Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) EXAMINATION – SUMMER 2021

Subject Code: 161901 Date:09/08/2021

Subject Name: Dynamics Of Machinery

Time:02:30 PM TO 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)** What is damping? Why there is need of damping? What are the different ways of providing the damping to the vibratory systems? **07**

(b) How will you measure the damping coefficient of a given viscous fluid? **07**

Q.2 **(a)** Explain the procedure for balancing of radial engines. **07**

(b) A body of mass 100 Kg is suspended from a spring of 18 KN/m. A dashpot is connected between the mass and damper with a damping coefficient of 0.1667 N-S/m. Determine (i) the critical damping coefficient, (ii) the amplitude of the body 10 cycles after it was released from an initial amplitude of 2.5 cm. **07**

OR

(b) A shaft has three eccentrics, each 75 mm diameter and 25 mm thick, machined in one piece with the shaft. The central planes of the eccentric are 60 mm apart. The distance of the centers from the axis of rotation are 12 mm, 18 mm and 12 mm and their angular positions are 120° apart. The density of metal is 7000 kg/m3. Find the amount of out-of-balance force and couple at 600 r.p.m. If the shaft is balanced by adding two masses at a radius 75 mm and at distances of 100 mm from the central plane of the middle eccentric, find the amount of the masses and their angular positions. **07**

Q.3 **(a)** A circular disc of mass 4 Kg and radius 15 cm is connected by a spring of stiffness 4000 N/m as shown in figure (3.1). It is free to roll on horizontal rough surface without slipping, determine the natural frequency. **07**

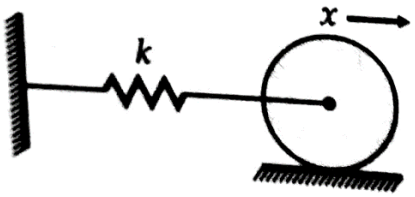

Figure 3.1

(b) A vertical four stroke in-line engine has a firing order of 1-4-2-6-3-5. The piston stroke is 100 mm and the length of each connecting rod is 200 mm. The pitch distances between the cylinder centerlines are 100 mm, 100 mm, 150 mm, 100 mm and 100 mm respectively. The reciprocating mass per cylinder is 1 kg and the engine runs at 3000 rpm. Determine the unbalanced primary and secondary forces and couples on this engine, taking into a plane midway between the cylinder 3 and 4 as the reference plane. **07**

OR

Q.3 **(a)** The three cranks of a three-cylinder locomotive are all on the same axle and are set at 120^0. The pitch of the cylinders is 1000 mm and the stroke of each piston is 600 mm. The reciprocating masses are 300 kg for inside cylinder and 260 Kg for each outside cylinder and the planes of rotation of the balance masses are 800 mm from the inside crank. If 40 % of the reciprocating masses are to be balanced; find (i) the magnitude and the position of the balancing masses required at a radius of 600 mm and (ii) the hammer blow per wheel when the axle makes 6 revolutions per second. **07**

(b) Explain in brief Coulomb damping. Derive an expression for loss of amplitude per cycle in Coulomb damping. **07**

Q.4 **(a)** Derive an expression for amplitude of steady state forced vibration. **07**

(b) A machine 100 Kg mass is subjected to a unbalanced force of 39.44 N. The mounting springs have stiffness of 85 KN/m, and damping factor 0.2. The operating speed of machine is 600 rpm. Find, (i) the amplitude of steady state vibration and (ii) the force transmitted to the supports. **07**

OR

Q.4 **(a)** Explain Holzer's method of determining the natural frequencies of multi-rotor system. **07**

(b) A mass of 1.93 kg is suspended in a box by vertical spring whose stiffness is 10 * 10^3 N/m. The box is placed on the top of a shake table producing a vibration of x = 0.09 sin8t. Find the absolute amplitude of mass. Assume no damping. **07**

Q.5 **(a)** Explain polydyne cam. **07**

(b) Derive an expression for critical speed of shaft carrying a single rotor with damping. **07**

OR

Q.5 **(a)** What is the need of balancing of rotating and reciprocating masses? Differentiate between static balancing and dynamic balancing. **07**

(b) A mass of 10 kg is kept on two slabs of isolators placed one over the other. One of the isolator is of rubber having a stiffness of 3 KN/m and damping coefficient of 100 N-S/m while the other isolator is of felt with stiffness of 12 KN/m and damping coefficient 300 N-S/m. If the system is set in vertical direction, determine the damped and undamped natural frequencies of the system. **07**

****