

Unit-V Worksheet

C5.1 A shaft 1.5 m long, supported in flexible bearings at the ends carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375 mm from the centre towards left. The shaft is hollow of external diameter 75 mm and internal diameter 40 mm. The density of the shaft material is 7700 kg/m^3 and its modulus of elasticity is 200 GN/m^2 . Calculate the lowest whirling speed of the shaft, taking into account the mass of the shaft.

C5.2 A steel shaft ABCD 105m long has flywheel at its ends A&B. the mass of flywheel A is 600kg with radius of gyration 0.6m. The mass of flywheel D is 800kg with radius of gyration 0.9m. The connecting shaft has the diameter 50mm for the portion AB which is 0.4m long and diameter of 60mm for portion BC which is 0.5m long and diameter of d mm for portion CD which is 0.6m long. Determine: (i) the diameter 'd' of portion CD to that node of torsional vibration of system will be at centre of length BC. (ii) Natural frequency of torsional vibration. The modulus of rigidity for the shaft material is 80 GN/m^2 .

1. When there is a reduction in amplitude over every cycle of vibration, then the body is said to have

a) free vibration b) forced vibration c) damped vibration d) none of the mentioned

(Ans: c)

2. Longitudinal vibrations are said to occur when the particles of a body moves

a) perpendicular to its axis b) parallel to its axis
c) in a circle about its axis d) none of the mentioned

(Ans: b)

3. When a body is subjected to transverse vibrations, the stress induced in a body will be

a) shear stress b) tensile stress
c) compressive stress d) none of the mentioned

(Ans: b)

4. The natural frequency (in Hz) of free longitudinal vibrations is equal to

a) $1/2\pi\sqrt{s/m}$ b) $1/2\pi\sqrt{g/\delta}$ c) $0.4985/\delta$ d) all of the mentioned

(Ans: d)

5. The factor which affects the critical speed of a shaft is

a) diameter of the disc b) span of the shaft c) eccentricity d) all of the mentioned

(Ans: d)

6. The equation of motion for a vibrating system with viscous damping is

$$d^2x/dt^2 + c/m \cdot dx/dt + s/m \cdot x = 0$$

If the roots of this equation are real, then the system will be

- a) over damped b) under damped c) critically damped d) none of the mentioned

(Ans: a)

7. In under damped vibrating system, if x_1 and x_2 are the successive values of the amplitude on the same side of the mean position, then the logarithmic decrement is equal to

- a) x_1/x_2 b) $\log(x_1/x_2)$ c) $\log_e(x_1/x_2)$ d) $\log(x_1 \cdot x_2)$

(Ans: b)

8. The ratio of the maximum displacement of the forced vibration to the deflection due to the static force, is known as

- a) damping factor b) damping coefficient
c) logarithmic decrement d) magnification factor

(Ans: d)

9. In vibration isolation system, if ω/ω_n is less than $\sqrt{2}$, then for all values of the damping factor, the transmissibility will be

- a) less than unity b) equal to unity c) greater than unity d) zero

where, ω = Circular frequency of the system in rad/s, and

ω_n = Natural circular frequency of vibration of the system in rad/s.

(Ans: c)

10. In vibration isolation system, if $\omega/\omega_n > 1$, then the phase difference between the transmitted force and the disturbing force is

- a) 0° b) 90° c) 180° d) 270°

(Ans: c)

11. In steady state forced vibrations, the amplitude of vibrations at resonance is _____ damping coefficient.

- a) equal to b) directly proportional to
c) inversely proportional to d) independent of

(Ans: c)

12. While calculating the natural frequency of a spring-mass system, the effect of the mass of the spring is accounted for by adding X times its value to the mass, where X is

- a) 1/2 b) 1/3 c) 1/4 d) 3/4

(Ans: b)

13. Critical speed is expressed as

- a) rotation of shaft in degrees b) rotation of shaft in radians
c) rotation of shaft in minutes d) natural frequency of the shaft

(Ans: d)

14. The first critical speed of an automobile running on a sinusoidal road is calculated by (modeling it as a single degree of freedom system)

- a) Resonance b) Approximation c) Superposition d) Rayleigh quotient

(Ans: a)

15. Which type of vibrations are also known as transient vibrations?

- a. Undamped vibrations b. Damped vibrations
c. Torsional vibrations d. Transverse vibrations

(Ans: b)

16. $\delta = (Wa^2b^2) / (3 EIL)$ is the value of deflection for _____

- a. simply supported beam which has central point load
b. simply supported beam which has eccentric point load
c. simply supported beam which has U.D.L. point load per unit length
d. fixed beam which has central point load

(Ans: b)

17. Which among the following is the value of static deflection (δ) for a fixed beam with central point load?

- a. $(WL^3) / (192 EI)$ b. $(WL^2) / (192 EI)$
c. $(WL^3) / (384 EI)$ d. None of the above

(Ans: a)

18. According to which method, maximum kinetic energy at mean position is equal to maximum potential energy at extreme position?

- a. Energy method
- b. Rayleigh's method
- c. Equilibrium method
- d. All of the above

(Ans: b)

19. Torsional vibrations are said to occur when the particles of a body moves

- a. perpendicular to its axis
- b. parallel to its axis
- c. in a circle about its axis
- d. none of these

(Ans: c)

20. What is meant by node point?

- a. The point at which amplitude of vibration is maximum
- b. The point at which amplitude of vibration is minimum
- c. The point at which amplitude of vibration is zero
- d. None of the above

(Ans: c)