Ex/BBSUS/AM- 601/06

B.E. (ME) Part-III 6th Semester Examination, 2006

Mechanisms and Dynamics of Machines-II

(AM-601)

Time : 3 hours **Full Marks : 100**

*Use separate answerscript **for** each half. Answer SIX questions, taking THREE from each half.*
*The questions are of equal value. Two marks **are** reserved **for** neatness in each half.*

FIRST HALF

1. a) Each crank of a four cylinder vertical engine is 225 mm. The reciprocating masses of the first, second and the third cranks are 100 kg, 120 kg and 100 kg and the planes of rotation are 600 mm, 300 mm and 300 mm from the plane of rotation of the third crank. Determine the mass of the reciprocating parts of the third cylinder and the relative angular positions of the crank if the engine is in complete primary balance.

~ ~b~) Explain the method of direct and reverse cranks to determine the unbalance forces in radial engines.

2. The cranks of a three-cylinders locomotive are set at 120°. The reciprocating masses are 450 kg for the cylinder and 390 kg for each outside cylinder. The pitch of the cylinders is 1.2 m and the stroke of each piston 500 mm. The planes of rotation of the balance masses are 960 mm from the inside cylinder. If 40% of the reciprocating masses are to be balanced, determine the magnitude and the position of the balancing masses required at a radial distance of 500 mm, and the hammer-blow per wheel when the axle rotates at 350 rpm.

3. Each road wheel of a motor cycle is of 600 mm diameter and has a moment of inertia of 1.1 kg.m^2. The motor cycle and the rider together weigh 220 kg and the combined centre of mass is 620 mm above the ground level when the motorcycle is upright. The moment of inertia of the rotating parts of the engine is 0.18 kg.m^2. The engine rotates at 4.5 times the speed of road wheels in the same sense. Find the angle of heel necessary when the motor cycle is taking a turn of 35 m radius at a speed of 72 km/h.

4. a) What is the effect of the gyroscopic couple on the stability of a four wheeler while negotiating a curve? In what way this effect along with that of the centrifugal force limit the speed of the vehicle.

b) Describe the function of a Pivoted-cradle balancing machine with the help of a neat sketch. Show that it is possible to make only four test runs to obtain the balance masses in such a machine.

5. Write short notes on the following: i) Tractive force and swaying couple ii) Field balancing of rotors iii) Static and dynamic balancing iv) Spin, precession, gyroscopic planes and gyroscopic couple.

SECOND HALF

6. A vibrating system consists of mass 20kg, a spring of stiffness 20kN/m and a damper. The damping provided is only 30% of critical value. Determine the natural frequency of the damped vibration and the ratio of two consecutive amplitude.

7. In a single degree damped vibrating system , the suspended mass of 4 kg makes 24 oscillations in 20 seconds . The amplitude decreases to 0.3 of the initial value jafler 4 oscillations. Find the stiffness of the spring, the logarithmic decrement, the damping factor and damping coefficients.

8. The following data relate to a machine supported by four spring:
Mass of the machine = 120kg, stroke 90mm ,
mass of reciprocating parts = 2.5 kg and speed = 750 rpm.
Springs are symmetrically placed with respect to the center of mass of the machine. Neglecting damping, find the combined stiffness of the springs so that the force transmitted to the foundation is 1/22 of the impressed force.

If under actual working conditions, the damping reduces the amplitude of successive vibrations by 25% determine the forces transmitted to the foundation at 750 rpm and at resonance. Also find out the amplitude of vibrations at resonance.

9. A mass of 50 kg suspended from a spring produces a statical deflection of 17mm and when in motion it experiences a viscous damping force 250 N at velocity of 0.3m/s . Calculate the periodic time of damped vibration. If the mass is then subjected to a periodic disturbing force having a maximum value 200 N and making 2 cycles/s , find the amplitude of ultimate motion.

10. Write short notes on the following :
i) Critical speed
ii) Over damped , under damped and critical damped vibration
iii) Logarithmic decrement
iv) Rayleigh's method
v) Forced vibration