ME

C 58394 (Pages 4) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2009

ME 04 606—DYNAMICS OF MACHINERY

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Missing data if any may be suitably assumed. Clearly mention the assumption made.
Draw neat sketches.
Drawing conventions are to be strictly followed.

I. (a) What are the conditions of state equilibrium of a three-force member and a member with two forces and a torque ?

(b) With suitable example explain the principle of super position.

(c) What is the function of a flywheel ? How does it differ from that of a governor ?

(d) Explain the terms "static balancing" and "Dynamic balancing". State the necessary conditions to achieve them.

(e) Discuss the effect–inertia of the shaft, in transverse vibration.

(f) Find the natural frequency of the system shown in figure 1.

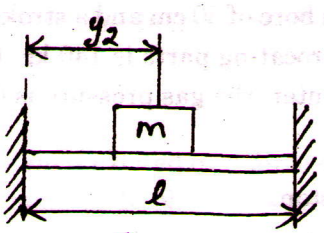

Figure-1

(g) Use Lagrange's equation to find equations of motion for a system shown in Figure 2.

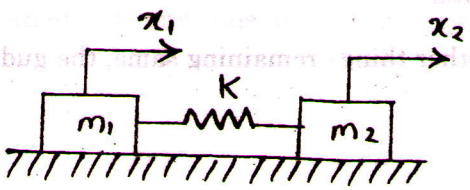

Figure -2

(h) Explain with suitable sketches, the co-ordinate coupling.

(8 × 5 = 40 marks)

Turn over

II. (a) For the static equilibrium of the quick-return mechanism shown in Figure 3, find the required input torque T_2 for a force of 3500 N on the slider. Angle of link EB with the vertical is 70°. The impending motions of the slider is to the left. Assume the coefficient of friction $\mu = 0.17$ for each sliding pair.

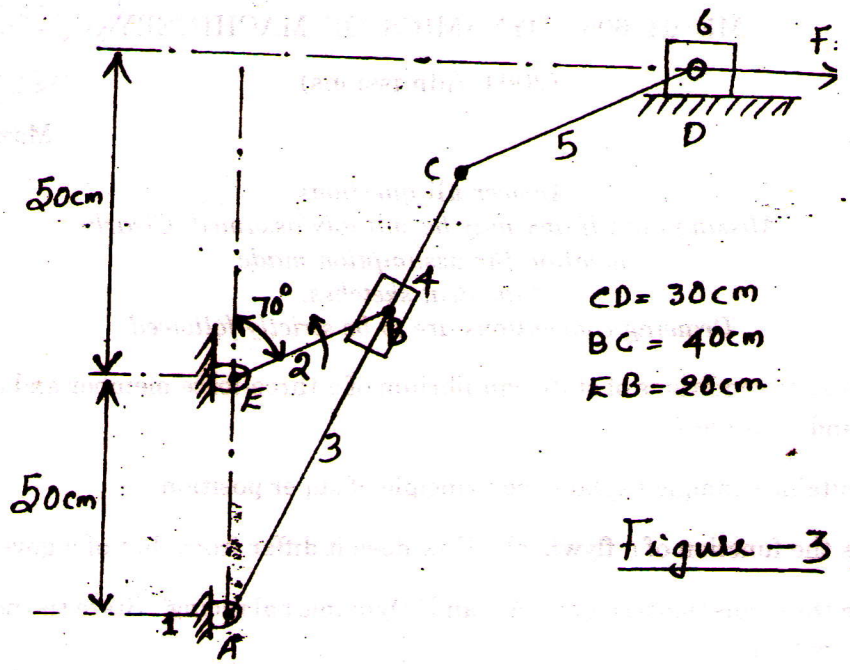

Figure – 3

(15 marks)

Or

(b) A single cylinder vertical engine has a bore of 30 cm and a stroke of 40 cm. The connecting rod is 100 cm long. The mass of the reciprocating parts is 140 kg. On the expansion stroke with the crank at 30° from the top dead center, the gas pressure is 0.7 MPa. If the engine runs at 250 r.p.m., determine :

(i) The net force acting on the piston.

(ii) Resullant load on the gudgeon pin.

(iii) Thrust on the cylinder walls.

(iv) The speed above which, other things remaining same, the gudgeon pin load would be reversed in direction.

(15 marks)

III. (a) A machine requiring a driving torque of (2000 + 3000 sin θ) N-m is driven by a directly coupled two stroke engine whose turning moment is given by (2000 + 4000 sin 2θ). The average speed is 150 r.p.m. Determine :

(i) The power output of the engine.

(ii) The maximum angular acceleration of the flywheel. and

(iii) The moment of inertia of the flywheel to limit the speed of fluctuation within ± 2 % of the average speed.

(15 marks)

Or

(b) A racing car of mass 2500 kg has a wheel base of 2 m and track width of 105 cm. The center of gravity lies-mid-way between the front and the rear axels and is 0.4 m above the ground. The engine rotating part are equivalent of a flywheel of moment of inertia of 50 kg-m^2 rotating at 6000 r.p.m. in clockwise direction when viewed from the front. If the car speeding at 50 Km/hr rounds a curve of 15 m radius, determine the reaction between the wheels and the ground. Consider the gyroscopic effect of the flywheel, the dead weight of the car and the centrifugal effects. Neglect the effect due to rotating wheels.

(15 marks)

IV. (a) A mass of 2 kg is supported on an isolator having a spring scale of 2940 N/m and viscous damping. If the amplitude of free vibration of the mass falls to one half its original value in 1.5 seconds, determine the damping coefficient of the isolator.

(7 marks)

(b) A spring mass system is excited by a force 4 sin wt N. The stiffness of the spring is 5 N/cm and the weight of the mass in 10 N, determine

(i) the magnification factor for w = 12 rad/sec.

(ii) the amplitude and time after 10 cycles at resonance.

(8 marks)

Or

(c) A circular cylinder of mass 4 kg and radius 15 cm is connected by a spring of stiffness 4000 N/m as shown in figure 4. It is free to roll on horizontal rough surface without slipping, determine the natural frequency.

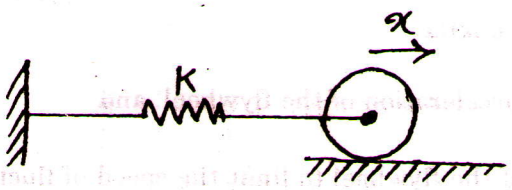

Figure – 4

(7 marks)

(d) Determine the value of 'b' for which the system shown in figure 5, will not vibrate. Assume K_1, K_2, a and b fixed.

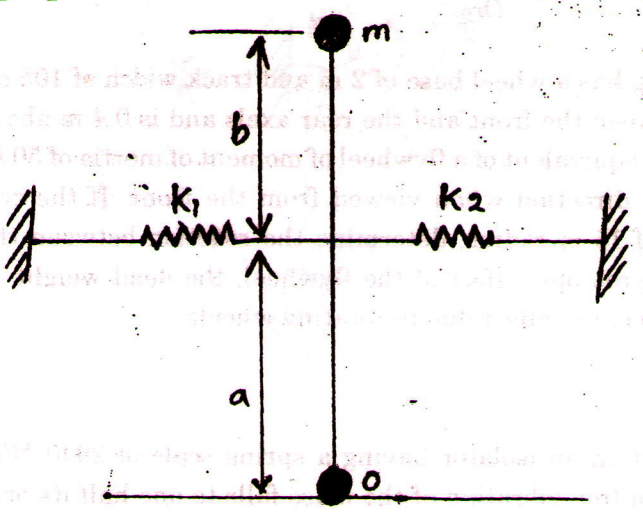

Figure – 5

(8 marks)

V. (a) Find the natural frequency and amplitude ratio of the system shown in Figure 6.

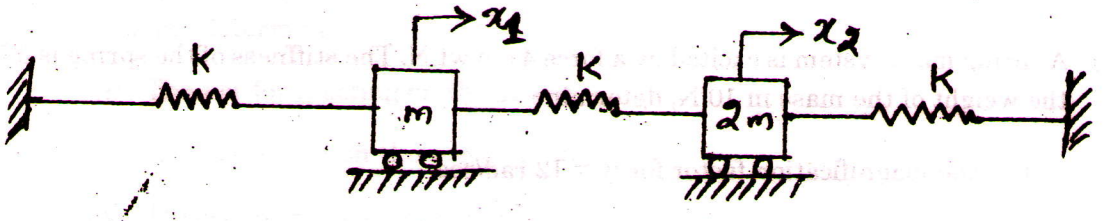

Figure – 6

(15 marks)

Or

(b) An automobile weighs 2000 kg and has a wheel base of 3.0 m. Its center of gravity is located 1.4 m behind the front wheel axis and has a radius of gyration about its center of gravity as 1.1 m. The front springs have a combined stiffness of 6000 kg/cm and rear springs 6500 kg/cm. Find the principle mode of vibration of the automobile and locate the model points for each mode.

(15 marks)

(4 × 15 = 60 marks)