

Uva Wellassa University, Sri Lanka
End Semester Examination – June/July 2009
ENG 306-2 Mechanics of Machines

Time: Two (02) hours



Total 04 Questions
Answer All questions

1. A single cylinder, four stroke spark ignition internal combustion engine develops 25kW of power at 250 rev/min. It is found that the work done by the gases during the expansion (power) stroke is approximately equal to 3 times the work done on the gas during the compression stroke. Compared to the work done during the expansion and compression strokes, the work done during the suction and exhaust strokes is found negligible. Due to space limitations, the radius of gyration of the flywheel is to be limited to a maximum value of 0.6 m. Assuming the turning moment diagram during the compression and expansion strokes are isosceles triangles (two edges are of equal length), find:
 - a. Coefficient of fluctuation of energy,
 - b. The minimum mass of the flywheel in order to limit the coefficient of fluctuation of speed to 3%.

2. A Hartnell governor having a central sleeve spring and two right angled bell crank levers moves between 290rev/min and 310 rev/min for a sleeve lift of 15mm. The sleeve arms and ball arms are 80mm and 120 mm respectively. The levers are pivoted at 120mm from the governor axis and the mass of each ball is 2.5kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine;
 - a. Load on the spring at the lowest and the highest equilibrium speeds
 - b. Stiffness of the spring

3.

a. Show that the friction torque of an old collar bearing with inner and outer diameters r_1 and r_2 respectively can be expressed as $T = \frac{1}{2} \mu W [r_1 + r_2]$ Where W is the axial force and μ is the friction coefficient.

b. The axial spring force operating a single-plate clutch is 8250 N. The inner and outer diameters of the friction plate are 200 mm and 350 mm respectively. The coefficient of friction is 0.3. Assuming the clutch is old calculate the maximum power the clutch can transmit at the speed 300 rev/min.

4. A screw operated lift as shown in Figure Q4 is used to lift an object of mass 50 kg. The thread pitch and the mean diameter of both screws are 6 mm and 20 mm, respectively. The angle β for the position shown is 30° . The coefficient of friction between the nuts and the threads is 0.12. The total frictional torque required to overcome the friction at the bearing $B1$ and $B2$ is 5 Nm. Assume that both the threads TA and TB are of single start.

- If the thread TA , shown in the figure, is a right hand thread, what should be the type of thread of TB ?
- If the radius of the operating lever is 150 mm, estimate the force required to turn the operating wheel for the configuration shown.
- Is this screw a self-locking or an overhauling screw? Justify your answer.
- Briefly explain whether the given screw geometry is appropriate for this application.

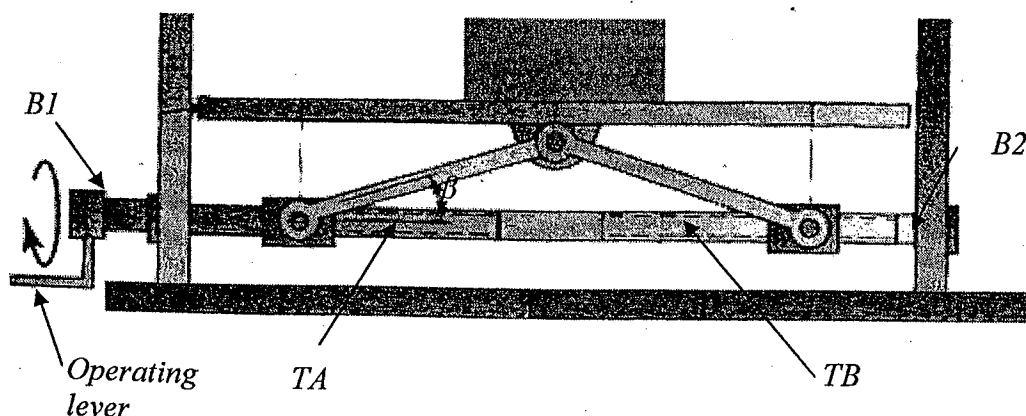


Figure Q4