Total No. of printed pages = 6

PH 181201

Roll No. of candidate

2019

B.Tech. 2nd Semester (Group - A) End-Term Examination

PHYSICS

New Regulation (w.e.f. 2017-18)

New Syllabus – (w.e.f. 2018-19)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *four* from the rest.

1.   Answer the following :   (10 × 1 = 10)

(i)   The total energy of a particle executing simple harmonic motion is directly proportional to

(a)   amplitude

(b)   square of amplitude

(c)   square root of amplitude

(d)   reciprocal of amplitude

(ii) Chromatic aberration in a lens is caused by the phenomenon of light known as

(a)   reflection of light

(b)   interference of light

(c)   diffraction of light

(d)   dispersion of light

[Turn over

(iii) Young's modulus (y), modulus of rigidity (η) and Bulk modulus (k) are related as

(a) $\dfrac{1}{K} = \dfrac{1}{3\eta} + \dfrac{1}{9Y}$

(b) $\dfrac{1}{\eta} = \dfrac{1}{3Y} + \dfrac{1}{9K}$

(c) $\dfrac{Y}{3} = \dfrac{1}{\eta} + \dfrac{1}{9K}$

(d) $\dfrac{1}{Y} = \dfrac{1}{3\eta} + \dfrac{1}{9K}$

(iv) If the radius of a tube is increase two times keeping other quantities constant the rate of flow of liquid through a capillary tube.

(a) decreases by sixteen times

(b) increases by sixteen times

(c) increases by four times

(d) remains same

(v) Two lenses of the same material can form an achromatic combination when they are separated by a distance equal to

(a) product of the focal lengths of the lenses

(b) mean of the focal length of two lenses

(c) sum of the focal lengths of two lenses

(d) difference of the focal lengths of two lenses

(vi) An achromatic combination of lens produces

(a) images of black and white

(b) coloured images

(c) highly enlarged images

(d) images unaffected by variation of refractive index with wavelength

(vii) In SI units the sabine formula for the time of reverberation, T is given by

(a) $T = \dfrac{0.35\,S}{\Sigma aV}$ (b) $T = \dfrac{0.16V}{\Sigma aS}$

(c) $T = \dfrac{0.26a}{\Sigma VS}$ (d) $T = \dfrac{\Sigma aV}{0.32S}$

Where V is volume, S is surface area and a is absorption coefficient.

(viii) Ultrasonic waves

(a) are sound waves of very long wavelength

(b) are sound waves of very high frequency

(c) move faster than sound waves

(d) move faster than electromagnetic waves

(ix) What is the general name for the class of structures made of rolled up carbon lattices

(a) Nanorods

(b) Nanotubes

(c) Nanosheets

(d) Fullerrods

(x) Young's modulues of a solid depends upon

(a) length

(b) area of crossection

(c) material

(d) all of the above

2.   (a) Write three conditions for a force to be conservative. 'The orbit of a particle moving under the influence of a central, force always lies in a plane'. Justify the statement.

$(3 + 2 = 5)$

(b) A frame 'A' is rotating with respect to a fixed frame 'B' with a uniform angular velocity w. If the position, velocity and acceleration of a particle in frame 'A' are represented by r, V_A and f_A respectively show that the acceleration of that particle in the fixed frame 'B' is given by

$$f_B = f_A + 2w \times V_A + W \times (w \times r)$$

Hence, identify the Coriolis acceleration and mention the condition for its existence. When does weight lessness occur? $(7 + 2 + 1 = 10)$

3.   (a) Define simple harmonic motion. Write its differential equation.

(b) Assuming the damping to be proportional to the velocity, set up the differential equation of the damped oscillation.

(c) A uniform heavy beam is clamped horizontally at one end and loaded at the other. Obtain the relation between the load and the depreciation at the loaded end. $(2 + 6 + 7 = 15)$

4.   (a) Define 'Coefficient of viscosity' for a liquid. Find its dimensions.

(b) Derive Poiseuille's formula for the rate of flow of a liquid through a capillary tube. Why does it fail in the case of a gas?

(c) Calculate the mass of water flowing in 10 minutes through a tube 0.1 cm in diameter, 40 cm long if there is a constant pressure head of 20 cm of water. The coefficient of viscosity of water is 0.0089 eg.s. units.

$$(2 + 1 + 6 + 2 + 4 = 15)$$

5. (a) How is the intensity of a sound expressed in decibels? Mention the level of sound intensity in decibels at which the normal human ear stars experiencing pain.

(b) Define reverberation time.

(c) Why ultrasound cannot be produced by the usual method of a diaphragm loud speaker? How is the magnetostriction effect used in production of ultrasound? Mention two industrial applications of ultrasound.

$$(2 + 1 + 2 + 2 + 6 + 2 = 15)$$

6. (a) What is spherical aberration in a lens? Explain with diagram.

(b) Write the method for minimization of spherical aberration by using two converging lenses separated by a distance.

(c) What is achromatism? Deduce the condition for achromatism when the two lenses are in contact. Then prove that this achromatison is possible only when the two lenses are made of different materials.

(d) If is desired to make a converging achromatic lens of mean focal length 30 cm by using two lenses in contact and of materials A and B. If the dispersing powers of A and B are in the ratio 1:2 find the focal length of each lens.

$$(2 + 3 + 1 + 5 + 4 = 15)$$

7. (a) Define nanomaterials.

   (b) Give classification of nanomaterials.

   (c) What are nanolayers and nano particles? Give examples.

   (d) Write a short note on properties and applications of carbon nanotubes.

   (e) Write about Giant Magneto Resistance. (GMR).

   $$(2 + 1\frac{1}{2} + 4 + 4 + 3\frac{1}{2} = 15)$$