Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2152509 **Date: 03/06/2019**

Subject Name: Machine Dynamics

Time: 02:30 PM TO 05:00 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)** Define and explain the term: (i)Piston effort and (ii)Crank effort **03**

(b) Briefly explain a dynamically equivalent system? **04**

(c) A single cylinder vertical engine has a bore of 300 mm and stroke of 400mm. The connecting rod is 1 m long. The mass of the reciprocating parts is 140 kg. On the expansion stroke with the crank at 30° from the top dead centre the gas pressure is 0.7 Mpa. If the engine runs at 250 rpm , determine : **07**

(i) net force acting on cylinder

(ii) Resultant load on gudgeon pin

(iii) Thrust on sides of cylinder walls.

Q.2 **(a)** Derive an expression for the correction torque to be applied to a crank shaft if the connecting rod of a reciprocating engine is replaced by two lumped masses at the piston pin and crank pin respectively. **07**

(b) Explain the procedure to partially balance the primary forces in single cylinder engine. **07**

OR

(b) Reciprocating parts of an inside cylinder locomotive are having a mass of 300 kg. The distance between the two cylinders is 600 mm. the cranks are at 90˚ and are 0.3 m long. The driving wheels have diameter of 2m and are 1.5 m apart. Revolving balancing masses are introduced to balance two third of the reciprocating parts. Find the variation in tractive effort and the value of variation in wheel reaction, when the locomotive is running at 110 kmph. **07**

Q.3 **(a)** What will be the harm if the rotating parts of a high speed engine are not properly balanced? **03**

(b) Prove that the maximum variation of tractive force is obtained when θ= 135˚or 315˚ **04**

(c) A number of masses are attached to a shaft which is rotating at an angular speed of ω rad/sec. if all the masses are in same plane, then describe the graphical method to balance these masses by a single mass only. **07**

OR

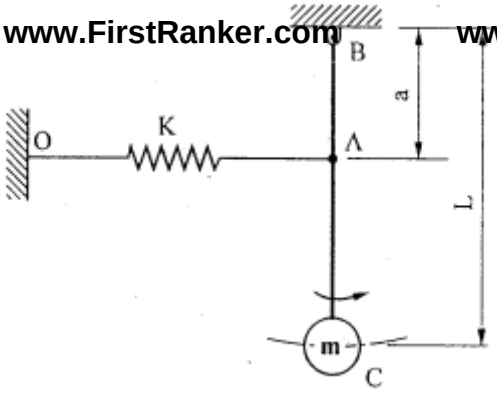
Q.3 **(a)** State the types of vibrations and give at least one application of each. **03**

(b) Derive the expression of natural frequency of two rotor torsional vibratory system. **04**

(c) A shaft is rotating at uniform angular speed. Four masses m_1 ,m_2, m_3, and m_4 of magnitudes 300kg, 450kg, 360kg and 390kg respectively are attached rigidly to the shaft. The masses are rotating in the same plane. The corresponding radii of rotation are 200 mm, 150 mm, 250 mm and 300 mm respectively. The angles made by these masses with horizontal are 0˚, 45˚, 120˚ and 255˚ respectively. Find magnitude and position of balancing mass if its radius of rotation is 200 mm. **07**

Q.4 **(a)** Discuss the effect of inertia of a shaft on free longitudinal vibration. **07**

(b) Find the equation of motion for the system shown in figure below. **07**



OR

Q.4 **(a)** Prove that the ratio of two successive amplitudes in case of under-damped system is constant. **07**

(b) A spring-mass damper system has a mass of 3.43 kg, stiffness K as 343N/m and damping coefficient C as 34.3N-sec/m. Determine the **07**

(i) Natural frequency of damped vibration.

(ii) Natural frequency of the system if instead of viscous damping, dry friction damping is present.

Q.5 **(a)** Explain the term: (i) damping factor, (ii) Co-efficient of damping and (iii) damped frequency of vibratory system. **03**

(b) What is isochronism in governor? Prove that a porter governor cannot be isochronous. **04**

(c) A loaded porter Governor has four links each 250 mm long, two revolving masses each of 3kg and central dead-weight of mass 20kg. All the links are attached to respective sleeves at radial distance of 40 mm from the axis of rotation. The masses revolve at a radius of 150 mm at minimum speed and at a radius of 200 mm at maximum speed. Determine the range of speed. **07**

OR

Q.5 **(a)** Derive an equation of motion for a simple spring-mass system using energy method. **03**

(b) Differentiate between Governor and Flywheel. **04**

(c) Describe the function of a Proell governor with the help of neat sketch. Establish a relation among various forces acting on the bent link. **07**

****