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Question Paper Code : 31568

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

Fifth Semester

Mechanical Engineering

ME 2302/ME 52/ME 1301/10122 ME 503 — DYNAMICS OF MACHINERY

(Regulation 2008/2010)

(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 — ($10 \times 2 = 20$ 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 step input and harmonic forcing function.

8. Define transmissibility.

9. Define sensitiveness of a governor.

10. List some of the terms related to motion of ships using gyroscopic principle.

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's 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 0.5m. (16)

12. (a) The following data refer to an outside cylinder uncoupled locomotive

Mass of rotating parts per cylinder = 350 kg

Mass of reciprocating parts per cylinder = 300 kg

Angle between cranks = 90°

Crank radius = 0.3 m

Cylinder centers = 1.8 m

Radius of balance masses = 0.8 m

Wheel centers = 1.5 m.

If whole of the rotating and 2/3rd of the reciprocating parts are to be balanced in planes of the driving wheels, find (i) magnitude and angular positions of balance masses, (ii) speed in Km/hr at which the wheel will lift off the rails when the load on each driving wheels is 30 KN and the diameter of tread driving wheels is 1.8 m and (iii) swaying couple at speed found in (ii) plane. (16)

Or

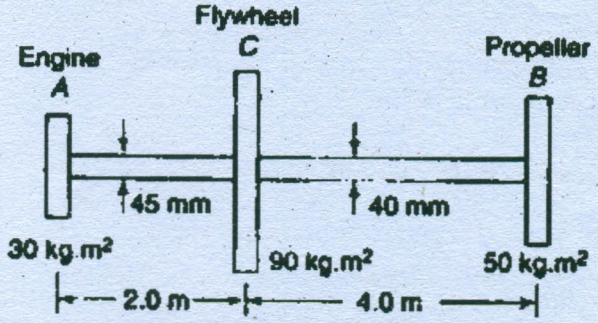
(b) The axes of the three cylinder air compressor are at 120° to one another and their connecting rods are coupled to a single crank. The length of each connecting rod is 240 mm and the stroke is 160 mm. The reciprocating parts have a mass of 2.4 kg per cylinder. Determine the primary and secondary forces if the engine runs at 2000 rpm. (16)

13. (a) (i) A machine weighs 18 kg and is supported on springs and dashpots. The total stiffness of the springs is 12 N/mm and damping is 0.2 N/mm/s the system is initially at rest and a velocity of 120 mm/s is imparted to the mass. Determine (1) the displacement and velocity of mass as a function of time (2) the displacement and Velocity after 0.4s. (12)

(ii) Describe the types of vibrations with simple sketch. (4)

Or

(b) A torsional system is shown in fig. find the frequencies of torsional vibrations and the positions of the nodes also find the amplitudes of vibrations $G = 84 \times 10^9 N/m^2$. (16)



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) (i) Explain the function of a proell governor with the help of a neat sketch. Derive the relationship among the various forces acting on the link. (12)

(ii) What are centrifugal governors? How do they differ from inertia governors? (4)

Or

(b) (i) 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 the rotor is 320 rpm. Determine gyroscopic Couple and its effect when

(1) The ship turns right at a radius of 250m with a speed of 25 km/h.

(2) The ship pitches with the bow rising at an angular velocity of 0.8 rad/s.

(3) The ship rolls at an angular velocity of 0.1 rad/s. (12)

(ii) What is the effect of gyroscopic couple on the stability of a two wheel vehicle taking a turn? (4)
