

TIET Patiala

Department of Mechanical Engineering

UMT 304: Theory of Machines

Tutorial Sheet No 7

1. Each crank and the connecting rod of a vertical petrol engine, running at 1800 rpm are 60 mm and 270 mm respectively. The diameter of the piston is 100 mm and the mass of the reciprocating parts is 1.2 kg. During the expansion stroke when the crank has turned 20° from the top dead centre, the gas pressure is 650 kN/m². Determine the
 - i. net force on the piston
 - ii. net load on the gudgeon pin,
 - iii. thrust on the cylinder walls,
 - iv. speed at which the gudgeon pin load is reversed in direction.
2. The piston diameter of an internal combustion engine is 125 mm and the stroke is 220 mm. The connecting rod is 4.5 times the crank length and has a mass of 50 kg. The mass of the reciprocating parts is 30 kg. The centre of mass of the connecting rod is 170 mm from the crank-pin centre and the radius of gyration about an axis through the centre of mass is 148 mm. The engine runs at 320 rpm. Find the magnitude and the direction of the inertia force and the corresponding torque on the crankshaft when the angle turned by the crank is 140° from the inner dead centre.
3. The speed variation of an Otto cycle engine during the power stroke is limited to 0.8% of the mean speed on either side. The engine develops 40 kW of power at a speed of 130 rpm with 65 explosions per minute. The work done during the power stroke is 1.5 times the work done during the cycle. If the hoop stress in the rim of the flywheel is not to exceed 3.5 Mpa and the width is three times the thickness, determine the mean diameter and the cross section of the rim. Assume that the energy stored by flywheel is 1.1 times the energy stored by the rim and the density of the rim material is 7300 kg/m³. The turning moment diagram during the expansion stroke may be assumed to be triangular in shape.
4. The turning-moment diagram for a petrol engine is drawn to a vertical scale of 1 mm to 6 N.m and horizontal scale of 1 mm to 1°. The turning moment repeats itself after every half revolution of engine. The areas above and below the mean torque line are 305, 710, 50, 350, 980 and 275 mm². The rotating parts amount to a mass of 40 kg at a radius of gyration of 140 mm. Calculate the coefficient of fluctuation of speed if the speed of the engine is 1500 rpm.

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