Syllabus of test in autopsy:

1. **Thanatology** – definition = science about dying, death and postmortal changes
   - **Dying and death:**
     - basic biological processes
     - and of existence of each individual
   - **Dying:** = complicated process of gradual decrease to final failure of all vital processes in the body as a consequence of permanent and severe disorder of vital organ or systems
     - may last various time (very short time; from minutes to hours)

2. **Agonia**
   - **Agonia:** = gradual diminishing and final failure of vital functions of the body; typical for death caused by a disease
   - **Course of agonia:**
     - at the beginning the consciousness and ability to act may be preserved, the individual is able to communicate
     - with advanced failure of vital functions (respiration, heart and brain functions), the contact with the other and ability to act decreases; starts disorientation, fails orientation in place, time and situation
     - failure of circulation worsens the nutrition and oxygen supply in brain and other organs ⇒ further state worsening
     - laborious, irregular, usually superficial respiration or gasping
     - irregular, weak, on periphery sometimes unpalpable pulse
     - cold skin – esp. on acral parts of the body, caused by circulation failure
     - frequent are drops of cold sweat
     - slow decrease of body temperature
     - gradual decrease of muscle tone due to nervous system function failure
     - facies hyppocratica appears in longer lasting agonia = prominating chin and nose, a little bit open descented eyes, a little bit open mouth, prominating os zygomaticum, prominati ng paleness of face, cold sweat on forehead

3. **Death** = characterized by 3 facts:
   1. cardiac arrest
   2. cessation of respiration
   3. failure of all brain and brainstem functions
   - **Death:**
     - represents permanent and irreversible failure of vital functions of the body
     - final loss of regulation and integrity of physiological processes in the body causes homeostasis extintion
     - further processes taking place in a dead body are cadaverous (postmortal) processes
     - due to different sensitivity of organ systems to cessation of nutrition and oxygen the death does not appear in all organs at one moment

4. **Vital reactions**
   = stereotypic reactions of the body to noxious stimulus
   - May be:
     - general = reactions of cardiovascular system, respiration, CNS, endocrine glands (principly reactions characteristic for any shock)
     - local = bleeding, colour and margins of a wound, reparation of damaged tissue, production of a scar

5. **Supravital reactions**
   = ability of some organs, tissues and cells to react to appropriate stimulus also a certain time after the death:
   - mechanical irritability of muscles
   - irritability of small muscles to faradic current
   - photoreactions of pupils after application of medication into conjunctival sack
   - sperm movement
   - leucocytes survival
   - postmortal coagulation of blood

6. **Atria mortis** (= the most frequent causes of death, failure of vital systems):
   1. failure of heart (e.g. rupture of heart)
   2. failure of circulation (e.g excessive loss of blood – severe bleeding)
   3. failure of respiration (e.g. suffocation)
   4. failure of central nervous system (e.g. bleeding into medulla oblongata)
   5. failure of hormonal regulation (e.g. bleeding into suprarenal gland)

7. **Categories of death:**
   - **Clinical death (partial):**
     = cessation of spontaneous heart action and respiration
     - this process is reversible to some extent – in a case of appropriate and immediate resuscitation
     - adequate time for resuscitation is 30 minutes, may last longer if necessary
     - if there is a possibility to measure ECG, the resuscitation is stopped if during 10 minutes no activity is recorded
Brain death:
= certified isolated, permanent and irreversible damage of all brain and brainstem functions, while heart activity and respiration are still present and supported by devices
- is important for the possibility of taking organs and tissues for transplantation
- is stated by medical consultation composed of a treating doctor, neurologist, radiologist and anaesthesiologist

Criteria of brain death:
- muscle atonia
- missing movement activity to any stimulus
- loss of spontaneous breathing and stop of breathing after interruption of artificial ventilatory device support
- arreflexive coma (the deepest unconsciousness with the absence of reflexes above the level of the 1.cervical vertebra)
- patient can not be influenced by substances with suppressive influence on CNS and neuro-muscular transference, and the body temperature must be above 32°C

Examinations:
- absence of photoreactions of pupils
- absence of corneal reflex
- cessation of oculo-cephalic reflex
- cessation of oculo-vestibular reflex
- cessation of cough- and swallow- reflexes
- absence of brain circulation in panangiography performed 2 times within the interval of 30 minutes
- isoelectric line on EEG

Biological death:
= irreversible, demarcated by appearance of physico-chemical changes of dead body

We recognize:
- certain signs of death: postmortal patches, postmortmal stiffness, late postmortmal changes, extensive destructive injuries incompatible with life
- uncertain signs of death: postmortmal paleness, postmortmal coldness, muscle weakening, arreflexia, absence of respiratory movement and heart activity and pulse on periphery

Virtual death (Vita minima):
= semblance of death in a person with inhibition of life manifestation due to outer and inner causes

Signs:
- disordered normal ventricle depolarisation and very slow heart rate on ECG
- unpalpable pulse on a.carotis
- invisible chest movements

Causes:
- severe algidity
- electric current injury
- lightning injury
- deep unconsciousness caused by CNS depressat intoxication (alcohol, sedatives, hypnotics)
- uncompleted sinking
- metabolic disorders
- skull and brain injury

8. Classification of death
- non-violent (natural) – caused by a disease
- violent – caused by unfavourable outer influences with/without responsibility of other person
- death in medical institution
- death outside the medical institution
- mors in tabula = death on operating table during diagnostic or therapeutic procedure, or a certain time after this procedure
- violent death suspicious of criminal act
- violent death related to professional injuries and industrial intoxications
- death in prisons

9. Non-violent death
- sudden
- unexpected
- expected

Sudden death (mors subita):
- is observed in person who subjectively feels completely healthy, or shows only unimportant signs, or shows more serious signs but only for a short time
- is a natural death that occurs up to 6 hours (not later) after the beginning of clinical signs, nevertheless the previous health-state did not witness a risk of death
dead person was considered healthy
- if death occurs in a few seconds, it is immediate death
- in a case of sudden death the cause of death is frequently hidden, it is not possible to reveal it by observation, and this is the reason to order an autopsy

**Unexpected death (mors inexpectata):**
- natural death
- in a person who is treated for certain time because of known disease, this state changed unexpectedly and this change caused death
- the health-state of a patient with respect of the course of disease and its therapy did not seem to cause the death
- the death appears usually after a short period of agonia
- the cause of death is a complication of contemporary disease, or overcome disease, or associated disease non-related to basic disease
- if associated disease was diagnosed during the autopsy but not during the life, then the death is sudden

**Expected death (mors expectata):**
- occurs due to unfavourable course of severe disease, the causative therapy was unsuccessful or impossible, the health-state did not improve in spite of a medical effort
- the patient is given only paliative or basal therapy
- paliative therapy = procedures aimed to improve the quality of life of the untreatable patients
- basic therapy = supports vital functions of patients

10. Violent death
- mechanical factors (sharp and blunt violence)
- chemical factor (intoxications)
- physical factors (low and high temperatures, increased and decreased atmospheric pressure, electric currant, lightning, radiation)
- inhibited source of air (various form of suffocation)
- starvation
- complications of mechanical, chemical and physical factors
- consequences of inappropriate, illegal medical management

11. Postmortal changes

**Early postmortal changes:** = develop during several hours
- postmortal paleness (pallor mortis)
- postmortal coldness (algor mortis)
- postmortal desiccation
- postmortal stiffness (rigor mortis)
- postmortal hypostasis
- autolysis

**Late postmortal changes:** = develop after weeks
- putrefaction
- rot
- mummification
- saponification
- skeletisation
- fauna and flora influence

**Categories of postmortal changes:**
1. physical postmortal changes (7)
2. chemical postmortal changes (3)
3. biological postmortal changes (4)

**Physical postmortal changes:**
- postmortal alg (algor mortis)
- postmortal paleness (pallor mortis)
- postmortal patches (livores mortis)
- hypostasis (hypostasis)
- postmortal gas diffusion (phasellus postmortem diffusio)
- postmortal fluid diffusion (postmortem diffusio fluidum)
- desiccation (mummification)

**a. Postmortal coldness:** = consequence of equilibration of human body and environment temperature
- Factors of environment – (temperature, humidity, airflow)
- Factors of human body – (body volume, temperature of the body before death, nutrition)
- begins 1-2 h after the death, cca 1°C per 1 hour
- complete decrease of body temperature in cca 10 hours.
b. Postmortalm paleness: Develops in relation to reflex contraction of superficial arteries, arterioles and capillaries.
c. Postmortalm patches: Develops in skin. Gravity of Earth cause Ery fall down to the lowest places of the body.
- In midle Europe culture postmortalm patches are on the back chrbte, elbows, calfs, bottom – dead person lies on back.
- purple, disappear when pressed
- In a case of CO intoxication and freezing the patches are red.
d. Hypostasis: Takes place in organs
- The same process as in skin – Ery fall down to the lowest places in organs.
e. Postmortalm gas diffusion: Consequence of effect of H2S from bowels to hemoglobin, verdohemogoblin develops →
greenishgrey colour (psedomelanosis) of abdominal organs and abdominal wall.
The most often:
- maceration of skin in intrauterine death of fetus – fetus maceratus.
- maceration of urine bladder epithelium – floccose cloudiness of urine.
g. Postmortalm dessication: Is present in places exposed to open air, e.g. skin excoriation, scleras and exposed mucosa.
Skin around mouth exposed to vomitus and mummmificated looks like pergamen.

Chemical postmortalm changes:
a. postmortalm stiffness (rigor mortis)
b. postmortalm coagulation of blood (coagulatio)
c. autolysis (autolysis)
a. Postmortalm stiffness:
- is explained by release and insufficient resynthesis of macroergic binds of ATP – this is necessary for muscle fibres relaxation
- Begins 4 – 10 hod. after death according Nysten-Regel rule – begins in face muscle and continues caudal direction.
- Terminates spontaneously depending on the way of death and temperature after 2 – 3 days in the same direction as is began.
- If the stiffness is artificially interrupted, it appears never more. The most stiff are people with a big amount of muscle mass (bodybuilders), less people with little muscle mass (disabled people in wheel chair).
b. Postmortalm blood coagulation:
- results in blood coagulation formation
- blood coagulates - elastic consistency
- do not adhere to lamina intima of vessel wall and may be released easily from vessel lumina (dif.dg. from intravital thromboses)
- red or amber-like colour
c. Autolysis: develops in all organs, beginning in these with high concentration of proteolytic enzymes (e.g. mucosa of the stomach, esophagus, bowels and pancreas

Biological postmortalm changes:
a. putrefaction (putrificatio)
b. rot (putrescatio)
c. saponification (saponificatio)
d. dessication (mummificatio)
a. Putrefaction
- putrefactive bacteria in bowels proliferate and get into the wall of intestine changed by autolysis
- reductive process
- putrefactive bacteria destruct proteins, lipids and saccharides
- humid and warm enviroment accelerate putrefaction
b. Rot:
= oxidative process of postmortalm decomposition
- „slower“ putrification
c. Saponification:
- develops in excessively humid conditions and lack of air
- decomposition of body fat → soaps
- impregnation of soapy mass → „standstill“
d. Dessication:
- loss of water prevents putrefaction.
- may be: a. parcial
- b. complete

12. Autopsy
When is autopsy performed?
- 2 hours or more after the death was diagnosed on a base of permanent respiratory and heart arrest, if the person did not refuse an autopsy
- in a period up to 2 hours after the death is autopsy performed only in a case of taking organs or tissues for transplantation, if brain death was diagnosed and the patient did not refuse giving organs for transplantation

Types of autopsy:
1. **anatomic autopsy** – anatomist, Dept. of anatomy
   patients: people without family, „reverz“
   goal: education and research
2. **patologic autopsy** – patologist, Dept. of pathology
   patients: hospitalized patients, including women in the period of labor and children up to 15 years
   goal: the cause of death statement
3. **forensic autopsy** – doctor from Dept. of forensic medicine
   patients: murders, suicides, people found at home, in the woods, drowning, accidents and similar
   goal: determination of violent/non-violent death
4. **Autopsy ruled by a court** – doctor from Dept. of forensic medicine with presence of police, required by prosecutor
   patients: suspecting crime
   goal: confirm the crime and help the police

Significance of autopsy:
a. cause of death determination
b. confirmation or revision of clinical diagnoses
c. pregradual and postgradual education
d. research
e. incidence of diseases statistics
f. taking samples of tissue

Autopsy shall explain:
a. **basic disease** (primary cause of death) – disease that itself or by its complications causes death
b. **immediate cause of death** – concerns vital organs and organ systems (brain, circulation, respiratory system, liver, kidneys, immune system)
c. **complications** – findings related to and complicating basic disease
d. **accessory diseases** – other significant diseases non-related to basic diseases, but influencing the process of basic disease

Autopsy:
- findings are written in **autopsy protokol**
- **epicrisis** is at the end of findings
Epicrisis summarises main findings according the coincidence or differences in clinical and pathological diagnoses.
Postmorten examination (autopsy) is completed by **microscopic examination of the tissue** of the patient. Samples are examined by virologic, bacteriologic, parasitologic, serologic, biochemic and other examinations.

Autopsy must be performed in these cases:
1. Suspicion of **transmissible diseases**
2. Suspicion of **contamination by radioactive materials**
3. Death of **unknown causes**

The most frequent diagnoses found out by autopsy, not diagnosed clinically:
- pneumonia
- pulmonary embolism
- acute pancreatitis
- mesenteric thrombosis
- aneuryzms
- infective endocarditis
- myocardial infarction
- liver cirhosis
- tumorous diseases
- otitis media
- complications of therapy
- iatrogenic complications

13. **Death certificates**
14. **Inspection of a dead body (external, internal)**