

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI • EXAMINATION – WINTER • 2014

Subject Code: 161901

Date: 26-11-2014

Subject Name: Dynamics of Machinery

Time: 02:30 pm - 05:00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Justify the sentence “Reciprocating masses are partially balanced.” **07**
(b) Define Static and Dynamic balancing with suitable example. **07**

- Q.2** (a) Give the reason of coupling the locomotives. **04**
(b) Four masses A, B, C and D are completely balanced. Masses C and D make angles of 90° and 195° respectively with B in the same sense. The rotating masses have following properties. **10**

$m_b = 25 \text{ kg}$, $m_c = 40 \text{ kg}$, $m_d = 35 \text{ kg}$, $r_a = 150 \text{ mm}$, $r_b = 200 \text{ mm}$, $r_c = 100$, $r_d = 180 \text{ mm}$,

Planes B and C are 250 mm apart.

Determine

1. The mass A and its angular position,
2. The position of planes A and D.

OR

- (b) The following data apply to an outside cylinder uncoupled locomotive : **10**

Mass of rotating parts per cylinder = 360 kg; Mass of reciprocating parts per cylinder = 300 kg; Angle between cranks = 90° ; Crank radius = 0.3 m; Cylinder centres = 1.75 m; Radius of balance masses = 0.75 m; Wheel centres = 1.45 m. If whole of the rotating and two-thirds of reciprocating parts are to be balanced in planes of the driving wheels, find :

1. Magnitude and angular positions of balance masses,
2. Speed in kilometres per hour at which the wheel will lift off the rails when the load on each driving wheel is 30 kN and the diameter of tread of driving wheels is 1.8 m, and
3. Swaying couple at speed arrived at in (2) above.

- Q.3** (a) Discuss the effects of partial balancing in locomotives. **05**

- (b) The following data refer to four coupled wheel locomotive with two inside cylinders: **09**

Pitch of the cylinders = 600 mm, reciprocating mass/cylinder = 315 kg, revolving mass/cylinder = 260 kg, distance between driving wheels = 1.6 m, distance between coupling rods = 2 m, diameter of driving wheels = 1.9 m, revolving parts for each coupling rod crank = 130 kg, engine crank radius = 300 mm, coupling rod crank radius = 240 mm, distance of centre of balance mass in planes of driving wheels from axle centre = 750 mm, angle between engine cranks = 90° , angle between coupling rod crank with adjacent engine crank = 180° .

The balanced mass required for the reciprocating parts is equally divided between each pair of coupled wheels. Determine

1. The magnitude and position of the balance mass required balancing two-third of reciprocating and whole of the revolving parts.
2. The hammer blow and the maximum variation of tractive force when the locomotive speed 80 km/hr.

OR

- Q.3** (a) Derive the expression for primary and secondary forces on V-engines. **05**

- (b) A five cylinder in-line engine running at 750 rpm has successive cranks 144° apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225 mm **09**

and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of the central crank at which these maximum values occur. The reciprocating mass for each cylinder is 15 kg.

- Q.4 (a)** Derive the expression for naturally frequency for free vibration using equilibrium and energy method. **06**
- (b)** A machine weighs 18 kg and is supported on springs and dashpots. The total stiffness of the springs is 12 N/mm and damping is 0.2 N/mm/s. the system is initially at rest and a velocity of 120 mm/s is imparted to the mass. Determine: **08**
1. The displacement and velocity of mass as a function of time
 2. The displacement and velocity after 0.4 s.

OR

- Q.4 (a)** Write the short note on **06**
1. Torsionally equivalent shaft
 2. Free torsional vibrations
- (b)** A coil of spring stiffness 4 N/mm supports vertically a mass of 20 kg at the free end. **08**
The motion is resisted by the oil dashpot. It is found that the amplitude at the beginning of the fourth cycle is 0.8 times the amplitude of the previous vibration. Determine the damping force per unit velocity. Also find the ratio of the frequency of damped and undamped vibrations.

- Q.5 (a)** Explain Vibration isolation and transmissibility **07**
- (b)** A refrigerator unit having mass of 35 kg is to be supported on three springs, each **07**
having a spring stiffness s . the unit operates at 480 rpm. Find the value of stiffness s if only 10% of the shaking force is allowed to be transmitted to the supported.

OR

- Q.5 (a)** Discuss the effect of inertia of constraint in longitudinal and transverse vibrations. **07**
- (b)** A 30 kg weight of motor mounted on a damper which deflects by 2 mm due to motor **07**
weight. The weight of the rotor is 8 kg and has an eccentricity of 0.2 mm. the motor rotates at 1800 rpm. Find the amplitude of vibration of the motor and force transmitted to the foundation.
