Register No: ……

B.E.DEGREE EXAMINATIONS: NOV/DEC 2010

Fifth Semester

MECHANICAL ENGINEERING

U07ME501: Dynamics of Machinery

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions: -

PART A (10 x 1 = 10 Marks)

1. When the crank is at the inner dead centre, in a horizontal reciprocating steam engine, then the velocity of piston will be……..
   a) Zero b) Minimum c) Maximum d) One

2. In a turning moment diagram, the vibration of energy above and below the mean resisting torque line is called…….
   a) Fluctuation of energy b) Maximum Fluctuation of energy
   c) Coefficient of fluctuation of energy d) Minimum Fluctuation of energy

3. In order to facilitate the starting of locomotive in any position, the crank of a locomotive, with two cylinders are placed at…….to each other
   a) 45 degree b) 90 degree c) 120 degree d) 180 degrees

4. The effect of hammer blow in a locomotive can be reduced by…….
   a) Increasing the speed
   b) Using two (or) three pairs of wheels coupled together
   c) Balancing whole of the reciprocating parts
   d) Decreasing the wheel diameter

5. Which of the following governor is used to drive a gramophone…….
   a) Watt governor b) Pickering governor c) Porter governor d) Hartnell governor

6. The engine of an aero plane rotates in clockwise direction when seen from the tail end and the aero plane takes a turn to the left. The effect of the gyroscopic couple on the aero plane will be …….
   a) To raise the nose and dip the tail b) To dip the nose and raise the tail
   c) To raise the nose and tail d) To dip the nose and tail

7. Longitudinal vibration are said to occur when the particles of body moves……
   a) Perpendicular to its axis b) Parallel to its axis
   c) In a circle about its axis d) Inclined to its axis

8. The factor which affects the critical speed of a shaft is…….
   a) Material of the disc b) Toughness of the shaft c) Eccentricity d) Thickness of the disc

9. The ratio of the maximum displacement of the forced vibration to the deflection due to the static force is …….
   a) Damping factor b) Damping coefficient c) Logarithmic decrement d) Magnification factor

10. At a nodal point in a shaft the amplitude of torsional vibration is……..
    a) Zero b) Minimum c) Maximum d) Moderate.

PART B (10 x 2 = 20 Marks)

11. State D-Alembert's principle.
12. Define co-efficient of fluctuation of speed in flywheel.
13. Why balancing of rotating parts necessary for high speed engines? .
14. Define swaying couple.
15. Define sleeve lift in Governors.
16. Define the term pitching in ships.
17. What are types of free vibrations?
18. Define damping factor.
19. What is transmissibility ratio?
20. Write the expression for natural frequency of free torsional vibrations of a shaft.

PART C (5 x 14 = 70 Marks)

21. a) A vertical petrol engine 100mm diameter and 120mm stroke has a connecting rod 250mm long. The mass of the piston is 1.1kg. The speed 2000 r.p.m. On the expansion stroke with a crank 20° from top dead centre, the gas pressure is 700KN/m^2. Determine 1. Net force on the piston, 2. Resultant load on the gudgeon pin, 3. Thrust on the cylinder walls and 4. Speed above which other things remaining same. The gudgeon pin load would be reversed in direction.

(OR)

b) A single cylinder, single acting, four stroke gas engine develops 20kW at 300 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. If the total fluctuation of speed is not to exceed ±2 per cent of the mean speed and the turning moment diagram during compression and expansion is assumed to be triangular in shape, find the moment of inertia of the fly wheel.

22. a) Four masses m1, m2, m3 and m4 are 200kg, 300kg, 240kg, and 260kg respectively. The corresponding radii of rotation are 0.2m; 0.15m 0.25m and 0.3m respectively and the angels between successive masses are 45°, 75° and 135° .find the position and magnitude of the balance mass required, if its radius of rotation is 0.2m.

(OR)

b) The following data refer to two cylinder locomotive with crank at 90°: Reciprocating mass per cylinder=300kg; crank radius=0.3m; Driving wheel diameter =1.8m; Distance between cylinder centre lines =0.65m; Distance between the driving wheel central planes=1.55m. Determine (1) The fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46kN at 96.5kmph; (2) The variation in tractive effort (3) The maximum swaying couple.

23. a) A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and the mass of the central load on the sleeve is 25kg. The radius of rotation of the ball is 150mm when the governor begins to lift and 200mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor.

(OR)

b) The turbine rotor of a ship has a mass of 3500kg. It has a radius of gyration of 0.45m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship:

(i) When the ship is steering to the left on a curve of 100m radius at a speed of 36km/h.

(ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees

24. a) Prove the expression for natural frequency of free longitudinal vibrations

(OR)

b) A flywheel is mounted on a vertical shaft. The both ends of the shaft are fixed and its diameter is 50mm. the flywheel has a mass of 500kg. Find the natural frequencies of longitudinal and transverse vibrations. Take E =200 GN/m^2.

25. a) The measurements on a mechanical vibrating system show that it has a mass of 8kg and that the springs can be combined to give an equivalent spring of stiffness 5.4N/mm. If the vibrating systems have a dashpot attached which exerts a force of 40N when the mass has a velocity of 1 m/s, Find: 1. Critical damping coefficient, 2. Damping factor, 3. Logarithmic decrement and 4.ratio of two consecutive amplitudes.

(OR)

b) Calculate the whirling speed of a shaft 20 mm diameters and 0.6m long carrying a mass of 1kg at its mid-point. The density of the shaft material is 40Mg/m^3. Assume the shaft to be freely supported.

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