COLLEGE OF ENGINEERING, PUNE
Department of Mechanical Engineering
End Semester Examination 2013

CLASS: T Y BTECH (Mech.)   **MAX. MARKS: 60**
**SUBJECT: THEORY OF MACHINES II (ME 304)**   **TIME: 3 Hrs**

Q.1   **a)**   A leather belt 125 mm wide and 6 mm thick transmits power from a pulley 750 mm diameter which runs at 500 rpm. The angle of lap is 150^0 and the coefficient of friction is 0.3. If mass of 1 m^3 of leather is 1 Mg and the stress in the belt is not to exceed 2.75 MN/m^2, Find the maximum power which can be transmitted.

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b)   A shaft rotates in two bearings A and B, 180 cm apart and projects 45 cm beyond A and B. At the extreme ends of the shafts are attached two pulleys of masses 20kg and 48 kg their center of gravity being 12.5 mm and 15.5 mm from the axis of the shaft respectively. In the middle of the bearings a third pulley of mass 50 kg with a center of gravity out by 15.5 mm is attached. If the three pulleys have been arranged so as to obtain static balance, determine the dynamic forces produced on the bearings when shaft speed is 500 rpm.

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Q.2   Derive an expression for the efficiency of a worm gear connecting two perpendicular shafts. In a gear of this kind, the worm (which is driving member) has 4 threads of pitch diameter 75 mm. The worm- wheel has 22 teeth of 412.5 mm pitch diameter. The effective coefficient of friction between the sliding surfaces is 0.050. The driving torque applied to the worm is 50 Nm. Calculate the end thrust exerted on each shafts and the efficiency of the gear.

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Q.3   **A**   A truck with four wheels, each of 750 mm diameter, travels on rails round a curve of 75 m radius at a speed of 50 km/h. The total mass of the truck is 5t and its center of gravity is midway between the axels, 1.05 m above the rails and midway between them. Each pair of wheel is driven by a motor rotating in the opposite direction to the wheels and at four times the speed. The moment of inertia of each pair of wheels is 15 kgm^2 and of each motor shaft 5 kgm^2. The rails lie on the horizontal plane and 1.45 m apart. Determine the load on each rail.

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B   Explain in detail (any 3)
Slip and Creep in belt drive
Damping ratio
Logarithmic decrement
Gyroscopic couple and its effects on ship

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C   The six cylinders of a single acting, two stroke cycle diesel engines are pitched 1m apart and the cranks are spaced at equal interval. The crank length

is 300 mm and the ratio of connecting rod to crank is 4.5. The reciprocating mass per line is 1450 kg. The speed is 200 rpm. Compare the unbalanced forces and couple for firing order 1-5-3-6-2-4 and 1-4-5-2-3-6

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Q.4   The fig below shows a brake drum 330 mm diameter, acted on by two brake shoes which are mounted on a pin A, and pushed apart by two hydraulically operated pistons at B, each exerting a force P N on the shoe on which it makes contact. The brake lining on each shoe extends 60^0 above and below the horizontal center line. The coefficient of friction is 0.2. The radial pressure between the lining and the drum is proportional to the rate of wear of the lining. Find the value of P to produce a braking torque of 180 Nm.
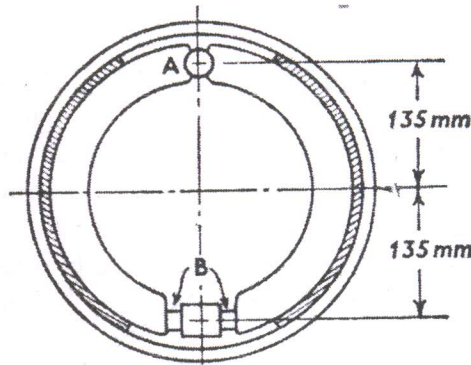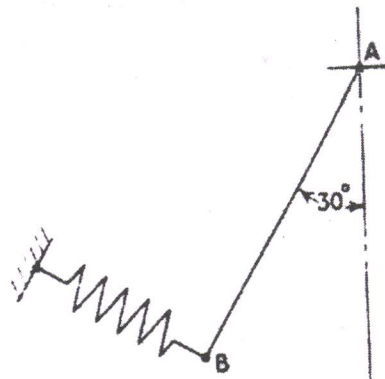

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Q.5   **A**   A machine of 70 kg is mounted on spring and is fitted with a dash-pot to damp out vibrations. There are three springs each of stiffness 9 KN/m and it is found that the amplitude of the vibration diminishes from 36 mm to 6 mm in two complete vibrations. Assuming that the damping force varies directly as the velocity, determine the resistance of the dash-pot at unit velocity.

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B   In fig. AB is a uniform rod 400mm long and of mass 4kg which is pivoted on a fixed pin at A. A tension spring is attached at the end B of the rod. In the position of equilibrium the rod is inclined at 30^0 to the vertical and the axis of spring is perpendicular to the rod. The stiffness of the spring is 45N/m. Neglecting the friction; calculate the natural frequency of vibration of the system for oscillations of small amplitude.

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