Syllabus

1. General information on the course

Full course name	Instrumental methods of functional diagnostic
Full official name of a higher education institution	Sumy State University
Full name of a structural unit	Medical Institute. Department of Internal Medicine with a Center of respiratory medicine
Authors	Fadieieva Hanna, Pogorielova Oksana
Cycle/higher education level	The Second Level Of Higher Education, National Qualifications Framework Of Ukraine – The 7th Level, QF-LLL – The 7th Level, FQ-EHEA – The Second Cycle
Semester	18 weeks during the 5-th semester
Workload	5 ECTS credits, 150 hours, which include 36 hours of contact work with the teacher (36 hours of practical classes), and 114 hours of self-work
Language	English

2. Place in the study programme

Relation to curriculum	Elective course available for study programme "Medicine"
Prerequisites	There are no specific prerequisites
Additional requirements	There are no specific requirements
Restrictions	There are no specific restrictions

3. The purpose of the discipline

To achieve modern knowledge, professional practical skills in functional investigation methods in internal medicine, indications and contraindications, algorithms for interpreting the results with further interpretation of the severity of dysfunction of patients at different stages of the disease, forming a conception about the relationship between the detected instrumental changes and the pathogenesis and clinical manifestations of the disease.

4. The content of the discipline

Topic 1 Methods of functional diagnostics in pulmonology

The structure and functions of the respiratory system. The main methods of functional diagnostics of the respiratory diseases, interpretation of its results (spirography; pneumotachometry; peakflowmetry; "flow-volume" curve of forced exhalation). Indications and contraindications for carrying out, methods of implementation, interpretation of results.

Topic 2 Provocation tests in pulmonology.

Indications and contraindications; methods of carryng out; interpretation of results. The concept of body plethysmography: indications and contraindications for carrying out, methods of implementation, interpretation of results. Assessment of bronchial resistance and gas analysis of exhaled air: indications and contraindications for carrying out, methods of implementation, interpretation of results.

Topic 3 Methods of functional diagnostics in gastroenterology.

The structure and functions of the digestive system. The main methods of functional diagnostics of the digestive system diseases, interpretation of its results (pH-metry, breath tests, video capsule endoscopy, electrogastroenterography, endoradiosonde techniques). Indications and contraindications for carrying out, methods of implementation, interpretation of results.

Topic 4 Gastrocardiomonitoring, gastrointestinal manometry. Oral glucose tolerance test, the test to iron absorption assessment.

Indications and contraindications for carrying out, methods of implementation, interpretation of results.

Topic 5 Electrophysiological methods of examination: electrocardiographic method of examination. ECG in healthy persons.

The main properties of the heart (automaticity, conductivity, contractility, irritability and refractoriness). Electrocardiographic standard and chest leads. ECG recording technique. Electrophysiological basis of ECG. Normal ECG characteristics (waves, intervals, segments). Determination of the electrical axis of the heart. ECG analysis.

Topic 6 ECG in hypertrophy of different parts of the heart.

Signs of the left and right atrial hypertrophy, combined ventricular hypertrophy. Ventricular overload. ECG changes in pulmonary embolism and acute cor pulmonale, chronic cor pulmonale, acquired heart valve disorders, hypertension, cardiomyopathy.

Topic 7. ECG in heart rhythm disorders.

ECG during heart rhythm disorders: SA node disorders, ectopic (heterotopic) rhythms due to the predominance of the automatism of ectopic centers, ectopic (heterotopic) cycles and rhythms, mainly associated with automatism disorders (extrasystoles, paroxysmal tachyarrhythmia, atrial fibrillation and flutter, ventricular tachycardia and ventricular fibrillation).

Topic 8. ECG in heart conduction disorders

ECG during heart conduction disorders (SA block, atrial block; AV-block I-III degree; Stokes-Adams syndrome; Frederick's syndrome; left and right bundle-branch block; syndromes of ventricular pre-excitation). ECG during implanted pacemaker, its peculiarities according to the type of pacemaker.

Topic 9. ECG in myocardial infarction.

Electrophysiological equivalents of ischemia, damage and necrosis of the heart muscle on the ECG. ECG in STEMI, non-STEMI. ECG diagnostic of myocardial infarction according to localization. ECG diagnosis of myocardial infarction in different stages. ECG diagnosis of complications of myocardial infarction.

Topic 10. Electrophysiological methods of examination: electromyography, electroencephalography.

Neurophysiological base of electromyography, mechanism the formation of of electromyogram, main indications and contraindications for examination, normal and pathological characteristics of EMG during surface electrodes registration, the results of electromyography according to the main types of neuromuscular lesions (muscle fiber lesions, neuromuscular disorders) transmission, lesions of peripheral nerve trunks).

Neurophysiological base of electroencephalography, main indications and contraindications for examination, normal EEG in healthy adult, pathological activities in adults, changes in EEG-changes during the waking cycle - sleep, features of EEG in major diseases of the central nervous system (the epilepsy, tumors and inflammatory diseases of the brain, vascular diseases, traumatic brain injury).
Topic 11. Daily blood pressure monitoring (DBPM) Methods of research, the main indications and contraindications for the examination, interpretation of the results. Advantages and disadvantages of oscillometric and auscultatory methods of blood pressure measurement. The role of DMAT in the diagnosis of hypertension. Analysis of DMAT results: indicators of SBP, DBP, average blood pressure. The higher and minimal ranges of blood pressure in different times of the day. Hypertension time index (HTI); Hypertension area index; variability of BP. The degree of nocturnal blood pressure reduction (circadian blood pressure profile). Degree and speed of blood pressure increase. Artery rigidity index. Circadian heart rate index.
Topic 12. Holter ECG Monitoring. Methodic, main indications and contraindications for examination, main steps of analysis of Holter monitoring, normal Holter monitoring indicators, interpretation of the obtained Holter ECG monitoring results.
Topic 13. Echocardiography. Transthoracic echocardiography: standard positions, anatomical norms in echocardiography, indicators of systolic and diastolic LV function. Tissue Doppler. Due to transesophageal echocardiography, stress - echocardiography. Fundamentals of methods, diagnostic value, indications and contraindications to the implementation, interpretation of results.
Topic 14. Echocardiography in the diagnostic of heart disorders. Ischaemic heart disease, arterial hypertension, myocarditis, pericarditis, congenital and acquired heart valve diseases, diseases of aorta. Possibilities of visualization, analysis of the received data.
Topic 15. Densitometry. Physiological basis of the method, methodic of it, main indications and contraindications for examination, interpretation of results.
Topic 16. Polysomnography: The basis of the method, methodic of it, main indications and contraindications for examination, the role of this method for diagnostic of obstructive sleep apnea in adults.
Topic 17. Thermography. Physical basis of the method, physiological base of thermoregulation, the methodic, main indications and contraindications for examination, characteristics of thermograms of the human body, interpretation of the obtained results in diseases of internal organs.
Topic 18. Practice-oriented graded test.

5. Intended learning outcomes of the course

After successful study of the course, the student will be able to:

LO1	To interview and to do the objective examination of patients according to ethical aspects. Ability to justify and apply clinical methods in understanding of diseases manifestation.
LO2	Be able to make a differential diagnosis, interpretate and formulate the diagnosis based on analyzing of the instrumental examination results.
LO3	To master the skills of functional diagnostic methods for diseases of the internal organs. Be able to choose the method of functional examination depending on the pathology for the differential diagnosis of diseases of the internal organs
LO4	Interpret, analyze and summarize the data obtained by applying functional diagnostic methods in accordance with the goals, objectives and criteria for

	achieving the expected results in the study of pathology.
LO5	To demonstrate the ability of moral and deontological principles as a medical specialist and the principles of professional subordination.

7. Types of training sessions and educational activities

7.1 Types of training sessions

Topic 1. Methods of functional diagnostics in pulmonology
Pr1. «Methods of functional diagnostics in pulmonology» The structure and functions of the respiratory system. The main methods of functional diagnostics of the respiratory diseases, interpretation of its results (spirography; pneumotachometry; peakflowmetry; "flow-volume" curve of forced exhalation). Indications and contraindications for carrying out, methods of implementation, interpretation of results. The study of this topic involves theoretical work in the study room (testing, discussion of situational tasks), at the patient's bed – mastering the skills of taking anamnesis, physical examination, analyzing instrumental examination results; use of a spirograph, peak flowmeter at the functional diagnostic room. With quarantine restrictions, work with the use of a virtual simulation of the collection and analysis of the above information, mastering skills through role-playing games, case-study.
Topic 2. Provocation tests in pulmonology. Body plethysmography.
Pr2. «Provocation tests in pulmonology. **B**ody plethysmography». Indications and contraindications; methods of carryng out; interpretation of results. The concept of body plethysmography: indications and contraindications for carrying out, methods of implementation, interpretation of results. Assessment of bronchial resistance and gas analysis of exhaled air: indications and contraindications for carrying out, methods of implementation, interpretation of results. The study of this topic involves theoretical work in the study room (testing, discussion of situational tasks); use of a spirograph, peak flowmeter at the functional diagnostic room. With quarantine restrictions, work with the use of a virtual simulation of the collection and analysis of the above information, mastering skills through role-playing games, case-study.
Topic 3. Methods of functional diagnostics in gastroenterology
Pr3. "Methods of functional diagnostics in gastroenterology" The structure and functions of the digestive system. The main methods of functional diagnostics of the digestive system diseases, interpretation of its results (pH-metry, breath tests, video capsule endoscopy, electrogastroenterography, endoradiosonde techniques). Indications and contraindications for carrying out, methods of implementation, interpretation of results. The study of this topic involves theoretical work in the classroom (testing, discussion of situational tasks), mastering the skills of taking anamnesis, physical examination, analyzing instrumental investigation results, as well as viewing videos of gastroscopy, colonoscopy and analysis of images made during irigoscopy. With quarantine restrictions, work with the use of a virtual simulation of the collection and analysis of the above information, mastering skills through case-study.
Topic 4. Gastrocardiomonitoring, gastrointestinal manometry. Oral glucose tolerance test, the test to iron absorption assessment.
Pr4. "Gastrocardiomonitoring, gastrointestinal manometry. Oral glucose tolerance test, the test to iron absorption assessment". Indications and contraindications for carrying out, methods of implementation, interpretation of results. The study of this topic involves theoretical work in the classroom (testing, discussion of situational tasks), mastering the skills of taking anamnesis, physical examination, analyzing instrumental investigation results, as well as viewing videos of gastrocardiomonitoring, gastrointestinal manometry. With quarantine restrictions, work with the use of a virtual simulation of the collection and analysis of the above information, mastering skills through case-study.

Topic 5. Electrophysiological methods of examination: electrocardiographic method of examination. ECG in healthy persons.

Pr5. «Electrophysiological methods of examination: electrocardiographic method of examination. ECG in healthy persons».

The main properties of the heart (automaticity, conductivity, contractility, irritability and refractory state). Electrocardiographic standard and chest leads. ECG recording technique. Electrophysiological basis of ECG. Normal ECG characteristics (waves, intervals, segments). Determination of the electrical axis of the heart. ECG analysis.

The study of this topic involves theoretical work in the classroom (solving of situational tasks in teams), training skills in application of instrumental (work with electrocardiograph, ECG data) methods of examination with further discussion of the results.

Topic 6. ECG in hypertrophy of different parts of the heart.

Pr6. «ECG in hypertrophy of different parts of the heart».

Signs of the left and right atrial hypertrophy, combined ventricular hypertrophy. Ventricular overload. ECG changes in pulmonary embolism and acute cor pulmonale, chronic cor pulmonale, acquired heart valve disorders, hypertension, cardiomyopathy.

The study of this topic involves theoretical work in the classroom (solving of situational tasks, ECG data in teams), training skills in application of instrumental methods of examination

Topic 7. ECG in heart rhythm disorders.

Pr7. "ECG in heart rhythm disorders".
ECG in SA node disorders, ectopic (heterotopic) rhythms due to the predominance of the automatism of ectopic centers, ectopic (heterotopic) cycles and rhythms, mainly associated with automatism disorders (extrasystoles, paroxysmal tachyarrhythmia, atrial fibrillation and flutter, ventricular tachycardia and ventricular fibrillation).

The study of this topic involves solving of situational tasks, ECG data interpretation with further discussion of the results.

Topic 8. ECG in heart conduction disorders

Pr8. «ECG in heart conduction disorders»
ECG in SA block, atrial block; AV-block I-III degree; Stokes-Adams syndrome; Frederick's syndrome; left and right bundle-branch block; pre-excitation syndromes. ECG in implanted pacemaker, its peculiarities according to the type of pacemaker. The study of this topic involves solving of situational tasks, ECG data interpretation with further discussion of the results.

Topic 9. ECG in myocardial infarction.

Pr9. «ECG in myocardial infarction»

Electrophysiological equivalents of ischemia, damage and necrosis of the heart muscle on the ECG. ECG in STEMI, non-STEMI. ECG diagnostic of myocardial infarction according to localization. ECG diagnosis of myocardial infarction in different stages. ECG diagnosis of complications of myocardial infarction.

The study of this topic involves solving of situational tasks, ECG data interpretation with further discussion of the results.

Topic 10. Electrophysiological methods of examination: electromyography, electroencephalography.

Pr10. «Electrophysiological methods of examination: electromyography, electroencephalography»
Neurophysiological base of electromyography, mechanism of the formation of electromyogram, main indications and contraindications for examination, normal and pathological characteristics of EMG in surface electrodes registration, the results of electromyography according to the main types of neuromuscular lesions (muscle fiber lesions, neuromuscular transmission disorders, lesions of peripheral nerves).

Neurophysiological base of electroencephalography, main indications and contraindications for examination, normal EEG in healthy adult, pathological activities in adults, changes in EEG-changes during the waking cycle - sleep, features of EEG in major diseases of the central nervous system (the epilepsy, tumors and inflammatory diseases of the brain, vascular diseases, traumatic brain injury).
Practical work in functional diagnostic room. EEG and EMG interpretation.

Topic 11. Daily blood pressure monitoring (DBPM)

Pr11. «Daily blood pressure monitoring (DBPM)»

Method of investigation, the main indications and contraindications for the examination, interpretation of the results. Advantages and disadvantages of oscillometric and auscultatory methods of blood pressure measurement. The role of DMAT in the diagnosis of hypertension. Analysis of DMAT results: indicators of SBP, DBP, average blood pressure. The higher and minimal ranges of blood pressure in different times of the day. Hypertension time index (HTI); Hypertension area index; variability of BP. The degree of nocturnal blood pressure reduction (circadian blood pressure profile). Degree and speed of blood pressure increase. Artery rigidity index. Circadian heart rate index. The study of this topic involves solving of situational tasks, DMAT data interpretation with further discussion of the results.

Topic 12. Holter ECG Monitoring.

Pr12. «Holter ECG Monitoring».

Methodic, main indications and contraindications for examination, main steps of analysis of Holter monitoring, normal Holter monitoring indicators, interpretation of the obtained Holter ECG monitoring results.

Topic 13. Echocardiography.

Pr13. "Echocardiography"

Transthoracic echocardiography: standard positions, anatomical norms in echocardiography, indicators of systolic and diastolic LV function. Transesophageal Tissue Doppler. echocardiography, stress-echocardiography. Fundamentals of methods, diagnostic meaning, indications and contraindications to the implementation, interpretation of results. Application of virtual simulation (watching videos about the methodic of ultrasound from different views), cardiac ultrasound methods of examination in practice.

Topic 14. Echocardiography in the diagnostic of heart disorders.

Pr14. «Echocardiography in the diagnostic of heart disorders».

EchoCG in ischaemic heart disease, arterial hypertension, myocarditis, pericarditis, congenital and acquired heart valve diseases, diseases of aorta. Possibilities of visualization, analysis of the received data.

Application of virtual simulation (watching videos of ultrasound exam in cardiac pathology), cardiac ultrasound method of examination in practice.

Topic 15. Densitometry.

Pr15. «Densitometry».

Physiological basis of the method, methodic of it, main indications and contraindications for examination, interpretation of results.

Application of virtual simulation (watching videos of densitometry), interpretation of densitometry results.

Topic 16. Polysomnography

Pr16. «Polysomnography» The basis of the method, methodic of it, main indications and contraindications for examination, the role of this method for diagnostic of obstructive sleep apnea in adults. Application of virtual simulation - watching videos of Polysomnography
Topic 17. Thermography.
Pr17. «Thermography». Physical basis of the method, physiological base of thermoregulation, the methodic, main indications and contraindications for examination, characteristics of thermograms of the human body, interpretation of the obtained results in diseases of internal organs. Application of virtual simulation - watching videos of Thermography
Topic 18. Practice-oriented graded test.
Pr18 «Practice-oriented graded test» (денна)

7.2 Learning activities

LA1	Self-study
LA2	Preparing to practice-oriented graded test
LA3	Preparing presentation and reporting
LA4	Solving of situational clinical tasks
LA5	E-learning on platforms (GoogleMeet, MIX.sumdu.edu.ua)
LA6	Preparing to practical classes
LA7	Watching training videos
LA8	Working with books and relevant information resources
LA9	Practical work with the patient at the functional diagnostic room and specialized departments of hospitals

8. Teaching methods

Course involves learning through:

TM1	Case-based learning.
TM 2	Team-based learning.
TM 3	Think-pair-share
TM 4	Role playing
TM 5	Practical-based learning
TM 6	Brain storm.
TM 7	Study discussion.

The discipline is taught using advanced teaching methods that contribute to developing professional skills aimed at training practice-oriented specialists and stimulating scientific activity.

Ability to abstract thinking, analysis and synthesis. Ability to learn and master modern knowledge, applying it in practice. Knowledge and understanding of the subject area and

professional activity comprehension. Ability to adapt and act in a new situation. Ability to make reasonев decisions; work in a team; skills in interpersonal relationship. Ability to use information and communication technologies. Determination and persistence to the tasks and commitments undertaken.

9. Methods and criteria for assessment

9.1. Assessment criteria

ECTS	Definition	National scale	Rating scale
	Outstanding performance without errors	5 (Excellent)	170 ≤ RD ≤ 200
	Above the average standard but with minor errors	4 (Good)	140 ≤ RD < 169
	Fair but with significant shortcomings	3 (Satisfactory)	120 ≤ RD < 139
	Fail – some more work required before the credit can be awarded	2 (Fail)	0 ≤ RD < 119

9.2 Formative assessment

FA1	Peer assessment
FA2	Teacher's instructions in the process of performing practical and situational tasks
FA 3	Clinical cases assessment
FA 4	Questionnaire and oral comments of the teacher based on the results of survey
FA 5	Assessment of spirograms, ECG, echocardiography, data of densitometry, etc.

9.3 Summative assessment

SA1	Evaluation of written tasks, questionary, solving of situational case
SA2	Assessment of spirograms, ECG, echocardiography, data of densitometry, etc.
SA3	Final evaluation: practice-oriented graded test

Form of assessment:

11 semester		200 scores
SA1. Evaluation of written tasks, questionary, solving of situational case		120
	Answering the questions, situational tasks solving, assessment of spirograms, ECG, echocardiography, data of densitometry, etc.	120
SA3. Final evaluation: practice-oriented graded test		80
	Evaluation of theoretical answers (2x20)	40
	Assessment of spirograms, ECG, echocardiography, data of densitometry, etc.	20

	Evaluation of practical skills	20

Form of assessment (special cases):

11 semester		200 scores
SA1. Evaluation of written tasks, questionary, solving of situational case		100
	In particular situations and limitation practical classes must be conducted distantly using such platforms as Mix.sumdu.edu.ua, Google meet.	100
SA2. Assessment of spirograms, ECG, echocardiography, data of densitometry, etc.		20
	In particular situations and limitation practical classes must be conducted distantly using such platforms as Mix.sumdu.edu.ua, Google meet	20
SA3. Final evaluation: practice-oriented graded test		80
	In particular situations and limitation practical classes must be conducted distantly using such platforms as Mix.sumdu.edu.ua, Google meet	80

Total mark of discipline is defined as the summarizing of points for current educational activities (not less than 72) and points for exam (not less than 48).
The calculation of the number of points for the current performance is based on the student's marks on the traditional 4-point rating scale by arithmetic mean calculating. The resulting value is converted into points by the formula: 120 multiplied by the arithmetic mean and divided by 5. The maximum number of points for the current educational activities of the student - 120.
The final assessment of the discipline is a practice-oriented graded test done at the end of the study semester according to the schedule completed by the Dean's office of the Medical institute. Students who have a current educational score of at least 72 points, who have not missed practical classes are admitted to the graded test. The practice-oriented graded test consists of 2 theoretical questions, each is graded at 12, 16 or 20 points, which corresponds to the traditional 4-point system "3", "4" or "5" respectively. The following marks for practical skill are: "5" - 20 points, "4" - 16 points, "3" - 12 points, "2" - 0 points. The assessment of spirograms, ECG, echocardiography, data of densitometry is evaluated in 20, 16 or 12 points, which corresponds to the traditional 4-point system "3", "4" or "5". Having summarized all the points for theoretical questions, practical skill and assessment of spirograms, ECG, echocardiography, data of densitometry the graded test is credited to the student if he scored at least 48 points out of 80 possible.
General mark of the discipline must be not more than 200.

10. Learning resources

10.1 Material and technical support

MTS1	Information and communication systems
MTS2	Library funds, archive of spirograms**,** electrocardiograms, Holter monitoring data, densitometry data, video of colonoscopy and gastroscopy, results of laboratory methods of examination
MTS3	Computers, computer systems and networks

MTS4	Multimedia, video and audio, projection equipment (video cameras, projectors, screens, laptops, etc.)
MTS5	Software (for support of distant learning)
MTS6	Municipal Non-Commercial Enterprise of Sumy Regional Council "Sumy Clinical Cardiology Dispensary", "Sumy Regional Clinical Hospital"
MTS7	Medical equipment (spirometer, peakflowmeter, electrocardiograph, height meter, scales, tonometer, fibrogastroscope, phonendoscope, ultrasound machine, glucometer)

10.2 Information and methodical support

Essential Reading	
1	Cardiology Procedures [Електронний ресурс]: A Clinical Primer / edited by Robert C. Hendel, Carey Kimmelstiel. – 1st ed. 2017. – London: Springer London, 2017. – XI, 347 p.
2	Pogorielova, O. S. Acute coronary syndrome [Текст]: study guide / O. S. Pogorielova. — Sumy: Sumy State University, 2021. — 73 p.
3	Internal Medicine. An Illustrated Radiological Guide / J.A. Al-Tubaikh; by Jarrah Ali Al-Tubaikh. — 2nd ed. 2017. — Cham: Springer International Publishing, 2017. — XVI, 592 p.
Supplemental Reading	
1	Integrative Cardiology [Електронний ресурс]: A New Therapeutic Vision / edited by Massimo Fioranelli. – 1st ed. 2017. – Cham: Springer International Publishing, 2017. – XII, 276 p.
2	Goldman-Cecil medicine [Текст]. V.1 / L. Goldman, L. Schafer, M. Crow etc. —25-th ed. — Saunders: Saunders Elsevier, 2016. — 1489 p.
3	Braunwald's heart disease: A textbook of cardiovascular medicine, 2-Volume Set 10th Edition. International edition. // by Douglas L. Mann, Douglas P. Zipes, Peter Libby, Robert O. Bonow. – Publisher: Elsevier, 2015. – 2136 pages.
Web-based and electronic resources	
https://empendium.com/ua/	