Quality Management System

SYLLABUS on
«Theory of Machines and Mechanisms»

Field of study: 27 “Transport Services”
Speciality: 272 “Aviation Transport”
Specializations: Maintenance and Repair of Aircraft and Aircraft Engines
Airports Technologies of Works and Technological Equipment

Year of Study – 2nd Semester – 4th
Classroom Sessions – 64 Examination – 4th semester
Self-study – 101
Total (hours/ECTS credits) – 165/5,5
Term Paper – 4th semester

Index CB-1-272/16-2.12

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The Syllabus on "Theory of Machines and Mechanisms" is based on the educational and professional program and Bachelor Curriculum № CB-1-272/16 for Speciality 272 «Aviation Transport» and Specializations «Maintenance and Repair of Aircraft and Aircraft Engines», «Airports Technologies of Works and Technological Equipment» and correspondent normative documents.

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Discussed and approved by the Graduate Department for Speciality 272 «Aviation Transport» and Specialization «Airports Technologies of Works and Technological Equipment» – the Airport Technologies Department, Minutes № _____ of _______2017.
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Discussed and approved by the Graduate Department for Speciality 272 «Aviation Transport» and Specialization «Maintenance and Repair of Aircraft and Aircraft Engines» – the Aircraft Airworthiness Retaining Department, Minutes № _____ of _______2017.
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Document level – 3b
The planned term between the revisions – 1 year
Master copy
1. EXPLANATORY NOTE

The Syllabus of discipline "Theory of Machines and Mechanisms" is developed on the basis of "The guidelines for the development and execution of training programs and work training courses", enacted by order 16.06.2015 №37/роз.

This discipline is the theoretical basis of combined knowledge and skills that form the profile of aviation specialist in fields of kinematics and dynamics of mechanisms and machines, the foundations of mechanism design scheme for a given kinematic and dynamic parameters.

The purpose of teaching the discipline is to form future professionals knowledge on the structure, kinematics and dynamics of modern machines and mechanisms, as well as methods for their design. Acquired knowledge is the basis for the study of modern aeronautical engineering at special departments and need professionals who work in the fields of aircraft and helicopters.

The tasks of the discipline are studying general principles of analysis and synthesis of leverages, cam mechanisms and gear trains, acquisition of practical skills of mechanism structure determination, carrying out kinematic and force analysis of mechanisms, acquaintance with the method of law of motion determination and methods of balancing and motion control of mechanisms and machines.

As a result of studying the discipline a student shall

KNOW:
- principles of designing of mechanisms and machines;
- methods of kinematic analysis of different types of mechanisms;
- designing features of leverage, gear trains and cam mechanisms;
- methods of determination the law of motion of mechanisms under action of applied forces;
- method of balancing and motion control of mechanisms and machines.

ABLE:
- to divide mechanisms into separate simpler kinematic chains (groups of links);
- to carry out kinematic analysis of leverage, gear trains and cam mechanisms;
- to determine forces acting on the links of mechanisms and machines as well as reacting forces in movable connections of mechanism links;
- to reduce masses, forces of inertia and moments of a couple of inertia forces to reduced link of a mechanism;
- to solve tasks of designing mechanisms for the given initial data.

The subject matter of discipline is structured with module principle and is divided into two modules:

training module №1 „Structure, kinematics and dynamics of mechanisms and machines”;

training module № 2 „Mechanisms with higher pairs”, each of which is logically complete, relatively independent, integral part of the discipline, learning of which provides for modular test and analysis of its doing.

A separate third module is a term paper, which is done by student in the fourth semester. Course paper is an important part to fix and to deepen theoretical and practical knowledge and skills, acquired by student during studying the discipline.

2. SUBJECT CONTENT

2.1. Module №1 “Structure, kinematics and dynamics of mechanisms and machines”

**Topic 2.1.1. Main terms and definitions.**

Machine-building as the leading branch of the national economy. Theory of mechanisms and machines as a science. Interrelation of TMM with other related disciplines. The role of TMM in the preparation of specialists in aircraft and helicopter engineering. Definition of mechanism, machine, link, kinematic pair. Classification of kinematic pairs. Degree of freedom of a mechanism.

**Topic 2.1.2. Structural analyses of mechanisms.**


**Topic 2.1.3. Kinematic analysis of mechanisms.**


**Topic 2.1.4. Kinetostatics of mechanisms.**

Kinetostatic method of mechanisms force analysis. Main tasks. Classification of acting forces. The forces of inertia. The order of the force analysis of the Assours groups. Determination of balancing moment which is applied at the initial link. Method of Zhukovsky’s rigid lever.

**Topic 2.1.5. Balancing of rotating links.**

The tasks of mechanisms balancing. The static, dynamic and total balancing of rotating links. Determination of balances magnitude and position by graphical and analytical methods. Balancing of aircraft mechanisms.

**Topic 2.1.6. The motion of mechanism.**

Reducing forces and masses to the reduced link. Dynamic model of mechanisms. Reduced force. Reduced moment

2.2. Module №2. “Mechanisms with higher pairs”

**Topic 2.2.1. Gear trains. The parameters of involute spur gear.**


**Topic 2.2.2. Modified gearing.**


**Topic 2.2.3. Determination of the velocity ratio of gear trains. Theory of gearing.**


**Topic 2.2.4. Analysis and synthesis of planetary gearings.**


**Topic 2.2.5. Mechanisms of intermittent action.**

The main types of mechanisms of intermittent action. Analysis and synthesis of Maltese, ratchet and other mechanisms with given duration of stopping.

**Topic 2.2.6. Cam mechanisms. Plotting the graphs of the follower paths.**
Cam mechanisms. Plotting the graphs of the follower paths. Types of plane cam mechanisms. Method of reversed motion.

**Topic 2.2.7. Profiling plane cam mechanisms.**
Plotting the cam profile for different types of cam mechanisms. Designing cam mechanisms taking into account pressure angle. Laws of motion of the follower

**Topic 2.2.8. Friction in kinematic pairs. The efficiency.**

### 2.3. Module №3 «Term Paper».

The term paper of discipline is performed in the fourth semester, according to the established approved methodical recommendations, in order to consolidate and extend the knowledge and skills acquired by students in the process of learning the discipline about kinematics and dynamics of mechanisms and machines, bases of mechanism diagram design according to given kinematic and dynamic parameters.

The aim of the course work is to consolidate the knowledge obtained by students in the study subjects and practical skills of research and design mechanisms of modern aircraft. The course work is a major, the most important type of independent work.

For successful implementation of the course the student should know the methods for determining the forces and moments of inertia, basic parameters of gears, parameters of involute gearing, conditions of assembly of planetary gearing, to be able to draw velocity and acceleration diagrams, to determine the magnitude and direction of the linear and angular velocities and accelerations of mechanism links, to build gear meshing according to calculated data, to draft force diagrams and to determine forces in kinematic pairs, to determine balancing force and balancing moment.

Performance, design and defense of the term paper are carried out by a student individually according to the methodological guides.

The elapsed time for doing term paper – up to 30 hours of student’s individual work.

### 3. LIST OF REFERENCES

#### 3.1 Basic recommended sources


#### 3.2. Additional recommended sources


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