TIET Patiala

Department of Mechanical Engineering

UMT 304: Theory of Machines

Tutorial Sheet No 7

1. Each wheel of a four-wheeled rear engine automobile has a moment of inertia of 2.4 *kg.m²* and an effective diameter of 660 *mm*. The rotating parts of the engine have a moment of inertia of 1.2 *kg.m²*. The gear ratio of engine to the back wheel is 3 to 1. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The mass of the vehicle is 2200 *kg* and the centre of the mass is 550 *mm* above the road level. The track width of the vehicle is 1.5 *m*. Determine the limiting speed of the vehicle around a curve with 80 *m* radius so that all the four wheels maintain contact with the road surface.

2. The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from the aft. The radius of gyration of the rotor is 320 *mm*. Determine the gyroscopic couple and its effect when the (*i*) ship turns right at a radius of 250 *m* with a speed of 25 *km/h*, (ii) ship pitches with the bow rising at an angular velocity of 0.8 *rad/s*, (iii) ship rolls at an angular velocity of 0.1 *rad/s*.

3. The moment of inertia of an aeroplane air screw is 20 *kg. m²* and the speed of rotation is 1000 rpm clockwise when viewed from the front. The speed of the flight is 200 *km* per hour. Find the gyroscopic reaction of the air screw on the aeroplane when it makes a left-handed turn on a path of 150 *m* radius.

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