Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VI • EXAMINATION – SUMMER • 2014

Subject Code: X 61902 **Date: 30-05-2014**

Subject Name: Dynamics of Machinery

Time: 10:30 am - 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)** What do you mean by vibration? What are the causes, advantages and disadvantages of the vibrations? **07**

(b) Four masses 200 kg, 300 kg, 240 kg and 260 kg are attached to a shaft revolving at radii 200 mm, 150 mm, 250 mm and 300 mm; in a same plane, respectively. The angles between the successive masses are 45^o, 75^o and 135^o. Find the position and magnitude of the balancing masse required, if its radius of rotation is 200 mm. **07**

Q.2 **(a)** Four masses *A, B, C* and *D* are carried by a rotating shaft at radii 100 mm, 125 mm, 150 mm and 200 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses *B, C* and *D* are 10 kg, 5 kg and 4 kg respectively. Find the required mass *A* and the relative angular positions of the four masses so that the system shall be in complete balance. **07**

(b) (i) Explain the terms ‘static’ and ‘dynamic’ balancing. **04**

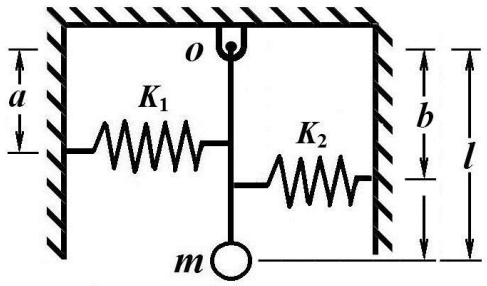
(ii)Why reciprocating masses are not balanced completely? **03**

OR

(b) What do you mean by ‘Multi-cylinder In-line engine’? How it is balanced for primary and secondary forces and couples? **07**

Q.3 **(a)** Classify the various types of vibrations in detail. **07**

(b) Derive the equation of natural frequency of free vibration for the system shown in the following figure with usual notations. **07**



OR

Q.3 **(a)** What are the different types of damping models? Derive the equation of motion of a single-DoF spring-mass-damper system with critical damping condition. **07**

(b) A 1200 kg mass is suspended on a helical spring and a viscous dashpot. The stiffness of the spring is 76800 N/m. It is observed that the successive amplitudes of the damped vibrations on the same side of the mean positions are 54 mm, 45 mm, 36 mm and so on. Determine the logarithmic decrement, damping factor, damping coefficient and damped natural frequency of the vibration. **07**

Q.4 **(a)** Explain the 'direct and reverse crank' method for determining the unbalanced forces in case of the radial engine. **07**

(b) The three cylinders of an air compressor have their axes at 120^o to one another and their connecting rods are coupled to a common crank. The stroke is 100 mm and the length of each connecting rod is 150 mm. The weight of the reciprocating parts per cylinder is 15 N. Find the maximum primary and secondary forces acting on the frame of the compressor when running at 3000 rpm. **07**

OR

Q.4 **(a)** Discuss the balancing of V-engine with usual notations. **07**

(b) In a 60^o V-engine, connecting rods operate on a common crank pin. The stroke of each piston is 80 mm and the length of each connecting rod is 160 mm. If the engine speed is 2000 rpm and the mass of reciprocating parts per cylinder is 1 kg, find the values of maximum primary and secondary unbalanced forces, when the crank bisects the line of action of forces by 30^o. **07**

Q.5 **(a)** A shaft of length 0.72 m, carries two rotors of mass moment of inertia 65 kgm^2 each. The shaft is of diameter 90 mm for first 0.3 m length, 120 mm for next 0.12 m length and 80 mm for the remaining length. Determine the natural frequency of the free torsional vibration and the position of the node on the actual shaft. Take the modulus of rigidity of the shaft material $G = 80\times10^9$ N/m^2. **07**

(b) A machine of mass 1000 kg is supported on an elastic support having total stiffness of 2000 kN/m and equivalent viscous damping coefficient of 1050 Ns/m. The machine is subjected to an external disturbing harmonic force of 600 N at the frequency of 6π Hz. Determine the amplitude of vibration of the machine, maximum force transmitted to the support, transmissibility and magnification factor. **07**

OR

Q.5 **(a)** Derive the generalized equation of transverse vibrations of a beam of uniform cross section carrying uniformly distributed load. **07**

(b) List out the various vibration measurement instruments and explain any one in detail. **07**

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