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Question Paper Code : 31346

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Mechanical Engineering

ME 2302 – DYNAMICS OF MACHINERY

(Regulation 2008)

(Common to PTME 2302 — Dynamics of Machinery for B.E. (Part-Time) Fourth Semester – Mechanical Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define shaking force.

2. Write the conditions for any distributed mass have the same dynamical properties.

3. Define hammer blow in locomotives.

4. What are the conditions required for complete balancing of reciprocating parts.

5. Define damping factor and damping coefficient.

6. What is nodal section in two rotor system?

7. Define vibration isolation.

8. What is fundamental frequency?

9. Why very high sensitivity Governors are not useful?

10. What is the function of active gyro couple?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the equation of forces on the reciprocating parts of an engine neglecting the weight of the connecting rod. (12)

(ii) What is turning moment diagram and draw it for four stroke IC engine. (4)

Or

(b) A single cylinder, single acting, four stroke gas engine develops 25 KW at 320 rpm. The work done by the gases during the expansion stroke is three times the work done on the gases during the compression stroke. The work done during the suction and exhaust stroke being negligible. The fluctuation of speed is not to exceed ± 2 % of the mean speed. The turning moment diagram during compression and expansion is assumed to be triangular in shape. Find the weight of the flywheel if its radius of gyration is 0.5 m. (16)

12. (a) Data of three unbalance masses A, B and C are given below M_a = 4 kg, M_b = 3 kg, M_c = 2.5 kg, R_a = 75 mm, R_b = 85 mm, R_c = 50 mm, θ_a = 45°, θ_b = 135° and θ_c = 240° (θ measured from right horizontal axis at the origin). The shaft length is 800 mm between bearings. These three masses are completely balanced by two counter masses located 75 mm from each bearing. The axial distances of 3 unbalance masses are L_a = 150 mm, L_b = 350 mm and L_c = 525 mm from the right hand side counter mass plane. Determine the masses and angular positions of counter masses, if the radial location of counter masses are R_{b1} = 75 mm and R_{b2} = 40 mm. (16)

Or

(b) The following data related to a single cylinder reciprocating engine.

(i) Mass of reciprocating parts = 40 kg

(ii) Mass of revolving parts = 30 kg at 180 mm radius

(iii) Speed = 150 rpm

(iv) Stroke = 350 mm

If 60% of the reciprocating parts and all the revolving parts are to be balanced determine

(1) The balance mass required at radius of 320 mm

(2) The unbalance force when the crank has turned 45° from top dead centre.

13. (a) The mass of a single degree damped vibrating system is 7.5 kg and makes 24 free oscillations in 14 seconds when disturbed from its equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after five oscillations. Determine

(i) Stiffness of the spring,

(ii) Logarithmic decrement and

(iii) Damping factor. (16)

Or

(b) (i) Derive an expression for the frequency of free torsional vibrations for a shaft fixed at one end and carrying a load on the free end. (8)

(ii) What is meant by torsionally equivalent length of a shaft as referred to a stepped shaft? Derive the expression for the equivalent length of a shaft which has several steps. (8)

14. (a) (i) Derive the relation for the displacement of mass from the equilibrium position of a damped vibration system with harmonic forcing. (12)

(ii) Define the term vibration isolation. (4)

Or

(b) (i) Discuss the forcing due to support motion. (10)

(ii) What is meant by magnification factor in case of forced vibrations? (6)

15. (a) In a spring loaded governor, the controlling force curve is a straight line. The balls are 400 mm apart, when the controlling force is 1500 N and 240 mm when it is 800 N The mass of each ball is 10 kg. Determine the speed at which the governor runs, when the balls are 300 mm apart. By how much should the initial tension be increased to make the governor isochronous? Also find the isochronous speed.

Or

(b) The turbine rotor of a ship has mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from the aft. The radius of gyration of rotor is 320 mm. Determine the gyroscopic couple and its effect when

(i) The ship turns right at a radius of 250 m with a speed of 25 km/hr

(ii) the ship pitches with the bow rising at an angular velocity of 0.8 rad/sec.

(iii) the ship rolls at an angular velocity of 0.1 rad/sec.
