Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – June 2023

Programme Name: B Tech (ME)

Semester: IV

Subject Code: MECHANICS OF MACHINES II

Subject Name: UG11T3403

Date: 05.06.2023 Max Marks: 70

Duration: 03 Hrs Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Choose the correct answer as applicable. **(1 x 10 = 10 Marks)**

1. In case of rotating masses, the magnitude of the balancing mass is ___ when the speed of the shaft is doubled
A) doubled B) halved C) unaffected D) quadrupled

2. A mass is suspended at the bottom of two springs in series having stiffness 10 N/mm and 5 N/mm. The equivalent spring stiffness of the two springs is nearly

A) 0.3 N/mm B)3.3 N/mm C) 5 N/mm D) 15 N/mm

3. During torsional vibration of a shaft, the node is characterized by the
A) Maximum angular velocity B) maximum angular displacement
C) Maximum angular acceleration D) zero angular displacement

4.) In a forced vibration with viscous damping, maximum amplitude occurs when forced frequency is
A) Equal to natural frequency B) Slightly less than natural frequency
C) Slightly greater than natural frequency D) Zero

5. 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) crushing stress

6. Whirling speed of shaft is the speed at which
A) Shaft tends to vibrate in longitudinal direction
B) Torsional vibrations occur
C) Shaft tends to vibrate vigorously in transverse direction
D) Combination of transverse and longitudinal vibration occurs

7. At a nodal point in a shaft, the amplitude of torsional vibration is

A) Minimum B) maximum C) zero D) none of the above

8. When the mass of a critically damped single degree of freedom system is deflected from its equilibrium position and released, it will
A) Return to equilibrium position without oscillation
B) Oscillate with increasing time period
C) Oscillate with decreasing amplitude
D) Oscillate with constant amplitude

9. If a spring-mass-dashpot system is subjected to excitation by a constant harmonic force, then at resonance, its amplitude of vibration will be
A) Infinity B) inversely proportional to damping
C) Directly proportional to damping D) decreasing exponentially with time

10. In a system subjected to damped forced vibrations, the ratio of maximum displacement to the static deflection is known as
A) Critical damping ratio B) Damping factor
C) Logarithmic decrement D) Magnification factor

Section B

(All Questions are compulsory)

Five Short Questions of 02 Marks each

(Marks 5x2=10)

11. Brief outline of D'Alembert's method and Rayleigh's method to solve vibration problems.

12. Explain logarithmic decrement

13. Define degrees of freedom and fundamental mode of vibration

14 What is the phenomenon happens when shaft operated at whirling speed.

15. Write a short note on free or natural and damped vibrations

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. The rotor of a turbine of mass 15 kg is supported at the mid span of a shaft 0.4 m. The rotor has an unbalance of 0.003 kg.m. Determine the force exerted on the bearing at a speed of 6000 rpm. The diameter of steel shaft is 25 mm and E = 25 GPa.

17. A shaft 30 mm diameter and 2 m long has a uniformly distributed load of 120 N/m length. It is simply supported at the ends and carries three loads of 1 kN, 1.5 kN and 0.5 kN at 0.6 m, 1m and 1.5 m respectively from the left end support. Calculate the natural frequency of transverse vibrations. E = 200 GPa

18. A torsional pendulum when immersed in oil indicates its natural frequency as 200 Hz. But when it was put to vibration in vacuum having no damping, its natural frequency was observed as 250 Hz. Find the value of damping factor of the oil.

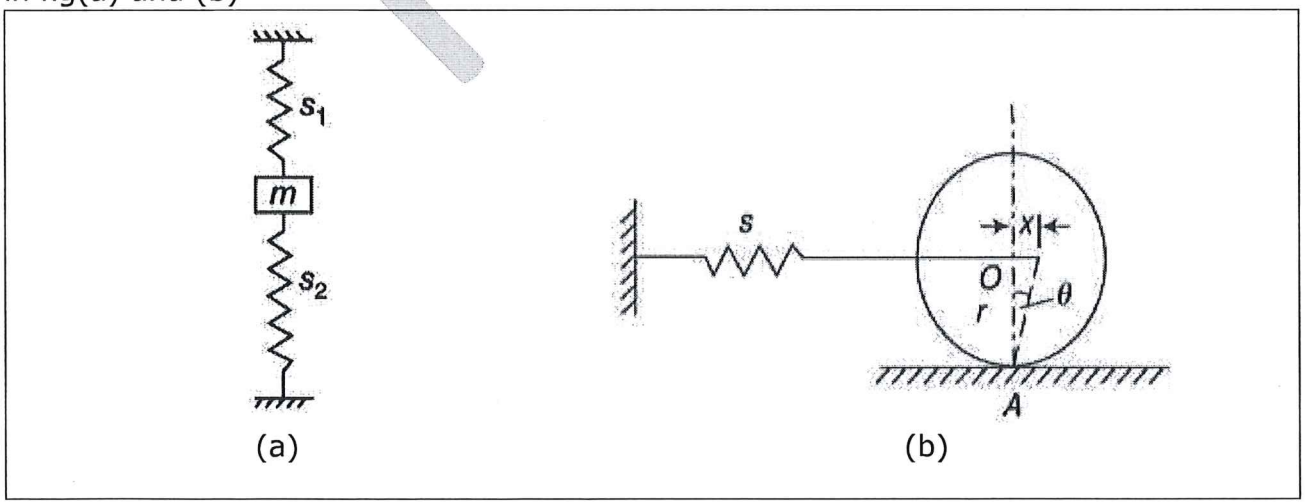
19. a) What do you understand by critical and whirling speed of shafts discuss with neat diagrams (6Marks)

b) A shaft is 300mm diameter and 4m long may be regarded as simply supported .The density is 7830kg/m^3. E= 205GPa.Calculate the first 3 critical frequencies. (4marks)

20. A mass of 5 kg hangs from a spring and makes damped oscillations. If the time of 50 complete oscillations is found to be 20s, and the ratio of the first downward displacement to the sixth is found to be 22.5, find the stiffness of spring and the damping coefficient.

21. A centrifugal fan of mass 5 kg has a rotating unbalance of 0.25kgm. When dampers having damping factor 0.2 are used, specify the springs for mounting such that only 10% of the unbalance force is transmitted to the floor and the force transmitted. The fan is running at a constant speed of 1000 rpm.

22. Find the natural frequency of the oscillation of the vibrating system as shown in fig(a) and (b)



(a) (b)