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Applied Mechanics (3rd Year): Technical School Examinations 1933

Department of Education: Technical Instruction Branch

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9. A water tank 120 feet above ground level is supplied by a hand force pump at ground level. The pump plunger is 3' diameter and it is operated by a handle which forms a lever having a long arm of 30' inches and a short arm of 5 inches. Find the force at the handle necessary to work the pump.

10. Fig 10 shows an insulator supporting 200 metres of electric cable. The cable is 50 sq.mm, cross section and made of copper weighing 9 grams per c.e. Find the weight of cable supported. The wind acting at right angles to the line blows the cable over so that the insulator (which is free to pivot about O) is deflected from the vertical through the angle AOB. Determine the wind pressure on the cable. You may neglect the weight of the insulator.

11. A quarry service waggon runs at 10 miles per hour. Portions of the track are sharply curved. Find the least radius of the curve so that the centrifugal force on the stone slabs in the waggon may not exceed one quarter of their weight.

12. In what units is kinetic energy measured? If the loaded waggon in question 11 weighs 15 cwt, what is its kinetic energy? How far should it run down a grade of 1 in 10 to acquire this kinetic energy?
1. In Fig. 1, ABC is a scale drawing of a belt passing under a jockey pulley D which weighs 50 lbs. The pulley axle turns in the end D of a radius link DE which can swing about a fixed pivot at E. Denoting the tension in the belt by T lbs., state all the forces acting on the jockey pulley. From your own measurements on the diagram find the moments of these forces about E and hence determine the belt tension T.

![Fig. 1](image)

2. An experimental model of a Porter Governor is shown to scale and the system of forces acting on it is indicated in Fig. 2. Find the tension in the strings BD, DC, AC and AB, and the force F in the horizontal strings pulling B and C apart.

![Fig. 2](image)

3. Which has the greater acceleration: An automobile getting under way at 2.5 miles per hour per second or an automobile stopping from a speed of 20 miles per hour in a distance of 20 feet? Calculate the tractive force required in each case if the automobile weighs 3,000 lbs.

4. The diameter of a cylinder is 54 inches. The piston working in this cylinder has a spring ring 6 inches wide and the pressure between it and the cylinder is 3 lbs. per sq. inch. Find the piston friction taking the coefficient of friction 0.05.

5. The buffers of a waggon are spring loaded. A compression of 5 inches is provided for and when fully compressed each buffer pushes with a force of 500 lbs. The waggon fully loaded weighs 13 tons. Find the greatest speed at which the waggon may strike a fixed stop without exceeding the compression allowed.

6. Find the stresses in the members of the cantilever frame shown in Fig. 6, which is drawn to scale.

![Fig. 6](image)

7. A crankshaft 12₄₃/₄ inch diameter weighs 12 tons and it is also pressed against the bearing by 36 tons acting horizontally. Find the horsepower lost in friction at 30 revs. per min. Coefficient of friction 0.06.

8. The railway sleeper, Fig. 8, is shown to scale and the system of forces acting on the sleeper when the load on each rail is 3 tons. After some time the packing at A and B gets beaten down and then it is supported in the middle at C only. What is now the greatest bending moment on the sleeper? Why is this latter condition objectionable?

![Fig. 8](image)
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