MANAV RACHNA vidyanatariksha

MANAV RACHNA UNIVERSITY

(FORMERLY MANAV RACHNA COLLEGE OF ENGINEERING
NAAC ACCREDITED 'A' GRADE INSTITUTION)

Declared as State Private University under section 2f of the UGC act, 1956

DEPARTMENT OF PHYSICS

"T3 Examination, May- 2018"

Semester: II
Subject:MECHANICS
Branch: MECHANICAL/IEM
Course Type:CORE
Time: 3 Hours
Max.Marks: 80

Date ofExam:23/05/2018.
Subject Code:PHH104T
Session:Morning
Course Nature: HARD
Program: B.Tech/M.Tech/B.Sc/BBA
Signature: HOD/Associate HOD:

Note*: All questions are compulsory from Part A* (2×10 = 20). Attempt any two questions from part B and two questions from part C.

PART-A

Q1

(a) Write down the differential equations for the mechanical and electrical damped harmonic oscillators.

(b) A mass of 25×10^{-3} Kg is suspended from the lower end of vertical spring having force constant 25 N/m. The mechanical resistance of the system is 1.5 N-sec/m.The mass is displaced vertically and released. Find whether the motion is oscillatory? If so, calculate the period of oscillation.

(c) What do you mean by quality factor of oscillations? What will be the value of quality factor for a free oscillator?

(d) Explain the condition for stable equilibrium.

(e) A mass of 1Kg is suspended from a spring of spring constant 25 N/m. If the undamped frequency is $\sqrt{\frac{2}{3}}$ times the damped frequency, calculate the damping factor.

(f) State the postulates of special theory of relativity.

(g) How fast would a rocket ship have to go relative to an observer for its length to be contracted to 99% of its length when at rest?

(h) Differentiate inertial and non-inertial frame of references.

(i) A proton of rest mass 1.67×10^{-27} Kg is moving with velocity 0.9c. Find its mass and momentum.

(j) A beam of particles of half life 2×10^{-6} sec. travels in the laboratory with speed 0.96 times the speed of light. How much distance does the beam travel before the flux fall to ½ times the initial flux.

PART-B

Q2

(a) What do you mean by virtual work? Explain the virtual work method to analyze the equilibrium of a beam. (5)

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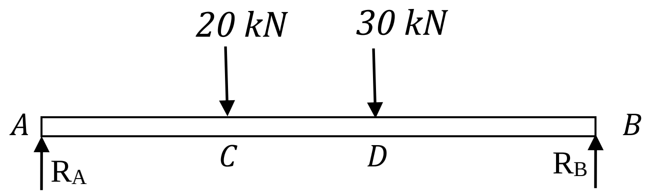
(b) A beam *AB* has been loaded and supported as shown in figure below. Use the method of virtual work to determine the reactions R_A and R_B at the end supports.(Given: AB = 5 m, AC = 2m and DB = 2m) (4)



(c) What do you mean by conservative and non-conservative force? Show that conservative force is negative of the potential energy gradient. (6)

Q 3 What do you mean by damped harmonic oscillations? Write down the differential equation of damped harmonic oscillator. Find the expression for displacement and discuss when we get oscillatory damped simple harmonic motion. Derive expression for average mechanical energy and hence for quality factor. (2+2+7+4)

Q4. Derive an expression for the displacement in steady state in case of a forced oscillator. Show that the resonant frequency is slightly less than the natural frequency of the oscillator. Also derive an expression for its quality factor. (10+2+3)

PART-C

Q5. What was the objective of conducting the Michelson's – Morley experiment? Describe the experiment. How was the negative result explained? (1+12+2)

Q6. Derive Lorentz transformation equations. Show that at low velocities these equations reduce to Galilean transformation equations. (13+2)

Q7

(a) Derive expressions for length contraction and time dilation. (5+5)

(b) Deduce velocity addition theorem. (5)

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