B.Tech. (Sem. - 7th / 8th)
MECHANICAL VIBRATIONS
SUBJECT CODE : ME - 408
Paper ID : [A0841]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours   **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.

2) Attempt any **Four** questions from Section - B.

3) Attempt any **Two** questions from Section - C.

Section - A

Q1)   *(10 x 2 = 20)*

a)   Define Mechanical Vibrations?

b)   Define D'Alemberts Principle?

c)   What is the importance of Holzer's method?

d)   What is influence coefficient?

e)   Define whirling speed of shafts.

f)   What is magnification factor?

g)   Define coulomb damping.

h)   What are undamped vibrations?

i)   Write the generalized solution for lateral vibrations of the spring in continuous systems?

j)   Define logarithmic decrement?

Section - B

(4 x 5 = 20)

Q2)   An Instrument has a natural frequency of 10Hz. It can stand a maximum acceleration of 10 m/sce². Find the maximum displacement amplitude.

Q3) A diesel engine of single cylinder has a mass of 500 kg and is mounted on mild steel chassis frame. The static deflection due to weight of the chassis is 2.5 mm. The reciprocating masses of the engine amounts to 20 kg and the stroke of the engine is 180 mm. A dashpot with a damping coefficient of 2000 N/m/s is also used to damper the vibrations. In the steady state of the vibrations, determine the amplitude of the vibrations if the driving shaft rotates at 400 rpm.

Q4) A horizontal spring mass system with coulomb damping has a mass of 5 kg attached to a spring of stiffness 980 N/m. If the coefficient of friction is 0.025, Calculate
   (a)   the frequency of the free vibrations.
   (b)   the number of cycles corresponding to 50% reduction in amplitude if the initial amplitude is 5 cm.
   (c)   the time taken to achieve this 50% reduction.

Q5) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The young's modulus for the shaft material in 200 GN/m². Determine the frequency of longitudinal and transverse vibrations of the shaft.

Q6) (a)   What are vibration absorbers? Explain the working principle of a centrifugal pendulum vibration absorber with the help of a neat sketch.
   (b)   For damped free vibration system, derive the equation for amplitude for over-damped and critically damped system.

Section - C

(2 x 10 = 20)

Q7) A uniform string of length l fixed at its ends has a large initial tension. It is plucked at $x = l/3$ through a distance a_0 and released. Determine the subsequent motion?

Q8) A uniform string is tightly stretched between $x = 0$ and $x = l$ and is plucked at $x = l/4$, through a distance h and then released from rest. Find its subsequent displacement.

Q9) Write short note on any two of the following :
   (a)   Stodola method.
   (b)   Eddy current damping.
   (c)   Vibrometer.

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