.8	5	4
C	630	69	43,470	0.317	5782	12.04	9.17	7.52	8	0.94	502.4	4.8	5	4
D	380	71	26,980	0.196	3575	7.44	9.4	7.55	8	0.94	490.1	4.7	5	4
F	790	49	38,710	0.282	5144	10.7	6.5	7.5	8	0.94	708.8	4.8	5	4
				∑=1										

Study guide to practical tasks on the topic "Standard construction plan of the closed subject-area"

Conditions of the exercise: The mechanical shop specializes in producing a small range of details which have a similar technological process. The type of production is batch. The line works 20 days, 2 shifts lasting 8 hours.

The initial data is in the Tab. 1 and Tab. 2.

It is necessary:

to calculate the amount of workplaces and their loading.
to determine normative sizes of details and their periodicity.
the graph (standard-plan) of the line's operation.

Table 1

Variant	Number of details	Program, unit	Rate of time for operation, min, min **(t units)**					
			01	02	03	04	05	06
1	2	3	4	5	6	7	8	9
1	15	280	18	17	8	25	—	—
	60	280	13	15	7	20	—	—
	90	280	28	16	6	27	—	—
	20	310	15	14	7	—	15	16
	30	310	20	23	—	13	17	13
	40	310	21	18	13	24	25	20
2	15	260	10	12	10	20	14	3
	60	260	20	22	—	30	14	18
	90	260	23	17	18	35	9	7
	20	300	16	20	—	38	12	10
	30	300	20	24	24	34	8	6
	40	300	25	29	9	29	13	11
3	15	260	26	21	22	10	15	14
	60	260	28	18	12	15	8	3
	90	260	—	25	13	—	9	—
	20	280	25	16	18	16	6	19
	30	280	32	17	23	7	17	15
	40	280	33	35	18	15	—	7
4	15	360	25	27	9	10	13	14
	60	360	10	10	14	15	18	19

Table 1. Cont.

1	2	3	4	5	6	7	8	9
	90	360	11	13	15	16	9	20
	20	280	13	15	17	18	2	—
	30	280	18	20	22	23	—	—
	40	280	19	21	23	24	20	10

Table 2

Retooling time of equipment **(t1)**					
01	02	03	04	05	06
20	20	16	35	10	10

$$n_{min} = \frac{t1(100 - \alpha)}{\alpha * tu}.$$

Table 3

The number of detail	average daily requirement, units	calculated size, units	periodicity, days		normative, size, units	Number of starts per month
			calculated	accepted		
15						
60						
90						
20						
30						
40						

Table 4

Opera-tion	Laboriousness of the monthly program, min						Total, laboriousness min	C_1	C_2	Load factor
	15	60	90	20	30	40				

3. Independent work of students

An essential element of successful discipline's studying is the independent work of students that includes: processing of lectures, work on legislative, regulatory and instructional materials, preparation for seminars and workshops, processing questions submitted to independent work.

The main types of independent work are:
1. The study of lecture material.
2. Working with the recommended literature.
3. Study the key terms and concepts of the topics of the discipline.
4. Preparation for practical training and testing.

Topic 1. Introduction to the field

1. What is operations management?
2. Historical development of OM.

***References*:** [1; 6; 7; 11; 13; 15; 18; 20].

Topic 2. Operations strategy and competitiveness

1. The corporate strategy.
2. Developing a manufacturing strategy.
3. Operations strategy in services.
4. Types of movements of labor's subjects.

***References*:** [1; 3; 4; 6; 7; 20; 23].

Topic 3. Project management

1. Project management.
2. Managing resources.

***References*:** [1 ─ 3; 7; 13 ─ 16; 20; 23].

Topic 4. Product design

1. The product development process.
2. Measuring product development performance.

***References*:** [2 – 4; 5; 11; 16; 21].

Topic 5. Process analysis

1. Process analysis.
2. Process of throughput time reduction.

***References*:** [2 – 5; 11; 16; 21].

Topic 6. Manufacturing process's selection and design

1. Selection of specific process equipment.
2. Manufacturing process.

***References*:** [1 – 3; 7; 12 – 15; 19; 22].

Topic 7. Service process's selection and design

1. Service strategy: focus and advantage.
2. New service development process.

***References*:** [1; 7; 19; 22].

Topic 8. Quality management

1. Service quality measurement.
2. Development of quality specification.

***References*:** [2; 3; 5; 8; 14; 17; 21].

Topic 1. Supply chain strategy

1. Global sourcing.
2. Mass customization.

***References*:** [1 – 6; 9; 17; 21].

Topic 2. Strategic capacity management

1. Using decision trees in order to evaluate capacity alternatives.
2. Planning service capacity.

***References*:** [1 – 3; 5; 7; 14; 19].

Topic 3. Lean production

1. The Toyota production system.
2. Lean applications for line flows.

***References*:** [1; 4; 8; 10; 12].

Topic 4. Operations consulting and reengineering

1. Business process reengineering (BPR).
2. The operations consulting process.

***References*:** [1; 3; 6; 8; 15].

Topic 5. Aggregate sales and operations planning

1. Aggregate planning techniques.
2. The aggregate operations plan.

***References*:** [2; 5; 11; 16].

Topic 6. Inventory control

1. Multi period inventory systems.
2. Inventory planning.

***References*:** [3; 5; 17; 21].

Topic 7. Material requirements planning

1. Demand for products.
2. Forecasting demand.

***References*:** [1; 2; 5; 6; 23].

4. Questions for self-control

1. What is operational management?
2. What factors account for resurgence of interest in OM today?
3. Differences between services and goods.
4. OM in the organizational chart.
5. Operations as a service.
6. Historical development of OM.
7. Total quality management and quality certification.
8. Current issues in operational management.
9. What is operational strategy?
10. Operational competitive dimension.
11. Attacking through operations.

12. Productivity measurement.
13. Strategic fit of operational activities to strategy.
14. What is project management?
15. Structuring project.
16. Project control chart.
17. Managing resources.
18. Time-cost models.
19. The marketing-operations link.
20. The corporate strategy.
21. Types of processes.
22. Examples of process analysis.
23. Measuring process performance.
24. Designing for the customer.
25. Process of selection.
26. Break-even analysis.
27. Measuring product development performance.
28. Manufacturing process's selection and design.
29. An operational classification of services.
30. Designing service organizations.
31. Total quality management.
32. Quality specification and quality costs.
33. ISO 9000 Certification.
34. Basic formats of a product layout.
35. Group technology.
36. Fixed-position layout.
37. Office-layout.
38. The nature of services.
39. An operational classification of services.
40. Three contrasting service designs.
41. Supply chain's strategy.
42. Measuring supply chain's performance.
43. Outsourcing.
44. Value density.
45. Mass customization.
46. Capacity management in operations.
47. Capacity planning concepts.
48. Planning service capacity.

49. JIT logic.
50. JIT in service.
51. The Japanese approach to productivity.
52. Overview of operational planning activities.
53. Aggregate production planning.
54. Yield management.
55. Definition of inventory.
56. Purpose of inventory.
57. Inventory cost.
58. Inventory system.
59. Special purpose models.
60. JIT in services.
61. The Toyota production system.
62. Capacity focus, flexibility & planning.
63. Decision trees.
64. Independent versus dependent demand.
65. Material requirement planning's system.
66. Material requirement planning's structure.
67. Flow manufacturing.
68. Where can MRP be used?

5. Recommended references

5.1. Main

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Contents

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