

APPROVED BY
Head of the Department
Arlyapov A.Yu.
« ____ » _____ 201__ г.

ANNOTATION OF THE SUBJECT

1. SUBJECT TITLE

MATERIAL CUTTING AND CUTTING TOOLS

2. CODE GIVEN IN CURRICULUM III.B.1.1.0

3. CURRICULUM 150700 Mechanical Engineering

4. COURSE

Technologies, Equipment and Automation of Engineering Manufacturing

5. QUALIFICATION (DEGREE) Bachelor

6. PROVIDING DEPARTMENT Automated Mechanical Manufacturing Engineering of Institute of Cybernetics

7. LECTURERS Kirsanov S.V., Kozlov V.N., Kim A. B.
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8. OBJECTIVES:

Elaboration of the proficiency in applying knowledge, skills and experience in the field of metal cutting, designing, manufacturing and application of common cutting tools.

9. COURSE OUCOMES

After the completion of the «Material cutting and cutting tools» course student is to:

know

- physics of material cutting;
- types of chip and ways of chip type management;
- chip formation influence on residual stresses, depth and degree of machined surface workhardening;
- types of cutting tools and peculiarities of their use;
- characteristics of cutting tool wear, optimal tool life and methods of cutting capabilities recovery;
- characteristics of the basic methods of machining;
- cutting tools design peculiarities;

be able to

- rationally choose methods of machining depending on the type of workpiece surfaces, workpiece material and surface finish requirements;
- choose cutting tools, grades of cutting tool materials, optimal geometric parameters and cutting parameters;
- choose type and grade of coolant depending on surface finish requirements and economy;
- calculate cutting forces and required machine tool power;
- resharpen cutters, drills, core drills and milling cutters;
- calculate values of the cutting tool geometric parameters;

apply the following methods

- calculation of the cutting parameters;
- designing of the form cutters and broaches.

The outcomes stated above is in accordance with 3.5.2, 3.6.1, 3.11.2 and 3.13.1; Y.4.1, Y.4.3, Y.6.2 and Y.11.1; B.4.1, B.5.1, B.10.2 and B.11.2 described in the Educational Program 150700 “Mechanical Engineering”.

The following competences are formed upon completion of the course:

1. Universal (cultural) -

- an ability to apply basic and special knowledge of math, natural science, humanities and economic sciences in engineering (OK-10).

2. Professional -

- an ability to apply basic laws of natural sciences, methods of mathematic analysis and simulation, basics of theoretical and experimental researches in engineering to design objects and engineering processes in mechanical engineering using standard CAD software (IK-10);
- readiness to maintain engineering discipline during production, develop new engineering methods of production, apply methods of quality assessment of samples, parts, assemblies and products (IK-1);
- readiness to apply state-of-the-art methods for developing low-waste, energy-saving and environmentally friendly mechanical engineering techniques, that ensure human safety and protection from potential accidents and natural disasters, readiness to apply methods of conservation of raw materials, energy and other resources (IK-8).

10. SUBJECT CONTENT

10.1 Basics of Cutting (lectures – 8 hours, practice – 2 hours, laboratory works – 6 hours, self-study – 18 hours)

10.2 Basic Types of Machining (lectures – 6 hours, practice – 6 hours, self-study – 18 hours)

10.3 Grinding operations (lectures – 4 hours, practice – 2 hours, laboratory works – 2 hours, self-study – 8 hours)

10.4 Design and Calculation of Broaches and Cutters (lectures – 4 hours, practice – 4 hours, laboratory works – 4 hours, self-study – 12 hours)

10.5 Design and Calculation of Drills, Core-Drills and Reamers (lectures – 4 hours, practice – 4 hours, laboratory works – 4 hours, self-study – 12 hours)

10.6 Design and Calculation of Milling Cutters (lectures – 6 hours, practice – 6 hours, laboratory works – 6 hours, self-study – 18 hours)

10.7 Design and Calculation of Thread Cutting Tools (lectures – 4 hours, practice – 4 hours, laboratory works – 4 hours, self-study – 12 hours)

10.8 Design and Calculation of Gear Cutting Tools (lectures – 6 hours, practice – 6 hours, self-study – 12 hours)

10.9 Cutting Tools for Automated Production (lectures – 4 hours, practice – 8 hours, self-study – 12 hours)

11. YEARS OF STUDY 3, 4 SEMESTERS 6, 7, 8 CREDITS 9 (2+4+3)

12. PREREQUISITES

III.Б.2.0 «Constructional Materials Engineering»; III.Б.3.0 «Metrology, Standardisation and Certification»; III.Б.7.0 «Materials Science»

13. COREQUISITES III.Б.1.2.0 «Metal Cutting Machine Tools»; III.Б.8.0 «Fundamentals of Mechanical Engineering»; III.Б.1.4.0 «Mechanical Engineering»

14. ALLOCATION OF CLASS HOURS:

<u>LECTURES</u>	<u>18+18+9=45 hours</u>
<u>PRACTICAL CLASSES</u>	<u>10+17+15=42 hours</u>
<u>LABORATORY WORKS</u>	<u>8+19+0=27 hours</u>
<u>CLASS HOURS IN TOTAL</u>	<u>36+54+24=114 hours</u>
<u>SELF-STUDY TRAINING</u>	<u>96 hours</u>
<u>TOTAL</u>	<u>210 hours</u>

EDUCATION FORM full-time

15. LIST OF LABORATORY WORKS

Cutting tool geometry measurement, influence of the cutting parameters on cutting force and temperature, wear and tool life in turning operations, influence of the cutting parameters on cutting force in grinding and milling, sharpening of turning cutters, sharpening of form cutters, sharpening of twist drills, sharpening of core-drills and reamers, sharpening of plain milling cutters, sharpening of special milling cutters, sharpening of thread cutter, sharpening of thread chasers.

16. COURSEWORK

According to the educational program the «Material cutting and cutting tools» course is accomplished with a coursework.

17. PERSONAL HOME ASSIGNMENTS

- Selection of Grinding Wheels, Depending on the Workpiece Material and the Required Accuracy and Surface Finish;
- Design of Form Cutters;

- Design of Broaches;
- Design of Involute Gear Cutters;
- Peculiarities of Design of Cutting Tools for Automated Production;
- Peculiarities of Design of Auxiliary Tools for Automated Production;
- Cutting Tool Materials
- Indexable Cutting tools
- Abrasives for Cutting Tools Sharpening
- Cutting Fluids for Grinding Operations
- Special Types of Drills
- Applications of Solid Endmills
- Cutting Tools for Finishing Operations
- Auxiliary Tools for CNC MACHINES
- Non-traditional Machining
- Influence of Cutting Parameters on Surface Integrity
- Circular Broaches for gear Cutting
- Cutting Instruments for Bevel Gears Cutting
- Modern Designs of Threading Heads
- Balancing of Tools for High Speed Machining

18. ASSESSMENT FORM Test, examination, differential test

19. BASIC AND AUXILIARY LITERATURE

Required textbooks:

1. Кожевников Д.В., Схиртладзе А.Г., Кирсанов С.В. Резание материалов. –М.: Машиностроение, 2007. –304 с.
2. Кожевников Д.В., Кирсанов С.В. Metallорежущие инструменты: Учебник. –Томск: Изд-во Том.ун-та, 2003. –392 с.
3. Справочник технолога-машиностроителя. В 2-х томах, т.2. Под ред. Косиловой А.Г. и Мещерякова Р.К. – М.: Машиностроение, 1985. 496 с., ил.
4. Metallорежущие инструменты/ Г.Н.Сахаров, О.Б.Арбузов и др. М.:Машиностроение, 1989. –328 с.
5. Иноземцев Г.Г. Проектирование metallорежущих инструментов. М.:Машиностроение, 1984, -270 с.

Recommended textbooks:

1. Кожевников Д.В., Гречишников В.А., Кирсанов С.В., Кокарев В.И., Схиртладзе А.Г., Режущий инструмент: Учебник для вузов / Под редакцией С.В. Кирсанова. – 2-е изд. Доп. М.: Машиностроение, 2005. 528 с.: ил.
2. Грановский Г.И., Грановский Э.Г. Резание металлов. –М.:Высшая школа, 1985. –304 с.
3. Справочник инструментальщика/ Под ред.И.А.Ординарцева. – Л.:Машиностроение, 1987. –846 с.

4. Справочник конструктора-инструментальщика/ Под ред.В.И.Баранчикова. 1994. –560 с.
5. Протяжки для обработки отверстий/ Д.К.Маргулис, М.М.Тверской и др. –М.:Машиностроение, 1986. –232 с.
6. Нефедов Н.А., Осипов К.А. Сборник задач и примеров по резанию металлов и режущему инструменту. –М.:Машиностроение, 1990. –448 с.
7. Полетика М.Ф. Теория резания металлов. Учебное пособие. Выпуск 1. Томск, ТПИ, 1974. –186 с.
8. Полетика М.Ф. Теория обработки резанием. Учебное пособие. Часть 2. Томск, ТПИ, 1975. –102 с.
9. Полетика М.Ф. Теория резания металлов. Учебное пособие. Часть 3. Томск, ТПИ, 1980. –95 с.
- 10.Полетика М.Ф. Фрезерование. Учебное пособие. Томск, ТПУ. 1994. – 46 с.

20. COORDINATOR Assistant Professor Kim A. B. (tel. 41-95-39)

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