Methodical Instruction N. 5
for the 2\textsuperscript{d} year students’ self – preparation work
(at class and at home)

<table>
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<th>The subject under the study</th>
<th>Hygiene and Ecology</th>
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<td>Module No.</td>
<td>1</td>
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<tr>
<td>Year study</td>
<td>2</td>
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<td>Faculty</td>
<td>Medical</td>
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\textbf{1. The topic basis:}

The factors of a microclimate have the large importance in maintenance normal hygienic conditions in inhabited and working premises and rooms for health of the people. The future doctor should well be guided in methods of researches and estimation factors of a microclimate.

\textbf{2. The aims of the training course:}

A=1. 1) To have general knowledge of the topic studied;
A=2. 2) To understand, to remember and to use the knowledge received;
A=2. 3) To learn hygienic requirements to microclimate;
A=3. 4) To form the professional experience by reviewing, training and authorizing it;

\textbf{3. Materials for the before – class work and self – preparation work:}

3.1 Basic knowledge, experience, skills necessary for studying the topic in connection with other subjects:

<table>
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<th>Preclinical disciplines</th>
<th>To know</th>
<th>To be able to</th>
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<td>Physiological significance of the temperature, humidity.</td>
<td>Measure of air temperature, humidity.</td>
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\textbf{3.2 The contents of the topic:}

\textit{Text:}

\textbf{HYGIENIC REQUIREMENTS TO THE MICROCLIMATE.}

\textbf{Concept about microclimate.}

Microclimate - physical parameters of air in small territory (quarter, street) or in rooms.

\textbf{Major factors of microclimate:}

Temperature, humidity, speed air movement, atmospheric pressure (it in rooms varies a little, therefore it is usual at estimation microclimate is not taken into account).

\textbf{Specifications microclimate and methods of their measurement.}

\textbf{1. Temperature of air.}

Optimum range for any rooms is 18-22°C. In sports halls is 16-18°C, in operational is 23-25°C (prevention postoperative cold complications, because patient is under narcosis and centers of thermoregulation do not work).
Devices for measurement are thermometers (household, minimal, maximal), thermographs. A rule of measurement is in 3 points on a vertical and in 5 points across (a rule of an envelope). Differences must be no more, than 2-3 degrees.

2. Humidity of air. Kinds of humidity:
   a) Absolute is amount of water pairs in air now (g / m³ or mm Hg.)
   b) Maximal is the greatest possible saturation air by water pairs at given temperature,
   c) Relative is absolute / maximal in %.

   Norm airs humidity 40-60 % (30-70 %), at smaller humidity - dryness of skin and mucous membranes, at the greater - infringement heat-return In operational - up to 55 % (prevention explosion narcotic-air mix).

Measurement air humidity.
Psychrometr August, Psychrometr Assman (aspiration). Hygrometer (the long skin hair - changes length depending on humidity of air). Hygrograph - write indications of humidity.

DEVICES for the ESTIMATION FACTORS of MICROCLIMATE
Temperature of air, instruments and methods of its measuring
The instruments measuring temperature of air are called thermometers.
The thermometers may be: home, minimum and maximal.
The home thermometer shows temperature in the given instant, it does not fix the temperature.
The minimum thermometer fixes minimal temperature for any period. The minimum thermometers have tank with alcohol inside.
The maximal thermometer fixes maximal temperature for any period. The maximal thermometers have tank with Hydrargyrum inside.
The medical thermometers are maximal thermometers.

Rules of measurement of temperature of air in a room.
1. Measurement of temperature of air on a horizontal. Temperature of air is measuring at a distance of 1.5 meters from a floor in five points. First, second, third and fourth points are in four corners of a room. The fifth point is in the center of a room. The odds between metrics of temperature of air in these points should be no more than 2 °C.
2. Measurement of temperature of air on a vertical. Temperature of air is measuring in the centre of a room apart 0.2 meters from a floor (there are legs of the man) and 1,5 meters from a floor (there are respiration of the man). The odds between metrics of temperature of air in these points should be no more than 2,5 °C.
3. Measurement of air temperature during a day. Temperature in a room in the morning, afternoon, evening and night is measured. The odds between this metrics should be no more 5 °C at local heating (fireplaces, furnace). The odds between these metrics should be no more than 3 °C at the centralised heating (battery of central heating).

THE THERMOGRAPH

Device and principle of work:
   1. A perceiving part - gauge of temperature - bent bimetallic a plate consisting of 2 metals, having various temperature factors. At fluctuations of temperature radius of curvature of plate changes, which is transferred to an pointer with the help of system of levers (the transfer mechanism).
   2. A recording part:
      - the pointer, which on the end has pen, writing on a tape drawn on hours and days of change of temperature.
- drum with the hour mechanism. The tape is reeled up on a rotating drum; the drum can make a complete revolution for one day or for one week. Thermograph provides continuous registration of temperature of air in a range from -45 up to +55 °C with accuracy +10 °C.

**DEVICES FOR MEASUREMENT OF HUMIDITY OF AIR.**

**Assman’s psychrometer (aspirational).**

The way of definition of humidity. To moisten the wet thermometer with water, to start by a key the fan, to hang up the device on a support on distance 2 m from a floor.

The device can be used in negative temperatures, but it is not lower than 10 °C. To write down the indications of dry and wet thermometers through 4-5 minutes. There is an evaporation of a moisture and absorption of heat from a surface of mercury ball of the wet thermometer, it will show lower temperature.

Calculation of absolute humidity is made under the formula:

\[ A = f - 0.5 (t-t_1) H / 755 \]

- A - absolute humidity;
- f - maximal pressure (voltage) water pairs at temperature of the damp thermometer;
- 0.5 - constant psychrometric factor (amendment on speed of movement of air);
- t - temperature of the dry thermometer;
- t₁ - temperature of the damp thermometer;
- H - barometric pressure;
- 755 - average barometric pressure.

Maximal pressure (voltage) water pairs at temperature of wet (f) and dry (F) thermometers determine under the tables.

Relative humidity (R) expect under the formula:

\[ R = \frac{A \cdot 100}{F} \]

- R - relative humidity;
- A - absolute humidity;
- F - maximal humidity at temperature of the dry thermometer.

### 3.4 How to work with the literature recommended:

<table>
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<th>Main tasks</th>
<th>Recommendations</th>
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| - to learn the devices for definition of temperature, humidity of air;  
  - to know structure and rules of work of devices for definition temperature in degrees on a scale Celsium: the thermometer minimal; the thermometer maximal; the thermometer household; the thermometer electronic; thermograph; | - to take possession of a technique of definition temperature and humidity of air in premises (rooms);  
  - the definition of humidity of air will be carried out with use psychrometer Assman and August with use of the formulas and psychometric tables; |

### 3.5. Self-control material:

**A. Questions to be answered:**

1. Hygienic importance of temperature of air and rule of measurement.
2. Hygienic importance of humidity of air and methods of definition.
3. Characteristic of a microclimate of hospital wards and operational, other premises (rooms).

**B. Test tasks to be done:**
1. What devices are used for definition of humidity?
A. Thermograph
B. Barometer
C. Psychrometer
D. Anemometer
E. Vane

2. The optimum norm of relative humidity for premises (rooms) is:
A. 40-60%
B. 30-70%
C. 10-30%
D. 20 - 40 %
E. 20 - 50 %

3. Specify major factors of a microclimate of rooms:
A. Temperature, humidity, atmospheric pressure, light exposure;
B. Humidity, ionization of environment, atmosphere pressure;
C. Temperature, humidity, contents CO2 in air;
D. Temperature, atmosphere pressure, speed of movement of air;
E. Temperature, humidity, speed of movement of air.

4. The optimum norm of air temperature for hospital ward is:
A. 16°C
B. 17°C
C. 16-18°C
D. 18°C
E. 18-22°C

5. To study the effect of microclimate on human organism, it is necessary to organize the systematic observation over air temperature during 3 days. Choose device which allows doing it the most exactly:
A. August psychrometer
B. Thermograph
C. Mercury thermometer
D. Alcohol thermometer
E. Assman psychrometer

Situational tasks
1. A inspection of conditions of stay of the patients in hospital is established: the area of ward for 1 bed is 6 m², average temperature of air is 18 °C, humidity is 60 %, speed of movement of air is 0,18 m/s. Give a hygienic estimation to a microclimate in ward.
2. To determine the parameters of the microclimate, the student used a mercury thermometer and hygrometer. What devices can be used too?
3. To assess the parameters of the microclimate, the student measured the air temperature at 6 points in the room (3 at a height of 1 m and 3 at a height of 0.2 m) near the outer wall, in the center, and near the inner wall. Were there any mistakes? If so, which ones?

4. Self-preparation at class.

Algorithm of practical work of the students.
The first stage. Work above the tests of the control of an initial level of knowledge and skills. The second stage. Active participation in discussion of educational questions on a theme of lesson.
The third stage. Realisation of independent work by definition of parameters of a microclimate in an educational audience (temperature, humidity, speed of movement of air).

Fig. 1.
Points and results of the measurements along the horizontal and vertical line

\[ t_1 = (h=1.5m) \ldots \ldots \ldots \ldots ^\circ C \]
\[ t_2 = (h=0.2m) \ldots \ldots \ldots \ldots ^\circ C \]
\[ t_3 = (h=1.5m) \ldots \ldots \ldots \ldots ^\circ C \]
\[ t_4 = (h=0.2m) \ldots \ldots \ldots \ldots ^\circ C \]
\[ t_5 = (h=1.5m) \ldots \ldots \ldots \ldots ^\circ C \]
\[ t_6 = (h=0.2m) \ldots \ldots \ldots \ldots ^\circ C \]

\[ n=6 \]

Total \( \Sigma t_6 \) =

Calculation of the average temperature:

\[ T_{av} = \frac{\sum_{n} t_6}{n} \]

Calculation of the temperature differences.

- on the vertical line

\[ t_v = \frac{t_1 + t_3 + t_5}{3} - \frac{t_2 + t_4 + t_6}{3} \]

- on the horizontal line

\[ t_h = \frac{t_5 + t_6}{2} - \frac{t_1 + t_2}{2} \]

The fourth stage. The decision situational tasks.

**Literature recommended**

- **Main Sources:**

- **Additional ones:**

Information Resources:
1. www.umsa.edu.ua
2. www.dovkil-zdorov.kiev.ua
3. www.who.int/topics/hygiene