(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4076   **Roll No.** ⬛⬛⬛⬛⬛⬛⬛⬛⬛⬛⬛

B.Tech.

(..M. V) ODD SEMESTER THEORY EXAMINATION 2012-13

DYNAMICS OF MACHINE

Time : 3 Hours   *Total Marks : 100*

Note : *(1) Attempt **all** questions.*

(2) Assume suitable data, if required.

1. Attempt any **FOUR** questions :   (5×4=20)

    (a) What is turning moment diagram ? What are its advantages ?

    (b) Deduce the expression for the inertia force in the reciprocating force neglecting the weight of the connecting rod.

    (c) Define coefficient of fluctuation of speed and coefficient of fluctuation of energy.

    (d) What do you mean by equivalent offset inertia force ? How it is calculated ?

    (e) State D' Alembert's principle. What is its use ?

    (f) In a reciprocating engine mechanism, if the crank and connecting rod are 300 mm and 1 m long respectively and the crank rotates at a constant speed of 200 r.p.m. determine analytically :

        (i) The crank angle at which the maximum velocity occurs

        (ii) Maximum velocity of piston.

2. Attempt any **TWO** parts : (10×2=20)

(a) What do you mean by balancing of reciprocating masses ? Why it is not possible to balance reciprocating masses completely ?

(b) Four masses A, B, C and D i.e. 40 Kg, 50 Kg, 60 Kg and M Kg respectively are rigidly connected to shaft at 30 cm, 24 cm, 28 cm and 24 cm respectively from the axis of the shaft. The shaft revolves about its axis and the planes of revolution of mass are at equal interval apart. Determine M and the angular position of B, C and D in relation to that of A in order that masses may completely balanced one other.

(c) The cranks of a two cylinders, uncoupled inside cylinder locomotive are at right angles and are 325 mm long. The cylinders are 675 mm apart. The rotating mass per cylinder is 200 Kg at the crank pin and the mass of reciprocating parts per cylinder is 240 Kg. The wheel center lines are 1.5 m apart. The whole of the rotating and 2/3 of the reciprocating masses are to be balanced and the balance masses are to be placed in the planes of the rotation of the driving wheels at a radius of 800 mm. Find :

(i) The magnitude and direction of the balance masses

(ii) The magnitude of hammer blow.

3. Attempt any **TWO** parts : (10×2=20)

(a) Determine the maximum power that can transmitted through a flat belt having the following data :

Cross section of the belt = 300 mm × 12 mm

Ratio of friction tensions = 2.4

Maximum permissible tension in belt = 2 MPa

Mass density of the belt material = 1.1×10^{-3} g/mm^3

(b) Stabilize a formula for the maximum torque transmitted by a single plate clutch of external and internal radii r_1 and r_2 if the limiting coefficient of friction is μ and the axial spring load is w. Assume that the pressure intensity on the contact faces is uniform.

(c) Show that, in a band and block brake, the ratio of the maximum and minimum tensions in the brake strap is :

$$\frac{T_o}{T_n} = \left(\frac{(1 + \mu \tan \theta)}{(1 - \mu \tan \theta)} \right)^n$$

Where, T_o = maximum tension

T_n = minimum tension

μ = coefficient of friction between the blocks and drum, and

2θ = angle subtended by each block at the centre of the drum.

4. Attempt any **TWO** parts : (10×2=20)

(a) Explain the term height of the governor. Derive the expression for the height in the case of proell governor and also write its limitation.

(b) Define the following terms related to a governor :

(i) Stability

(ii) Sensitiveness

(iii) Isochronisms

(iv) Hunting.

(c) The following particulars refer to a porter governor :

All the arms of the governor are 178 mm long and hinged at a distance of 38 mm from the axis of rotation. The mass of each ball is 1.15 Kg and mass of sleeve is 20 Kg. The governor sleeve begins to rise at 280 rpm when the link are at an angle of 30° to the verti Assuming the frictional forces to be constant, determine the minimum and maximum speed of the rotation when the inclination of arm to the vertical is 45°.

5. Attempt any **TWO** parts : (10×2=20)

(a) The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 300 rpm clockwise when looking from stern the radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effect upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 16.1 knots (1 knot = 1855 m/hr). Calculate also the torque and its effect when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 sec and the total angular displacement between the two extreme positions of pitching is 12°. Find the maximum acceleration duri pitching motion.

(b) What do you mean by the stability of moving vehicle ? What are the various factors affecting the stability of a four wheeled vehicle negotiating a curve ?

(c) Write short notes on :—

(i) Logarithmic decrement

(ii) Critical speed of shaft.