Mech

College of Engineering, Pune

Department of Mechanical Engineering

END –SEM Examination(2012)

Class : T Y Mech **Duration: 3 hrs**

Course: Theory of Machines II (ME304) **Marks: 50**

Q1. a) The six cylinders of a single acting two stroke diesel engine are in line and are symmetrically spaced on either side of the central plane. The center lines of cylinders 1 and 6 are 4.8 m apart. Cylinder 2 and 5 are 3 m apart and cylinders 3 and 4 are 1.2 m apart. The reciprocating mass per cylinder is 800 kg, the crank radius is 0.3 m, the speed is 180rev/min and the connecting rod is 1.35 m long. Show that primary and secondary forces are in balance for any order of firing in the cylinders and investigate the out of balance primary and secondary couple effects when the firing order is 1-4-5-2-3-6, giving maximum values. **(5)**

b) An open belt drive connects two pulleys, 1.2 and 0.5 m diameter, on parallel shafts 3.6 m apart. The belt has a mass of 0.9 kg /m length, and the maximum tension in it is not to exceed 2 kN. The 1.2 m pulley, which is the driver, runs at 200 rpm. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 rpm. Calculate the torque on each of the two shafts, the power transmitted and the power lost in friction. $\mu = 0.3$. What is the efficiency of the drive? **(5)**

Q2. a) Establish a formula for the maximum torque transmitted by a cone clutch of internal and external radii, the limiting coefficient of friction is μ, and the axial spring loading is **P** for uniform pressure and uniform wear condition with neat diagram and principle working of clutch **(5)**

b) The following particulars are given for a motor vehicle: total mass 1.5 t; wheel base 3.2 m; track width 1.5 m; center of gravity 1.8 m behind the front axle and 0.95 m above road level; moment of inertia of two wheels 15 kgm^2; moment of inertia of parts turning at engine speed 2 kgm^2; wheel diameter 0.64 m; gear ratio from engine to road wheels 10 to 1. The engine turns in a clockwise direction when viewed from the front of the vehicle. The vehicle travels at a constant speed of 80 km/h and enters a right hand curve of 150 m radius. Determine the total vertical load on each wheel. **(5)**

Q3. a) Derive the equations for velocity and acceleration for the follower motion when it is S.H.M and Cycloidal motion. **(3)**

b) Cam with 25mm minimum radius has to give the motion to the roller follower 10 cm diameter as follows: .

(a) Follower to complete outward stroke of 25 mm during 110° of cam rotation with S.H.M

(b) Follower to return to its initial position during next 90° of cam rotation with uniform acceleration and retardation. Layout the cam profiles when:

(i) The follower axis passes thro' centre of cam.

(ii) The follower axis is offset by 20 mm with respect to cam centre.

Find maximum velocity and acceleration during these motions **(7)**

Q4. a) A small three – throw crankshaft has cranks of radii 125 mm, set at 120^0 to each other, and equally spaced with a pitch of 250 mm. The revolving masses at crank radii are the same for each line and of amount 15 kg. the shaft is supported in two bearings symmetrically arranged with respect to the cranks and 850 mm apart. Determine the dynamical loads on the bearings for a speed of 500 rev/min.

The shaft is to be balanced by means of a mass at radius of 187.5 mm in the plane of crank 1, and a mass at radius 250 mm attached to the flywheel situated 225 mm beyond the bearing adjacent to crank 3. Determine the magnitude of these balance masses and their angular positions relative to crank 1. **(5)**

b) A brake consists of a flexible band on the periphery of a wheel of 800 mm diameter. One end of the band is attached to a fixed pin and other is subjected to a pull of 225 N. The angle of lap is 270° and μ= 0.25. Sketch the arrangement, showing the direction of rotation of the wheel, and find the value of the maximum braking torque. If the wheel and the parts attached to it have a moment of inertia of 70 kgm^2, find the time to come to rest from an initial speed of 700 rev/min. **(5)**

Q5. Solve any two

a) Determine the natural frequency of vibration for the system. (Fig.1) **(5)**

b) Find the natural frequency of the system shown in fig. where k1=k2=k3=k4=k5=k6=1000 N/m. (Fig.2) **(5)**

c) For the given system calculate the natural frequency of vibration when inclined surface is making 25 degree angle with horizontal plane. (Fig.3) **(5)**

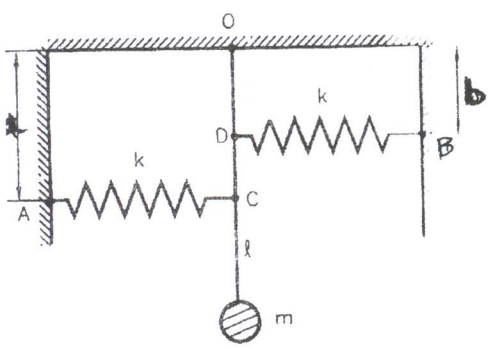

Fig 1

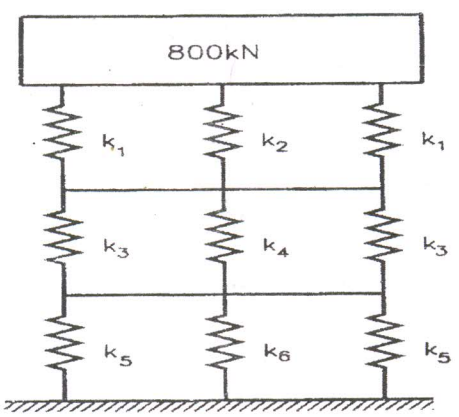

Fig 2

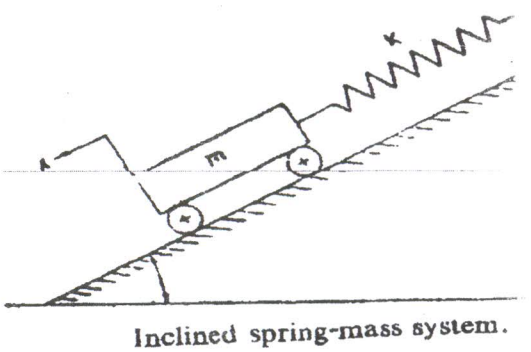

Fig 3