Topic 5 Machines

Past Paper Questions

Q1. A screw jack has a single start screw thread with a pitch of 6mm and the effective length of the operating bar is 300mm. the screw jack has an efficiency of 27% when lifting a load using an effort of 50N. Calculate

a. Load that is being lifted (7M)
b. The effort required to raise a mass of 600 kg after lubrication raises the efficiency to 32% (3M)

Q2. Lifting tackle comprised of a set of pulleys, with three pulleys in the upper block and two pulleys in the lower block, is used to lift a mass of 150 kg. Take the gravitational acceleration as 9.81 m/s^2. If the effort required to make the lift is 0.7 kN. Determine

a. The efficiency of the lifting tackle (4M)
b. The effort used to overcome friction in the lifting gear (3M)
c. The work expended by the user to lift the load by 2.5m (3M)

Q3. A screw jack lifts a load of 1.65 tonne with an effort of 90N. The jack has single start screw thread with a pitch of 6mm. The effort is applied to the end of a lever having effective length of 0.83m Calculate

a. The velocity ratio (4M)
b. The Mechanical Advantage (3M)
c. The percentage efficiency (3M)

Q4. A mass of 45 kg is raised 2.5m using a pulley system, the upper block having 3 pulleys and the lower block 2 pulleys. The efficiency of the machine is 80%. Calculate

a. The distance moved by the effort (4M)
b. The mechanical advantage (3M)
c. The effort (3M)

Q5. The winding handle of a car jack has a radius of 0.2m. To lift a load of 500 kg through a height of 0.3m, the handle must be turned 50 times. The average tangential force on the handle is 70N, and the operator takes 30 sec to lift the load. Determine

a. The work done on the load (2M)
b. The work done by the effort (3M)
c. The efficiency of the jack (2M)
d. The power input to the jack (3M)

Q6. Lift machinery with a capacity of 2 tonnes is used to lift a load with a mass of 1800 kg. The load is lifted a total distance of 2.5m. The lift gear winding drum takes six times to complete the lift with an average torque of 1300 N-m to complete the lift in six seconds. Calculate

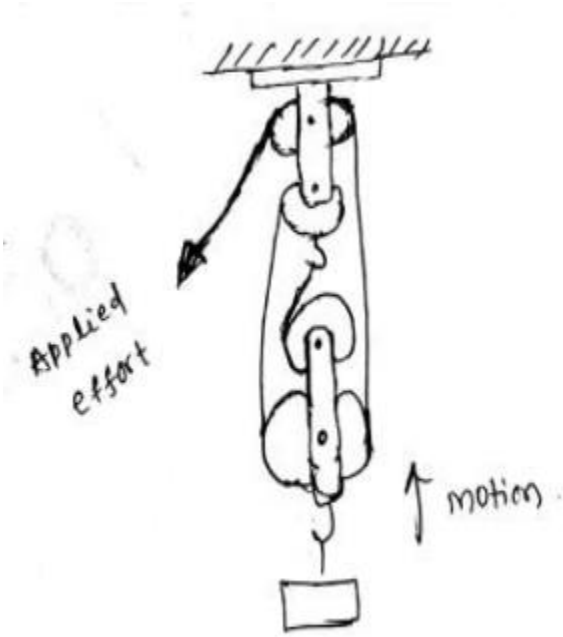
a. The work output from the winding engine (2M)
b. The work input to the lifting gear (2M)
c. The lift machinery efficiency (3M)
d. The power input to the lift machinery (3M)

Q7. Lifting tackle comprised of a set of pulleys, with three pulleys in the upper block and lower blocks, is used to lift a mass of 200 kg. Take the gravitational acceleration as 9.81 m/s^2. If the effort required to make the lift is 0.75 kN. Determine

a. The efficiency of the lifting tackle (4M)
b. The effort used to overcome friction in the lifting gear (3M)
c. The work expended by the user to lift the load by 2.5m (3M)

Q8. Calculate the power required to pump a mass of fluid of 50 tonne to a height of 30 m every 30 seconds. Take gravitational acceleration as 9.81 m/s^2 (2M)

Q9. For the Pulley system shown in the figure. The effort applied is 200N and system is 92% efficient.



Calculate

a. The mass being raised (8M)
b. The distance moved by the effort when the mass is raised a height of 4m (2M)

Q10. A simple ideal machine consists of a wheel and axle. The wheel has a diameter of 260mm and a mass of 500kg is lifted a distance of 3m.The operation takes 10 seconds and it winds 19.5m of cable off the wheel. Calculate

a. The diameter of the axle (4M)
b. The power required (6M)