Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 161901 **Date: 10/05/2017**

Subject Name: Dynamics of Machinery

Time: 10:30 AM to 01:00 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)** Explain with neat sketch why reciprocating masses are partially balanced? **07**

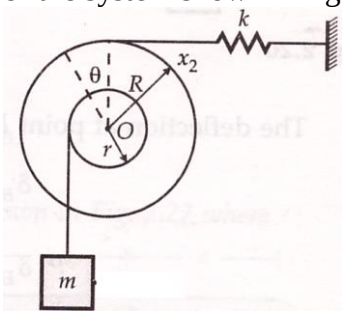
(b) Explain with neat sketch experimental method of determination of damping coefficient of oil. **07**

Q.2 **(a)** Explain direct and reverse crank method of balancing of radial engines. **07**

(b) The cranks and connecting rod of a four cylinder in-line engine running at 1800 rpm are 50 mm and 250 mm respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90^0 in an end view in order 1-4-2-3. The reciprocating mass correspondence to each cylinder is 1.5 Kg. Determine the (i) the unbalanced primary and secondary forces, if any. (ii) The unbalanced primary and secondary couples with reference to the central plane of the engine. **07**

OR

(b) Find the natural frequency of the system shown in figure given below; **07**



Q.3 **(a)** The following particulars relate to an outside cylinder uncoupled locomotive; **07**

Revolving mass per cylinder	300 Kg
Reciprocating mass per cylinder	450 Kg
Length of each cranks	350 mm
Distance between wheels	1600 mm
Distance between cylinder centers	1900 mm
Diameter of driving wheels	2000 mm
Radius of balancing mass	800 mm

If whole of the revolving and 2/3 of reciprocating masses are to be balanced, determine the magnitude and position of the balancing mass required in the planes of driving wheels. Angle between the cranks of the two cylinders is 90^0.

(b) A vibrating system is defined by the following parameters; **07**

mass = 3 Kg, stiffness = 100 N/m and damping coefficient = 3 N-sec/m.

Determine (i) the damping factor, (ii) the natural frequency of damped vibration, (iii) logarithmic decrement, (iv) the ratio of two consecutive amplitudes and (v) the number of cycles after which the original amplitude is reduced to 20 %.

OR

Q.3	**(a)**	A four masses P, Q, R, and S are attached on shaft at radii 100 mm, 225 mm, 150 mm and 150 mm respectively. Planes in which masses revolve are spaced 600 mm apart and the weights of Q, R and S are 10 Kg, 5.5 Kg and 3.6 Kg respectively. Estimate the required mass at P and the relative angular position of all the four masses so that the shaft is in complete balance.	**07**
	(b)	A seismic instrument is used to find the magnitude of vibration of a machine tool structure. It gives a reading of relative displacement of 0.4 μm. The natural frequency of the seismic instrument is 5 Hz. The machine tool structure is subjected to a kinematic excitation at a frequency of 2 Hz. Find the magnitude of acceleration of the vibrating machine tool structure. Assume that the damping of the seismic instrument is negligible.	**07**
Q.4	**(a)**	A mass of 1 kg is supported on a spring of 9800 N/m and has dashpot having damping coefficient of 5.9 N-sec/m. Find the damped natural frequency. Also find the logarithmic decrement and amplitude after 3 cycles, if the initial amplitude is 3 mm.	**07**
	(b)	Derive an expression for critical speed of a shaft carrying rotor and with damping	**07**

OR

Q.4	**(a)**	Derive an expression for Torsionally Equivalent Shaft System.	**07**
	(b)	A vertical spring-mass system has a mass of 0.5 Kg and an initial deflection of 2 mm. Find the spring stiffness and the natural frequency of the system. The system is subjected to Coulomb damping. When displaced by 20 mm from the equilibrium position and released, it undergoes complete 10 cycles and comes to rest in the extreme position on the side on which it was displaced. Calculate the Coulomb damping.	**07**
Q.5	**(a)**	Define force transmissibility. Explain with neat sketch transmissibility curves.	**07**
	(b)	A vibrating body of mass 150 Kg supported on springs of total stiffness 1050 KN/m has a rotating unbalance force of 525 N at a speed of 6000 rpm. If the damping factor is 0.3, determine (i) the amplitude caused by the unbalance and its phase angle, (ii) the transmissibility and (iii) the actual force transmitted.	**07**

OR

Q.5	**(a)**	Write a short note with neat sketch on single reed and multi reed tachometers.	**07**
	(b)	A rotor having a mass of 5 kg is mounted midway on a simply supported shaft of diameter 10 mm and length 400 mm. Because of manufacturing tolerances, the CG of the rotor is 0.02 mm away from the geometric center of the rotor. If the rotor rotates at 3000 rpm, find the amplitude of steady state vibrations and the dynamic force transmitted to the bearings. Neglect the effect of damping. Take $E = 2 * 10^{11}$ N/m^2.	**07**

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