Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - VIth Semester–Examination – May- 2012

Subject code: X61902

Subject Name: Dynamics of machinery

Date:09/05/2012 **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)** Why balancing is necessary in high speed engines? Explain static and dynamic balancing with necessary conditions. **07**

(b) A, B, C and D are four masses carried by a rotating shaft at radii 110, 140, 210 and 160 mm respectively. The planes in which masses revolve are each 700 mm apart. The masses B, C and D are12 kg, 7 kg and 5 kg respectively. Find the mass A and its angular position so that shaft is in complete balance. **07**

Q.2 **(a)** A single cylinder reciprocating engine has a reciprocating mass of 50 kg and stroke of 300 mm. The mass of revolving parts at 150 mm radii is 30 kg. if two-third of the reciprocating parts and whole of the revolving parts are to be balanced. Find: i) the balance mass required at radii of 300 mm. ii) the unbalanced force when the crank has turned 45° from IDC. **07**

(b) Derive the equation for swaying couple. Also explain hammer blow. **07**

OR

(b) What are the causes, effects and remedies of vibration. **07**

Q.3 **(a)** Derive the equation of natural frequency for simple and compound pendulum. **07**

(b) An under damped shock-absorber is to be designed for a motor-cycle of mass 250 kg such that during road bump, the damped period of vibration is limited to 3 seconds and amplitude of vibration should reduce to one eighteenth in one cycle. Find i) the stiffness of spring required. ii) damping coefficient. **07**

OR

Q.3 **(a)** Prove: logarithmic decrement $\delta=1/n \log_e(X_0/Xn)$ for under damping system. **07**

(b) A mass of 90 kg is suspended from a spring which deflects by 20 mm due to weight. If the damping coefficient is 0.25 times critical damping coefficient. Find the damped natural frequency and ratio of successive amplitude of vibration. If the mass is subjected to a harmonic force of 300 N at frequency equals to 0.75 times the natural undamped frequency, find the amplitude of forced vibration. **07**

Q.4 **(a)** The rotating machine having total mass of 20 kg is having an eccentric mass of 1.5 kg with eccentricity 25 mm. The machine rotates at 720 rpm. If the amplitude of vibration which is 20 mm lags the eccentric mass by 90°.find **07**

1) The natural frequency of the system.
2) The damping factor.

Damped natural frequency.

(b) A vehicle moves over the road surface making sinusoidal profile with wave **07**

length 14 m and amplitude of 80 mm. The spring of the vehicle is compressed by 0.1 m under its vehicle weight. Find: i) The critical speed of the vehicle. ii) The amplitude of vibration when vehicle moves at a speed of 60 km/hr. Neglect damping.

OR

Q.4 **(a)** A centrifugal compressor weighing 981 N has a rotating unbalance of 0.1kg-m. The isolator has damping factor of 0.2. The compressor runs at 1500 rpm. If the isolator transmits only 10% of the unbalanced force to the foundation, find the spring stiffness. **07**

(b) Explain: Critical speed of shaft and derive the equation for the same. **07**

Q.5 **(a)** A shaft carries two identical rotors A and B having mass of 400 kg and radius of gyration 0.4 m. They are keyed to the shaft of 600 mm long at the ends. The diameter of the shaft is 75 mm for the first 250 mm length, 125 mm for the next 100 mm length and 85 mm for the remaining length. Find the natural frequency of the torsional vibration. G=84 GPa. **07**

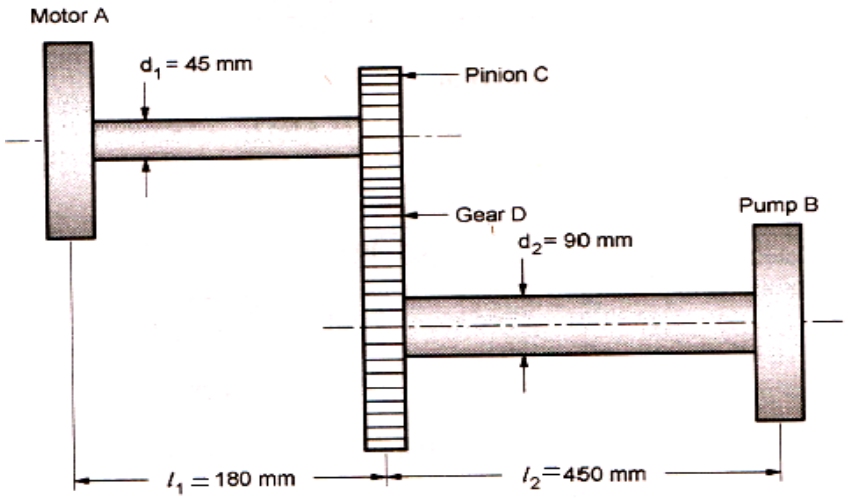
(b) An electric motor running at 1500 rpm drives a pump through gearing (figure-1). Pump runs at 500 rpm. The motor armature has mass moment of inertia 400 kg-m^2 and the pump impeller mass moment of inertia 1400 kg-m^2.find: **07**

1) Find the equivalent system having a uniform shaft diameter of 45 mm and running at 1500 rpm.
2) Find the natural frequency of the system neglecting inertia of the gears. G=84 GPa.

OR

Q.5 **(a)** Derive: Wave's equation,. **07**

(b) Give names of various vibration measuring instrument and explain any one with neat sketch. **07**



[figure-1]

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