Subject	DIAGNOSTIC METHODS
Study programme	Professional study programme for nurses and technicians
Code	SMS/T-216
Academy year	II (second)
Semester	III (third) and IV (fourth)
Total of classes	120
ECTS credits	8
Type of subject	Obligatory / Compulsory
Precondition	Completion/ realization of all preconditions for enrolling in third and fourth academy year
Perform/Realize	Department of Biochemistry, Department of Transfusiology, Department of Radiology, Department of Nuclear medicine
Responsible professor	1. Doc. Svetlana Cekovska, PhD (Department of Biochemistry) 2. Prof. d-r Milenka Blagoevska, PhD (Department of Transfusiology) 3. Prof.d-r Nadica Mitrevska, PhD (Department of Radiology) 4. Prof Daniela Pop Gjorcheva, PhD MD (Department of Nuclear medicine)
Address	Coordinator professor for 2012/2013 academy year: Prof Daniela Pop Gjorcheva, PhD MD (D.of nuclear medicine) Institute of pathophysiology and nuclear medicine, Medical Faculty, Vodnjanska 17, Skopje, R.Macedonia Tel.+389 2 31 12 831; e-mail: dpopmed@gmail.com
Key words	Study programme for nurses and technicians, basic subjects, laboratory medicine, in vivo and in vitro diagnostic procedures
Educational purposes:	**Clinical biochemistry:** - to become familiar about the role and functioning of laboratory services in clinical diagnostics; - to learn about basic biological materials and methods for their collection and transport; - to learn about the importance of laboratory findings in clinical practice **Transfusiology:** - To learn about the importance of the laboratory findings in clinical practice -To learn the basic principles of transfusiology and the role of the nurse/technician in the transfusion practice -To learn the basic immunohaematologic testing **Radiology:** -- To learn how x-ray images are created with x-ray beam , what are physical and chemical characteristics of x-rays and their impact on biological tissue . -To learn about application of contrast agents - To be familiar with diagnostic methods in respiratory system, gastrointestinal system, cardiovascular system, angio and neurovascular system and the role of the nurse in these diagnostic investigations. Nuclear medicine: - To learn for radiation and its influence on environment - To learn for basic principles of radionuclide application in diagnosis and therapy of diseases. - To learn for biological effects of radiation and possible negative consequences of

	radiation exposure, as well as, about low- regulated aspects of dosimetry and protection against radioactivity. **Nuclear medicine:** - To learn about radiation and its influence on environment - To learn about basic principles of radionuclide application in diagnosis and therapy of diseases. - To learn about biological effects of radiation and possible negative consequences of radiation exposure, as well as, about low- regulated aspects of dosimetry and protection against radioactivity.
Short contents	**Theoretical course / education** **Clinical biochemistry (20 classes)** 1. Definining of terms: laboratory, clinical chemistry, clinical biochemistry, laboratory diagnostics; 2. Organization of laboratory services on different levels (primary, secondary, tertiary) in diagnostics; 3. Biological materials, their importance and methods for collection, storage and transport; 4. Anticoagulants and other additives in preparation of samples and their function; 5. Respiration; 6. Senses; 7. Importance of laboratory findings for further professional activity (procedure); 8. The role of the nurse/technician in communication with laboratories **Transfusiology (15 classes)** Providing blood and blood products: Blood donation 1. Donor selection 2. Blood collection and testing 3. Storage, transport and distribution of blood and blood products 4. Autologous transfusion Principles of immunohaematology 1. Blood groups 2. Rh blood system 3. Other red blood cell antigens 4. Diagnostic significance of the direct and indirect Coombs test 5. INR 6. Pregnancy testing 7. Pretransfusion testing Clinical transfusiology 1. Blood component therapy **2.** Adverse events of transfusion **Radiology (15 classes)** 1. Basic principles in radiology, x-ray tube, characteristics of x-ray beam 2. Physical, chemical and ionization characteristics of x-rays 3. Impact of x-rays on biological tissue 4. Contrast agents and contrast enhancement ,local and general reactions to contrast application with medicament therapy 5. Diagnostic methods for respiratory and gastrointestinal system 6. Nurse role in preparation of patient in evaluation of deferent organs and systems

	7. Diagnostic methods for urogenital ,neurovascular system 8. Preparing of pediatric patient for radiology investigation **Nuclear medicine (5 classes)** 1.Basic aspects of radioactivity and radionuclide decay (alpha, beta and gamma decay) 2.Principles of detection of radioactivity, scintillation and ionization detectors in nuclear medicine 3.Production of radionuclides (reactors, cyclotrons, generators) 4.Radiopharmaceuticals- production and application 5.Principles of radiotracers methods, application of radionuclides in diagnostic procedures and therapy of diseases. 6.Biological effect of radiation **Practice training** **Clinical biochemistry (25 classes)** 1. Vein and capillary blood collection; 2. Testing of urinary samples with test stripes; 3. Testing of blood samples for glucose with test stripes; 4. Preparation of biological specimens for transport; 5. Learning about analytical methods for determination of glucose, urea and proteins in sera; 6. Laboratory analyses, their interpretation (measuring units, values) and importance **Transfusiology (10 classes)** 1. Blood collection, transport and storage 2. Blood typing 3. Immunohaematologic testing 4. Patient care during and after the transfusion **Radiology (15 classes)** 1. Dark room , x-ray tube, cassettes, x-ray machines 2. Practical application of contrast agent 3. Preparing patient for gastrointestinal investigation 4. Working with pediatric patient 5. Working in angio neurodiagnostic department **Nuclear medicine (15 classes)** 1.Radionuclides transformation, absolute radioactivity - measurement units, principles of detection and measurement of radioactivity (background radioactivity, collimation, field of view, standard geometry of measuring Statistics of radioactive decay), 2.Dosimetry and protection against radiation 3.Contamination and decontamination 4.Radiolabeling and quality control of radiopharmaceuticals 5.The application of radionuclides for In vitro procedures 6.Presentation of the most common performed nuclear medicine visualizing diagnostic procedures
Organization	Lecture: 55 classes Practice training: 65 classes
Methods of learning	Lectures, practice training
Predicted/Expected	**Knowledge and understanding:** to achieve a knowledge about basic principles of

<table>
<tr><td>learning results</td><td>laboratory methods, diagnostic procedures in transfusiology, radiology and nuclear medicine and their importance in diagnosis and therapy of disease in routine clinical practice.
Key skills: implementation of achieved knowledge in routine practice.</td></tr>
<tr><td>Specific recommendation during the teaching process</td><td>To get signature, students are obliged to attend lectures and practice training. Admittance to continuous examinations is precondition for getting signature, too.

All predetermined teaching activities are valued as:
Attendance of the lectures:
51% - 60% - 2.5 points
61% - 70% - 3.5 points
71% - 80% - 4.5 points
81% - 90% - 6 points
91% -100% - 7.5 points

Attendance of practice training:
51% - 60% - 0.5 points
61% - 70% - 1.0 points
71% - 80% - 1.5 points
81% - 90% - 2.0 points
91% -100% - 2.5 points

Activity grading:
Fair-7
Good - 9
Excellent-10

Table 1.
<table>
<tr><td>Type of teaching activities</td><td>Biochemistry</td><td>Transfusiology</td><td>Radiology</td><td>Nuclear medicine</td></tr>
<tr><td>Lectures</td><td colspan="4">2.5-7.5</td></tr>
<tr><td>Practice training</td><td colspan="4">7.5-12.5</td></tr>
<tr><td>Continuous testing – Colloquiums (two)</td><td>10-15</td><td>5-7.5</td><td>6-10</td><td>5-7.5</td></tr>
<tr><td>Final exam (Practice testing)</td><td colspan="4">24-40</td></tr>
<tr><td>Total</td><td colspan="4">60-100</td></tr>
</table>
Table 2. Passing grades:
<table>
<tr><td>Scores</td><td>Mark</td><td>Grade</td></tr>
<tr><td>93-100 points</td><td>10</td><td>A</td></tr>
<tr><td>85- 92 -//-</td><td>9</td><td>B</td></tr>
<tr><td>77- 84 -//-</td><td>8</td><td>C</td></tr>
<tr><td>69- 76 -//-</td><td>7</td><td>D</td></tr>
<tr><td>60- 68 -//-</td><td>6</td><td>E</td></tr>
<tr><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>Knowledge examination</td><td>Continuous examination:
Regular attendance of lectures and practice training are precondition for admittance of students to continuous knowledge testing/examination. Two colloquiums (clinical biochemistry and transfusiology, and radiology and nuclear medicine) are anticipated, both in written form (mostly in multiple questionare form). The continuous examinations are thought to be passed with minimum 60% achieved points for each colloquium, which allow admittance to final exam (after getting signature). Passing of one of two colloquiums allows students admittance to complete final exam (failed colloquium and final exam). Failing of both</td></tr>
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	colloquiums do not allow admittance to final exam. Passed colloquiums /exams are valid during the six sessions after getting signature. **Final exam (in written form):** Include practical course of the subject and examination of practical skills of the students. Final exam is a part of an examination session (May/June and August/September). **Complete final exam** is a part of examination sessions (May/June and August/September). It includes failed colloquium/exam and final exam. Passing the colloquium first is a precondition for admittance the students to final exam. Complete final exam should be passed during the next six sessions after getting signature (independent of students admittance to the exam). The mark of the whole subject mark is composed by responsible professor, according to a total points achieved from attendance of lectures, practice course and practice training and points achieved from continuous testing and final exam (Table 1 and Table 2). An extraordinary study programme is organized to perform 40% of anticipated theoretical and practical course of ordinary study programme. Final exam as a part of exam session is in written form (MCQ) and includes both part of the education, theoretical course and practice activities. Theoretical colloquium should be passed before admittance to examination of practical course. Subject mark is composed according the total achieved points and passing grade (see Table 1 and Table 2)
Textbooks	1.B. Straus. Medicinska biohemija. Medicinska naklada, Zagreb, 2009. 2. Seward.Bushong, Radiologic Science for technologist 3. J.Ball, T.Price; Chesneys radiographic imaging 4.Vaskova O, Miceva Ristevska S, Pop Gjorcheva D, Miladinova D, Loparska S, Janevik-Ivanovska E: Basic nuclear medicine, Boro Grafika, Skopje, 2008