UNIT:-7:- BALANCING AND VIBRATION

Q:1 state needs of Balancing.

A:1 (i) To protect from producing unbalanced forces and couple.

(ii) To remove stresses and vibrations produced in machine.

(iii) Keep away shaft from wear and tear.

(iv) To protect machines from accidents.

Q:2 Balancing of reciprocating masses explain.

A:2

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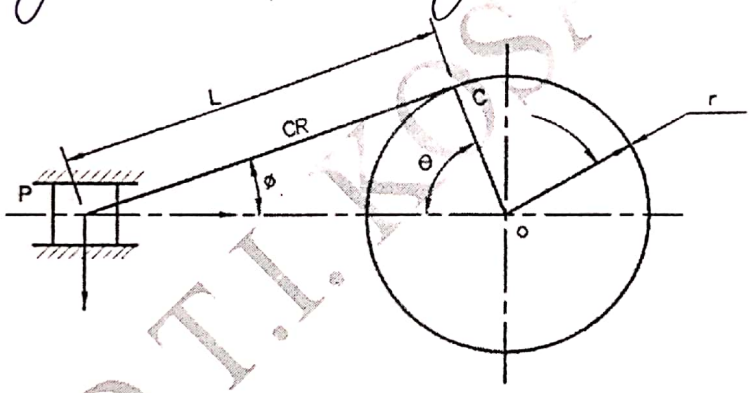
P-322



→ Fig shows single slider crank, with piston (P), conn. rod (CR), and crank (C).

→ Acceleration of piston (P) is.

$$a_p = \omega^2 . r\left(\cos\theta + \frac{\cos 2\theta}{n}\right)$$

where, a_p = Acceleration of piston, m/sec²

ω = Angular velo of crank, rad/sec

r = Radius of crank, m

θ = Angle of crank

$n = L/r$, L = Length of conn. Rod.

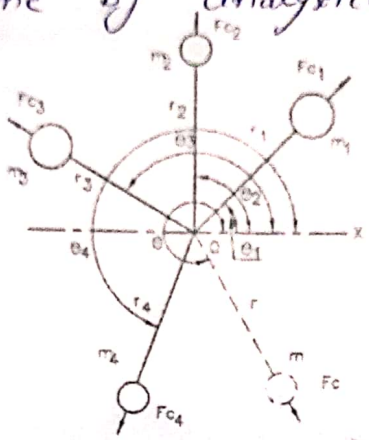
→ Mass of reciprocating part

$\therefore$ F = mass × accelerution

$\therefore F = m \cdot \omega \cdot r \left(\cos\theta + \frac{\cos 2\theta}{n}\right)$

Q:3 Explain balancing of several masses rotating in the same plane by Analytical method.

A:3



→ As shown in fig masses m_1, m_2, m_3 and m_4 are attached on shaft in same plane and rotating about point 'O'.

→ r_1, r_2, r_3, r_4 = radius of respective mass

→ $\theta_1, \theta_2, \theta_3, \theta_4$ = Angle of respective masses with OX

→ Centrifugal force $F_c = m \times r$ (mass × radius)

→ Resolving horizontal forces,

$$\Sigma H = m_1 r_1 \cos\theta_1 + m_2 r_2 \cos\theta_2 + m_3 r_3 \cos\theta_3 + m_4 r_4 \cos\theta_4$$

→ Resolving vertical forces,

$$\Sigma V = m_1 r_1 \sin\theta_1 + m_2 r_2 \sin\theta_2 + m_3 r_3 \sin\theta_3 + m_4 r_4 \sin\theta_4$$

→ Resultant force,

$$F_c = \sqrt{\Sigma H^2 + \Sigma V^2}$$

Q:4 Define vibration. Explain mechanical system of vibration.

OR

Define vibration. classify vibrating system and explain any one.

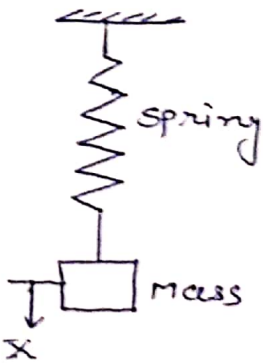
A:4 Vibration :- The body having repeted motion during a period of time, with mass and elasticity is known as Vibration.

→ Following is the mechanical system of vibration

(i) spring mass system
(ii) simple pendulum
(iii) Torsional Pendulum
(iv) Geared system
(v) simply supported beam with point load at middle
(vi) Cantilever beam with point load at free end.

⇒ spring mass system.

→ As shown in fig one end of spring is fixed and other end is free which atteched with mass.



Q:5 List causes and remedies of vibration.

A:5 Causes of vibration

→ Unbalanced force produce in machine.
→ Incorrect alignment of shaft.
→ Lack of isolation.
→ Loose fitting
→ vibrating waves.

⇒ Remedies :-
→ proper balancing is required before operating system.
→ Use shock absorber.
→ Use vibration isolator.
→ Use better material for construction.

Q:6 Give classification of vibration.

A:6 (A) Based on force acting on body.
(i) forced vibration
(ii) Free vibration.
(iii) Damped vibration
(iv) Un-damped vibration

(B) Based on stress acting on body.
(i) Longitudinal vibration
(ii) Torsional vibration
(iii) Transverse vibration.

Q:7 Define following with SI units.

A:7 (i) Time-period :-
→ It is the time interval after the motion is repeated itself.
→ It's SI unit is second.

(ii) Cycle :-
→ It is the motion completed during one time period.

(iii) Frequency :-
→ It is the number of cycle described in one second.
→ It's SI unit is hertz (Hz).

(iv) Amplitude :-

→ It is maximum displacement of body from its mean position.

→ SI unit is mm.

Q:8 Define following term.

A:8 (i) Degree of freedom :-

→ It is defined as minimum number of independent co-ordinates required to determine the position of all parts of system.

(ii) Resonance.

→ When frequency of external force is equal to the frequency of vibrating system, then it is known as state of resonance.

→ Resonance means high vibration.

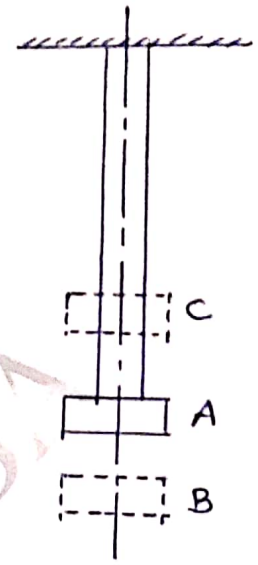
(iii) Damped vibration :-

→ When system is provided with damping devices, the vibration is known as damped vibration.

Q:9 Explain Longitudinal, Torsional and Transverse vibration.

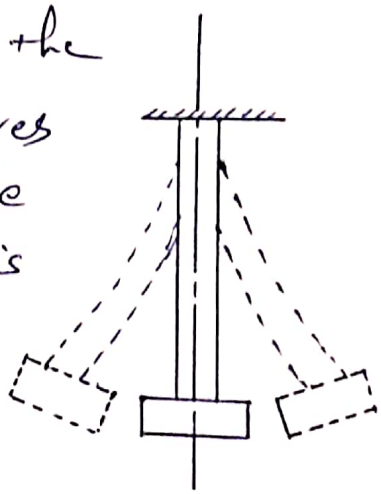
A:9 (i) Longitudinal vibration:-

→ Due to disturbing force acting on the free end of the shaft, shaft moves with mass along the axis of shaft, then the vibration is known as Longitudinal vibration.



(ii) Transverse vibration:-

→ when disturbing force acting on the shaft and shaft with mass moves along with the axis ⊥ to the axis of shaft, then vibration is known as Transverse vibration.



(iii) Torsional vibration:-

→ when disturbing force acting on the shaft, and shaft along with the disc, twist and untwist about the axis of shaft, then vibration is known as Torsional vibration.