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Question Paper Code : 57572

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Mechatronics Engineering

ME 6505 – DYNAMICS OF MACHINES

(Common to Fourth Semester Mechanical Engineering (Sandwich))

(Regulations 2013)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Distinguish between crank effort and piston effort.

2. Define D'Alembert's principle.

3. Diffrentiate : Static and Dynamic balancing.

4. What is meant by balancing of rotating masses ?

5. Define the term logarithmic decrement.

6. What are the different types of vibratory motions ?

7. Define magnification factor.

8. What is the effect of inertia on the shaft in longitudinal and transverse vibrations ?

9. Write short note on "hunting of governors".

10. The engine of an aeroplane rotates in clockwise direction when seen from the tail end and the aeroplane takes a turn to the left. What will be the effect of gyroscopic couple on the aeroplane ?

PART – B (5 × 16 = 80 marks)

11. (a) The ratio of the connecting rod length to crank length for a vertical petrol engine is 4:1. The bore/stroke is 80/100 mm and mass of the reciprocating part is 1kg. The gas pressure on the piston is 0.5 N/mm² when it has moved 10 mm from the TDC on its power stroke. Determine the net head on the gudgeon pin. The engine runs at 1800 rpm. What engine speed will this load be zero ?   (16)

OR

   (b) (i) Derive the equation of forces on the reciprocating parts of an engine, neglecting the weight of the connecting rod.   (10)

       (ii) What is turning moment diagram and draw it for 4 stroke IC engine.   (6)

12. (a) Three masses are attached to a shaft as follows : 10 kg at 90 mm radius; 15 kg at 120 mm radius and 9 kg at 150 mm radius. The masses are to be arranged so that shaft is in static balance. Determine the angular position of masses relative to 10 kg mass. All the masses are in the same plane.   (16)

OR

   (b) (i) What is meant by Swaying couple ? Deduce the expression for its magnitude and explain its influence.   (10)

       (ii) State the methods of force balancing of linkages by Lowen and Berk of method.   (6)

13. (a) Derive an expression for the natural frequency of the free longitudinal vibrations by (i) Equilibrium method, (ii) Energy method.   (16)

OR

(b) Find the equation of motion for the spring-mass-dashpot system shown in fig. For cases, when (i) $\zeta = 2$, (ii) $\zeta = 1$, and (ii) $\zeta = 0.3$. The mass 'm' is displaced by a distance of 30 mm and released. (16)
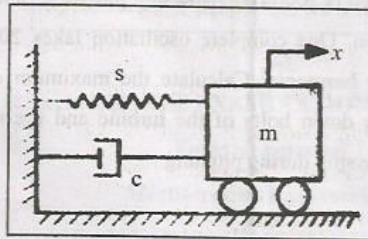
14. (a) A single cylinder vertical petrol engine of total mass of 200 kg is mounted upon a steel chassis frame. The vertical static deflection of the frame is 2.4 mm due to the weight of the engine. The mass of the reciprocating parts is 9 kg and the stroke of the piston is 160 mm with S.H.M. If dashpot of damping coefficient of 1 N/mm/s is used to dampen the vibrations, calculate at steady state : (16)

   (i) The amplitude of forced vibrations at 500 rpm engine speed and

   (ii) The speed of the driving shaft at which resonance will occur.

OR

(b) (i) Derive the equation of vibration isolation factor or transmissibility ratio. (10)

   (ii) Write short notes on (1) frequency response curve and (2) phase frequency response curve. (6)

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15. (a) (i) Discuss the effect of the gyroscopic couple on a two wheeled vehicle while taking a turn. (6)

(ii) A turbine rotor of a ship has a mass of 20 tonnes and a radius of gyration of 0.75 m. Its speed is 2000 rpm. The ship pitches 6° above and below the horizontal position. One complete oscillation takes 20 seconds and the motion is simple harmonic. Calculate the maximum couple tending to shear the holding down bolts of the turbine and the maximum angular acceleration of the ship during pitching. (10)

OR

(b) 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 distance of 3.5 mm from the axis. The mass of each ball is 7 kg and mass on the sleeve is 54kg. If the extreme radii of rotation of the balls are 200 mm and 250 mm. Determine the range of speed of the governor. (16)

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