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Question Paper Code : 41041

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Mechanical Engineering

080120026 — DYNAMICS OF MACHINERY

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by inertia force and inertia torque? Give one example to each.

2. What is coefficient of fluctuation of energy?

3. What is static and dynamic balancing? Draw a simple sketch.

4. What is primary balancing and secondary balancing of reciprocating masses?

5. List out the different classification of governors.

6. What is meant by gyroscopic couple?

7. Write the equation of motion for Forced vibration of single degree of freedom with damping also explain each terms.

8. What is transmissibility ratio?

9. What is lumped parameter systems and continuos system?

10. What is degree of freedom system? Give one example of multi degree of freedom explain.

PART B — (5 × 16 = 80 marks)

11. (a) The four –bar linkage of Figure 1 has crank 2 driven by an input torque M_{12}; An external load P=120 N act at point Q on link 4. For the particular position of the linkage shown in Figure, find all constraint forces and their relations necessary for to be a position of equilibrium. The

dimensions of the links are O_2O_4 = 80 mm, O_2A = 60mm, AB = 180mm, BO_4 = 120mm, QO_4 = 50mm.

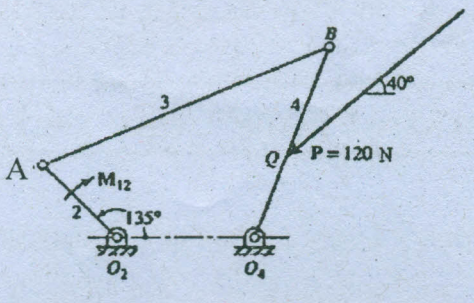

Figure 1

Or

(b) In the turning movement diagram for one revolution of a steam engine the area above and below the curve of resistance, taken in order, are +5.3,-3.3,+3.8,-4.7,+1.8,-3.6,+3.5 and -2.8 cm^2. The scale of the diagram are: Turning movement: 1cm = 1200 N.m. and Crank angle: 1cm = 80°. The mean revolutions per minute are 150, and the total fluctuation of speed must not exceed 3 percent of the mean. Determine a suitable cross sectional area of the rim of the flywheel assuming the total energy of the flywheel to be 15/16 that of the rim. The peripheral velocity of the flywheel is to be 20 m/sec. Take the density of the material as 0.008 kg/cm^3.

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

Or

(b) Investigate the stroke of primary and secondary balancing of a four-stroke –cycle four cylinder engine with a firing order I-II-III-IV. What will be the change in this state when the firing order is altered to I-II-IV-III?

13. (a) A porter governor has all four arms 300 mm long. The upper arms are pivoted on the axis of rotation and lower arms are attached to the sleeve at a distance of 3.5 mm from the axis. The mass of each ball is 7 kg and the mass on the sleeve is 54 kg. If the extreme radii of rotation of the balls are 200 mm and 250 mm, find the range of speed of the governor.

Or

(b) Explain the gyroscopic effect on four wheeled vehicle with a neat sketch.

14. (a) An instrument vibrates with a frequency of 1Hz when there is no damping. When the damping is provided, the frequency of damped vibrations was observed to the 0.9Hz. Find

(i) The damping factor and

(ii) Logarithmetic decrement.

Or

(b) A machine supported symmetrically on four springs has a mass of 80 kg. The mass of the reciprocating parts is 2.2 kg which move through a vertical stroke of 100 mm with simple harmonic motion. Neglecting damping, determine the combined stiffness of the springs so that the force transmitted to the foundation is 1/20th of the impressed force. The machine crankshaft rotates at 800 rpm. If under actual working conditions, the damping reduces the amplitudes of successive vibrations by 30 %, find :

(i) the force transmitted to the foundation at 800 rpm,

(ii) the force transmitted to the foundation at resonance, and

(iii) the amplitude of the vibrations at resonance.

15. (a) The moment of inertia of three rotors A, B and C are respectively 0.3, 0.6 and 0.18 kg m^2. the distance between A and B is 1 .5m and B and C is 1 m. the shaft is 70mm in diameter and the modulus of rigidity for the shaft material is 84 x 10^{9}N/m^2. Find

(i) The frequencies of torsional vibrations,

(ii) Position of nodes and

(iii) Amplitude of vibrations.

Or

(b) Use the Holzer method to determine the natural frequencies for torsional vibration of the four degree of freedom system as shown in Figure 2. Where J1 = 4, J2= 3, J3= 2, J4= 1.

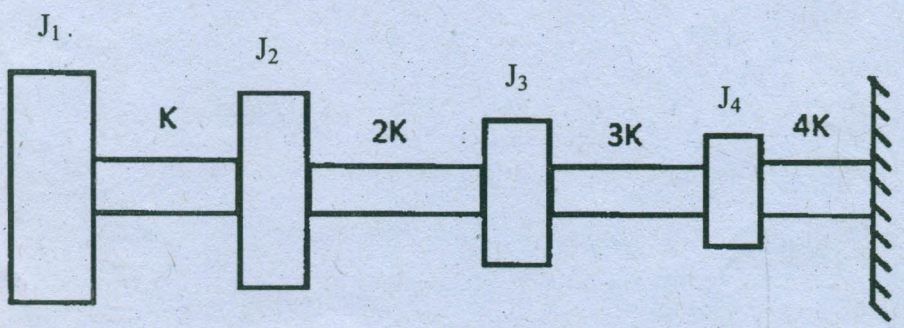

Figure 2