Design and Management of Technological Processes

**1) Main problems in today's intensive agriculture**

a) Technogenic soil compaction – causes, consequences

b) Soil erosion – causes, consequences

c) Reduction of yields on headlands – causes, consequences

**2) Soil physical properties**

a) What is the soil – definitions, soil formation, the importance of soil, soil fertility

b) Causes of soil losses – non-agriculture, agriculture, erosion, contamination

c) Soil survey – soil forming factors, soil profile, soil texture, grain composition

**3) Measurement of soil physical properties**

a) Cone index – definition, introduction, standards, measurement

b) Disturbed and undisturbed soil properties – bulk density, porosity

c) Disturbed and undisturbed soil samples – methodology, standards

**4) Soil and water**

a) Direct and non-direct methods of measurement

b) Infiltration parameters of soil – the relationship of infiltration, bulk density and porosity

c) Saturated hydraulic conductivity – definition, measurement

**5) Trends in soil tillage**

a) Transmission of tensile force to the ground – machines size and working width, tyres and belts

b) Vertical tillage – principles, technologies, strip-till

c) “Anti-erosion” technologies

**6) Use of organic matter in soil tillage technologies**

a) Forms of organic matter – crops, plant root system, soil crust

b) Surface water runoff causes, measurement

c) Influence of the use of different technologies on surface water runoff

**7) Precision agriculture**

a) Principles, assumptions, technical possibilities

b) Satellite guidance, use of navigation devices, other navigation options

c) Spatial variability of yields, soil physical and agrochemical properties

**8) Sensors for precision agriculture**

a) Sensors for yield mapping – crops, principles, function

b) Sensors for mapping soil variability – principles, instruments

c) Telematics, data acquisition, machine monitoring

**9) Modern trends in planting and plant establishment**

a) Factors leading to changes in planting technology

b) Tillage operations as a factor affecting soil properties

c) Changes in cereal growing technologies

**10) Electrical power transmission on agricultural machinery**

a) Advantages and disadvantages of using electric drives on agricultural machinery

b) Architectures of electric power transmission on agricultural machinery

c) Expectations of agricultural equipment producers (required power, advantages, availability etc.)

**11) Electrification of the tractor**

a) Generator powered by tractor power take-off

b) Generator built directly as part of the tractor

c) Usual power and voltage of PTO powered and tractor mounted generators

**12) Robotics in plant production**

a) Possible advantages of field robotics

b) Necessary conditions for the use of field robots

c) Potential of electrification and robotization of tractors

**Business Economics and Management**

**1) Market segmentation and targeting**

a) Segmentation of the market, customers segments

b) Requirements for effective segmentation

c) Selecting target market segments

**2) Marketing mix**

a) Product

b) Price and Place

c) Promotion

**3) Marketing plan**

a) Content and the process

b) Business mission statement

c) Objectives, SMART objectives

**4) Situation Analysis**

a) Global environmental analysis

b) Market analysis

c) SWOT analysis

**5) Management**

a) Basic definitions of management

b) Creative management methods

c) Analytical thinking

**6) Definition, purpose, and history of law**

a) Legal systems, cultures, and traditions (ancient legal cultures; law, ethics, and religion; common law tradition and civil-continental legal culture)

b) Categorization of law (substantive/procedural law; positive/natural law; public/private law)

c) Types of legal norms (peremptory/provisional; injunctive/prohibitive/entitling), structure of a legal norm (hypothesis, disposition, sanction)

**7) Legal system in the Czech Republic**

a) Law-making process in the Czech Republic (bicameral parliament, presidential veto)

b) Hierarchy of legal provisions (constitutional acts, other statutes, government decrees)

c) Czech domestic law in relation to international and European law

**8) Public and private law**

a) Public and private interests, superordination and subordination in legal relations, sanctions under public and private law

b) Institutes and principles of criminal, administrative, and constitutional law

c) Institutes and principles of civil law, commercial law, and labour law

**9) Corporations and entrepreneurship**

a) Types of corporations, internal structure, internal legal regulations, financing

b) Tax law, cross-border transactions

c) Individuals and legal persons as legal actors, acting by proxy

**10) Legal responsibility**

a) Responsibility under public law, types of crimes, aggravating and mitigating circumstances, punishments

b) Responsibility under private law, pecuniary and non-pecuniary harm, compensations

c) International legal responsibility, extradition, sovereignty, jurisdiction, international organizations

**11) The financial statements of a company**

a) the Balance sheet (assets, equity, liabilities)

b) the Income statement (expenses, revenues, profit)

c) other financial statements

**12) The Balance sheet Assets reported in the balance sheet**

a) Long-term assets (intangible, tangible, financial)

b) Short-term assets (inventories, receivables, financial, cash)

c) Examples of Assets in agriculture

**13) The Balance sheet Equity and Liabilities in the balance sheet**

a) Equity items in the balance sheet

b) Liability items in the balance sheet

c) Examples of liabilities in agriculture

**14) The Income statement – expenses and revenues reported in the Income statement**

a) expenses (operating, financial)

b) revenues (operating, financial)

c) examples of expenses and revenues in agriculture

**15) Profit/Loss calculation**

a) expenses of an agricultural company

b) revenues of an agricultural company

c) profit/loss calculation

**Technology and Machines of Livestock Production**

1. **Housing systems for breeding pig**

1. Main types of pens for pig
2. Requirements for pen enclosure
3. Grates and their design

2. **Technology of feeding pigs**

1. Technological equipment for feeding pigs by dry and liquid mixtures
2. Hoppers, conveyors for bulk fodder
3. Equipment for watering pigs

3. **Machinery for removal of excrement pigs**

1. Main types of technological equipment for removal excrements
2. Methods of excrement processing
3. Methods of excrement storage and handling

4. **Pig slaughtering**

1. Types of transport technology
2. Preparation before slaughtering
3. Slaughter, stunning principles and meat processing

5. **Technological equipment for poultry housing**

1. Systems stabling of poultry
2. Capacity and spatial characteristics of floor breeding
3. Alternative poultry farming methods

6. **Poultry hatching technique**

1. Systems of breeding hens to produce eggs
2. Main types of hatcheries
3. Hatchery technical equipment – ways of heating chickens

7. **Poultry feeding technique**

1. Machinery and equipment for power feeding
2. Egg collection systems
3. Manure handling in poultry farms

8. **Technology and equipment for chicks**

1. Methods of processing of livestock during batch breeding of chicks
2. Transportation for slaughtering
3. Stunning principles, slaughter, meat processing

9. **Technology used for housing sheep and goats**

1. Main types of stables
2. Water and feed technology
3. Removal of excrements

10. **Technology for sheep and goats transport, milking and slaughtering**

1. Milking sheep and goats
2. Transport for slaughtering
3. Stunning methods, slaughter and meat processing

11. **Technological equipment for breeding rabbits**

1. Housing, feed and water distribution technology
2. Removal of excrements and handling
3. Slaughtering and meat processing

12. **Technology and technique used for dairy cattle**

1. Main types of stables
2. Functional, morphological and dimensional solutions of stables
3. Grates and their design

13. **Reproductive stables for cattle**

1. Technology and engineering for calves
2. Types of stables for young cattle, barriers
3. Breeding of claves and young cattle

14. **Stable elements for dairy cattle**

1. Barriers, feed troughs
2. Slatted floors for livestock
3. Livestock welfare equipment

15. **Distribution of feed in cattle stables**

1. Characteristics of feeding systems (stationary, mobile, and combined)
2. Variants of stationary feeding lines and watering
3. Mobile technology for cattle feeding

16. **Feed storage and preparation lines**

1. Main types of feed storage facilities
2. Feed preparation lines – technology steps
3. Machines and equipment for dosing and filling feeds feeding mix wagons

17. **Principles of milking equipment for dairy cattle**

1. Basic elements milking machines, pipe systems, mobile machinery
2. Equipment for cleaning and disinfection of milking equipment
3. Automation and robotics in the process of milking

18. **Milk treatment after milking, Slaughtering**

1. Cleaning of milked milk, cooling equipment, storage of milk
2. Transport technology of animals for slaughtering
3. Stunning principles, slaughter, meat processing

19. **Machinery and equipment for excrement removal from cattle stables**

1. Technology for cattle bedding
2. Mobile and stationary machinery for manure removal
3. Manure storage areas (liquid and solid parts) principles of handling

20. **Processing and utilization of animal excrement**

1. Rheological properties of excrements
2. Mechanical processing
3. Biogas production

**Technology and Machines of Crop Production**

**1) Technologies and machines for primary soil tillage**

a) Mouldboard ploughs – types, main parts

b) Trailed tillage machines - coulter cultivators, disc machines

c) Machines with driven working tools-rotary tillers

**2) Soil tillage technologies and machines**

a) Conventional soil tillage – principles, machines

b) Conservation soil tillage – principles, machines

c) Advantages and disadvantages of conventional and conservation soil tillage technologies

**3) Machines for seeding and planting**

a) Drill seeders. Precision drilling machines. Connection of soil tillage and drilling.

b) Potato planters.

c) Machines for separating stones from potato growing ground. Bed former machines. Inter - row cultivators.

**4) Sprayers and mistblowers**

a) Spray nozzles, droplet spectrum, volume rate, calibration

b) Field sprayers, air-assisted sprayers and mistblowers - description and function analysis

c) Field sprayers - nozzle output, unevenness of application, volume rate

**5) Potato and sugar beet harvesting machines**

a) Potato harvesting and post-harvesting technologies. Haulm cutters. Potato damage during harvesting.

b) Sugar beet harvesting technologies. Leaf-stripping, topping, lifting, cleaning and loading systems. Pick-up loaders.

c) Potato harvester´s and sugar beet harvester´s mechanisms - diggering, liftering and separation of clods and stones.

**6) Mowing machines**

a) Cycle bar mowing machines with fingers and with opposed knifes. Cutting theory. Cutting speeds, stubble bending and stubble length.

b) Rotary mowers with horizontal and vertical axis of rotation

c) Conditioning machines.

**7) Forage harvesters**

a) Tedders, rakes

b) Cutting tables, feeding mechanisms. Screw conveyors.

c) Pick up trailers and comparison with forage harvesters.

**8) Design of combine harvesters**

a) Cutting tables, connection with main unit

b) Threshing mechanisms, straw walkers

c) Cleaning units. Movement of the material on the sieve

**9) Combine harvesters – types and comparison**

a) Tangential combine harvesters – technological process, main working units

b) Axial combine harvesters – technological process, main working units

c) Comparison of tangential and axial combine harvesters

**10) Projecting of machinery sets**

a) Projecting of machinery sets with serial energy transfer

b) Projecting of machinery sets with parallel energy transfer

c) Technological calculation, capacity of machines and machinery sets

**11) Optimisation of Machinery utilisation**

a) Machinery utilization during basic soil tillage, seed bed preparation and sowing

b) Projecting of fertilization and chemical protection

c) Projecting of technological processes for cereal production

**12) Dimensional analysis, relative movement of particles**

a) Physical similarity and dimensional analysis. Principles, applications.

b) Relative movement of particle on horizontal and inclined plate

c) Machines used the principle of particles relative movement.

**13) Particular solids and their properties**

a) Mechanics of particular solids

b) Mechanical processing, classification, separation

c) Hydraulic processing - stationary and nonstationary movement

**14) Air humidity and material moisture content**

a) Air humidity, definition, determination of air humidity and its measurement (incl. measuring devices)

b) Material moisture content, its definition, determination and measurement (incl. measuring devices)

c) Mollier diagram

**15) Drying of particulate solids**

a) Theory of drying. Static processes. Heat and material balance.

b) Kinetics of drying - drying curves, speed of drying

c) Drying machines, types of dryers