Seat No. | | | | | | |

DBI 1378

Mechanical Vibration
(New) (1290)

P.Pages : 3

Time : Three Hours **Max. Marks:100**

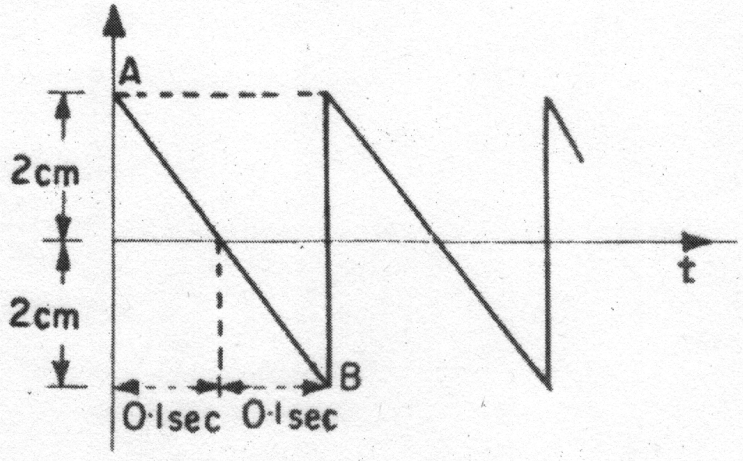
Instructions to Candidates:

1. Do not write anything on the question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Student should note, no supplement will be provided.
4. All questions are compulsory, solve **any two** bits out of **A, B** and **C** from each question.
5. Figures to the right indicate full marks.
6. Draw neat figures whenever necessary.
7. Use of non-programmable calculator is allowed.
8. Assume suitable data if necessary.

A) i) Discuss the importance of study of vibration in engineering. 10
ii) Discuss beats phenomenon.

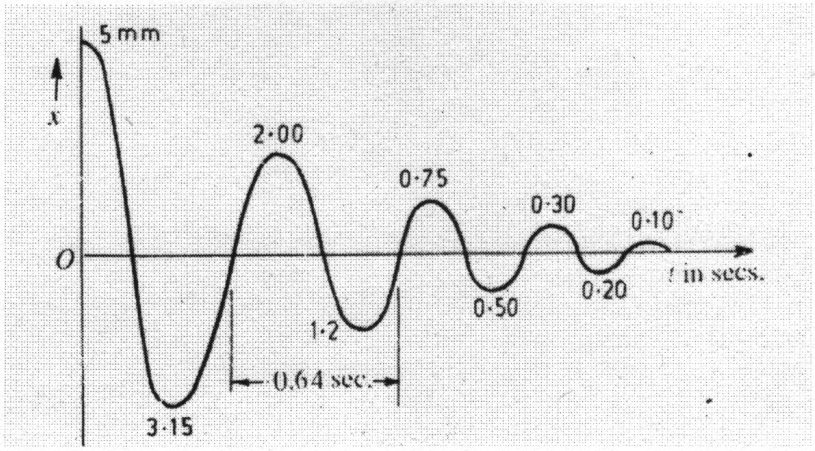
B) Add two following harmonic motions analytically and check solution graphically. 10
$x_1=4\cos(\omega t+10^0)$, $x_2=6\sin(\omega t+60^0)$

C) Represent periodic motions given of figure below by harmonic series. 10



2. A) Explain 10
i) Coulomb damping .
ii) Viscous damping.

B) Free vibration records of one tone machine mounted on an isolator is shown in figure identify the type of isolator and its characteristic. 10

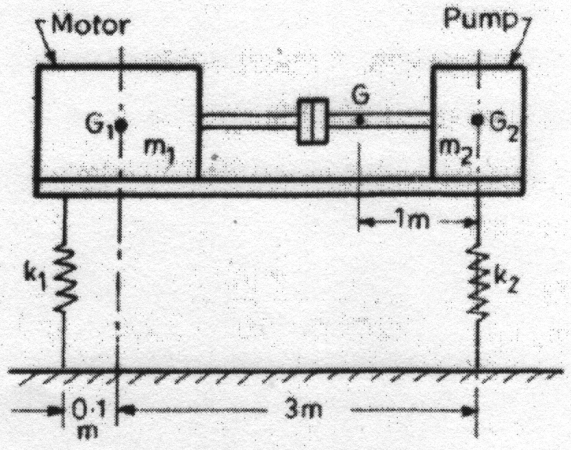


C) A machine of 100 kg mass is supported on springs of total stiffness 700 KN/m has an unbalanced rotating element, which results in a disturbing force of 350 N at a speed of 3000 rpm. Assuming a damping factor of ξ =0.20, determine (a) its amplitude of motion due to the unbalance, (b) the transmissibility, and (c) the transmitted force. 10

3. A) Explain the following. 10
i) Centrifugal pendulum absorber.
ii) Houdaille Damper with frequency response curve.

B) Calculate natural frequency of a shaft of diameter 10 cm and length 300 cm carrying two discs of diameters 125 cm and 200 cm respectively at its ends and weighing 480 N and 900 N respectively . Modulus of rigidity of the shaft is 1.96×10^{11} N/m^2. 10

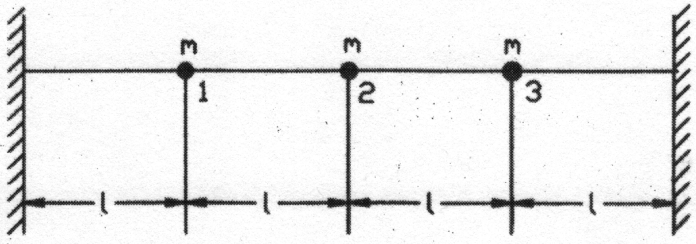
C) An induction motor driving reciprocating pump is shown in figure. Mass of motor m_1 = 750 kg. Mass of pump m_2 =2500 kg, mass moment of inertia of motor about its C.G.,I_1 =50 kg. m^2, mass moment of inertia of pump about its C.G.,I_2 =150 kg. m^2, spring constant k_1= k_2=1.5 MN/m. The combine C.G. is at a distance of 1 m from the C.G. of the pump. Calculate the two natural frequencies. 10



4. A) Explain stiffness influence coefficient and flexible influence coefficient in detail. 10

B) A solid steel shaft of uniform diameter of 30 cm length. Its one end is fixed and two discs are mounted on the shaft of mass m_1 =100 kg. and m_2=50 kg. respectively. The distance of disc one from fixed end of the shaft is 18 cm and for disc two is 30 cm. Determine the natural frequency by using Rayleigh's method and compare it with Dunkerley's method. $E=1.96 \times 10^{11} N/m^2$, $I=4 \times 10^{-7} m^2$. 10

C) Obtain the three natural frequencies and corresponding mode shapes for the system shown in figure. Assume tension T in the string to be large. Use the matrix method with flexibility influence coefficients. 10



5.A) Explain following in details. 10
i) Self excited vibrations.
ii) Phase plane representation

B) Generate the wave equation for the lateral vibration of string. 10

C) Determine the shock spectrum of rectangular pulse. 10

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