**Final control**

subject "Theoretical mechanics"

**1- OPTION**

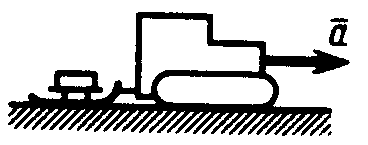
1. **Axioms of statics:**

(**key words**: balance of bodies, forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

2**. Kinematics of a point**:

(**key words**: methods for determining the movement of a point, speed and acceleration of a point by the coordinate method)

**3.Problem.** A tractor moving along a horizontal road with an acceleration a=1m/s2 pulls skates with mass m=600kg. If the coefficient of friction of skates on snow is f=0.04, calculate how much force the tractor needs to pull the skates with.



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**Final control**

subject "Theoretical mechanics"

**2- OPTION**

1. **Basic concepts of statics**:

(**key words**: connections and reactions of connections, axioms of statics, resultant force)

2. **Equilibrium of bodies under the action of friction force**

**(key words:** Sliding friction force Rolling friction force.)

|  |  |
| --- | --- |
| **3.Problem.** If a beam with a length of AB=4 m is pressed against the wall, on which a force F=4 N and a moment M=2 Nm act, find the moment of reaction to the support A.  . |  |
|  |  |

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**Final control**

subject "Theoretical mechanics"

**3- OPTION**

1 **The equilibrium conditions of a system of forces on a plane**:

**(key words:** the moment of force, the projection of the force on the axis, the main vector of the system of forces and the main moment.)

2. **Basic concepts of point dynamics**:

**(key words** part of dynamics, basic laws of classical mechanics, two main problems of dynamics.)

|  |  |
| --- | --- |
| **3.Problem.** The heavy load is attached to the wall using weightless rods AC and BC. If the rod AC forms an angle of α=60° with the wall, the rods form an angle of β=45°, and the compression of the rod AC is F2=25N, calculate the tension in the rod BC. |  |

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**Final control**

subject "Theoretical mechanics"

**4- OPTION**

1. **Converging force systems on plane:**

(**key words:** converging forces**,** equilibrium conditions of converging force systems, resultant forces,.)

1. **Complex motion of a material point:**

(**key words:** relative motion of a point, the theorem on the ADDITION of the velocities of a point in a complex motion, Coriolis acceleration.)

|  |  |
| --- | --- |
| **3.Problem.** The vertical force F1 acts on the hinge C attached to the cables AC and BC. If the cables form an angle =30° and =75° from the vertical, and the tension force of the AC cable F2=15 N, determine the tension of the cable F3. |  |

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**Final control**

subject "Theoretical mechanics"

**5- OPTION**

1 **Kinematics of a rigid body**:

(**key words**: the rotational motion of a rigid body around a fixed axis, the law of rotational motion around a fixed axis, the velocity and acceleration of points of a body in rotational motion around a fixed axis.)

**2 Introduction to the dynamics of mechanical system**:

**(key words:** mechanical system, classification of forces acting on mechanical system, external and internal forces, properties of internal forces.)

|  |  |
| --- | --- |
| **3.Problem.** Vertical forces F1=1kN, F2=2kN and F3=3kN act on the beam AB. If its dimensions are AC=CD=DE=1m, BE=2m, determine the reaction force of support B in kN. |  |

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**Final control**

subject "Theoretical mechanics"

**6- OPTION**

1. **Kinematics of a rigid body:**

**(key words** translational motion of a rigid body, law of translational motion, velocity and acceleration of points of a body in translational motion.)

2.**Basic concepts of point dynamics**:

( **key words**: subject of dynamics, basic laws of classical mechanics, two main problems of dynamics.)

**3.Problem.**

|  |  |
| --- | --- |
| A vertical force F=5kN and a distributed force of intensity q=4kN/m act on the beam AB. If its dimensions are AC=3m and BC=6m, find the reaction force at support B in kN  . |  |

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**Final control**

subject "Theoretical mechanics"

**7- OPTION**

**1.Concept of couple force:**

**(key words:** couple force and its moment, addition of couple forces, equivalent couples)

**2.Point kinematics:**

**(key words** methods of determining the motion of a point, velocity and acceleration of a point in a natural method.)

|  |  |
| --- | --- |
| **3.Problem.**.Gear wheels with radius R1=0.8m and R2=0.4m rotate and move the 3rd rail. If the 1st wheel rotates according to the law φ1=4t2, determine the acceleration of the 3rd rail. | 8_4_7 |

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**Final control**

subject "Theoretical mechanics"

**8- OPTION**

1. **Spatial force system**:

(**key words**: projection of spatial force, moment of spatial force, equilibrium conditions of spatial force system)

1. **Point kinematics**:

**(key words:** methods of determining the motion of a point, velocity and acceleration of a point in the vector method.)

|  |  |
| --- | --- |
| **3.Problem.** Gear wheels with radii R1=0.4m, R3=0.5m move from rest under the influence of external forces. Determine the speed of point M at t=2s if the 1st wheel rotates with a linearly accelerated angular acceleration 1=4rad/s2. | 8_4_4 |

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**Final control**

subject "Theoretical mechanics"

**9- OPTION**

**1.Parallel force systems on plane**

**(key words:** parallel forces, equilibrium conditions of parallel forces, addition of parallel forces**)**

**2**.**Introduction to Mechanical System Dynamics. Moment of inertia.**

**(key words:** Mass and center of mass of a mechanical system.Properties of internal forces. Moment of inertia)

|  |  |
| --- | --- |
| **3.Problem.** A beam AB with a weight of G=20kN is acted upon by distributed forces with an intensity of q=0.5kN/m. If its dimensions are AB=6m, AC=BC, find the base reaction A in kN. |  |

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**Final control**

subject "Theoretical mechanics"

**10- OPTION**

**1.Types of support**

(**keywords:** roller support,pinned support, fixed support, reaction forces of supports)

2.**Point kinematics**

(**keywords:** rotational motion of rigid body around fixed axis, angular velocity, angular acceleration)

|  |  |
| --- | --- |
| **3.Problem.** A beam with length AB=9m is acted upon by distributed forces with intensity q=5kN/m, so that the base reaction B is 10 kN, what should be the distance AC of the distributed force? |  |

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**Final control**

subject "Theoretical mechanics"

**11- OPTION**

1. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

1. **Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Loads of weights 1, 2 and 3are hanged from blocks by strings. If G2=55N and α=75°, β=60°, determine the value of G3. |  |

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**Final control**

subject "Theoretical mechanics"

**12- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane**)**

**2.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**3.Problem.** If a material point with a mass of m=1.4 kg moves along a straight line according to the law x=6t2+6t+3, find the amount of equal acting force on it.

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**Final control**

subject "Theoretical mechanics"

**13- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

**3.Problem.**. If the body rotates around a fixed axis according to the law φ=4+2t3, determine the angular acceleration of the body when the angular speed is ω=6rad/s.

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**Final control**

subject "Theoretical mechanics"

**14- OPTION**

1**.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

**3.Problem.** If a material point with a mass of m=3kg moves along a straight line with the law x=0.04t3, find the amount of equal force at t=6s?

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**Final control**

subject "Theoretical mechanics"

**15- OPTION**

1. **Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

2. **Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

|  |  |
| --- | --- |
| **3.Problem.** If three forces F1=10N, F2=15N and F3=20N intersecting at one point form angles α1=30°, α2=45° and α3=60° with the Ox axis, determine the amount of resultant force |  |

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**Final control**

subject "Theoretical mechanics"

**16- OPTION**

**1.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

2**. Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.Force F=150N acts on point A of the square plate. If the  sides of the square are 0.2m, find the moment of the force about point B. |  |

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**Final control**

subject "Theoretical mechanics"

**17- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane,converging,parallel and arbitrary force systems**)**

2. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

|  |  |
| --- | --- |
| **3.Problem.**. If the force F1=4kN and F2 act on the beam BC fixed by the hinge A and it is in equilibrium, the distances AC=2m, AB=6m, find the amount of the F2 forces in kN |  |

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**Final control**

subject "Theoretical mechanics"

**18- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
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| **3.Problem.** Body 1 on an inclined plane is acted upon by a force F=90 N. If the coefficient of friction between the object and the plane is f=0.3, how much should the load weigh in order to move? |  |

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**Final control**

subject "Theoretical mechanics"

**20- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**. Load 1 with a weight of 100 N is connected by a string to load 2 through a block. If the coefficient of friction between load 1 and the plane is f=0.3, find the maximum value of load 2 so that load 1 stays in place? | *2_5_8* |

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**Final control**

subject "Theoretical mechanics"

**19- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane, converging, parallel and arbitrary force systems**)**

**2.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

**3.Problem.** A landing plane descends to the ground at a speed of 180 km/h and stops after covering a distance of 1000 m. Calculate the average deceleration modulus of the plane.

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**Final control**

subject "Theoretical mechanics"

**21- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

2**. Kinematics of a point**:

(**key words**: methods for determining the movement of a point, speed and acceleration of a point by the coordinate method)

|  |  |
| --- | --- |
| **3.Problem.** The heavy load is fixed to the wall using weightless rods AC and BC. If the rod AC is at an angle of =60° with the wall, αand the rods βform an angle of =45° to each other, and the compression of the rod AC is F 2 =25N, calculate the tension in the rod BC. | *1_2_5* |

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**Final control**

subject "Theoretical mechanics"

**22- OPTION**

1. **Basic concepts of statics**:

(**key words**: connections and reactions of connections, axioms of statics, resultant force, unit of forces, distributed forces.)

2. **Equilibrium of bodies under the action of friction force**

**(key words:** Sliding friction force , Rolling friction force.coefficient of friction, equilibrium conditions)

|  |  |
| --- | --- |
| **3.Problem.**. Loads 1 and 2 weighing 400 N and 96 N are connected through the block using a string. Find the minimum coefficient of friction between the plane and the 1st load so that the 1st load is not pulled by the 2nd load and does not move. | *2_5_5* |
|  |  |

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**Final control**

subject "Theoretical mechanics"

**23- OPTION**

1 **The equilibrium conditions of a system of forces on a plane**:

**(key words:** the moment of force, the projection of the force on the axis, the main vector of the system of forces and the main moment.)

2. **Basic concepts of point dynamics**:

**(key words** part of dynamics, basic laws of classical mechanics, two main problems of dynamics, two main problems of dynamics.)

|  |  |
| --- | --- |
| **3.Problem.** Two cars with masses m1=6⋅104kg and m2=2⋅104kg move on a horizontal railway with speeds v1=1m/s and v2=3m/s. After some time, the 2nd car catches up with the 1st car, and if they move together, find velocityof them without considering the resistance forces  . |  |

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**Final control**

subject "Theoretical mechanics"

**24- OPTION**

**1.Converging force systems on plane:**

(**key words:** converging forces**,** equilibrium conditions of converging force systems, resultant forces,.)

2. **Complex motion of a material point:**

(**key words:** relative motion of a point, the theorem on the ADDITION of the velocities of a point in a complex motion, Coriolis acceleration.)

|  |  |
| --- | --- |
| **3.Problem.** If a body rotates around fixed axis according to the law φ=t3+2, find its angular velocity when the angle of rotation is equal to φ=10rad |  |

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**Final control**

subject "Theoretical mechanics"

**25- OPTION**

1 **Kinematics of a rigid body**:

(**key words**: the rotational motion of a rigid body around a fixed axis, the law of rotational motion around a fixed axis, the velocity and acceleration of points of a body in rotational motion around a fixed axis.)

**2 Introduction to the dynamics of mechanical system**:

**(key words:** mechanical system, classification of forces acting on mechanical system, external and internal forces, properties of internal forces.)

|  |  |
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| **3.Problem.** The body rotates around a fixed axis according to the law φ=t2. If after some time the body rotates through an angle φ=25rad, find the instant velocity of the point which is r=0.5m away from the rotational axis. |  |

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**Final control**

subject "Theoretical mechanics"

**26- OPTION**

1. **Kinematics of a rigid body:**

**(key words:** kinematics, main tasks, aims,translational motion of a rigid body, velocity and acceleration of points of a body in translational motion.)

2.**Basic concepts of point dynamics**:

(**key words**:part of dynamics, basic laws of classical mechanics, two main problems of dynamics, two main problems of dynamics.)

**3.Problem.** If the point moves according to the law s=0.3t2 along a circle with radius r=7m, after how much time will its normal acceleration be equal ?

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**Final control**

subject "Theoretical mechanics"

**27- OPTION**

**1.Concept of couple force:**

**(key words:** couple force and its moment, addition of couple forces, equivalent couples)

**2.Point kinematics:**

**(key words:** material point, methods of determining the motion of a point, velocity and acceleration of a point in a natural method.)

|  |  |
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| **3.Problem.**.During 10 s, the amount and direction of the body does not change, the projections are respectively Fx=3N; If a force of Fy=4N acts, calculate the magnitude of the impulse of the force. |  |

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**Final control**

subject "Theoretical mechanics"

**28- OPTION**

1. **Spatial force system**:

(**key words**:main concepts of forces, projection of spatial force, moment of spatial force, equilibrium conditions of spatial force system)

1. **Point kinematics**:

**(key words:** methods of determining the motion of a point, velocity and acceleration of a point in the vector method.)

**3.Problem.** A material point with a mass of m=4kg is moving along a straight line on a horizontal plane with an acceleration of a=0.3t. Determine the value of the force acting on the point at t=3s.

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**Final control**

subject "Theoretical mechanics"

**29- OPTION**

**1.Parallel force systems on plane**

**(key words:**forces, unit of forces**,** parallel forces, equilibrium conditions of parallel forces, addition of parallel forces**)**

**2**.**Introduction to Mechanical System Dynamics. Moment of inertia.**

**(key words:** Mass and center of mass of a mechanical system.Properties of internal forces. Moment of inertia)

**3.Problem.**. If a body of mass m=50kg is pulled vertically up by a rope with an acceleration of a=0.5m/s2, find the tension force of the rope.

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**Final control**

subject "Theoretical mechanics"

**30- OPTION**

**1.Types of support**

(**keywords:** roller support,pinned support, fixed support, reaction forces of supports)

2.**Point kinematics**

(**keywords:** rotational motion of rigid body around fixed axis, angular velocity, angular acceleration, units of angular velocity and angular acceleration.)

|  |  |
| --- | --- |
| **3.Problem.**. Material point with mass m=5kg moves under the influence of forces F1=3H and F2=10H. Calculate the projection of the acceleration of the point onto the horizontal axis Ax |  |

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**Final control**

subject "Theoretical mechanics"

**31- OPTION**

1. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

1. **Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.Loads of weights 1, 2 and 3 are hanged from blocks by strings. If G2=55N and α=75°, β=60°, determine the value of G3. |  |

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**Final control**

subject "Theoretical mechanics"

**32- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane**)**

**2.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**3.Problem.**. If a material point with a mass of m=1.4 kg moves along a straight line according to the law x=6t2+6t+3, find the amount of equal acting force on it.

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**Final control**

subject "Theoretical mechanics"

**33- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

**3.Problem.** If the body rotates around a fixed axis according to the law φ=4+2t3, determine the angular acceleration of the body when the angular speed is ω=6rad/s.

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**Final control**

subject "Theoretical mechanics"

**34- OPTION**

1**.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

**3. Problem.** If a material point with a mass of m=3kg moves along a straight line with the law x=0.04t3, find the amount of equal force at t=6s?

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**Final control**

subject "Theoretical mechanics"

**35- OPTION**

1. **Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

2. **Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

|  |  |
| --- | --- |
| **3.Problem.**.Calculate the reaction force in kN in support B if a pair of forces with moments M1=2kN⋅m and M2=8kN⋅m act on the beam AB of length L=3m. |  |

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**Final control**

subject "Theoretical mechanics"

**36- OPTION**

**1.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

2**. Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Calculate the reaction force at point D if F1=84.6N and F2=208N act on a block with dimensions AB=1m, BC=3m, CD=2m. |  |

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**Final control**

subject "Theoretical mechanics"

**37- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane,converging,parallel and arbitrary force systems**)**

2. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

|  |  |
| --- | --- |
| **3.Problem.** If the force F1=4kN and F2 act on the beam BC fixed by the hinge A and it is in equilibrium, the distances AC=2m, AB=6m, find the amount of the F2 forces in kN |  |

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**Final control**

subject "Theoretical mechanics"

**38- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.A triangular body rotates around side AB with angular velocity ω=4rad/sec. Point M moves along the side of the triangle with a speed of vr=2m/sec. If α=30°, determine the Coriolis acceleration of point M. |  |

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**Final control**

subject "Theoretical mechanics"

**39- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.The car moves with speed of v1=3.6km/h. The device installed on it rises with a speed of v2=0.5m/sec. Find the absolute velocity of the worker at rest inside the device. |  |

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**Final control**

subject "Theoretical mechanics"

**40- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane, converging, parallel and arbitrary force systems**)**

**2.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration.)

|  |  |
| --- | --- |
| **3.Problem.**.A body with a mass of m = 100 kg moves along a horizontal plane under the influence of a constant force from rest. If it travels 5m with a speed of 5m/s, the magnitude of the frictional force is FF=20N and determine the modulus of the force F. |  |

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**Final control**

subject "Theoretical mechanics"

**41- OPTION**

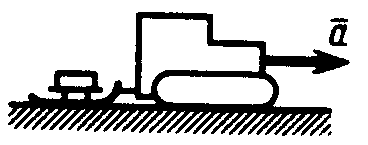
1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

2**. Kinematics of a point**:

(**key words**: methods for determining the movement of a point, speed and acceleration of a point by the coordinate method)

**3.Problem.**. A tractor moving along a horizontal road with an acceleration a=1m/s2 pulls skates with mass m=600kg. If the coefficient of friction of skates on snow is f=0.04, calculate how much force the tractor needs to pull the skates with.



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**Final control**

subject "Theoretical mechanics"

**42- OPTION**

1. **Basic concepts of statics**:

(**key words**: connections and reactions of connections, axioms of statics, resultant force)

2. **Equilibrium of bodies under the action of friction force**

**(key words:** Sliding friction force Rolling friction force.)

|  |  |
| --- | --- |
| **3.Problem.**.If a beam with a length of AB=4 m is pressed against the wall, on which a force F=4 N and a moment M=2 Nm act, find the moment of reaction to the support A.  . |  |
|  |  |

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**Final control**

subject "Theoretical mechanics"

**43- OPTION**

1 **The equilibrium conditions of a system of forces on a plane**:

**(key words:** the moment of force, the projection of the force on the axis, the main vector of the system of forces and the main moment.)

2. **Basic concepts of point dynamics**:

**(key words** subject of dynamics, basic laws of classical mechanics, two main problems of dynamics.)

|  |  |
| --- | --- |
| **3.Problem.**.The heavy load is attached to the wall using weightless rods AC and BC. If the rod AC forms an angle of α=60° with the wall, the rods form an angle of β=45°, and the compression of the rod AC is F2=25N, calculate the tension in the rod BC. |  |

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**Final control**

subject "Theoretical mechanics"

**44- OPTION**

1. **Converging force systems on plane:**

(**key words:** converging forces**,** equilibrium conditions of converging force systems, resultant forces,.)

2. **Complex motion of a material point:**

(**key words:** relative motion of a point, the theorem on the ADDITION of the velocities of a point in a complex motion, Coriolis acceleration.)

|  |  |
| --- | --- |
| **3.Problem.** The vertical force F1 acts on the hinge C attached to the cables AC and BC. If the cables form an angle =30° and =75° from the vertical, and the tension force of the AC cable F2=15 N, determine the tension of the cable F3. |  |

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**Final control**

subject "Theoretical mechanics"

**45- OPTION**

1 **Kinematics of a rigid body**:

(**key words**: the rotational motion of a rigid body around a fixed axis, the law of rotational motion around a fixed axis, the velocity and acceleration of points of a body in rotational motion around a fixed axis.)

**2 Introduction to the dynamics of mechanical system**:

**(key words:** mechanical system, classification of forces acting on mechanical system, external and internal forces, properties of internal forces.)

|  |  |
| --- | --- |
| **3.Problem.**. Vertical forces F1=1kN, F2=2kN and F3=3kN act on the beam AB. If its dimensions are AC=CD=DE=1m, BE=2m, determine the reaction force of support B in kN. |  |

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**Final control**

subject "Theoretical mechanics"

**46- OPTION**

1. **Kinematics of a rigid body:**

**(key words** translational motion of a rigid body, law of translational motion, velocity and acceleration of points of a body in translational motion.)

2.**Basic concepts of point dynamics**:

( **key words**: subject of dynamics, basic laws of classical mechanics, two main problems of dynamics.)

**3.Problem.**

|  |  |
| --- | --- |
| A vertical force F=5kN and a distributed force of intensity q=4kN/m act on the beam AB. If its dimensions are AC=3m and BC=6m, find the reaction force at support B in kN  . |  |

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**Final control**

subject "Theoretical mechanics"

**47- OPTION**

**1.Concept of couple force:**

**(key words:** couple force and its moment, addition of couple forces, equivalent couples)

**2.Point kinematics:**

**(key words** methods of determining the motion of a point, velocity and acceleration of a point in a natural method.)

|  |  |
| --- | --- |
| **3.Problem.** Gear wheels with radius R1=0.8m and R2=0.4m rotate and move the 3rd rail. If the 1st wheel rotates according to the law φ1=4t2, determine the acceleration of the 3rd rail. | 8_4_7 |

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**Final control**

subject "Theoretical mechanics"

**48- OPTION**

1. **Spatial force system**:

(**key words**: projection of spatial force, moment of spatial force, equilibrium conditions of spatial force system)

**2.Point kinematics**:

**(key words:** methods of determining the motion of a point, velocity and acceleration of a point in the vector method.)

|  |  |
| --- | --- |
| **3.Problem.** Gear wheels with radii R1=0.4m, R3=0.5m move from rest under the influence of external forces. Determine the speed of point M at t=2s if the 1st wheel rotates with a linearly accelerated angular acceleration 1=4rad/s2. | 8_4_4 |

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**Final control**

subject "Theoretical mechanics"

**49- OPTION**

**1.Parallel force systems on plane**

**(key words:** parallel forces, equilibrium conditions of parallel forces, addition of parallel forces**)**

**2**.**Introduction to Mechanical System Dynamics. Moment of inertia.**

**(key words:** Mass and center of mass of a mechanical system.Properties of internal forces. Moment of inertia)

|  |  |
| --- | --- |
| **3.Problem.** A beam AB with a weight of G=20kN is acted upon by distributed forces with an intensity of q=0.5kN/m. If its dimensions are AB=6m, AC=BC, find the base reaction A in kN. |  |

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**Final control**

subject "Theoretical mechanics"

**50- OPTION**

**1.Types of support**

(**keywords:** roller support,pinned support, fixed support, reaction forces of supports)

2.**Point kinematics**

(**keywords:** rotational motion of rigid body around fixed axis, angular velocity, angular acceleration)

|  |  |
| --- | --- |
| **3.Problem.** A beam with length AB=9m is acted upon by distributed forces with intensity q=5kN/m, so that the base reaction B is 10 kN, what should be the distance AC of the distributed force? |  |

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**Final control**

subject "Theoretical mechanics"

**51- OPTION**

1. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

1. **Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Loads of weights 1, 2 and 3are hanged from blocks by strings. If G2=55N and α=75°, β=60°, determine the value of G3. |  |

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**Final control**

subject "Theoretical mechanics"

**52- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane**)**

**2.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**3.Problem.**. If a material point with a mass of m=1.4 kg moves along a straight line according to the law x=6t2+6t+3, find the amount of equal acting force on it.

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**Final control**

subject "Theoretical mechanics"

**53- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

**3.Problem.** If the body rotates around a fixed axis according to the law φ=4+2t3, determine the angular acceleration of the body when the angular speed is ω=6rad/s.

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**Final control**

subject "Theoretical mechanics"

**54- OPTION**

1**.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

**3.Problem.**. If a material point with a mass of m=3kg moves along a straight line with the law x=0.04t3, find the amount of equal force at t=6s?

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**Final control**

subject "Theoretical mechanics"

**55- OPTION**

1. **Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

2. **Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

|  |  |
| --- | --- |
| **3.Problem.**.If three forces F1=10N, F2=15N and F3=20N intersecting at one point form angles α1=30°, α2=45° and α3=60° with the Ox axis, determine the amount of resultant force |  |

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**Final control**

subject "Theoretical mechanics"

**56- OPTION**

**1.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

2**. Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.Force F=150N acts on point A of the square plate. If the  sides of the square are 0.2m, find the moment of the force about point B. |  |

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**Final control**

subject "Theoretical mechanics"

**57- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane,converging,parallel and arbitrary force systems**)**

2. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

|  |  |
| --- | --- |
| **3.Problem.** If the force F1=4kN and F2 act on the beam BC fixed by the hinge A and it is in equilibrium, the distances AC=2m, AB=6m, find the amount of the F2 forces in kN |  |

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**Final control**

subject "Theoretical mechanics"

**58- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Body 1 on an inclined plane is acted upon by a force F=90 N. If the coefficient of friction between the object and the plane is f=0.3, how much should the load weigh in order to move? |  |

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**Final control**

subject "Theoretical mechanics"

**59- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Load 1 with a weight of 100 N is connected by a string to load 2 through a block. If the coefficient of friction between load 1 and the plane is f=0.3, find the maximum value of load 2 so that load 1 stays in place? | *2_5_8* |

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**Final control**

subject "Theoretical mechanics"

**60- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane, converging, parallel and arbitrary force systems**)**

**2.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

**3.Problem.** A landing plane descends to the ground at a speed of 180 km/h and stops after covering a distance of 1000 m. Calculate the average deceleration modulus of the plane.

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**Final control**

subject "Theoretical mechanics"

**61- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

2**. Kinematics of a point**:

(**key words**: methods for determining the movement of a point, speed and acceleration of a point by the coordinate method)

|  |  |
| --- | --- |
| **3.Problem.** The heavy load is fixed to the wall using weightless rods AC and BC. If the rod AC is at an angle of =60° with the wall, αand the rods βform an angle of =45° to each other, and the compression of the rod AC is F 2 =25N, calculate the tension in the rod BC. | *1_2_5* |

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**Final control**

subject "Theoretical mechanics"

**62- OPTION**

1. **Basic concepts of statics**:

(**key words**: connections and reactions of connections, axioms of statics, resultant force, unit of forces, distributed forces.)

2. **Equilibrium of bodies under the action of friction force**

**(key words:** Sliding friction force , Rolling friction force.coefficient of friction, equilibrium conditions)

|  |  |
| --- | --- |
| **3.Problem.** Loads 1 and 2 weighing 400 N and 96 N are connected through the block using a string. Find the minimum coefficient of friction between the plane and the 1st load so that the 1st load is not pulled by the 2nd load and does not move. | *2_5_5* |
|  |  |

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**Final control**

subject "Theoretical mechanics"

**63- OPTION**

1 **The equilibrium conditions of a system of forces on a plane**:

**(key words:** the moment of force, the projection of the force on the axis, the main vector of the system of forces and the main moment.)

2. **Basic concepts of point dynamics**:

**(key words** part of dynamics, basic laws of classical mechanics, two main problems of dynamics, two main problems of dynamics.)

|  |  |
| --- | --- |
| **3.Problem.**.Two cars with masses m1=6⋅104kg and m2=2⋅104kg move on a horizontal railway with speeds v1=1m/s and v2=3m/s. After some time, the 2nd car catches up with the 1st car, and if they move together, find velocityof them without considering the resistance forces  . |  |

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**Final control**

subject "Theoretical mechanics"

**64- OPTION**

**1.Converging force systems on plane:**

(**key words:** converging forces**,** equilibrium conditions of converging force systems, resultant forces,.)

2. **Complex motion of a material point:**

(**key words:** relative motion of a point, the theorem on the ADDITION of the velocities of a point in a complex motion, Coriolis acceleration.)

|  |  |
| --- | --- |
| **3.Problem.**. If a body rotates around fixed axis according to the law φ=t3+2, find its angular velocity when the angle of rotation is equal to φ=10rad |  |

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**Final control**

subject "Theoretical mechanics"

**65- OPTION**

1 **Kinematics of a rigid body**:

(**key words**: the rotational motion of a rigid body around a fixed axis, the law of rotational motion around a fixed axis, the velocity and acceleration of points of a body in rotational motion around a fixed axis.)

**2 Introduction to the dynamics of mechanical system**:

**(key words:** mechanical system, classification of forces acting on mechanical system, external and internal forces, properties of internal forces.)

|  |  |
| --- | --- |
| **3.Problem.** The body rotates around a fixed axis according to the law φ=t2. If after some time the body rotates through an angle φ=25rad, find the instant velocity of the point which is r=0.5m away from the rotational axis. |  |

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**Final control**

subject "Theoretical mechanics"

**66- OPTION**

1. **Kinematics of a rigid body:**

**(key words:** kinematics, main tasks, aims translational motion of a rigid body, law of translational motion, velocity and acceleration of points of a body in translational motion.)

2.**Basic concepts of point dynamics**:

( **key words**: subject of dynamics, basic laws of classical mechanics, two main problems of dynamics.)

**3.Problem.**. If the point moves according to the law s=0.3t2 along a circle with radius r=7m, after how much time will its normal acceleration be equal ?

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**Final control**

subject "Theoretical mechanics"

**67- OPTION**

**1.Concept of couple force:**

**(key words:** couple force and its moment, addition of couple forces, equivalent couples)

**2.Point kinematics:**

**(key words:** material point, methods of determining the motion of a point, velocity and acceleration of a point in a natural method.)

|  |  |
| --- | --- |
| **3.Problem.**.During 10 s, the amount and direction of the body does not change, the projections are respectively Fx=3N; If a force of Fy=4N acts, calculate the magnitude of the impulse of the force. |  |

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**Final control**

subject "Theoretical mechanics"

**68- OPTION**

1. **Spatial force system**:

(**key words**: projection of spatial force, moment of spatial force, equilibrium conditions of spatial force system)

**2.Point kinematics**:

**(key words:** methods of determining the motion of a point, velocity and acceleration of a point in the vector method.)

**3.Problem.** A material point with a mass of m=4kg is moving along a straight line on a horizontal plane with an acceleration of a=0.3t. Determine the value of the force acting on the point at t=3s.

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**Final control**

subject "Theoretical mechanics"

**69- OPTION**

**1.Parallel force systems on plane**

**(key words:**forces, unit of forces**,** parallel forces, equilibrium conditions of parallel forces, addition of parallel forces**)**

**2**.**Introduction to Mechanical System Dynamics. Moment of inertia.**

**(key words:** Mass and center of mass of a mechanical system.Properties of internal forces. Moment of inertia)

**3.Problem.** If a body of mass m=50kg is pulled vertically up by a rope with an acceleration of a=0.5m/s2, find the tension force of the rope.

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**Final control**

subject "Theoretical mechanics"

**70- OPTION**

**1.Types of support**

(**keywords:** roller support,pinned support, fixed support, reaction forces of supports)

2.**Point kinematics**

(**keywords:** rotational motion of rigid body around fixed axis, angular velocity, angular acceleration, units of angular velocity and angular acceleration.)

|  |  |
| --- | --- |
| **3.Problem.** Material point with mass m=5kg moves under the influence of forces F1=3H and F2=10H. Calculate the projection of the acceleration of the point onto the horizontal axis Ax |  |

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**Final control**

subject "Theoretical mechanics"

**71- OPTION**

1. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Loads of weights 1, 2 and 3are hanged from blocks by strings. If G2=55N and α=75°, β=60°, determine the value of G3. |  |

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**Final control**

subject "Theoretical mechanics"

**72- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane**)**

**2.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**3.Problem.** If a material point with a mass of m=1.4 kg moves along a straight line according to the law x=6t2+6t+3, find the amount of equal acting force on it.

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**Final control**

subject "Theoretical mechanics"

**73- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

**3.Problem.** If the body rotates around a fixed axis according to the law φ=4+2t3, determine the angular acceleration of the body when the angular speed is ω=6rad/s.

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**Final control**

subject "Theoretical mechanics"

**74- OPTION**

1**.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

**3.Problem.** If a material point with a mass of m=3kg moves along a straight line with the law x=0.04t3, find the amount of equal force at t=6s?

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**Final control**

subject "Theoretical mechanics"

**75- OPTION**

1. **Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

2. **Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

|  |  |
| --- | --- |
| **3.Problem.**.Calculate the reaction force in kN in support B if a pair of forces with moments M1=2kN⋅m and M2=8kN⋅m act on the beam AB of length L=3m. |  |

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**Final control**

subject "Theoretical mechanics"

**76- OPTION**

**1.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

2**. Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Calculate the reaction force at point D if F1=84.6N and F2=208N act on a block with dimensions AB=1m, BC=3m, CD=2m. |  |

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**Final control**

subject "Theoretical mechanics"

**77- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane,converging,parallel and arbitrary force systems**)**

2. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

|  |  |
| --- | --- |
| **3.Problem.**. If the force F1=4kN and F2 act on the beam BC fixed by the hinge A and it is in equilibrium, the distances AC=2m, AB=6m, find the amount of the F2 forces in kN |  |

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**Final control**

subject "Theoretical mechanics"

**78- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.A triangular body rotates around side AB with angular velocity ω=4rad/sec. Point M moves along the side of the triangle with a speed of vr=2m/sec. If α=30°, determine the Coriolis acceleration of point M. |  |

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**Final control**

subject "Theoretical mechanics"

**79- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** The car moves with speed of v1=3.6km/h. The device installed on it rises with a speed of v2=0.5m/sec. Find the absolute velocity of the worker at rest inside the device. |  |

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subject "Theoretical mechanics"

**80- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane, converging, parallel and arbitrary force systems**)**

**2.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration.)

|  |  |
| --- | --- |
| **3.Problem.**.A body with a mass of m = 100 kg moves along a horizontal plane under the influence of a constant force from rest. If it travels 5m with a speed of 5m/s, the magnitude of the frictional force is FF=20N and determine the modulus of the force F. |  |

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subject "Theoretical mechanics"

**81- OPTION**

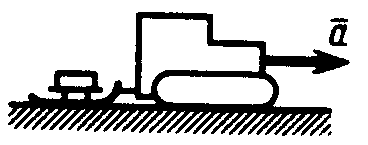
1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

2**. Kinematics of a point**:

(**key words**: methods for determining the movement of a point, speed and acceleration of a point by the coordinate method)

**3.Problem.**. A tractor moving along a horizontal road with an acceleration a=1m/s2 pulls skates with mass m=600kg. If the coefficient of friction of skates on snow is f=0.04, calculate how much force the tractor needs to pull the skates with.



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**Final control**

subject "Theoretical mechanics"

**82- OPTION**

1. **Basic concepts of statics**:

(**key words**: connections and reactions of connections, axioms of statics, resultant force)

2. **Equilibrium of bodies under the action of friction force**

**(key words:** Sliding friction force Rolling friction force.)

|  |  |
| --- | --- |
| **3.Problem.** If a beam with a length of AB=4 m is pressed against the wall, on which a force F=4 N and a moment M=2 Nm act, find the moment of reaction to the support A.  . |  |
|  |  |

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**Final control**

subject "Theoretical mechanics"

**83- OPTION**

1 **The equilibrium conditions of a system of forces on a plane**:

**(key words:** the moment of force, the projection of the force on the axis, the main vector of the system of forces and the main moment.)

2. **Basic concepts of point dynamics**:

**(key words** part of dynamics, basic laws of classical mechanics, two main problems of dynamics.)

|  |  |
| --- | --- |
| **3.Problem.**.The heavy load is attached to the wall using weightless rods AC and BC. If the rod AC forms an angle of α=60° with the wall, the rods form an angle of β=45°, and the compression of the rod AC is F2=25N, calculate the tension in the rod BC. |  |

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**Final control**

subject "Theoretical mechanics"

**84- OPTION**

1. **Converging force systems on plane:**

(**key words:** converging forces**,** equilibrium conditions of converging force systems, resultant forces,.)

2. **Complex motion of a material point:**

(**key words:** relative motion of a point, the theorem on the ADDITION of the velocities of a point in a complex motion, Coriolis acceleration.)

|  |  |
| --- | --- |
| **3.Problem.** The vertical force F1 acts on the hinge C attached to the cables AC and BC. If the cables form an angle =30° and =75° from the vertical, and the tension force of the AC cable F2=15 N, determine the tension of the cable F3. |  |

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**Final control**

subject "Theoretical mechanics"

**85- OPTION**

1 **Kinematics of a rigid body**:

(**key words**: the rotational motion of a rigid body around a fixed axis, the law of rotational motion around a fixed axis, the velocity and acceleration of points of a body in rotational motion around a fixed axis.)

**2 Introduction to the dynamics of mechanical system**:

**(key words:** mechanical system, classification of forces acting on mechanical system, external and internal forces, properties of internal forces.)

|  |  |
| --- | --- |
| **3.Problem.** Vertical forces F1=1kN, F2=2kN and F3=3kN act on the beam AB. If its dimensions are AC=CD=DE=1m, BE=2m, determine the reaction force of support B in kN. |  |

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**Final control**

subject "Theoretical mechanics"

**86- OPTION**

1. **Kinematics of a rigid body:**

**(key words** translational motion of a rigid body, law of translational motion, velocity and acceleration of points of a body in translational motion.)

2.**Basic concepts of point dynamics**:

( **key words**: subject of dynamics, basic laws of classical mechanics, two main problems of dynamics.)

**3.Problem.**

|  |  |
| --- | --- |
| A vertical force F=5kN and a distributed force of intensity q=4kN/m act on the beam AB. If its dimensions are AC=3m and BC=6m, find the reaction force at support B in kN  . |  |

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**Final control**

subject "Theoretical mechanics"

**87- OPTION**

**1.Concept of couple force:**

**(key words:** couple force and its moment, addition of couple forces, equivalent couples)

**2.Point kinematics:**

**(key words** methods of determining the motion of a point, velocity and acceleration of a point in a natural method.)

|  |  |
| --- | --- |
| **3.Problem.** Gear wheels with radius R1=0.8m and R2=0.4m rotate and move the 3rd rail. If the 1st wheel rotates according to the law φ1=4t2, determine the acceleration of the 3rd rail. | 8_4_7 |

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**Final control**

subject "Theoretical mechanics"

**88- OPTION**

1. **Spatial force system**:

(**key words**: projection of spatial force, moment of spatial force, equilibrium conditions of spatial force system)

**2.Point kinematics**:

**(key words:** methods of determining the motion of a point, velocity and acceleration of a point in the vector method.)

|  |  |
| --- | --- |
| **3.Problem.** Gear wheels with radii R1=0.4m, R3=0.5m move from rest under the influence of external forces. Determine the speed of point M at t=2s if the 1st wheel rotates with a linearly accelerated angular acceleration 1=4rad/s2. | 8_4_4 |

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**Final control**

subject "Theoretical mechanics"

**89- OPTION**

**1.Parallel force systems on plane**

**(key words:** parallel forces, equilibrium conditions of parallel forces, addition of parallel forces**)**

**2**.**Introduction to Mechanical System Dynamics. Moment of inertia.**

**(key words:** Mass and center of mass of a mechanical system.Properties of internal forces. Moment of inertia)

|  |  |
| --- | --- |
| **3.Problem.** A beam AB with a weight of G=20kN is acted upon by distributed forces with an intensity of q=0.5kN/m. If its dimensions are AB=6m, AC=BC, find the base reaction A in kN. |  |

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**Final control**

subject "Theoretical mechanics"

**90- OPTION**

**1.Types of support**

(**keywords:** roller support,pinned support, fixed support, reaction forces of supports)

2.**Point kinematics**

(**keywords:** rotational motion of rigid body around fixed axis, angular velocity, angular acceleration)

|  |  |
| --- | --- |
| **3.Problem.** A beam with length AB=9m is acted upon by distributed forces with intensity q=5kN/m, so that the base reaction B is 10 kN, what should be the distance AC of the distributed force? |  |

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**Final control**

subject "Theoretical mechanics"

**91- OPTION**

1. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

1. **Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.Loads of weights 1, 2 and 3are hanged from blocks by strings. If G2=55N and α=75°, β=60°, determine the value of G3. |  |

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**Final control**

subject "Theoretical mechanics"

**92- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane**)**

**2.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**3.Problem.**. If a material point with a mass of m=1.4 kg moves along a straight line according to the law x=6t2+6t+3, find the amount of equal acting force on it.

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**Final control**

subject "Theoretical mechanics"

**93- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

**3.Problem.** If the body rotates around a fixed axis according to the law φ=4+2t3, determine the angular acceleration of the body when the angular speed is ω=6rad/s.

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**Final control**

subject "Theoretical mechanics"

**94- OPTION**

1**.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

**3.Problem.**. If a material point with a mass of m=3kg moves along a straight line with the law x=0.04t3, find the amount of equal force at t=6s?

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**Final control**

subject "Theoretical mechanics"

**95- OPTION**

1. **Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

2. **Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

|  |  |
| --- | --- |
| **3.Problem.**.If three forces F1=10N, F2=15N and F3=20N intersecting at one point form angles α1=30°, α2=45° and α3=60° with the Ox axis, determine the amount of resultant force |  |

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**Final control**

subject "Theoretical mechanics"

**96- OPTION**

**1.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

2**. Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**.Force F=150N acts on point A of the square plate. If the  sides of the square are 0.2m, find the moment of the force about point B. |  |

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**Final control**

subject "Theoretical mechanics"

**97- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane,converging,parallel and arbitrary force systems**)**

2. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

|  |  |
| --- | --- |
| **3.Problem.** If the force F1=4kN and F2 act on the beam BC fixed by the hinge A and it is in equilibrium, the distances AC=2m, AB=6m, find the amount of the F2 forces in kN |  |

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**Final control**

subject "Theoretical mechanics"

**98- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Body 1 on an inclined plane is acted upon by a force F=90 N. If the coefficient of friction between the object and the plane is f=0.3, how much should the load weigh in order to move? |  |

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**Final control**

subject "Theoretical mechanics"

**99- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**. Load 1 with a weight of 100 N is connected by a string to load 2 through a block. If the coefficient of friction between load 1 and the plane is f=0.3, find the maximum value of load 2 so that load 1 stays in place? | *2_5_8* |

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**Final control**

subject "Theoretical mechanics"

**100- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane, converging, parallel and arbitrary force systems**)**

**2.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

**3.Problem.** A landing plane descends to the ground at a speed of 180 km/h and stops after covering a distance of 1000 m. Calculate the average deceleration modulus of the plane.

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**Final control**

subject "Theoretical mechanics"

**101- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

2**. Kinematics of a point**:

(**key words**: methods for determining the movement of a point, speed and acceleration of a point by the coordinate method)

|  |  |
| --- | --- |
| **3.Problem.** The heavy load is fixed to the wall using weightless rods AC and BC. If the rod AC is at an angle of =60° with the wall, αand the rods βform an angle of =45° to each other, and the compression of the rod AC is F 2 =25N, calculate the tension in the rod BC. | *1_2_5* |

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**Final control**

subject "Theoretical mechanics"

**102- OPTION**

1. **Basic concepts of statics**:

(**key words**: connections and reactions of connections, axioms of statics, resultant force, unit of forces, distributed forces.)

2. **Equilibrium of bodies under the action of friction force**

**(key words:** Sliding friction force , Rolling friction force.coefficient of friction, equilibrium conditions)

|  |  |
| --- | --- |
| **3.Problem.** Loads 1 and 2 weighing 400 N and 96 N are connected through the block using a string. Find the minimum coefficient of friction between the plane and the 1st load so that the 1st load is not pulled by the 2nd load and does not move. | *2_5_5* |
|  |  |

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**Final control**

subject "Theoretical mechanics"

**103- OPTION**

1 **The equilibrium conditions of a system of forces on a plane**:

**(key words:** the moment of force, the projection of the force on the axis, the main vector of the system of forces and the main moment.)

2. **Basic concepts of point dynamics**:

**(key words** part of dynamics, basic laws of classical mechanics, two main problems of dynamics, two main problems of dynamics.)

|  |  |
| --- | --- |
| **3.Problem.** Two cars with masses m1=6⋅104kg and m2=2⋅104kg move on a horizontal railway with speeds v1=1m/s and v2=3m/s. After some time, the 2nd car catches up with the 1st car, and if they move together, find velocityof them without considering the resistance forces  . |  |

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**Final control**

subject "Theoretical mechanics"

**104- OPTION**

**1.Converging force systems on plane:**

(**key words:** converging forces**,** equilibrium conditions of converging force systems, resultant forces,.)

2. **Complex motion of a material point:**

(**key words:** relative motion of a point, the theorem on the ADDITION of the velocities of a point in a complex motion, Coriolis acceleration.)

|  |  |
| --- | --- |
| **3.Problem.**. If a body rotates around fixed axis according to the law φ=t3+2, find its angular velocity when the angle of rotation is equal to φ=10rad |  |

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**Final control**

subject "Theoretical mechanics"

**105- OPTION**

1 **Kinematics of a rigid body**:

(**key words**: the rotational motion of a rigid body around a fixed axis, the law of rotational motion around a fixed axis, the velocity and acceleration of points of a body in rotational motion around a fixed axis.)

**2 Introduction to the dynamics of mechanical system**:

**(key words:** mechanical system, classification of forces acting on mechanical system, external and internal forces, properties of internal forces.)

|  |  |
| --- | --- |
| **3.Problem.**.The body rotates around a fixed axis according to the law φ=t2. If after some time the body rotates through an angle φ=25rad, find the instant velocity of the point which is r=0.5m away from the rotational axis. |  |

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**Final control**

subject "Theoretical mechanics"

**106- OPTION**

1. **Kinematics of a rigid body:**

**(key words:** kinematics, main tasks, aims,translational motion of a rigid body, velocity and acceleration of points of a body in translational motion.)

2.**Basic concepts of point dynamics**:

(**key words**:part of dynamics, basic laws of classical mechanics, two main problems of dynamics, two main problems of dynamics.)

**3.Problem.** If the point moves according to the law s=0.3t2 along a circle with radius r=7m, after how much time will its normal acceleration be equal ?

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**Final control**

subject "Theoretical mechanics"

**107- OPTION**

**1.Concept of couple force:**

**(key words:** couple force and its moment, addition of couple forces, equivalent couples)

**2.Point kinematics:**

**(key words:** material point, methods of determining the motion of a point, velocity and acceleration of a point in a natural method.)

|  |  |
| --- | --- |
| **3.Problem.** During 10 s, the amount and direction of the body does not change, the projections are respectively Fx=3N; If a force of Fy=4N acts, calculate the magnitude of the impulse of the force. |  |

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**Final control**

subject "Theoretical mechanics"

**108- OPTION**

**1.Spatial force system**:

(**key words**:main concepts of forces, projection of spatial force, moment of spatial force, equilibrium conditions of spatial force system)

1. **Point kinematics**:

**(key words:** methods of determining the motion of a point, velocity and acceleration of a point in the vector method.)

**3.Problem.** A material point with a mass of m=4kg is moving along a straight line on a horizontal plane with an acceleration of a=0.3t. Determine the value of the force acting on the point at t=3s.

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**Final control**

subject "Theoretical mechanics"

**109- OPTION**

**1.Parallel force systems on plane**

**(key words:**forces, unit of forces**,** parallel forces, equilibrium conditions of parallel forces, addition of parallel forces**)**

**2**.**Introduction to Mechanical System Dynamics. Moment of inertia.**

**(key words:** Mass and center of mass of a mechanical system.Properties of internal forces. Moment of inertia)

**3.Problem.** If a body of mass m=50kg is pulled vertically up by a rope with an acceleration of a=0.5m/s2, find the tension force of the rope.

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**Final control**

subject "Theoretical mechanics"

**110- OPTION**

**1.Types of support**

(**keywords:** roller support,pinned support, fixed support, reaction forces of supports)

2.**Point kinematics**

(**keywords:** rotational motion of rigid body around fixed axis, angular velocity, angular acceleration, units of angular velocity and angular acceleration.)

|  |  |
| --- | --- |
| **3.Problem.** Material point with mass m=5kg moves under the influence of forces F1=3H and F2=10H. Calculate the projection of the acceleration of the point onto the horizontal axis Ax |  |

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**Final control**

subject "Theoretical mechanics"

**111- OPTION**

1. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

1. **Material point dynamics**

**(keywords:** main concepts of dynamics,laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** Loads of weights 1, 2 and 3 are hanged from blocks by strings. If G2=55N and α=75°, β=60°, determine the value of G3. |  |

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**Final control**

subject "Theoretical mechanics"

**112- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane**)**

**2.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**3.Problem.**. If a material point with a mass of m=1.4 kg moves along a straight line according to the law x=6t2+6t+3, find the amount of equal acting force on it.

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**Final control**

subject "Theoretical mechanics"

**113- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

**3.Problem.**. If the body rotates around a fixed axis according to the law φ=4+2t3, determine the angular acceleration of the body when the angular speed is ω=6rad/s.

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**Final control**

subject "Theoretical mechanics"

**114- OPTION**

1**.Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

**3.Problem.** If a material point with a mass of m=3kg moves along a straight line with the law x=0.04t3, find the amount of equal force at t=6s?

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**Final control**

subject "Theoretical mechanics"

**115- OPTION**

1. **Simple and complex motion of rigid body**

(**keywords:** parallel plane motion, translational and rotational motion, relative, transport and absolute motion)

2. **Dynamics of a mechanical system**:

**(Keywords**: the theorem about the change of the amount of movement of a mechanical system, force impulse, the amount of movement of a mechanical system.)

|  |  |
| --- | --- |
| **3.Problem.**.Calculate the reaction force in kN in support B if a pair of forces with moments M1=2kN⋅m and M2=8kN⋅m act on the beam AB of length L=3m. |  |

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**Final control**

subject "Theoretical mechanics"

**116- OPTION**

**1.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

2**. Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem** If the velocity vector of the point is v=0.9t +t2, determine the acceleration **a** at time t=1.5s. |  |

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**Final control**

subject "Theoretical mechanics"

**117- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane,converging,parallel and arbitrary force systems**)**

2. **Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration)

|  |  |
| --- | --- |
| **3.Problem** Calculate the modulus of acceleration of the point given by the vector acceleration a=0.5t +0.2t2 for time t=2s. |  |

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**Final control**

subject "Theoretical mechanics"

**118- OPTION**

1. **Axioms of statics:**

(**key words**: balance of bodies,forces, distributed forces, resultant force, action and reaction, addition of two forces, line of action of forces.)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.**. If the acceleration of a point in rectilinear motion is constant a=0.3m/sec2, and after 6 seconds it reaches a speed of 3 m/sec, what was the initial velocity of the point **v0**? |  |

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**Final control**

subject "Theoretical mechanics"

**119- OPTION**

1. **Introduction to Theoretical Mechanics**

(**Keywords:** parts of theoretical mechanics, aim of subjuct, history, main tasks, relationship theoretical mechanics with other subjects)

**2.Material point dynamics**

**(keywords:** main concepts of dynamics, laws of dynamics, main problems of dynamics, solutions of main problems of dynamics)

|  |  |
| --- | --- |
| **3.Problem.** The movement of the point in the method of coordinates x=2t; If y=t is given, after how much time **t** will it move 10m away from the coordinate origin? |  |

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**Final control**

subject "Theoretical mechanics"

**120- OPTION**

1. **Force systems on plane**

(**Keywords:** main concepts of forces, vector and scalar quantities, types of force systems on plane, converging, parallel and arbitrary force systems**)**

**2.Complex motion of material point and rigid body**

**(Keywords**:Relative, Transport, and Absolute Motion, Relative, Transport, and Absolute velocities and acceleration.)

|  |  |
| --- | --- |
| **3.Problem.**. If the projections of the force F on the coordinate axes are: Fx=20N: Fy=25N: Fz=30N, determine moduls of force F ? |  |

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