

State Final Examinations	Academic Year: 2020/2021
Master's Degree Studies Program:	Engineering Informatics
Study Branch:	Integrated Systems in Buildings

## Integrated Systems

1. **External Climatic Conditions** – Air pressure, gaseous air components, air temperature, wind conditions, solar radiation and geometry, contaminants and their concentration, external environmental parameter measurements.
2. **Internal Climatic Environment and its Parameters** – Thermal comfort and parameters, air temperature, effective temperature of surrounding surfaces, globular thermometer temperature, air humidity, air-flow speed, thermal comfort equations, energy expenditures  $M$  [met], clothing parameters  $I$  [clo], index PMV, parameter PPD, operating temperature, air purity (NPK, PEL), acoustic parameters, lighting technical parameters, internal environment parameter measurements.
3. **Basics of Construction Engineering Physics** – Internal surface temperature, heat transfer coefficient structures, average heat transfer coefficient, structural moisture characteristics, internal space thermal stability, and heating energy consumption.
4. **Heating Equipment Performance** – Heat losses due to heat penetration, heat losses due to ventilation, hot water heating expenses, technological requirements, and heat source performance parameters.
5. **Cooling Equipment Performance** – External thermal load, internal thermal load, setting cooling performance.
6. **Spatial Acoustics** – Basic acoustic variables, octave bands, integrated levels of acoustic variables and determination, basic acoustic parameters of internal spaces, and the acoustic parameters of noise sources.
7. **Air Humidity** – Relative humidity, absolute humidity, measurable humidity, partial pressure of water vapor in the air, the air humidity  $h$ - $x$  diagram, basic changes in air thermal and humidity parameters in the  $h$ - $x$  diagram, energetic interpretation of changes, mixing.
8. **Liquid Flow Streams** – The Continuity Equation, Bernoulli's Equation, real liquid flow streams, pressure losses, isothermal and non-isothermal flow streams (air flow stream range) from outlets.
9. **Heating System Hydraulics** – Pressure losses in the hydraulic system, characteristics of pipeline networks and pumps, pump types, pump regulation, control valves, hydraulic equilibration of the pipe network, and hydraulic connections.
10. **Technical Environment Systems** – Internal and external environment parameters, internal environment requirement specification, and the basics of selecting thermal micro-climate creation systems.
11. **Heating Systems** – Heating systems breakdown: local convection heating (stoves), local radiant heating (gas heaters, electric heaters), central heating systems, connecting these systems, heating (utility) water, linking systems using alternative energy sources.
12. **Heating System Resources** – Resources (types, performance settings), boiler-rooms, heat exchanger rooms, boilers, heat exchangers – steam and water (calculation and connections). Heating System Components – radiators, radiant surfaces, pipes, valves, pumps, heating system safety equipment.

13. **Heating System Control** – Heating systems as a controlled system, the principle of choice of regulated circuits, regulation of heat outputs (quantitative control, qualitative control), types of system control modes (overall, zonal, local), DHW temperature regulation, heat source performance control, sensors, actuators, central control and communication systems.
14. **Ventilation and Air-conditioning Systems** – Ventilation requirements, ventilation systems, connecting systems (constant through-flow streams, variable through-flow streams), comfort air-conditioning, high-pressure air-conditioning and its components, system design approach (h-x diagram).
15. **Ventilation System Elements** – Terminal elements (types, air-flow depiction), VAV boxes, ducting (types, insulation, design) ventilators, air exchangers, silencers, filters, humidification and dehumidification.
16. **Air-conditioning System Regulation** – Heating performance regulation (quantitative regulation, qualitative regulation), types of regulation from a systems perspective (overall, zonal, decentralized), ventilator regulation, outlets, heat source performance regulation, sensors, activators, central control and communication systems.
17. **High-voltage Electro-technical Systems in Buildings** – Basic and specific requirements for electrical wiring, types of environments, coverage of electrical machinery and equipment, internal electrical wiring (appropriate dimensions), distribution systems (TNC, TNS, IT, TT), overload and short-circuit protection, protection against dangerous contacts with live or non-live parts.
18. **Lighting Technology** – Types of lighting and their parameters, natural lighting, artificial lighting of individual interiors (accommodation, industrial, and school buildings), combined lighting systems, lighting and dimming resources, and the basics of lighting system design.
19. **Bus Control System Control in Buildings** – Intelligent buildings and their requirements, collection systems, bus system types, The European (KNX) bus system, the LonWorks bus system.
20. **Systems Integration** – Technical specifications, legislative restraints, data security, accumulator and bus systems, core lines, communication gates, the communications environment, control from a distance communication and protocol resources.