

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY
ECONOMICS AND MANAGEMENT FACULTY**

Public Management and Administration Department

ECONOMICS OF PRODUCTION

**Methodical recommendations
for practical classes and individual work
for english-speaking students**

Production Functions

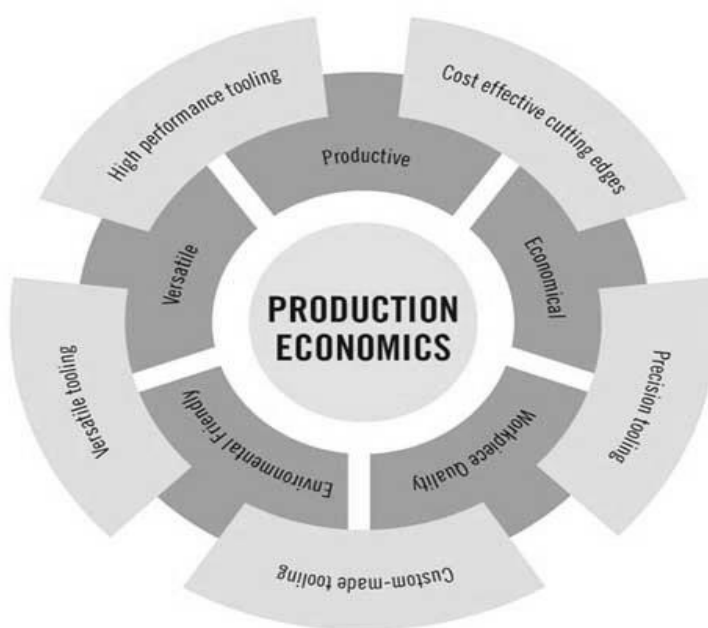


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**Methodical recommendations
for practical classes and individual work
for english-speaking students
of master's degree
of speciality 073 "Management"
Education Program "Administrative management"
for daily form of studying
General production economics model**



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Methodical recommendations are aimed to give students methodical assistance during the studying of "Economics of production" discipline. There are control questions, practical tasks, methodical recommendations for tasks solution, topics for report, questions and tasks for individual work, tests for self-control of knowledge and questions for preparing to examination presented.

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INTRODUCTION

Methodical recommendations for practical classes and individual work of “Economics of production” discipline for english-speaking students of master’s degree of speciality 073 “Management”, education program “Administrative management” for daily form of studying are designed relatively to the curriculum of “Economics of production” course.

The main goal of discipline’s studying is forming of deep student’s knowledges of theoretical bases of economic aspects of different agriculture production processes, such as plant growing and livestock production, forming the economic thinking for master's degrees of agrarian complex, enterprise and commercial approach to the production tasks decision. Besides, as the results of discipline’s studying, students must know the main features of certain plant growing and livestock production process, in particular, to know the systematization of output products and principles of their estimation, to know the methods of costs estimation and principles of marginal analysis, to know and to be able to use the methods of production processes efficiency estimation at practice, to estimate production and technical alternatives in plant growing and stock-raising, to analyze the results of general economy and public development from economic point of view.

Practical classes are the main element of “Economics production” course curriculum. Rational organization of practical studies is the important factor of effective mastering of theoretical bases of discipline that makes possible to use got knowledge and skills in practical tasks solving.

Studying the discipline during the practical employments allows forming the practical skills of decisions making, to provide the forming of modern economic thinking, to form the skills of practical incomes, costs and profit analysis and estimation of economic efficiency of various production processes in agriculture.

1. MODULE 1. DOCTRINE OF ECONOMICS OF PRODUCTION. BASES OF PRODUCTION THEORY

As the result of module’s studying students must know methods of management, essence of production function, variable production factors. Students must be able to apply and realize the production function essence, variable factors determinations etc.

1.1. THEME 1. METHODS OF PRODUCTION PROCESSES ESTIMATION

The aims of theme’s studying are:

- to learn the basic features of agriculture production process in general;
- to determine the limits of production process;
- to research the main elements of agriculture production output;
- to study the indices of input estimation and costs classification;
- to learn the indices of production efficiency estimation and their meaning.

Student must know the principles and theoretic bases of economy of production

and to be able to apply the theoretic bases in practice at different economic conditions:

- to determine the production process, its features;
- to learn the principles of differentiation of production processes;
- to calculate the sizes of production processes determination (output and input determination, efficiency).
- to know the principles of marginal analysis (calculation of costs, income).

Short content of theme

Production process is examined as the least unit of economy. Production processes are named by finish goods. Production processes are characterized by the sizes of output determination and indexes of production factors usage (Inputs).

There are the indexes of output determination: value of output (revenue, income) of basic and side products and half-finished products.

There are indexes of production means usage determination (Input): direct or indirect costs; fixed or variable costs; a half-finished products requirement; the fixed assets requirement (areas under the crops; working time requirement; machines requirements; building and construction requirement; limits of crop rotation).

The efficiency of certain production process is estimated by productivity (of areas, labour, capital), intensity and profitability. The important indices of profitability are: threshold of profitability (threshold of profit), threshold of production, marginal income, recoupment of production factors.

Threshold of profitability (threshold of profit) determines the price that is over than all costs.

The threshold of production marks a point where marginal value of certain product exceeds the maximum costs of its production. It means that marginal costs of product are less than its price. Thus, a threshold of production is the lower limit of production price.

Marginal income can be calculated by “Methodically actual marginal income” approach, “Practical method of marginal income calculation” and “Standard marginal income” approach.

Recoupment of production factors shows the recoupment of production factor by the certain production process realization. The calculating of recoupment bases on the calculation of total costs, but takes into account all values. It is calculated for estimation of area (UAH per 1 ha), labour (UAH per 1 man.-hour), capital (UAH per 100 UAH invested capital in average) usage.

Control questions:

- 1.Explain the costs differentiation into fixed and variable.
- 2.Explain the interrelation between the threshold of production, threshold of profitability and price.

Questions for discussion:

- 1.What does the feature of analysis and estimation of certain agricultural production process consist on?
- 2.Why does the necessity of differentiation of agricultural production processes exist? What is taken into account?
- 3.Why does the output estimation ground on market prices?
- 4.What does the “Living capital” represent itself? Why is it considered as circulating?
- 5.What does the necessity of alternative costs estimation consist on?
- 6.How to increase the intensity of production process?
- 7.Give the examples of using the standard marginal income estimation approach in practice.
- 8.What is the recoupment of production factors determined for?

Solve the tasks:

Task 1. Count the costs of fertilizers usage for the production process of «Growing of sugar beet» from next data. Productivity: sugar beet – 300 c/ha; the tops (forage) is 200 c /ha. Information about fertilizers usage is shown at Table 1.1.

Table 1.1. Initial data

Type of fertilizer	Requirement, kg/c		Price, uah/kg
	beet	tops	
N	0.18	0.35	1.1
P	0.09	0.11	1.3
K	0.25	0.59	0.5

Task 2. Expect the value of output of production process the «Spring barley» from next data: the productivity is 28 c/ha; a price of grain is a 430 uah/c; ratio of grain and straw is equal 1,1: 1; a substitution value of straw is a 0,3 uah/c.

Task 3. Count the thresholds of production and profitability of oat growing in Germany (per 1 c) taking into account a bonus. The data are given in the table below (Table 1.2).

Table 1.2. Initial data

Item	Size	
Productivity	45	c/ ha
Price	18	UAH / c
Bonus	479	UAH / ha
Variable Costs from MI *)	780	UAH / ha
A requirement of turnover means	468	UAH / ha
Expenses of work hours	5	man-hour. /ha
Salary	18	UAH / man-hour.
Lease of 1 hectare land	150	UAH / ha
Fixed costs of own mechanization per 1 hectare (Depreciation decrees, Expenses of capital, Maintenance)	235	UAH / ha
Indirect costs per 1 hectare	50	UAH / ha
Rate	6%	
*) the alternative costs of turnover means usage and salary are not taken into account.		

Task 4. Determine the economic efficiency of production process from next data: productivity of wheat is 4 t / ha, price is 200 UAH / t, threshold of production is 160 UAH / t, threshold of profitability is 210 UAH /t

Task 5. Will be there the need to increase the production of winter barley, if mechanization is completed. The next data are known: productivity is 3 t/ ha, price is 220 UAH /t, threshold of production is 180 UAH /t, threshold of profitability is 230 UAH /t.

Task 6. Count fixed costs of the enterprise technique usage, using next data: initial costs of technique are 150 thousand uah. Remaining costs of technique are 2 thousand uah. Duration of usage, years – 8. Own capital is 30%, calculation rate is 18%, bank rate for attracted capital is 22 %.

Task 7. Count the marginal income and recoupment of used capital (winter wheat production) using the next data. Annual output of grain is 280 c. The market price of grain is 200 UAH /c. The

sum of proportional variable costs is 30500 UAH. The requirement of capital per centner of grain is 30 uah.

Task 8. Count the recoupment of used areas (winter wheat production) using the next data. The household cultivates 10 ha of area. Productivity of area is 28 c/ha. The market price of grain is 200 UAH /c. Total costs of production are 42500 UAH, including the costs of areas usage (rent payments) – 20 000 UAH.

Methodical recommendations for tasks solving:

The general expenses of fertilizers (GEF) are calculated by:

$$GEF = \sum_{i=1}^n P_i * \sum_{j=1}^m R_j^i * Q_j, \quad (1.1)$$

where GEF - general expenses of fertilizers, uah; P_i – price of i-type of required fertilizer ($i=1\dots n$, for this case, N, P, K), uah; R_{ij} – requirement of i-type of fertilizer to produce the j- type of product ($j = 1\dots m$, for this case, sugar beet and tops), kg/c; Q_j - quantity of output of j-type of products (productivity of landed area).

The value of output (VO) is calculated by:

$$VO = \sum_{i=1}^n P_i * Q_i, \quad (1.2)$$

where VO – value of output, uah; P_i – price of i-type of products ($i=1\dots n$, for this case, grain, straw), uah; Q_j - quantity of i-type of products (productivity of landed area).

There is the necessary to determine the quantity of grain and straw. It is possible by decision the next equation: Quantity of straw – x, c/ha; quantity of grain – 1,1x c/ha: $1,1x + x = 28$.

The fixed costs of the usage of technique of enterprise per year include the sum of annual depreciation decrees (D) and costs of capital usage (CCU):

$$\text{Depreciation decrees } D = \frac{CFA}{UD}, \quad (1.3)$$

where CFA – cost of fixed assets (for this case, initial costs - remaining), uah; UD – usage duration, years.

$$CCU = C * r_{calc}, \quad (1.4)$$

where C – sum of used capital, uah, C I calculated the next way:

$$C = \frac{\text{Initial Value} + \text{Remaining Value}}{2}, \quad (1.5)$$

r_{calc} - calculation percent rate, which is calculated the next way:

$$r_{calc} = \frac{Q_{own} * r_{own} + Q_{loan} * r_{loan}}{Q_{own} + Q_{loan}}, \quad (1.6)$$

Q_{own} – quantity of used own capital; r_{own} – percent rate of own capital usage, %; Q_{loan} – quantity of used loan capital; r_{loan} – percent rate of loan capital usage, %.

The calculation of threshold of production is done the next way:

- 1) the estimation of variable costs reduced by subsidy plus costs of circulating capital usage – it is the threshold of production I (per ha and per 1 c)
- 2) TP I + salary – it is threshold of production II (per ha and per 1 c)
- 3) TP II + costs of area usage – it is threshold of production III (per ha and per 1 c)
- 4) TP III + fixed costs + indirect costs – it is threshold of profitability (per ha and per 1 c).

Make the conclusion about effectiveness of production, basing on the calculated sizes of threshold of production, threshold of profitability and price, taking into account the information shown at Table 1.3.

Table 1.3. Interpretation of thresholds of production and profitability

Conditions	Production has sense		The profit is got
	without an investment	with investment *)	
$P < TP < TPr$	no	no	no
$TP < P < TPr$	yes	no	no
$TP < TPr < P$	yes	yes	yes

P - Price (franco-court price); TP - Threshold of production; TPr - Threshold of profitability

* if all fixed factors must be again purchased

The recoupment of production factor (RF) is estimated by the calculation of marginal income (MI) and requirement of resource (RR):

$$RF = \frac{MI}{RR}, \quad (1.7)$$

Where MI – marginal income calculated per unit of products, uah, RR – requirement of production resource per unit.

The recoupment of production factor unit (RF_u) also can be estimated by the calculation of total revenue (TR) and total production costs (TC):

$$RF_u = \frac{TR - TC}{QR}, \quad (1.8)$$

Where TC – total production costs without costs, related with analyzed resource usage, uah, QR – quantity of used production resource.

1. MODULE 1.2. THEME

2. ESTIMATION OF CIRCULATING CAPITAL REQUIREMENT

The aims of theme's studying:

to define invariable and variable costs;
to determine the requirements of circulating capital at different agricultural production processes.

Student must know:

the principles of cost systematization and classification of production factors;
difference between fixed and circulating assets;
principles of circulating assets requirements estimation.

and to be able

to apply the theoretic bases in practical calculations of circulating capital requirement for different production process (plant growing, stock-raising industries).

Short content of theme

Circulating capital is the capital, which is used for purchasing production factors that are used during one production cycle. Animals with named before assets are united into a group "living and circulating capital", because animals execute similar with circulating production assets functions, from the economic point of view.

A requirement of living and circulating capital represents the average sum of the capital involved in the production process. Requirement of circulating capital depends on: the volume of resources expenses; duration of capital investment (date of invested capital return); possibilities of the further usage of the again created capital.

The long duration of capital investment is the characteristic of plant growing commodity goods production processes. For the calculation of requirement of circulating capital it is necessary to know the exact dates of payments and receivables. *The difference between these dates of payments represents the duration of investment of capital in days.*

Calculation of requirement of circulating capital at "Dairy cattle breeding" production process is the same to the plant growing production processes calculations. But there are some features: invested capital will return due to monthly receivables of sold milk and calves during realization of production process; it is accepted that a requirement of the capital, necessary for production of half of all basic forage in average, is distributed on all production period.

In the pigs growing production process a capital is releasing during its usage (like at the production process of dairy cattle breeding). Revenues of first and second farrows sold pigs cover production costs. At the calculation of forage costs it is accepted that 1/4 of annual requirement of forage are present on an enterprise constantly.

The duration of "Big horned cattle (BHC) breeding" and "Bulls fattening" production processes are more than 1 year. As unit of product it is taken one grown head of cattle per a year. Therefore payments that take place during more protracted period of time must be erected to annual. It is accepted to consider that the half of annual requirement of basic forage is present at an enterprise constantly.

Pigs fattening production period is less than 1 year. The invested capital releases and is again invested after every rotation of population.

Costs of the inlaid living and circulating capital in accordance with classification of costs belong to the proportionally-variable special costs and that's why at the calculation of marginal income together with other proportional special costs are subtracted from a total income.

Control questions:

1. How is the annual requirement of circulating capital calculated at plant growing?
2. How is the annual requirement of circulating capital calculated at dairy cattle breeding?
3. How is the annual requirement of circulating capital calculated at pigs growing?
4. How is the annual requirement of circulating capital calculated at pigs fattening?

Questions for discussion:

1. Why are the growing and fattening cattle considered as work in progress?
2. What do production stocks represent themselves?
3. How is the efficiency of circulating assets usage estimated?
4. What does the necessity of estimation of circulating capital requirement consist on? What is requirement of circulating capital determined by?

Solve the tasks:

Task 1. Estimate the efficiency of circulating assets usage, using the next data. Farmer treatments 12 ha of area. Harvest of grain is 60 c/ha, grain was sold by the price 30 uah/c, the volume of harvested side product (straw) is 80% of basic product. Straw was sold by the price 15 uah/c. The annual requirement of circulating capital for grain growing is 5000 uah.

Task 2. Estimate the annual requirement of circulating capital of plant growing production process, using the next data. Farmer is engaged in “Winter wheat” growing production process.

The area productivity is 50 c.

Price of grain is 30 uah/c.

The data are given in the table below (Table 1.4)

Table 1.4. Initial data

Payments (invested capital)	Sum, uah	Date of payments
Variable costs of mechanization, all:	95.00	
incl. VC of mechanization, autumn	57.00	30 of September 2017
VC of mechanization, spring	9.50	15 of February 2018
VC of mechanization, summer	28.50	30 of May 2018
Fertilizers	177.00	30 of September 2017
Seed	120.00	30 of September 2017
Means of plants protection, all:	100.00	
incl. Herbicides	65.00	15 of March 2018
Fungicides	35.00	15 of July 2018
Combaning	112.00	30 of August 2018
Insurance and drying of grain	48.00	30 of August 2018

The harvest was sold at market at 30 of September 2018.

Task 3. Estimate the annual requirement of circulating capital of plant growing production process, using the next data. Farmer is engaged in potato growing production process. The potato for sowing was bought at 15 of March 2017. Fertilizers were bought at 2 of March 2017. Means of plants protection were bought at 10 of June. The costs of resources consist in:

Costs of potato purchasing – 1.2 uah/c. Farmer purchased 5 t.

Costs of fertilizers purchasing – 0.8 uah/c. Farmer purchased 2 t.

Costs of means of plant protection purchasing – 1.2 uah/c. Farmer purchased 10 c.

Transportation costs – 0.5 uah/c.

The potato was harvested at 20 of August 2017 and sold at 5 of November 2017. The harvest was 15 t of potato and the market price was 2.5 uah/kg.

Task 4. Calculate the annual requirement of living and circulating capital of “Pigs growing” production process, using the next data:

Grown pigs 220.00 kg/year
 Price of pigs 15 uah/kg
 Requirement of work 18 man-hours
 Salary 1.5 uah/man-hour
 Sow price is 800.00 uah
 Repair of herd 40%
 The data are given in the table below (Table 1.5).

Table 1.5. Initial data

Payments (invested capital)	Sum, uah	Date of payments
Forage, all:	500.00	1 of January 2017
Costs of insemination, all	28.00	
incl. Costs of first insemination	14.00	15 of March 2018
Costs of second insemination	14.00	15 of September 2018
VC of mechanization and others	177.00	1 of July 2017

The pigs of first farrow were sold at 1 of April 2017 and of second – at 1 of October 2017.

Task 5. Calculate the approximate annual requirement of living and circulating capital of “Pigs growing” production process, using the next data:

The annual requirement of basic forage is 300 kg for 1 pig, the requirement of concentrative forage is 100 kg per 1 pig. Farmer has 100 pigs. The market price of basic forage is 100 uah/c, and price of concentrative forage is 150 uah/c. The market price of pedigree sow is 500 uah.

Methodical recommendations for tasks solving:

The estimation of circulating assets usage presupposes the calculation of coefficient of rotation of circulating assets (k_r), duration of 1 rotation (D_r).

1) the calculation of coefficient of rotation of circulating assets:

$$k_r = \frac{Income}{VCA} \quad (1.9)$$

where VCA – value of circulating assets, uah.

2) duration of 1 rotation (D_r) is calculated the next way:

$$D_r = \frac{365}{k_r}, \quad (1.10)$$

where 365 – the duration of analyzed period (year as a rule).

2. MODULE 2. ECONOMICS OF PLANT GROWING INDUSTRIES

As the result of module's studying students must know classification of costs and making in an agricultural production, costs of exploitation of fixed assets, basic aspects of economy of labour resources. Students must be able to realize production process determination, founding on the mastered theoretical theses of the module, to calculate the income, costs and profit of plant growing production.

2.1. THEME 3. GENERAL ECONOMIC ASPECTS OF PLANT GROWING

The aims of theme's studying are:

to investigate the structure and trends of plant growing (incl. modern trends all over the world);

to learn the principles of cultures systematization and types of crops by different criteria;

to research the structure and changes of area under crops usage;

to research the forms of arable land organization and principles of choosing the crop rotation;

to learn the principles of bringing of fertilizers, their types and substitution;

to investigate the types of plants protection measures.

Student must know:

the types of cultures and conditions of their growing;

forms of plant growing process organization (forms of land usage, crop rotations, machine and technique usage, implementation of works);

the forms of plants protection and principles of these measures implementation.

and to be able:

to determine the agrotechnical operations efficiency;

to calculate the marginal income of plant growing production process;

to estimate the efficiency of plant growing production processes.

Short content of theme

There are the criteria of cultures systematization: by area usage; agrarian-statistical account; arable and botanical distribution; by technical requirements, conditioned by harvesting.

Factors, that explain changes of treatment structure. Factors that conduct changes of productivity development.

Production processes of plant growing require economic reasonable decisions relatively: implementation of works and machines presence; bringing of organic and mineral fertilizers; geographical hygiene and plants protection.

Plants protection covers all measures, directed into receiving the healthy vegetation, free of negative influence on the productivity and quality of cultures by the fight against weeds, wreckers and illnesses. It is subdivided into 2 basic directions, depending on aims of plant protection: events aimed to the improvement of plants and their microenvironment (prophylactic plants protection); events aimed to the direct fight against reasons and danger of plants damage (active plants protection).

There are indices of estimation of degree of defeat of plants: threshold of harmfulness, threshold of fight. Results of plants protection can be divided into main and side: reducing of damage to the harvest, reducing of damage to the quality; side effect of productivity increasing.

Control questions:

1.Characterize the cereals.

2.Characterize basic, repeated and intermediate cultures.

3.Determine the bases and reasons of crop rotation choice.

- 4.Characterise the types of crop rotation.
- 5.Give the determination of thresholds of harmfulness and fight.
- 6.How are expenses of plants protection measures realization calculated?

Questions for discussion:

- 1.What determines the changes of incomes and costs in plant growing?
- 2.What determines the forms of arable land organization?
- 3.What do the features of mineral and organic fertilizers bringing consist on?
- 4.Why is it necessary to use means of plant protection?

Solve the tasks:

Task 1. Determine the optimal level of fertilizers bringing (nitric fertilizers), using the next data. There is the next function of the productivity of winter wheat depending on bringing of nitric fertilizers : $\text{Productivity}(y) = 50,1 + 0.3 * \text{kg of N/ha} - 0.063 * \text{kg of N/ha}^2$

The price of nitric fertilizers, including the expenses of bringing is 1,30 DM/of kg. The price of product is 27 DM/c.

Task 2. Calculate the high limit of costs of plants protection measures, using the next data. Production process of winter wheat growing without plants protection measurement is characterized by: productivity is 30 c/ha; requirement of labour for field works is 100 man-hour/ha; costs of additional operations during the harvesting and drying of grain is 150 uah/ha; ratio of commodity and forage grain is 1: 1.3. Production process of winter wheat growing within the plants protection measurement is characterized by: productivity is 40 c/ha; requirement of labour for field works is 75 man-hour/ha; ratio of commodity and forage grain is 1: 0,8. The price of commodity grain is 27 uah/c, forage grain – 15uah/c. Salary is 8 uah/man-hour.

Task 3. Calculate the marginal income of production process the «Winter wheat» from the next data: The productivity of grain is 30 c / ha

A price is a 500 uah / c

Grain : straw = 1,1: 1

A substitution value of straw is a 0,2 uah / c

Costs of seed – 300 uah.

Costs of fertilizers – 220 uah.

Costs of own mechanization – 250 uah.

Means of plant protection costs – 145 uah.

Costs of insurance and drying are 80 uah.

Task 4. A farmer has the opportunity to increase efficiency of production of grain by the improvement of technology of production (fertilizers, means of plant protection, mechanization). Production process (PP) 1 represents an actual situation. Production processes 2 and 3 are examined as alternative variants. The data are given in the table below (Table 2.1)

Table 2.1. Initial data

Item	PP 1	PP 2	PP 3
Gain of realization, uah /ha	3500	4200	4900
Variable costs (without salary and percents), uah. /ha	1500	1700	2300
Expenses of work hours, hours /ha	3	4	6

A requirement of turnover means presents 50 % of variable costs. Salary is 70 uah / hour, a capital can alternatively bring 10%. Fixed costs do not change in all three variants. Are alternative variants expedient? Ground your answer.

Methodical recommendations for tasks solving

Determination of the optimal level of fertilizers bringing presupposes the estimation of: amount of brought fertilizers, productivity, income, costs of bringing of fertilizers, marginal profit, basing on the given function that describes the dependence between the productivity and fertilizers amount.

The high limit of plants protection measures costs is determined in compare with economic results of production processes without and within the plants protection measures. So the high limit of plants protection measures is equal to the size of economic losses without them.

2.2. THEME 4. PRODUCTION OF COMMODITY GOODS OF PLANT GROWING

The aims of theme's studying are:

to learn the essence of production process of plant growing (winter wheat);
to expect the total income, variable costs, marginal income, production factors requirement;
to learn the aspects of marginal calculation;
to investigate the thresholds of production and profitability, productivity and recoupment of production factors.

Student must to know:

the principles of output value estimation, costs and requirement of production factors in plant growing;
the types of fertilizers requirement and their estimation;
the features of nutritives estimation (requirement, returns)

and to be able:

to apply the marginal method of production process estimation;
to calculate the indices of production process efficiency (threshold of production, profitability);
to determine the production factors requirement.

Short content of theme

A certain production process is designated through: value, variable special costs, requirement of factors.

Marginal income is estimated per 1 ha in a year, as a rule.

The harvest of wheat is divided into a flour-miller and feed-stuff wheat, depending on quality. The different market prices are formed depending on quality.

The straw is considered as a side product. There are used the different methods of straw account in calculations, depending on its usage: straw as commodity side product or straw as uncommodity side product (half-finished product).

Fertilizers are brought basing on the economic-actual requirement of fertilizers.

The expenses of bringing of means of plants protection are taken into account at the calculation of variable costs of mechanization (or at determination of costs of another's mechanization services).

Control questions:

- 1.How are the side products estimated?
- 2.How is requirement of fertilizers calculated?
- 3.What does the requirement coefficient characterise?
- 4.Characterise the items of proportional variable costs at plant growing production.
- 5.What do the other variable costs consist on at plant growing production?
- 6.What do the fixed costs consist on at plant growing production?

Questions for discussion:

1. What kinds of information are used at plant growing production processes estimation?
2. What does the feature of entrepreneur's profit consist on?
3. Why are the fixed and alternative costs calculated separately?

Solve the tasks:

Task 1. Count the fact requirement of fertilizers per 1 ha using the next data. The data are given in the table below (Table 2.2)

Table 2.2. Initial data

Type of fertilizer	Content, kg/c		Productivity, c/ha	
	grain	straw	grain	straw
N	2.3	0.4	60.0	66.0
P ₂ O ₅	0.7	0.4	60.0	66.0
K ₂ O	0.8	1.2	60.0	66.0

Coefficient of requirement of N is 1.1 and coefficient of usage is 40%.

Case 1) Straw is removed from field;

Case 2) Straw is remained at field and arabled.

Task 2. Expect a requirement of NPK in kg per 1 hectare of growing wheat, and also costs of fertilizers from the next data :

Harvest of grain is 5t/ha

Harvest of straw is 30% of harvest of grain

Coefficient of requirement of N is 1,2

Coefficient of N usage from straw is 0.4

A straw is remained at the field and arabled.

The data are given in the table below (Table 2.3)

Table 2.3. Initial data

Fertilizers	Reuirement, kg/t		Price, uah/kg
	grain	straw	
N	14.00	8.3	0.8
P	8.00	5.0	1.0
K	6.00	28.0	0.5

Task 3. Calculate the marginal income of production process of «Growing of sugar beets» from the data shown at Table 2.4.

Table 2.4. Initial data

Item	Size	
Productivity: sugar beet	300	c/ ha
tops (on forage)	200	c / ha
Price: sugar beet	6,00	Uah / c
Substitution value of tops	1,5	Uah / c
Necessity: seed	5,00	uah / kg
Price: Seed	15	kg / ha
Fertilizers: N	1,10	Uah / kg
Fertilizers: P ₂ O ₅	1,30	Uah / kg
Fertilizers: K ₂ O	0,50	Uah / kg

Item	Size	
Herbicide 1	40,00	uah/ l
Herbicide 2	60,00	uah / l
Fertilizers: N	0,18 kg / c – beet +	0,35 kg / c – tops
Fertilizers: P2O5	0,09 kg / c – beet +	0,11 kg / c – tops
Fertilizers: K2O	0,25 kg / c – beet +	0,59 kg /c – tops
Fertilizers: N – factor of necessity :	1,1	
Necessity: Herbicide 1	4	l / ha
Herbicide 2	2	l / ha
Repair	250	Uah / ha
Mechanization	300	Uah / ha

Methodical recommendations for tasks solving:

The estimation of actual requirement of fertilizers at plant growing production process is based on the next statements:

3) the estimation of losses of fertilizers (LF) for each type of products (basic and side):

$$LF = N * P, \quad (2.1)$$

where N – necessity (or content) of fertilize, P – productivity of land for each type of products

4) Requirement of fertilize (R_{remove}) will be calculated the next way, if straw is removed from field:

$$R_{remove} = LF * c_{req}, \quad (2.2)$$

where c_{req} is the coefficient of requirement of fertilize, for N it is given as initial conditions of task, for P and K it is 1.

5) Requirement of fertilize (R_{remain}) will be calculated the next way, if straw is remained at field:

$$R_{remain} = R_{remove} - LF * c_u, \quad (2.3)$$

where c_u is the coefficient of usage of fertilize, for N it is given as initial conditions of task, for P and K it is 100%.

The general requirement of fertilize is the sum of requirement of fertilize of basic and side products.

The next stage is estimation of costs of fertilizers purchasing.

2.3. THEME 5. FEED CROP PRODUCTION PROCESS

The aims of theme's studying are:

to consider the classification of feed crop production processes;
to learn the general aspects of feed crop production and forage improvement;

Student must know:

the types of feed crop production processes;
the classification of making in feed crop production;
to research the forage improvement process;
principles of marginal analysis at feed crop production.

and to be able:

to analyse the threshold of production and threshold of profitability of feed crop production;
to estimate the productivity of green crops.

Short content of theme

The production processes of feed crop production are classified by the landed area (cultivated feed crop production, pascual and meadow feed crop production, cultivating of intermediate cultures, use of side products); by the duration of cultivating (one-year cultures, perennial cultures, perennial meadows and pastures); by the method of forage usage (pasture of cattle, mowing on a green feed); by types of forage (green feed, silage, hay); by mechanization and duty cycles.

The feed crop production process is aimed to receive high harvests of nutritives calculating per 1 ha of forage area; production of basic feed with the least expenses and his preservation with minimum losses of dry substance and nourishing energy; achievement of the desired productivity of cattle by means of the use maximally possible amounts of basic feed, or, in other words, with minimum expenses of concentrated forage.

Forage is not commodity product so the parameters of estimation of forage can come forward: exit of nutritives (for example, StU per 1 ha); quality of forage, (concentration of nutritives); seasonality of forage receiving.

At determination of exit of nutritives it is necessary to take into account the following: at estimation the content of nutritives in a forage it is necessary to take into account dry substance content; at the calculation of losses the losses of dry substance and losses of nourishing energy must be differentiated. Losses of nourishing energy, as a rule, higher than losses of dry substance; however both strongly depend on the processes of harvesting and preservation.

Variable costs of feed crop production include: seed, fertilizers, means of plants protection, mechanization of production process and other expenses.

The marginal income of feed crop production process is always negative (on the size of variable costs), because forage is not commodity good and so there is no income, as a rule.

Control questions:

- 1.Name the aims and tasks of feed crop production.
- 2.How are the feed crop production products estimated?
- 3.How is the output of nutritive energy of forage calculated?
- 4.Give the classification of feed crop production processes.

Solve the tasks:

Task 1. Expect total marginal income (MI) of enterprise at optimal productive direction, if it is known: general area of agricultural lands presents 120 hectare, from them 15 hectare forage lands. Limitations of crop rotation: 60% grain-growing maximally. Limitation of sugar beets - 30 hectare. MI of winter wheat is 300 uah/ ha. MI of spring barley is 290 uah /ha. MI of sugar beet is 560 uah /ha. MI of dairy cattle breeding is 600 uah /ha (necessity is 0,5 hectare of forage lands).

Task 2. Expect a requirement of NPK in kg per 1 hectare of oat, and also costs of fertilizers usage from the next data:

- Harvest of grain is 4 t/ha;
- Harvest of straw is 0,8 of harvest of grain;
- Coefficient of requirement of N is 1,1;
- Coefficient of N usage from straw is 0.5;
- A straw is remained at the field and arabled.
- The data are given in the table below (Table 2.5)

Table 2.5. Initial data

Fertilizers	Requirement, kg/t		Price, uah/kg
	grain	straw	
N	14.00	8.3	0.8
P	8.00	5.0	1.0
K	6.00	28.0	0.5

Task 3. The production capacity of some technique isn't enough longer. Determine the sum of additional fixed costs, which the enterprise can allow to increase production and to be profitable.

Productivity is 3 t/ha

A price is a 220 uah / t

A threshold of production is 180 uah / t

A threshold of profitability is 230 uah / t

Task 4. Calculate the net-exit of forage and nourishing energy of feed, using the next data. Productivity is 700 c/ha. Content of dry substance (DS) is 15 %. Losses of DS are 14%. Content of DS in forage is 87%. Content of nourishing energy (NE) in harvest is 130 mJ/c. Losses of NE are 22 %.

3. MODULE 3. ECONOMICS OF LIVESTOCK PRODUCTION INDUSTRIES

As a result of module's studying students must know classification of livestock production industries, general economic aspects, features of production of main and side products. Students must be able to estimate output value and to calculate marginal incomes for each of production processes, founding on the mastered theoretical theses of the module.

3.1. THEME 6. GENERAL ECONOMIC ASPECTS OF LIVESTOCK PRODUCTION

The aims of theme's studying are:

- to consider a content and structure of livestock production;
- to research the modern trends in a livestock production;
- to learn the economic bases, basic tasks of animal breeding.

Student must know:

- the structure of livestock production and directions of its development;
- factors that determine the livestock production development;
- tasks of productive animal breeding.

and to be able:

- to estimate the costs and values of livestock production industries.

Short content of theme

A livestock production presents the second stage of agricultural production process. It does not need area directly, but requires it through a requirement of forage. Systematization of production animals can be done by the types of animals, by the types of output, by the forms of their maintenance and by the other production and technical features. Division by the criterion of feeding has the significant meaning from the economic point of view.

Kinds, volumes and organizational forms of maintenance of animals differ at different enterprises and in different regions. The determinatives are the following: climatic and economic location, production and personal relations, economy development with a changing production and technical, market and legal relations.

Control questions:

- 5.Name the aims and tasks of stock-raising production.
- 6.Name the main industries of livestock production.
- 7.Characterise the determinatives of kind and volume of stock-raising production.
- 8.Characterize the dependence on area for different types of cattle.
- 9.Characterise the ruminant and monogastric animals. Give the examples.

Solve the tasks:

Task 1. Expect depreciation decrees of technique and building usage using the linear method from next data:

- Amount of places for dairy cattle – 50
- Amount of places for pigs – 120
- Value of technique per 1 cattle-place for horned cattle – 350 uah.
- Value of building per 1 cattle-place for horned cattle – 100 uah.
- Value of building per 1 cattle-place for pigs – 80 uah.
- Value of technique per 1 cattle-place for pigs – 200 uah.
- Duration of technique usage – 8 years
- Duration of building usage – 15 years

Task 2. Count fixed costs of technique usage, using next data: initial costs of technique are 120 thousand uah; remaining costs of technique are 10 thousand uah. Duration of technique usage is 10 years. Own capital is 60%, calculation rate is 18%, bank rate for attracted capital usage is 22 %.

Task 3. Count fixed costs of technique usage, using next data: initial costs of technique are 100 thousand uah; remaining costs of technique are 2 thousand uah. Duration of technique usage is 8 years. Own capital is 50%, calculation rate is 18%, bank rate for attracted capital usage is 22 %.

3.2. THEME 7. DAIRY CATTLE BREEDING

The aims of theme's studying are:

- to consider the general bases (features of dairy cattle breeding);
- to learn the principles of output estimation (milk, litter, for slaughter cattle etc.);
- to research the principles of forage production costs estimation;

Student must know:

- the forms of dairy cattle breeding output (basic and side products);
- the methods of output estimation;
- the method of forage requirement estimation.

and to be able:

- to determine the necessity of nutritives and forage;
- to estimate value of dairy cattle breeding production output.

Short content of theme

The dairy cattle breeding in an agricultural enterprise can not be examined independently from other production processes: a dairy animals consume the forage produced by feed crop production industry; for utilization of the got organic fertilizers the enterprise, as a rule, need own area; the litter got from dairy cows can be used for intrahousehold aims; heifers can be used for repair of basic herd.

So, there is the necessity to differentiate the dairy cattle breeding from other production processes.

The value of the produced commodity products in the dairy cattle breeding include: the produced milk; for slaughter cattle; litter; organic fertilizers (at methodically actual marginal income calculation – only for the intrahousehold usage).

To the variable costs of dairy cattle breeding belong, as a rule: the costs related to repair of basic population; the costs related to growing of young animals up to sale; costs of forage; variable costs of mechanization of production process; other variable costs (for example: veterinary, insemination, water, electricity, control of the milky productivity of cow etc.).

Estimation of forage production costs has such features: the forage, which can be sold, are estimated by the market prices. The costs of own production of basic forage don't relate to variable costs of stock-raising processes.

The incomes of feed crop productions are not estimated as a rule. The feed crop production costs are considered as cattle breeding costs only owing to agregation of feed crop and stock-raising production.

The requirements of basic or concentrate forage are estimated basing on the feed ration.

Necessity amount of concentrative forage is determined by the basis of cow productivity. The basic forage requirement is calculated as difference beetween the general requirement of nourishing substances and their maintenance in concentrative forage. There is the necessity to take into account the feeding losses.

At determination of variable costs of mechanization it is necessary to define the point of feed crop production and stock-raising differentiation. In this connection, bringing of organic belongs to the costs of stock-raising, costs of storage and warehousing of forage – to feed crop production.

Marginal income calculating per 1 MJ of nourishing energy of basic forage gives the information about its further usage.

Control questions:

- 1.How is the aggregation of cattle breeding and feed crop production done?
- 2.What are the main parts of output in dairy cattle breeding?
- 3.What does the price of milk depend on?
- 4.How is the annual percent of defected animals estimated?
- 5.What does the requirement of forage depends on?

Solve the tasks:

Task 1. Calculate the value of output of production process the «Dairy cattle breeding» from next data:

Annual hopes of milk are 4 thousands l;

Price of 1 l of milk is 1,2 uah;

Weight of cow is 480 kg, realization weight of calf is 90 kg;

Period of lactation – 305 days;

Period of maintenance in a basic herd – 4 years (for slaughter product is 50% of output);

Loss of cattle – 10%;

Price of meat is a 25 uah / kg;

Price of calf is 8 uah/ kg of living mass;

Exit of pus per 1 conditional head – 16 m3

Contents of nutritives in manure are shown below (Table 3.1).

Table 3.1. Initial data

Nutritives	Amount, kg/m3	Price, uah/kg
N	5.2	1.1
P	2.2	1.3
K	5.5	0.5

Task 2. Expect the value of fertilizers from production process the «Dairy cattle breeding», taking into account next data:

Living weight of cow is 620 kg;

Exit of pus –16 m3 per one conditional head (500 kg);

Losses of N are 60%. The data are given in the table below (Table 3.2)

Table 3.2. Initial data

Nutritives	Amount, kg/m3	Price, uah/kg
N	5.2	0.8
P	2.2	1.0
K	5.5	0.5

Task 3. Count the price of milk from the next data. Milk content: 7% of fat, 5% of protein. Basic price of milk is 5.5 uah/kg, additional price of 1% of fat is 0.17 uah/kg, for 1% of protein is 0.15 uah/kg. Value added tax is 20%.

Task 4. Calculate the value of output of dairy cattle breeding production process from the next data. The term of cows usage is 4.3 lactations. Intercalving period is 390 days. Annual amount of breded cows at the farm are 150. The price of beef is 55 uah/kg. Value added tax is 20 %.

Task 5. Calculate the requirement of forages for dairy cow from the next data. Milk contents 7% of fat, 5% of protein. Annual hopes of milk are 6000 kg/year.

Methodical recommendations for tasks solving:

Estimation of litter presupposes the calculation of quantity of litter (QL) per year and estimation of its value (VL).

$$QL = \frac{365}{IntercalvingPeriod} - LossOfCattle, \quad (3.1)$$

$$VL = QL * CalfWeight * Calf Price, \quad (3.2)$$

Calculation of value of meat (for slaughter cattle) is done by:

1) estimation of quantity of old animals for slaughter (QSA) within the losses

$$QSA = \frac{1}{MaintenanceDuration} - LossOfCattle, \quad (3.3)$$

2) estimation of value of sold meat (VSM):

$$VSM = QSA * CowWeight * SOW * Meat Price, \quad (3.4)$$

where SOW – weight of output for slaughter.

Estimation of organic fertilizers value at cattle breeding production process (dairy cattle breeding) depends on the output of processing substances and their prices. So the value is calculated by:

$$V_{o.f.} = \sum_{i=1}^n Q_i * P_i, \quad (3.5)$$

where Qi – quantity of i-type of processing substance in organic fertilize, kg/m3; Pi - price of i-type of processing substance in organic fertilize, uah/kg.

There is the necessity to take into account the losses of N, so the quantity of N must be reduced on the size of losses.

3.3. THEME 8. BREEDING AND FATTENING OF BIG HORNED CATTLE (PEDIGREE HEIFERS AND FATTENING BULLS)

The aims of theme's studying are:

to investigate the features of big horned cattle breeding and fattening production processes;
to research the principles of production process estimation.

Student must know:

the content and structure of big horned cattle breeding and fattening production processes;
the content of variable costs, output.

and to be able:

to calculate the output value of breeding and fattening of big horned cattle production process;
to estimate the living and circulating capital requirements.

Short content of theme

Big horned cattle breeding production process requires basic forage of own production. It leads to the necessity of dividing production process into such as feed crop production and cattle maintenance.

The main feature of big horned cattle breeding is the duration of production process. The duration of it is more than 1 year, as a rule. So the all costs, related to this process are took into account. The marginal calculation is formed depending on head of cattle, but not 1 cow per year in average.

There are the factors, considered in calculation of income of big horned cattle production process: products of high pedigree and unpedigree animals; loss of cattle during the breeding period; organic fertilizers output.

There are the factors, considered in calculation of income of big horned cattle fattening production process: products of fattening bulls; loss of cattle during the fattening period; got organic fertilizers.

All animals are estimated by market prices, independently of the aim of their usage (sale or herd repair). There is the distribution of sold bulls into live or slaughtered mass.

The value of fertilizers is calculated basing on the equivalent of mineral fertilizers, expressed in net output of nourishing substances (NON). The assimilated nourishing substances are estimated basing on the prices of NON as mineral fertilizers.

The requirements of basic or concentrate forage are estimated basing on the feed ration. The requirement of nourishing substances for 1 head of cattle depends on: live mass of animal; accretion of live mass during the breeding period; requirements for cows with calves; motion.

The requirement of nourishing substances is divided into: requirement for vital functions support; requirement for meat productivity provision (accretion of live mass, motion).

In practice the requirement of energy for heifers is expressed as MJ net energy and for fattening bulls as starch unit (StU).

Control questions:

- 1.How is quantity of grown animals estimated?
- 2.What does the revenue of BHC growing production process consist on?
- 3.How is quantity of fattened calves estimated?
- 4.How is requirement of nutritives in forage calculated?
- 5.What is the aim of feed crop production and cattle breeding aggregation?

Solve the tasks:

Task 1. Expect the value of fertilizers of production process «Fattening of bulls», taking into account the next data:

Initial weight is 120 kg;

Duration of fattening – 480 days;

Eventual weight is 650 kg;

Age sale – 19,5 months;

Exit of pus – 16 m³ per one conditional head (500 kg);

Losses of N are 60%. The data are given in the table below (Table 3.3)

Table 3.3. Initial data

Nutritives	Amount, kg/m ³	Price, uah/kg
N	5.2	0.8
P	2.2	1.0
K	5.5	0.5

Task 2. Expect the value of output of production process «Fattening of bulls», from next data:

Initial weight is 100 kg;

Duration of fattening – 480 days;

Eventual weight is 650 kg;

Age sale – 19,5 months;

Exit of pus – 16 m³ per one conditional head (500 kg);

Losses of N are 55%;

Slaughter product output – 60%;

Price of meat is 25 uah /kg. The data are given in the table below (Table 3.4)

Table 3.4. Initial data

Nutritives	Amount, kg/m ³	Price, uah/kg
N	5.2	0.8
P	2.2	1.0
K	5.5	0.5

Task 3. Calculate the annual requirement of living and circulating capital of “Big horned cattle growing and bulls fattening” production processes, using the next data:

Fattening duration – 18 monthes;

Requirement of work is 40 man-hours;

Salary is 7 uah/man-hour.;

Requirement of basic forage is 21000 mJ / head;

Value of basic forage is 0.018 uah/ MJ. The data are given in the table below (Table 3.5)

Table 3.5. Initial data

Payments (inlaid capital)	Sum, uah
Value of calf	200.00
Concentrative forage per head	400.00
VC of mechanization and others per head	150.00

3.4. THEME 9. PEDIGREE PIGS BREEDING

The aims of theme's studying are:

to consider the differences from other production processes;
to research principles of output value, variable costs and profit forming.

Student must know:

the production factors requirement determination;
the aspects of costs and profit calculation;

and to be able:

to estimate the output value and costs level.

Short content of theme

Pedigree pig breeding does not depend on basic forage production and relatively on agricultural area, as a rule. The unit of production process "Pedigree pigs breeding" estimation is maintenance of 1 sow per year. This includes some farrows on a year, as a rule. The value of output includes: received animals; slaughtered weight of basic animals; organic fertilizers. Value of sold slaughtered animals depends on: average duration of basic sows usage; losses of cattle; meat price.

The indicator of average duration of sows usage shows the amount of defected basic animals in average (the basic herd repair). If the losses of cattle are not taken into account, so the amount of defected old sows and amount of new young sows will be the same.

The variable costs of pedigree pigs maintenance include, as a rule: costs of basic herd repair; costs of pigs growing for sale weight (or before the start of their own usage); forage costs; costs of process mechanization; other variable costs (veterinarian, insemination, water, electricity, sale).

Control questions:

- 1.What does the difference between BHC and pedigree pig breeding consist on?
- 2.What is the unit of production of pedigree pig growing production process?
- 3.How are the forage costs estimated?
- 4.What do the variable costs of mechanization consist on?
- 5.What do the other variable costs include?

Solve the tasks:

Task 1. Farmer is engaged in growing of pigs for sale, production complex counts 58 places. Expect the annual value of output of production process of «Growing of pigs» from next data (the data are given in the table 3.6).

Table 3.6. Initial data

Item	Size	
Output of pigs	12	on a 1 sow per year
Losses during growing	5%	for a year
Value of organic fertilizers	50	uah /pig per a year
Weight of slaughtered pig	28	kg
Exit of slaughtered weight	78%	
Term of pig usage	4	years
Price of 1 pig	300	uah.

Task 2. Estimate the value of output of pigs growing production process from the next data:

The amount of growing pigs – 20. The weight of realization is 30 kg. Basic price is 200 uah (pig weight is 25 kg) the price of additional weight is 8 uah/kg. General amount of manure – 100 m3. Losses of N are 40 %. The data are given in the table below (Table 3.7)

Table 3.7. Initial data

Nutritives	Amount, kg/m3	Price, uah/kg
N	5.2	0.8
P	2.2	1.0
K	5.5	0.5

Task 3. Calculate the total costs, profit and profit of entrepreneur of pedigree pigs growing production process from the next data. Value of output is the same as in the task 2 (previous task). Costs data are given at the table 3.8.

Table 3.8. Initial data

Production resources usage	Expenses	Attracted, %	Own, %
Proportional-variable costs	1800.00 uah/sow		
Work expenses	18.00 man-hours	30	70
Basic salary	15.00 uah/man-hour	120	100
Circulating assets	1500 uah		100
Percent rate of assets (capital) usage		17	15
Fixed assets	2400 uah	50	50

Methodical recommendations for tasks solving:

The estimation of total costs, profit and entrepreneur's profit presuppose:

- 1) Estimation of variable costs (are equal to proportional-variable costs);
- 2) Estimation of variable costs I (taking into account expenses of circulating capital usage only at the calculation of total costs and entrepreneur profit).
- 3) Estimation of variable costs II (taking into account costs of work force usage, own work costs only at the calculation of total costs and entrepreneur profit).
- 4) Estimation of variable costs III (taking into account costs of area usage).
- 5) Estimation of fixed and indirect costs (estimation of costs of fixed assets (capital) usage, costs of own fixed capital usage are took into account only at the calculation of total costs and entrepreneur profit).
- 6) Estimation of total costs, profit and entrepreneur profit.

3.5. THEME 10. PIGS FATTENING

The aims of theme's studying are:

- to consider the features of pigs fattening up production process;
- to investigate variable costs, marginal income, the production factors requirement;
- to consider the aspects of output value and costs estimation.

Student must know:

principles of estimation of requirement of living and circulating capital;
principles of costs of pigs fattening estimation.

and to be able to estimate the productivity of production factors usage.

Short content of theme

Pigs fattening does not depend on basic forage production and relatively on agricultural area as a rule. The unit of "Pigs fattening" production process estimation is maintenance of 1 sow per year.

General additional weight is calculated as difference between the end weight of cattle and initial weight.

Market price of pork is determined by demand and proposition correlation mostly and so is significant various. The fluctuations of pork market prices are called "Pig cycles"

There are distinguished 2 forms of pork sale: sale of living weight; sale of slaughtered weight.

Control questions:

- 1.Name the forms of pork sale.
- 2.How is the quantity of fattened pigs estimated?
- 3.How is the quantity of organic fertilizers estimated?
- 4.How is the annual requirement of living and circulating capital estimated?

Solve the tasks:

Task 1. Determine the average daily accretion of pig's weight from the next data. The initial weight of pig is 25 kg. The end weight is 120 kg. The duration of fattening is 158 days.

Task 2. Calculate the proportional-variable costs related with repair of basic herd from the next data. The initial weight is 30 kg. Basic price is 200 uah (pig's weight is 25 kg) the price of additional weight is 8 uah/kg. Duration of production process (fattening) is 167 days.

Task 3. Calculate the annual requirement of living and circulating capital of "Pigs fattening" production process (per 1 head and per 1 cattle-place), using the next data:

Fattening duration is 122 days

Requirement of work is 1 man-hour per head

Salary is 7 uah/man-hour. The data are given in the table below (Table 3.9)

Table 3.9. Initial data

Variable costs (VC) (per 1 cattle-place in year)	Sum, uah
Value of pig	200.00
Concentrative forage	140.00
VC of mechanization and others per head	60.00

4. TOPICS FOR ESSAYS

1. Marginal analysis: essence, methods, scopes.
2. Basic and side products of various agricultural production processes (plant growing, stock-raising etc.).
3. Costs classification approaches (criteria).
4. Resources differentiation into fixed and turnover means.
5. Modern trends of agriculture productivity development.
6. Modern trends of agriculture development in different countries.
7. Structure of circulating assets in agriculture: world trends.
8. Methods of calculation of costs of living and circulating capital usage.
9. Criteria of circulating assets usage efficiency estimation.
10. Circulating capital cycle and its features in agriculture.
11. Means of plant protection: modern trends and ecological influence.
12. Modern trends of arable land treatment.
13. Precision farming.
14. Systematization of cultures in plant growing.
15. Plant growing production processes: types, features.
16. World trends of plant growing development.
17. Organic (green) agriculture: essence, content, trends.
18. Classification of feed crop production processes.
19. Feed crop production: types of grown cultures.
20. Interrelations between feed crop and stock raising production.
21. Ecological problems related with stock-raising industries.
22. Classification of animals in stock-raising.
23. Modern trends of livestock production development.
24. Modern types of animals for breeding.
25. Modern technique for area treatment.
26. Modern trends of dairy cattle breeding development.
27. Trends of dairy cattle breeding development in different countries.
28. Dairy cattle breeding and genetic modified organisms' usage.
29. Tell about modern trends of agriculture development in different countries (EU, Africa, USA and Canada).
30. The trends of plant growing development in different countries.
31. The trends of stock-raising development in different countries.
32. The problems of agriculture development in modern terms.
33. Sustainable development of agrarian regions: directions, limits.
34. Ecological impact of agriculture.
35. The principles and aim of marginal analysis.
36. Methods of alternative costs estimation.
37. Modern trends in dairy cattle breeding.
38. Using of robots in agriculture (examples, spheres, costs).
39. New tendencies in pigs fattening.
40. New tendencies in cattle breeding.
41. Organic agriculture: essence, direction, trends.
42. The methods of soil fertility increasing.
43. The structure of costs in agriculture (current and trends, all over the world).
44. The modern limits of agriculture development.
45. The agriculture countries (top-10 in the world).
46. Modern tendencies in flower growing.

5. INDIVIDUAL WORK

The aim of individual work is to research the questions, that are not included into the basic themes of discipline's studying and to control student's ability to work independently using additional literature. Complex tasks for individual work include theoretical questions and tasks for solving. Student must give answers on two theoretical questions (given at p. 5.1) and solve the tasks, given at p. 5.2.

Choose the theoretical questions free.

5.1. THEORETICAL QUESTIONS FOR INDIVIDUAL WORK.

1. Describe the essence and features of parallel (independent) production.
2. Describe the essence and features of competitive (alternative) production.
3. Describe the essence and features of constrained production.
4. How to determine the optimal production direction?
5. Describe the essence of direct and indirect costs. Give the examples.
6. Describe the essence of fixed and variable costs. Give the examples.
7. Describe the essence of alternative costs. Give the examples.
8. What does the work productivity depend on?
9. Name two groups of fixed assets, depending on their setting purpose. Give the examples.
10. Give the determination of initial, remaining value and depreciations decrees.
11. Describe the essence and features of linear method of amortization.
12. Describe the essence and features of value added tax (VAT).
14. Determine the cost price elements.
15. Determine the methods of price forming.
16. How are the half-finished products estimated?
17. Determine the difference between profit and profit of entrepreneur calculation.
18. Determine the principles and methods of marginal profit calculation.
19. Determine the principles and methods of marginal costs calculation.
20. What does the area productivity depend on?
21. Describe the indices of circulating assets usage efficiency estimation.
22. What is circulating capital cycle?
23. Name the criteria of plants systematization.
24. Name the criteria of animals' systematization.
25. Describe the methods of alternative costs estimation.
26. Describe the role of financial governmental support (bonus). How is it accounted at production efficiency estimation?
27. Give the examples of farmers' governmental support in different countries.
28. Determine the essence and main characteristics of enterprise competitiveness.
29. Name the indices of food quality estimation.
30. Name the indices of forage quality estimation.

5.2. TASKS FOR INDIVIDUAL WORK.

Task 1. Estimate the marginal income, profit, thresholds of production and profitability, recoupment of used production factors, using the data shown at Table 5.1. Make the conclusion of production process economic efficiency.

Choose the variant in accordance with last numbers of student's ticket.

Table 5.1. Initial data (plant growing production process)

Size	Variant (the last number of student's credit book)									
	0	1	2	3	4	5	6	7	8	9
Productivity, c/ha:										
Sugar beet	28	30	32	29	27	26	31	33	35	28
Tops, % of main product	50	40	60	70	75	55	65	45	62	56
Bonus, uah/ha	150	180	200	220	300	340	160	180	170	190
Requirement, kg/ha:										
Seed, kg/ha	28	30	32	29	27	26	31	33	35	28
Fertilizers (beet/tops), kg/c:										
N	0.18/0.35									
P	0.09/0.11									
K	0.29/0.59									
Work hours, man-hour./ha:										
Own	5	7	8	10	11	6	7	8	9	5
Attracted	7	5	3	4	6	5	4	5	6	7
Plant protection costs, uah/ha	160	170	150	155	145	165	180	200	220	250
Fixed costs of own mechanization, uah/ha	245	250	255	265	300	225	215	220	210	200
Lease area costs, uah/ha	400	450	455	465	470	425	400	455	460	450
Indirect costs, uah/ha	50	60	70	75	65	55	45	50	60	70
Size	Variant (the penultimate number of student's credit book)									
	0	1	2	3	4	5	6	7	8	9
Price, uah/kg:										
Sugar beet	4	5	6	4	5	3.5	2.8	4.5	6.5	7.6
Tops	0.8	1.2	0.9	0.7	0.8	0.6	0.6	0.7	1.2	1.1
Seed	3	4	5	4	4	3	2	4	5	5
Fertilizers:										
N	1.1	1.2	1.1	0.9	1	0.85	1.1	1.2	1.3	1.4
P	1.3	1.3	1.2	1.1	1.1	1.2	1.3	1.4	1.5	1.1
K	0.5	0.5	0.6	0.4	0.45	0.5	0.55	0.65	0.7	0.5
Salary, uah/man-hour.:	15	20	15	20	15	20	15	18	17	16
Alternative value of work, uah/man-hour.	20	15	15	22	16	17	18	19	20	15

Task 2. Estimate the marginal income, profit, thresholds of production and profitability, recoupment of used production factors, using the data shown at Table 5.2, 5.3. Make the conclusion of production process economic efficiency.

Choose the variant in accordance with last numbers of student's credit book.

Table 5.2. Initial data (livestock production process)

Size	Variant (the last number of student's ticket)									
	0	1	2	3	4	5	6	7	8	9
Exit of pus, m ³ /conditional head (500 kg) (or per 1 pig)	16	17	20	15	21	22	15	1	17	18
Content of nutritives in manure, kg/m ³ :										
N	5.2	5.3	5.4	5.5	5.6	4.8	5.0	5.1	4.9	4.6

P	2.2	2.1	2.0	1.9	1.8	1.7	2.2	2.3	2.0	2.1
K	5.5	5.4	5.5	5.6	5.7	5.8	4.5	4.6	4.7	4.8
Losses of N, %	38	39	40	41	42	45	44	43	38	39
Price of nutritives, uah/kg										
N	1.1	1.2	1.1	0.9	1	0.85	1.1	1.2	1.3	1.4
P	1.3	1.3	1.2	1.1	1.1	1.2	1.3	1.4	1.5	1.1
K	0.5	0.5	0.6	0.4	0.45	0.5	0.55	0.65	0.7	0.5
Work hours, man-hour./ha:										
Own	5	7	8	10	11	6	7	8	9	5
Attracted	7	5	3	4	6	5	4	5	6	7
Salary, uah/man-hour.	15	20	15	20	15	20	15	18	17	16
Alternative value of work, uah/man-hour.	20	15	15	22	16	17	18	19	20	15
Proportional-variable costs, uah/per 1 conditional head (or per 1 pig)	1800	1750	1600	1500	1400	1450	1300	1400	1500	1600
Circulating capital, uah:	1500	1400	1300	1200	1250	1500	1400	1350	1300	1400
Own, %	60	70	80	90	85	75	55	45	50	40
Attracted, %	40	30	20	10	15	25	45	55	50	60
Fixed capital, uah:	2400	2500	2600	2450	2550	2600	2700	2750	2800	2750
Own, %	40	30	20	10	15	25	45	55	50	60
Attracted, %	60	70	80	90	85	75	55	45	50	40
Percent rate of assets (capital) usage:										
Own, %	15	13	15	15	16	17	18	15	14	12
Attracted, %	16	12	14	13	15	14	17	16	15	18

Table 5.3 Initial data (parameters of livestock production process)

Size	Variant (the penultimate number of student's credit book)				
Production process: "Dairy cattle breeding"	0	1	2	3	4
Annual hopes of milk, thousands l	4	4.5	5	5.5	4.2
Weight of cow, kg	480	420	520	500	620
Sale weight of calf, kg	90	100	95	105	98
Period of lactation, days	305	345	320	315	310
Period of maintenance in a basic herd, years	4	4.5	4	4.5	4
Loss of cattle, %	10	15	12	13	15
Price of meat, uah/kg	25	22	25	23	24
Price of calf, uah/ kg live mass	8	7	6	8	7
Output of slaughtered product, %	50	45	65	60	45
Milk parameters:					
Fat, %	3	4	5	6	3
Protein, %	5	6	7	8	5
Price of milk:					
Basic, uah/l	2.5	3	2.8	2.7	2.6
Additional value of fat, uah/l per 1% of fat	0.07	0.08	0.06	0.07	0.05
Additional value of protein, uah/l per 1% of protein	0.05	0.07	0.04	0.08	0.07

Size	Variant (the penultimate number of student's credit book)				
Production process: "Pigs growing"	5	6	7	8	9
Amount of growing pigs	20	40	50	60	25
Sale weight, kg	30	35	45	40	32
Basic price (25 kg weight), uah/pig	200	250	270	260	300
Price of additional weight, uah/kg	8	9	10	11	8

6. TESTS

1. The intensity is determined as:
 - a. economic effect of production factors usage;
 - b. productivity of fixed assets unit;
 - c. correlation between production resources;
 - d. productivity of circulating assets unit.
2. The unit of work force, man of hour, requirement of work time, work time expenses, work potential – are:
 - a. indices of production efficiency;
 - b. indices of output estimation;
 - c. indices of input usage estimation;
 - d. indices of work usage estimation.
3. Indicator that bases on relationship and interaction of profit and costs, – is:
 - a. threshold of production;
 - b. recoupment;
 - c. profitability;
 - d. marginal income.
4. General structure of enterprise consists on:
 - a. departments of basic and additional production;
 - b. departments of basic production and management;
 - c. departments of basic, additional production, services, management departments;
 - d. there is no right answer;
5. The production cycle is:
 - a. the calendar period from start of production process (using of raw materials) to completely production of goods;
 - b. the calendar period from start of production process (using of raw materials) to completely production of goods and their removal to storehouse;
 - c. set of interrelated work and natural processes which lead to raw material and materials transformation into goods;
 - d. there is no right answer.
6. Point the right statement:
 - a. the gross output of department is more than sold products always;
 - b. the commodity goods of department is more than sold products always;
 - c. the difference between gross and commodity goods quantity depends on remains of work in progress;
 - d. there is no right answer.
7. Variable costs include:
 - a. expenses of materials;
 - b. costs of products sale;
 - c. a+b;
 - d. there is no right answer.
8. Coefficients that characterize production process are:
 - a. sizes of output and input determination;
 - b. types of used resources;
 - c. location of enterprise;
 - d. there is no right answer.
9. Commodity goods used as production factor are estimated:
 - a. by calculating fixed costs;
 - b. by its market price;
 - c. by calculating variable costs;
 - d. price is set by management free.

10. Income depends on:
 - a. quantity of used production factors in natural sizes;
 - b. quantity of used production factors in monetary sizes;
 - c. volume of basic and side products sale and proper prices;
 - d. duration of production process.
11. In practical calculation costs, depending on there relation to the production process, are divided into:
 - a. direct or indirect expenses;
 - b. fixed or variable costs;
 - c. material expenses;
 - d. expenses of fixed assets usage.
12. In practical calculation costs, depending on volume of production are divided into:
 - a. direct or indirect expenses;
 - b. fixed or variable costs;
 - c. material expenses;
 - d. expenses of fixed assets usage.
13. Variable costs, as a rule:
 - a. change with the volume of production and are related to the certain production process;
 - b. are constant independently of production volume changes;
 - c. are the lower limit of price;
 - d. present themselves the top limit of price.
14. Productivity of production factor presents:
 - a. the expenses per unit production factor;
 - b. the benefit of production assets usage;
 - c. the price of raw material and fuel;
 - d. salary rate.
15. The intensity of production factor is:
 - a. the quality of certain production factor relatively another production factor;
 - b. the quantity of certain production factor usage relatively another productive factor;
 - c. the price of certain production factor relatively another productive factor;
 - d. the volume of output.
16. Profitability of production process is:
 - a. the economic benefit of production in natural sizes;
 - b. the price of certain production factor relatively another productive factor;
 - c. the economic benefit of production in monetary sizes;
 - d. the volume of output.
17. Price that is over then all expenses is named:
 - a. market price;
 - b. threshold of profitability;
 - c. threshold of production;
 - d. profitable price.
18. Threshold of production is:
 - a. the lower limit of price;
 - b. profitable price;
 - c. market price;
 - d. sum of all expenses.
19. Threshold of production marks a point where:
 - a. marginal value of certain product exceeds the maximum expenses of its production;
 - b. average value of certain product exceeds the minimum expenses of its production;
 - c. average value of certain product is lower than maximum expenses of its production;
 - d. marginal value of certain product is lower than maximum expenses of its production;

20. Size of methodically actual marginal income depends on:
- gain of realization, variable costs;
 - gain of realization, proportional variable costs, value of half-finished products;
 - gain of realization, disproportional variable costs, value of half-finished products;
 - gain of realization, disproportional variable costs.
21. Size of marginal income by practical method depends on:
- gain of realization, variable costs;
 - gain of realization, proportional variable costs, value of half-finished products;
 - gain of realization, disproportional variable costs, value of half-finished products;
 - gain of realization, disproportional variable costs.
22. Capital is named circulating if:
- during one production process its costs will return to the businessman completely;
 - during one production process its costs will return to the businessman partially;
 - its costs will return to the businessman for 2 month;
 - its costs won't return to the businessman by one production process.
23. Requirement of living and circulating capital represents:
- the average sum of the capital involved in the process of production;
 - the average sum of fixed costs of the production process;
 - the marginal expenses;
 - the sum of expenses per unit of products.
24. The main directions of enterprise activity are:
- economic and social activity;
 - production, innovative, commercial activity, after sale services, goods market researching. They are penetrated by economic and social activities;
 - strategic and current planning, accounting and reporting;
 - there is no right answer.
25. Enterprise as a system includes:
- certain set of production and functional departments;
 - set of all production departments;
 - capital, production resources;
 - there is no right answer.
26. Features of any system are:
- relationships between system elements;
 - the each element of system has the features which are characteristic for it only;
 - any system is consist of 2 or more interrelated elements with characteristic only for them features;
 - there is no right answer.
27. The eventual aim of enterprise functioning is:
- increasing of production efficiency;
 - to receive the profit by production and sale of competitive high profitable goods;
 - full financial and economic independence;
 - there is no right answer.
28. Norm presents itself:
- maximal permissible size of absolute usage of raw material, fuels and other materials per unit of output (goods, services);
 - size of usage of raw material, fuels and other materials per unit of output (goods, services) certain quality;
 - relative size that characterize level of facilities and subjects of production usage;
 - there is no right answer.
29. All costs are divided into fixed and variable with the aim:

- a. to allocate technological, craft and production cost price;
 - b. determination the volume of realization providing without loss activity for each certain case;
 - c. detection of costs reducing reserves;
 - d. there is no right answer.
30. The reasons of economical losses arising are:
- a. default of contract obligations about purchasing terms;
 - b. default of contract obligations about volume, range and terms of purchase;
 - c. noncompliance of norms, quotas, limits;
 - d. there is no right answer.
31. The reasons of material losses are:
- a. default of contract obligations;
 - b. noncompliance of norms, quotas, limits and also thefts, damages;
 - c. downtime of equipment usage;
 - d. there is no right answer.
32. Operative production planning is the system of measures, aimed to:
- a. concretization of annual plan of economic and social development of enterprise in time and space;
 - b. providing the production by production assets, work, finance and material resources completely in time;
 - c. coordination of contiguous crafts, divisions, work places functioning;
 - d. there is no right answer.
33. Reason affects on certain result – is:
- a. reserve;
 - b. induction;
 - c. factor;
 - d. deduction.
34. Resource inventory which is not used, but supported on certain level as asset that provides reliability and continuity of system functioning is:
- a. factor;
 - b. reserve;
 - c. complex;
 - d. balance.
35. Profit of products sale is calculated as difference between:
- a. value of commodity goods and their full cost of price;
 - b. value of sold products and their full cost of price;
 - c. value of sold products reduced on size of profit tax and excise duty and their full cost of price;
 - d. volume of gross income and gross costs.
36. The product cost of price doesn't include:
- a. material expenses;
 - b. salary;
 - c. expenses on social measures;
 - d. excise payments.
37. The specialization of production is:
- a. concentration of production on big size enterprises;
 - b. concentration of production of homogenous products at 1 enterprise;
 - c. concentration the production of products of various industries of economy at 1 enterprise;
 - d. concentration of production relationships with less quantity of enterprises.
38. The quality of products is:
- a. the degree of conformity of product features set to requirements in accordance with

- products aim of usage;
 - b. the degree of conformity of product features set to requirements in accordance with quality standards;
 - c. the degree of conformity of product features set to customers requirements;
 - d. the degree of conformity of product features set to requirements of design and production of products.
39. The transfer of fixed assets value into the cost of price of products is realized by:
- a. indexing of fixed assets value;
 - b. depreciation of fixed assets value;
 - c. amortization of fixed assets;
 - d. usage of fixed assets.
40. The production cycle consists of such elements:
- a. consecutive, parallel, combined motion;
 - b. mass, serial, individual production;
 - c. current, partial, unitary production;
 - d. work period, time of natural processes, breaks.
41. Value of output is characterized by:
- a. quantity and price of used material resources;
 - b. rate salary;
 - c. kind and amount of got basic and side goods;
 - d. requirement of living and circulating capital.
42. The input of production process is:
- a. rate salary;
 - b. kind and amount of got basic and side goods;
 - c. requirement of living and circulating capital;
 - d. kind and amount of needed to produce goods production facilities.
43. A requirement of circulating capital depends on:
- a. duration of investment of capital;
 - b. quality of output;
 - c. value of output;
 - d. types of used resources.
44. A base for the calculation of duration of investment of capital is:
- a. dates of payments;
 - b. percent rate;
 - c. sum of invested capital;
 - d. value of output.
45. An annual requirement of circulating capital (ARLCC) is calculated the next way, in general:
- a. $ARLCC = \frac{SP * DI}{365}$;
 - b. $ARLCC = \frac{365}{SP * DI}$;
 - c. $ARLCC = \frac{SP + DI}{365}$;
 - d. $ARLCC = \frac{SP / DI}{365}$.
- where SP – sum of payments;
DI – investment duration, days.
46. Annual requirement of living and circulating capital (ARLCC) of “Dairy cattle breeding” production process is calculated by:

- a. Price of pedigree heifer purchase;
- b. $ARLCC = \frac{PHP + VC}{2} * \frac{MD}{12}$;
- c. $ARLCC = \frac{PHP}{2} * \frac{MD}{8}$;
- d. $ARLCC = \frac{VC}{2} + \frac{PHP * MD}{12}$.

where PHP – price of heifer purchasing; VC – variable costs, all; MD – duration of cattle maintenance, months.

47. Annual requirement of living and circulating capital (ARLCC) of “Big horned cattle (BHC) rearing” and “Bulls fattening” production processes is calculated by:

- a. Price of pedigree heifer purchase;
- b. $ARLCC = \frac{PHP + VC}{2} * \frac{MD}{12}$;
- c. $ARLCC = \frac{PHP}{2} + \frac{MD}{8}$;
- d. $ARLCC = \frac{VC}{2} + \frac{PHP * MD}{12}$.

where PHP – price of heifer purchasing; VC – variable costs, all; MD – duration of cattle maintenance, months.

48. The durations of “Big horned cattle (BHC) rearing” and “Bulls fattening” production processes are:

- a. more than 1 year;
- b. less than 1 year;
- c. more or less than 1 year;
- d. almost 5 years.

49. Expenses of the inlaid living and circulating capital in accordance with classification of expenses belong to:

- a. the proportionally-variable special expenses;
- b. the disproportionate variable expenses;
- c. the fixed expenses;
- d. the special expenses;

50. Strategic production planning is the system of measures, aimed to:

- a. concretization of annual plan of economic and social development of enterprise in time and space;
- b. providing the production by production assets, work, finance and material resources completely in time;
- c. coordination of contiguous crafts, divisions, work places functioning;
- d. there is no right answer.

7. EXAMINATION QUESTIONS

1. Give the determination of parallel (independent) production concept.
2. Give the determination of competitive (alternative) production concept.
3. Give the determination of related production concept.
4. What is the optimal production direction?
5. Give the classification of costs by their relation to finish good.
6. Give the classification of costs by their dependence of production volume.
7. Give the classification of costs by their dependence of planning.
8. Give the determination of «the fixed assets» concept and name 2 groups of fixed assets, depending on their setting purpose.
9. Give the determination of initial, remaining costs and depreciations decrees.
10. Give the determination of turnover means concept.
11. How is the annual requirement of circulating capital determined in the processes of commodity goods production in plant growing (exact calculation formula)?
12. How is an annual requirement of living circulating capital determined in the production process «Dairy cattle breeding»?
13. How is an annual requirement of living circulating capital in the production process «Pigs breeding» determined?
14. How is an annual requirement of living circulating capital determined in the production process «Big horned cattle growing and bulls fattening»?
15. How is an annual requirement of living circulating capital determined in the production process the «Pigs fattening»?
16. Sizes of output determination.
17. Indices of production assets usage determination: proportionally-variable costs (examples).
18. Indices of production assets usage determination: indirect costs (examples).
19. Indices of production assets usage determination: disproportionate and fixed direct costs (examples).
20. A half-finished products requirement.
21. Calculation of factors requirement: what do area requirement and crop rotation limitations depend on?
22. Calculation of factors: requirement of work time, requirement of machines, buildings and constructions.
23. Name the indices of estimation of production processes and give their determination.
24. Name the basic indices of profitability.
25. Concept and methodology of marginal calculation (MC).
26. Calculation of value of output, taking into account the commodity and side products.
27. What aims is marginal income accounted for?
28. Formula of calculation and essence of threshold of production.
29. Formula of calculation and essence of threshold of profitability.
30. How is the recoupment of production resources accounted and what does it show?
31. Production process «Plant growing». Economic systematization of cultures.
32. Production process «Plant growing». Efficiency of bringing of organic and mineral fertilizers.
33. Production process «Plant growing». Efficiency of prophylactic and active plants protection.
34. Production process «Plant growing». The gain of realization.
35. Production process «Plant growing». Variable expenses.
36. Production process «Plant growing». Aspects of marginal calculation.
37. Production process «Plant growing». Requirement of production factors.
38. Interpretation of thresholds of production and profitability.
39. Classification of feed crop production process.
40. How is the output of Feed crop production process estimated?
41. Feed crop production process. Variable expenses.

42. Feed crop production process. Aspects of marginal calculation.
43. What does the output value of «Dairy cattle breeding» production process include?
44. Production process “Dairy cattle breeding”. Variable expenses.
45. Production process “Dairy cattle breeding”. Expenses of forage production.
46. Production process “Dairy cattle breeding”. Requirement of production factors.
47. Essence of aggregating of production processes of «Feed crop production» and «Dairy cattle breeding».
48. The main features of production process "Big horned cattle breeding".
49. Production process “Big horned cattle breeding”. The gain of realization.
50. What does the value of output of production process the «Bulls fattening» include?
51. The variable expenses of production process "Big horned cattle breeding".
52. Production process "Big horned cattle breeding". Forage requirement.
53. Production process "Big horned cattle breeding". The requirement of production factors.
54. What does the value of output of production process of «Pigs breeding» consist on?
55. Production process “Pedigree pigs breeding”. Variable expenses.
56. Production process “Pedigree pigs breeding”. Productivity and recoupment of used production factors.
57. What does the value of output of production process the «Fattening of pigs» consist on?
58. The variable expenses of production process «Fattening of pigs».
59. Production process «Fattening of pigs». Production factors requirement.
60. Economics of production: the object of studying, the main tasks of science.

APPLICATION A

Table A.1. Norms of requirement of nourishing substances for dairy animals

Vital functions requirement	Energy	per kg MAM /day	0.293 mJ net energy
	Protein	per kg MAM /day	3.9 g
Dairy productivity	Energy	per % of fat in kg of milk	0.38 mJ
		per % of protein in kg of milk	0.21 mJ
		per kg of milk	1.05 mJ
	Protein	per % of protein in kg of milk	25 g
Calving period	Energy	per kg MAM /day	0.1 mJ net energy
	Protein	per kg MAM /day	4.2 g
Motion (only energy)	Energy	per kg LM /km	0.0034 mJ net energy
	Protein	per kg LM /km	0.000036 mJ net energy

LM - live mass, kg; MAM - metabolic mass of animal (= $LM^{0.75}$).

Table A.2. Norms of requirement of nourishing substances for big horned cattle

			Pedigree heifers	Fattening bulls
Vital functions requirement	Energy	per kg MAM /day	0.293 mJ net energy	28.3 StU
	Protein	per kg MAM /day	3.9 g	3.9 g
Accreation of live mass	Energy	per kg of additional weight	22.8 mJ net energy	2120 StU
	Protein	per kg of additional weight	625 g	425 g
Calving period	Energy	per kg MAM /day	0.1 mJ net energy	
	Protein	per kg MAM /day	4.2 g	
Motion (only energy)	Energy	per kg LM /km	0.0034 mJ net energy	0.263 StU
	Protein	per kg LM /km	0.000036 mJ net energy	0.0029 StU

LM - live mass, kg; MAM - metabolic mass of animal (= $l.m. 0.75$).

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