Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI- EXAMINATION – SUMMER 2016

Subject Code:161901 Date: 19/05/2016

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)** Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. **07**

(b) Discuss how a single revolving mass is balanced by two masses revolving in different planes. **07**

Q.2 **(a)** A rotating shaft carries four unbalanced masses 18 kg, 14 kg, 16 kg and 12 kg at radii 50 mm, 60mm,70 mm and 60 mm respectively. The 2nd, 3rd and 4th masses revolve in planes 80 mm, 160mm and 280 mm respectively measured from the plane of the first mass and are angularly located at 60°, 135° and 270° respectively measured clockwise from the first mass looking from this mass end of the shaft. The shaft is dynamically balanced by two masses, both located at 50 mm radii and revolving in planes mid-way between those of 1st and 2nd masses and midway between those of 3rd and 4th masses. Determine, graphically the magnitudes of the masses and their respective angular positions. **07**

(b) Derive the following expressions, for an uncoupled two cylinder locomotive engine : (*a*) Variation is tractive force ; (*b*) Swaying couple ; and (*c*) Hammer blow. **07**

OR

(b) Write a short note on primary and secondary balancing and Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass. **07**

Q.3 **(a)** The reciprocating mass per cylinder in a 60° V-twin engine is 1.5 kg. The stroke and connecting rod length are 100 mm and 250 mm respectively. If the engine runs at 2500r.p.m., determine the maximum and minimum values of the primary and secondary forces. Also find out the crank position corresponding these values. **07**

(b) An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles. The whole of the rotating and 2/3 of the reciprocating masses are to be balanced by Masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses. **07**

Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r.p.m.

OR

Q.3 **(a)** Find the natural frequency of oscillation for the roller rolling on horizontal surface without slipping, as shown in fig. no.1. The mass of roller is 5kg, radius of roller is 50mm and stiffness of spring is 2000 N/m. **07**

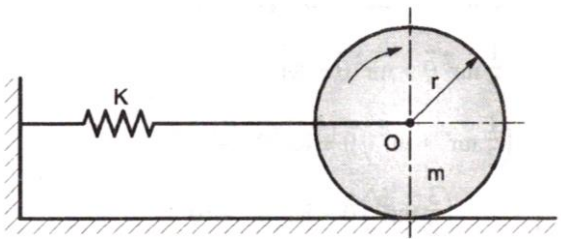

Fig.No.1

(b) A machine weight 18kg and is supported on spring and dashpots. The total stiffness of springs is 12 N/mm and damping co-efficient is 0.2N-s/mm. The system is initially at rest and a velocity of 120mm/s is imparted to the mass. Determine: The displacement and velocity of mass as a function of time; and The displacement and velocity after 0.5 sec. **07**

Q.4	**(a)**	Define logarithmic decrement and derive an expression for it?	**07**
	(b)	Two rotors, A and B are attached to the ends of the shaft 600 mm long. The mass and radius of gyration of rotor A is 40 kg and 400 mm respectively and that of rotor B are 50 kg and 500 mm respectively. The shaft is 80 mm diameter for first 250 mm, 120 mm for next 150 mm and 100 mm for the remaining length from the rotor A. Assume the modulus of rigidity of the shaft material 0.8×10^5 N/mm^2 and find: (i) Position of node on equivalent shaft of diameter 80 mm and on the actual shaft. (ii) Natural frequency of the torsional vibrations.	**07**
		OR	
Q.4	**(a)**	Derive an expression for Torsionally Equivalent Shaft System	**07**
	(b)	Discuss free torsional vibrations of geared system and derive the natural frequency relationships considering a three rotor system in conventional notations.	**07**
Q.5	**(a)**	Derive an expression for critical speed of a shaft carrying rotor and without damping.	**07**
	(b)	What are various frequency measuring instruments? Explain any one in detail.	**07**
		OR	
Q.5	**(a)**	What is Force Transmissibility? Why is it importance in mechanical vibrations? Explain with neat sketch Frequency response curve of force transmissibility.	**07**
	(b)	Using Stodola's Method Determine all modes of the system as shown in fig.no.2	**07**

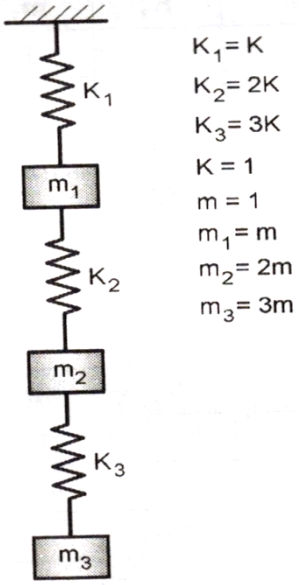

Fig.No.2

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