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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2018

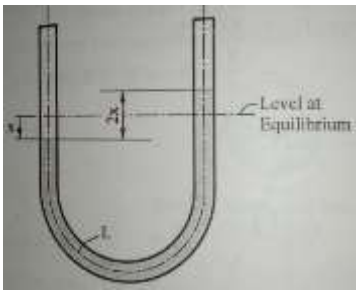
Subject Code:2161901 **Date:10/05/2018**

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	**(a)**	Why the shape of the crank is made like this  ?	**03**
	(b)	A shock absorber is to be designed so that its overshoot is 10% of the initial displacement when released. Determine the damping factor.	**04**
	(c)	Four masses A, B, C & D are completely balanced. Masses C & D makes an angle of 90^0 and 195^0 respectively with that of mass B in the counterclockwise direction. The rotating masses have the following properties: masses at B, C & D are 25 Kg, 40 Kg and 35 Kg respectively with their radii of rotations are 200 mm, 100 mm & 180 mm respectively. The radius of rotation of mass A is 150 mm. Planes B & C are 250 mm apart. Determine the (i) mass A and its angular position with that of mass B, (ii) position of all the planes relative to plane of mass A.	**07**
Q.2	**(a)**	What is the importance of forced transmissibility in mechanical vibrations?	**03**
	(b)	A gun barrel of mass 600 Kg has a recoil spring of stiffness 294 KN/m. If the barrel recoils 1.3 meter on firing, determine, (i) the initial recoil velocity of the barrel & (ii) the critical damping coefficient of the dashpot which is engaged at the end of the recoil stroke.	**04**
	(c)	The following data relate to a single cylinder reciprocating engine; mass of reciprocating parts = 40 kg, mass of revolving parts = 30 kg at crank radius, speed = 150 rpm and stroke = 350 mm. If 60 % of the reciprocating and all the revolving parts are to be balanced. Determine (a) the balance mass required at a radius of 320 mm & (b) the unbalanced force when the crank has turned 45^0 from top dead centre.	**07**
		OR	
	(c)	A U tube, open to atmosphere at both ends contains a column length L of a certain liquid as shown in figure. Find the natural period of oscillation of the liquid column. 	**07**
Q.3	**(a)**	List different types of dampings. Explain any one in detail.	**03**
	(b)	Plot the frequency response curve for the various damping factors in the rage 0 to 2. State the observations made from the plot.	**04**
	(c)	In a single degree viscously damped vibrating system, the suspended mass of 16 Kg makes 45 oscillations in 27 seconds. The amplitude of natural vibrations decreases to one fourth of the initial value after 5 oscillations. Determine: (i) The	**07**

logarithmic decrement, (ii) The damping factor and damping coefficient, (iii) The stiffness of the spring.

OR

Q.3 **(a)** Derive an expression for natural frequency of cantilever beam subjected to point load at the end. **03**

(b) A mass of 1 Kg is attached to a spring having a stiffness of 3920 N/m. The mass slides on a horizontal surface having coefficient of friction of 0.1. Determine the frequency of vibration of the system and the amplitude after one cycle if the initial amplitude is 2.5 mm. **04**

(c) A body of mass 70 Kg is suspended from a spring which deflects 20 mm under the load. If the damping factor of 0.23 is provided then find the natural frequency of damped vibrations and ratio of successive amplitudes for damped vibrations. **07**
If the body is subjected to a periodic disturbance of 700 N at a frequency of 17.277 rad/sec, find the amplitude of forced vibration and the phase angle with respect to the disturbing force.

Q.4 **(a)** Explain the method of balancing of several masses in different planes. **03**

(b) Derive an expression for length of torsionally equivalent shaft system. **04**

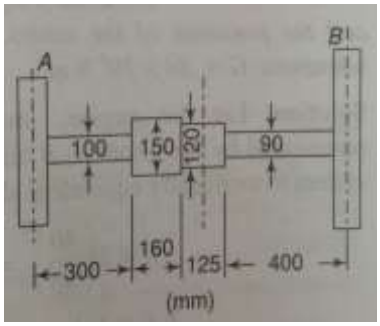
(c) The following data refers to a shaft held in long bearings. Length and diameter of shaft is 1200 mm and 14 mm respectively. Mass of the rotor at midpoint is 16 Kg, eccentricity of center of mass of rotor from center of rotor is 0.4 mm. Modulus of rigidity of shaft material 200 GN/m^2. Permissible stress in the shaft material is 70 x 10^6 N/m^2. Determine the critical speed of the shaft and the range of speed over which it is unsafe to run the shaft. Assume the shaft to be massless. **07**

OR

Q.4 **(a)** What do you mean by whirling of shaft? Why and where it is necessary to check the whirling speeds of the shaft? **03**

(b) Write a short note on Jump phenomenon in cam. **04**

(c) The shaft shown in figure carries two masses. The mass A is 300 kg with a radius of gyration of 0.75 m and the mass B is 500 Kg with a radius of gyration of 0.9 m. Determine the frequency of the torsional vibrations. It is desired to have the node at the mid-section of the shaft of 120 mm diameter by changing the diameter of the section having a 90 mm diameter. What will be the new diameter? **07**



Q.5 **(a)** What is damping coefficient? Explain with neat sketch experimental method of determination of damping coefficient of particular oil. **03**

(b) What is Hammer blow? Derive an expression for limiting speed required for hammer blow. **04**

(c) Explain the direct and reverse crank method for determining unbalanced forces in radial engines. **07**

OR

Q.5 **(a)** What are inline engines? How these engines are balanced? **03**

(b) Write a short note in seismic instruments. **04**

(c) A heavy machine weighing 3000 N is supported on a resilient foundation. The static deflection of the foundation due to the weight of the machine is found to be 75 mm. It is observed that the machine vibrates with an amplitude of 10 mm when the base of the foundation is subjected to harmonic oscillation at the undmped natural **07**

frequency of the system with an amplitude of 2.5 mm. find the (i) the damping constant of the foundation, (ii) the dynamic force amplitude on the base, (iii) the amplitude of the displacement of the machine relative to the base.

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