

School of Mechanical Engineering
Mechanical Engineering
ETE - Jun 2023

Time : 3 Hours

Marks : 50

Sem VI - BTME3008 - Dynamics of Machines

Your answer should be specific to the question asked

Draw neat labeled diagrams wherever necessary

1. Describe the condition for maximum value of swaying couple arises due to unbalanced primary forces. K2 CO2 (2)
2. Explain the working principle of Hartnell Governor K2 CO5 (2)
3. Describe the utilization of turning moment diagrams for flywheels. K2 CO1 (2)
4. Explain the method of finding the counterweights in two planes to balance the dynamic unbalance of rotating masses. K2 CO4 (2)
5. Discuss the application of bi-filar and tri-filar systems K2 CO3 (2)
6. Illustrate the gyroscopic effect on sea vessels. K3 CO5 (6)
7. Derive an expression for the natural frequency of a uniformly loaded simply supported shaft making transverse vibrations due to elastic forces. K3 CO4 (5)
8. Find the relation for natural frequency of a torsional vibratory system consisting of a single rotor. What is the inertia effect of the mass of the shaft K3 CO3 (5)
9. A single-cylinder reciprocating engine has a reciprocating mass of 60 kg. The crank rotates at 60 rpm and the stroke is 320 mm. The mass of the revolving parts at 160 mm radius is 40 kg. If two-thirds of the reciprocating parts and the whole of the revolving parts are to be balanced, determine the (i) balance mass required at a radius of 350 mm (ii) unbalanced force when the crank has turned 50° from the top-dead centre K4 CO2 (8)
10. In a single-acting four-stroke engine, the work done by the gases during the expansion stroke is three times the work done during the compression stroke. The work done during the suction and exhaust strokes is negligible. The engine develops 14 kW at 280 rpm. The fluctuation of speed is limited to 1.5% of the mean speed on either side. The turning-moment diagram during the compression and the expansion strokes may be assumed to be triangular in shape. Determine the inertia of the flywheel. K4 CO1 (8)
11. In a spring-loaded governor of the Hartnell type, the lengths of the horizontal and the vertical arms of the bell-crank lever are 40 mm and 80 mm respectively. The mass of each ball is 1.2 kg. The extreme radii of rotation of the balls are 70 mm and 105 mm. The distance of the fulcrum of each bell-crank lever is 75 mm from the axis of rotation of the governor. The minimum equilibrium speed is 420 rpm and the maximum equilibrium speed is 4% higher than this. Neglecting the obliquity of the arms, determine the (i) spring stiffness, (ii) initial compression, and (iii) equilibrium speed corresponding to radius of rotation of 95 mm. K4 CO5 (8)