

- N.B :**
1. Question No. 1 is compulsory.
 2. Attempt any three questions from remaining.
 3. Use suitable diagram whenever necessary.
 4. Assume suitable diagram whenever required & mention clearly.

1. (a) What is the controlling force of a governor ? How are the controlling force curve drawn ? Indicate the shape of such a curve for an isochronous governor. 4
- (b) What do you mean by gyroscopic couple ? Derive an relation for its magnitude. 4
- (c) What are the basic elements of a vibratory system ? 4
- (d) Define the terms : damping coefficient, critical damping coefficient & damping factor. 4
- (e) What is meant by magnification factor in case of forced vibrations ? 4
2. (a) Each ball of a porter governor has a mass of 3kg and mass of the sleeve is 15kg. 10
The governor has equal arm, each of 200mm length & pivoted on the axis of rotation. When the radius of rotation of the ball is 120mm, the sleeve begins to rise up 160mm at the maximum speed. Determine the.
 - (i) range of speed
 - (ii) Lift of sleeve
 - (iii) effort of the governor
 - (iv) power of the governor

What will be the effect of friction at the sleeve if it is equivalent to 9N
- (b) Find the natural frequency of the system shown in Fig. 1 6

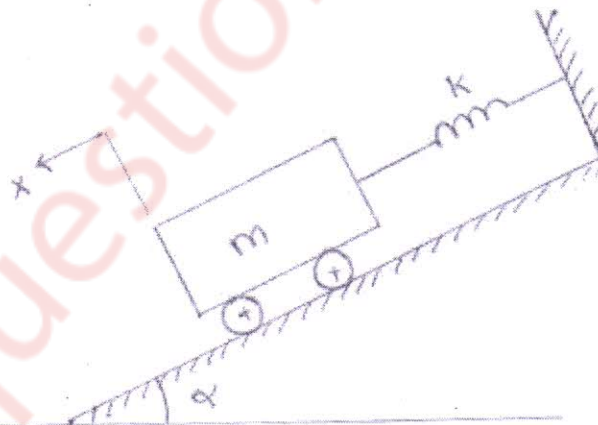


Fig. 1

- (c) A spring mass system has spring stiffness K N/m and a mass of M kg. It has 4
natural frequency of vibration as 12 Hz. An extra 2kg mass is coupled to M and the natural frequency reduced by 2 Hz. Find K & M .

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3. (a) Explain the terms : 8
- (i) Degree of freedom
 - (ii) Discrete and continuous system
 - (iii) Transverse vibration.
- (b) A compressor unit having a mass of 40 kg is to be supported on 3 spring, each having stiffness K the unit operates at 500rpm. Find the value of K, if only 10% of the shaking force is allowed to be transmitted to the supporting structure. 6
- (c) Explain basic principle of seismic instrument. 6
4. (a) The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 r.p.m. clockwise when viewed from the aft. The radius of gyration of the rotor is 320mm. Determine the gyroscopic couple and its effect when the 10
- (i) ship turn right at a radius of 250m with a speed of 25km/h
 - (ii) ship pitches with the bow rising at an angular velocity of 0.8 rad/sec.
 - (iii) ship rolls at an angular velocity of 0.1 rad/sec.
- (b) A single-cylinder vertical diesel engine has a mass of 400 kg and is mounted on a steel chassis frame. The static deflection owing to the weight of the chases is 2.4mm . The reciprocating masses of the engine amounts to 18kg and the stroke of the engine is 160mm. A dashpot with a damping coefficient of 2N/mm/s is also used to dampen the vibrations. In the steady state of the vibrations, determine the: 10
- (i) amplitude of the vibration if the driving shaft rotates at 500 rpm
 - (ii) speed of the driving shaft when the resonance occurs.
5. (a) In a single-degree damped vibrating system, a suspended mass of 8kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine the 10
- (i) stiffness of the spring
 - (ii) Logarithmic decreases
 - (iii) damping factor
 - (iv) damping coefficient.
- (b) Enlist machine conditioning monitoring & fault diagnosis technique and explain any two in details. 10
6. (a) Four masses A, B, C and D are completely balanced masses C & O makes angle of 90° and 195° respectively with that of mass B in the counter clockwise direction. 12
- The rotating masses have the following properties.
- | | | | | | |
|-------|---|------|-------|---|-------|
| m_b | = | 25kg | r_a | = | 150mm |
| m_c | = | 40kg | r_b | = | 200mm |
| m_d | = | 35kg | r_c | = | 100mm |
| | | | r_d | = | 180mm |
- planes B & C are 250mm apart. Determine the
- (i) mass A and its angular position with that of mass B
 - (ii) position of all the planes relative to plane of mass A.
- (b) What is whirling or critical speed ? Explain. 4
- (c) Explain with the help of transmissibility Vs. frequency ratio curves at various damping ratio. 4