Code No. : 3047

FACULTY OF ENGINEERING

B.E. 3/4 (Mech./Prod.) I Semester (Main) Examination, December 2010

DYNAMICS OF MACHINES

Time: 3 Hours] [Max. Marks: 75

*Note : Answer **all** questions from Part – A. Answer **any five** questions from Part – **B**.*

PART – A **(25 Marks)**

1. Explain the forces to which the connecting rod is subjected to.
2. Explain gyroscopic effect on rolling and pitching of ship.
3. Explain the advantages of a spring loaded governor over dead weight types governor.
4. Define : Coefficient of fluctuation of speed, coefficient of fluctuation of energy.
5. Explain how complete balance is achieved in case of multi-cylinder inline engines.
6. Explain the direct and reverse crank method. Where it is used ?
7. What is natural frequency ? Explain how they are useful in the design process.
8. What are critical speeds ? Why they must be known ?
9. Explain the usefulness and limitation of Dunkerley's method.
10. Explain the importance of Rayleigh's method.

PART – B **(50 Marks)**

11. A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm. stroke and runs at 200 rpm. The reciprocating parts has a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2. Calculate the effective turning moment on the shaft.

12. The rotor of a turbine installed in a boat with its axis along the longitudinal axis of the boat makes 1500 rpm clockwise when viewed from the stern. The rotor has a mass of 750 kg and a radius of gyration of 300 mm.. If at an instant, the boat pitches in the longitudinal vertical plane so that the bow rises from the horizontal plane with an angular velocity of 1 rad/s, determine the torque acting on the boat and the direction in which it tends to turn the boat at the instant.

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

14. In a Hartnell governor, the lengths of the ball and sleeve arms of a bell crank lever are 120 mm and 100 mm respectively. The distance of the fulcrum of the bell crank lever from the governor axis is 140 mm. Each governor ball has a mass of 4 kg. The governor runs at a mean speed of 300 rpm. With the ball arms vertical and sleeve arms horizontal. For an increase of speed of 4 percent, the sleeve moves upwards. Neglecting friction, find :
1) the minimum equilibrium speed of the total sleeve increment is limited to 20 mm.
2) the spring stiffness
3) the sensitiveness of the governor and 4 the spring stiffness if the governor is to be isochronous at 300 rpm.

15. A shaft of 50 mm diameter and 3 meters long is simply supported at the ends and carries three loads of 1000N, 1500N and 750 N at 1m, 2m and 2.5 m from the left support. The Young's modulus for shaft material is 200 GPa. Find the frequency of transverse vibration.

16. A machine of 75 kg is mounted on springs and is fitted with a dashpot to dampout vibrations. There are three springs, each of stiffness 10 N/mm and it is found that the amplitude of vibration diminishes from 38.4 mm to 6.4 mm in two complete oscillations. Assuming that the damping force varies as the velocity, determine :

    1) The resistance of the dashpot at unit velocity ;
    2) The ratio of the frequency of the damped vibration to the frequency of the undamped vibration ; and
    3) The periodic time of the damped vibration.

17. A steel shaft 1.5 m long is 95 mm in diameter for the first 0.6 m of its length, 60 mm in diameter for the next 0.5 m of the length and 50 mm in diameter for the remaining 0.4 m of its length. The shaft carries two fly wheels at two ends, the first having a mass of 900 kg and 0.85 m radius of gyration located at the 95 mm diameter end and the second having a mass of 700 kg and 0.55 m radius of gyration located at the other end. Determine the location of the node and the natural frequency of free torsional vibration of the system. The modulus of rigidity of the shaft material may be taken as 80 Gpa.