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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2161901 **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.**

			MARKS
Q.1		**Short Questions**	**(14)**
	1	Define the term "Dynamic balancing"	**01**
	2	Why balancing is necessary for high speed engines?	**01**
	3	What is secondary crank?	**01**
	4	When Swaying couple is maximum & minimum?	**01**
	5	Define "Degrees of Freedom" (D.O.F).	**01**
	6	Define Resonance & Damping.	**01**
	7	Define "Undammed Free Vibration".	**01**
	8	What is "Critical Damping Coefficient" (C_C)?	**01**
	9	Define Forced Vibrations.	**01**
	10	What is 'Force Transmissibility' (Tr)?	**01**
	11	Give one Example of two degree of freedom system.	**01**
	12	What is whirling speed of the shaft?	**01**
	13	What is the function of the accelerometer?	**01**
	14	What is Spring Surge in Cams Dynamics?	**01**
Q.2	**(a) (i)**	Explain Primary and Secondary Unbalanced Force Due to Reciprocating Masses.	**03**
	(ii)	Explain the balancing of several masses rotating in same plane by Graphical Method.	**04**
	(b)	Four masses 150 kg, 200 kg, 100 kg and 250 kg are attached to a shaft revolving at radii 150mm, 200 mm, 100 mm and 250 mm ; in planes A, B, C and D respectively. The planes B, C and D are at distances 350 mm, 500 mm and 800 mm from plane A. The masses in planes B, C and D are at an angle 105^o, 200^o and 300^o measured anticlockwise from mass in plane A. It is required to balance the system by placing the balancing masses in the planes P and Q which are midway between the planes A and B, and between C and D respectively. If the balancing masses revolve at radius 180 mm, find the magnitude and angular positions of the balance masses.	**07**
		OR	
	(b)	The three cranks of three cylinder locomotive are all on the same axle and are set at 120^o.The pitch of the cylinders is 1 meter and the stroke of each piston is 0.6 m. 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 0.8 m from the inside crank. If 40% of the reciprocating parts are to be balanced, Find:- 1. The magnitude and the position of the balancing masses required at a radius of 0.6 m. 2. The hammer blow per wheel when the axle makes 6 r. p. s	**07**
Q.3	**(a) (i)**	Explain concept of Direct and Reverse Crank.	**03**

	(ii)	Partial balancing of Primary Unbalanced Force in Reciprocating Engine	**04**
	(b)	The cranks and connecting rods of a 4-cylinder in-line engine running at 1800 r.p.m. are 60 mm and 240 mm each respectively and the cylinders are spaced 150 mm apart. The reciprocating mass corresponding to each cylinder is 10kg. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order 1-4-2-3. Determine: (I) Unbalanced primary and secondary forces, if any, and (ii) Unbalanced primary and secondary couples with reference to central plane of the engine.	**07**

OR

Q.3	**(a) (i)**	Write down short note on 'Variation of Tractive Force'.	**03**
	(ii)	Explain concept of Balancing of V engines.	**04**
	(b)	For a twin V-engine the cylinder centerlines are set at 90^o. The mass of reciprocating parts per cylinder is 2.5 kg. Length of crank is 100 mm and length of connecting rod is 400 mm. determine the primary and secondary unbalanced forces when the crank bisects the lines of cylinder centerlines. The engine runs at 1000 rpm.	**07**
Q.4	**(a) (i)**	Write down detail Classification of vibrations.	**03**
	(ii)	Define (1) Time Period (2) Stiffness of Spring (3) Damped Vibration (4) Equivalent Damper in series.	**04**
	(b)	A coil of spring stiffness 4 N/mm supports vertically a mass of 20 kg at the free end. 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	**07**

OR

Q.4	**(a) (i)**	Explain Equilibrium method to find the frequency of vibratory system.	**03**
	(ii)	Write short note on types of damping method.	**04**
	(b)	A single cylinder engine has a mass of 100 kg and is acted upon by a vertical unbalanced force of $400\sin(13\pi t)$ N. The engine block is supported on a spring having a stiffness 60 kN/m and a damper which gives a damping force of 700 N per unit velocity. Find the damping ratio and force transmitted to the foundation	**07**
Q.5	**(a) (i)**	Explain Vibration isolation.	**03**
	(ii)	Explain Torsionally Equivalent Shaft.	**04**
	(b)	A refrigerator unit having mass of 35 kg is to be supported on three springs, each 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.	**07**

OR

Q.5	**(a) (i)**	Classification of Vibration Measuring Instruments.	**03**
	(ii)	Explain Critical speed of shaft carrying single Rotor(without Damping)	**04**
	(b)	A horizontal shaft of 10 mm diameter is simply supported at both ends by bearings. A rotor of mass 5 Kg is attached at middle of the horizontal shaft. The span between two bearings is 500 mm. The center gravity of the rotor is 2.5 mm offset from the geometric center of the rotor. The equivalent viscous damping at the center of the rotor-shaft may be taken as 52 Ns/m. Find the deflection of the shaft and critical speed of the shaft.	**07**

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