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SARDAR PATEL UNIVERSITY
First Semester B. Sc. (F. Y. B. Sc.) Examination-2011
Saturday, 12th November-2011
Time: From 02.30: to 04:30 pm
Subject: PHYSICS [US01CPHY01]
Properties of Matter and Sound Wave

Total Marks 70

N.B: (i) All the symbols have their usual meanings.

(ii) Figures at the right side of questions indicate full marks.

Que.-1 To answer the questions choose the correct option. [10]

- (i) A unit of Poisson's ratio is
(a) dyne/cm² (b) dyne-cm (c) N/m² (d) unit less
- (ii) Compressibility of a material is reciprocal of
(a) bulk modulus (b) Young's modulus (c) modulus of rigidity
(d) Poisson's ratio.
- (iii) The twisting couple per unit twist of a cylinder depends on
(a) Young's modulus (b) bulk modulus (c) modulus of rigidity
(d) none of above
- (iv) In the statical method for the measurement of modulus of rigidity the force is applied
(a) at one end of rod (b) at two ends of rod (c) at centre of rod
(d) none of above
- (v) The bending moment of a beam is directly proportional to _____ of a beam
(a) Young's modulus (b) bulk modulus (c) modulus of rigidity (d) none of above
- (vi) According to Newton, propagation of sound wave through air is an _____ process.
(a) adiabatic (b) isothermal (c) isochoric (d) isobaric
- (vii) The speed of sound is directly proportional to _____ of absolute temperature
(a) square (b) cube root (c) square root (d) none of above.
- (viii) When a source of sound and an observer are in relative motion, pitch of the sound changes. This is known as (a) Doppler's principle (b) Newton's formula (c) interference (d) diffraction
- (ix) Loudness of sound is related to intensity of sound by
(a) $L=2K \log I$ (b) $L=I \log K$ (c) $L=K \log I$ (d) $L=K^2 \log I$
- (x) The same notes being played on the sitar and veena differ in
(a) pitch (b) quality (c) loudness (d) none of above

Que.-2 Answer *briefly* any ten of the following questions. [20]

- (1) Define stress and strain.
(2) Draw the stress-strain diagram indicating different regions.
(3) Define Poisson's ratio and give its limiting values.

- (4) State the drawbacks of statical method used for the measurement of modulus of rigidity.
- (5) State the advantages of Maxwell's needle method used for the measurement of modulus of rigidity.
- (6) Differentiate between beam and cantilever.
- (7) Define (i) longitudinal waves and (ii) Transverse waves. Give example of each.
- (8) With necessary derivation explain the effect of pressure on the velocity of sound.
- (9) State four applications of Kundt's tube experiment.
- (10) Give the difference between musical sound and noise.
- (11) What is Piezo-electric effect?
- (12) How are the ultrasonic waves useful in Sonar?

- Que. -3 (a) Define modulus of rigidity. Determine the expression for modulus of rigidity when shearing force is applied to a cube. [06]
- (b) Deduce an expression for the work done per unit volume in case of elongation strain. [04]

OR

- Que. -3 (a) Give the experimental arrangement for the determination of Poisson's ratio of rubber tube and derive the expression for Poisson's ratio. [06]
- (b) Obtain the expression relating three elastic constants, [04]
- $$\frac{9}{Y} = \frac{3}{\eta} + \frac{1}{K}$$

- Que. -4 (a) Derive an expression for torsional rigidity of a cylinder of uniform cross-section. [06]
- (b) Deduce an expression of periodic time for a torsional pendulum. [04]

OR

- Que. -4 (a) Explain the Maxwell's vibrating needle method for the determination of coefficient of modulus of rigidity for a wire. [06]
- (b) Obtain the expression for depression of a beam supported at the ends and loaded at the centre. [04]

- Que. -5 (a) Explain the propagation of sound waves in the metal rod and deduce the expression for its velocity. [06]
- (b) Discuss the effect of temperature on the velocity of sound. [04]

OR

- Que. -5 (a) Explain the Kundt's tube experiment to determine the velocity of sound in liquid. [06]
- (b) How is the Kundt's tube experiment useful to determine (i) Young's modulus and (ii) ratio of specific heats of a gas? [04]

- Que. -6 (a) What is Doppler's effect? Obtain the expression for apparent frequencies for the following cases, [06]
- (i) Source of sound in motion and observer at rest
- (ii) Observer in motion and source of sound is at rest
- (b) Explain briefly characteristics of musical sound. [04]

OR

- Que. -6 (a) Describe any one method for the production of ultrasonic waves with necessary circuit diagrams. [06]
- (b) Explain briefly various methods used for the detection of ultrasonic waves. [04]



SARDAR PATEL UNIVERSITY
 F. Y. B. Sc. (First Semester) Examination-2011
 Under CBCS
 Monday, 14th Nov-2011
 Time: 2-30 to 4-30 pm
 Subject: US01CPHY02 (PHYSICS)
 (Network Analysis, Optics and Laser)

Total Marks : 70

N.B: All the symbols have their usual meanings

- Que. -1** To answer the questions choose the correct option.(All questions [10] are compulsory).
- (i) Name the arrangement of active and passive elements which form a closed path,
 (a) Node (b) Network (c) Junction point (d) Branch
 - (ii) The number of independent equations required for the analysis of the circuit using node pair voltage method is,
 (a) $n=j-1$ (b) $n=2j-1$ (c) $n=j^2-1$ (d) $n=j-2$.
 - (iii) When a bridge is perfectly balanced the current through the null detector is,
 (a) Maximum (b) Zero (c) Balanced current (d) Negative.
 - (iv) The capacitive reactance of a capacitor X_c is given by the equation,
 (a) $X_c=1/2\pi fc$ (b) $X_c=2\pi/fc$ (c) $X_c=2\pi fc$ (d) $X_c=2\pi f/c$
 - (v) Rayleigh's interferometer works on the principle of division of,
 (a) Amplitude (b) Wavelength (c) Wave front (d) Frequency.
 - (vi) In Michelson interferometer, when M_1 intersects with M_2' in middle, the fringes obtained are,
 (a) Circular (b) curved (c) Straight (d) Dark region.
 - (vii) The resolving power of transmission grating depends on,
 (a) Number of lines (b) Frequency (c) Wavelength (d) Refractive index.
 - (viii) B_{12} is Einstein's co-efficient for,
 (a) Spontaneous emission (b) Stimulated emission
 (c) Stimulated absorption (d) population inversion.
 - (ix) ND: YAG laser is a _____ level laser.
 (a) One (b) Two (c) Four (d) Five.
 - (x) In CO₂ laser the element used as coolant is,
 (a) N₂ (b) O₂ (c) He (d) Kr

Que. -2

Answer the following questions in short. (Any Ten)

[20]

- (1) State and explain Superposition theorem.
- (2) Differentiate between loop and mesh of a network.
- (3) With neat circuit diagram write voltage divider theorem.
- (4) Explain limitations of Maxwell's bridge.
- (5) Write the applications of A.C. bridges.
- (6) Write down the errors occurs in the Wheatstone bridge measurement.
- (7) How Michelson interferometer is used to determine wavelength of light?
- (8) Explain meaning of the term Resolution and Resolving power.
- (9) Calculate the resolving power of a microscope with N.A. equal to 0.15 and wavelength of light is 6×10^{-5} cm.
- (10) Explain the directionality property of laser.
- (11) Enlist four applications of laser.
- (12) Enlist the methods used for pumping.

Que. -3

- (a) Discuss network analysis by two node pair voltage method.
- (b) State and explain Thevenin's theorem with proper illustration.

[05]

[05]

OR

Que. -3

- (a) State and explain Norton's theorem with proper circuit diagram.
- (b) With suitable circuit diagram, explain mesh current method for the analysis of three mesh network.

[05]

[05]

Que. -4

- (a) Obtain the expression $f = 1/2\pi RC$ using Wein bridge.
- (b) Obtain the balancing condition for A.C. bridge with necessary diagram.

[05]

[05]

OR

Que. -4

- (a) Explain how Kelvin bridge removes the effect of connecting leads to provide an accurate measurement of low value resistance.
- (b) Drawing necessary circuit diagram of Maxwell bridge, obtain its necessary equation.

[05]

[05]

- Que.-5 (a) Derive the equation for resolving power of a plane transmission Grating. [05]
(b) With necessary diagram, explain the construction and working of a Michelson interferometer. [05]

OR

- Que.-5 (a) Derive the equation for resolving power of a Telescope. [05]
(b) Derive the equation for resolving power of a Prism. [05]

- Que.-6 (a) With necessary diagram, explain the theory of population inversion. [05]
(b) With necessary diagram, discuss ND:YAG laser in detail. [05]

OR

- Que.-6 (a) What is a Holograph? Discuss the process involved in recording of the Hologram. [05]
(b) Discuss the process of spontaneous and stimulated emission. [05]

$$X = X = X$$