



Module-3

- 5 a. Derive an expression for gyroscopic couple. (06 Marks)  
 b. 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. (10 Marks)

OR

- 6 a. Define: i) Sensitiveness ii) Isochronism. (04 Marks)  
 b. A turbine rotor of a ship has a mass of 2.2 and Tonnes and rotates at 1800rpm clockwise when viewed from the stern. The radius of gyration of the rotor is 320mm. Determine the gyroscopic couple and its effect when the  
 i) Ship turns right at a radius of 250m with a speed of 25km/hr.  
 ii) Ship pitches with bow rising at an angular velocity of 0.8 rad/sec.  
 iii) Ship rolls at an angular velocity of 0.1 rad/sec. (12 Marks)

Module-4

- 7 a. Briefly explain, Free, Forced, damped and undamped vibration. (08 Marks)  
 b. Split up the harmonic motion  $X = 6 \cos(\omega t + 45^\circ)$  into two harmonic motions. One of them having phase angle of zero degree and other having phase angle of  $60^\circ$ . Check solution by graphically. (08 Marks)

OR

- 8 a. Obtain the equivalent stiffness of spring when springs are connected in series and parallel. (08 Marks)  
 b. Obtain the natural frequency of the system shown in Fig Q8 (b). (08 Marks)

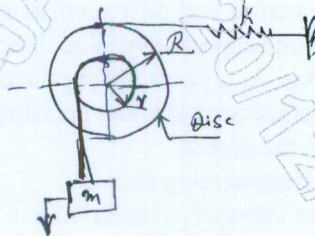


Fig. Q8(b)

Module-5

- 9 a. Define logarithmic decrement and derive the equation for same. (08 Marks)  
 b. Vibration system consisting of a mass 3kg a springs of stiffness 100kN/m and damper. Damping coefficient 30Ns/m. Determine Damping factor, critical damping coefficient logarithmic decrements, Ratio of two consecutive amplitudes. Number of cycles after which the initial amplitude is reduced to 20%? (08 Marks)

OR

- 10 a. Derive an expression for magnification factor or amplitude ratio for spring mass system with viscous damping subjected to harmonic force. (08 Marks)  
 b. A vibratory body of mass 150kg supported on springs of total stiffness 1050kN/m has a rotating unbalance force of 525N at a speed of 6000rpm. If the damping factor is 0.3. Determine :  
 i) The amplitude caused by the unbalance and its phase angle  
 ii) The transmissibility  
 iii) The actual force transmitted and its phase angle. (08 Marks)