

Total No. of printed pages = 4

**PH 131102**

Roll No. of candidate

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2018

*Upland*

**B.Tech. 1st Semester End-Term Examination**

**PHYSICS — I**

**(Old Regulation)**

Full Marks – 100

Time – Three hours

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

Answer Question No. 1 and any six from the rest.

1. Fill up the blanks : (10 × 1 = 10)
- (i) Poisson's ratio  $\sigma =$  \_\_\_\_\_.
  - (ii) \_\_\_\_\_ is a beam whose one end is fixed while other end is free or loaded.
  - (iii) Resolving power of a grating is expressed by \_\_\_\_\_.
  - (iv) \_\_\_\_\_ are concentric circles.
  - (v) The time constant of an LR circuit containing a resistance of 20 Ohms and an inductance of 0.5 Henry is \_\_\_\_\_.

[Turn over

- (vi) The emf equation of LCR circuit while on charging is given as \_\_\_\_\_.
- (vii) \_\_\_\_\_ materials are characterized by large hysteresis loop.
- (viii) The reverse magnetic field needed to make the magnetic flux zero is called \_\_\_\_\_.
- (ix) The equation of continuity is given by \_\_\_\_\_.
- (x) Ampere's law is given by \_\_\_\_\_.
- (a) Show that a simple shear  $\theta$  is equivalent to an extension and compression strain at right angle to each other.
- (b) A bronze rod of length 1.7 m and diameter 5 cm is subjected to a tensile stress of 70 mega  $\text{Nm}^{-2}$ .
- (i) Calculate the extension produced in the bar.
- (ii) Find also the work done during extension of the bar. Given,  $Y$  for bronze is  $85 \times 10^9 \text{ Nm}^{-2}$ . (5 + 10 = 15)
- (a) Show that when a cantilever of length  $l$  supported at its two ends is loaded at the middle with a weight  $W$ , the depression of the middle point will be given by  $Y = \frac{Wl^3}{48Yl_g}$ .
- (b) A beam of length 50 cm is loaded with a weight of 20 kg. The loaded end is depressed by 15 mm. Calculate the depression of the beam at a distance of 0.3 m from the fixed end. (10 + 5 = 15)

4. (a) Find the condition of achromatism when two lenses are to be placed at a distance from each other.
- (b) The focal length of an achromatic doublet of two lenses is 1.5 m. If the dispersive powers of the materials of the two lenses are 0.018 and 0.027, calculate the focal length of the two lenses. (10 + 5 = 15)
5. Write the differences between interference and diffraction phenomena. What are the two classes of diffraction? Explain mathematically the intensity distribution in the diffraction pattern of Fraunhofer diffraction in single slit. (3 + 2 + 10 = 15)
6. A charged condenser discharges through a circuit containing an inductance and a resistance in series. Discuss the nature of discharge. When will the discharge oscillatory? (10 + 3 + 2 = 15)
7. Define the polarizability of a dielectric. Explain the following types of polarisability :  
Electronic polarizability, Ionic polarizability, Oriental polarizability and Space charge polarizability. What are domains? State few properties of soft and hard magnetic material. (2 + 2 × 4 + 1 + 4 = 15)
8. Write the Maxwell's equation relating the electric field and changing magnetic field. Give its physical significance. Find the curl of the vector,  $\vec{D} = x^2y\hat{i} + xyz\hat{j} - x^2y^2\hat{k}$ . (10 + 5 = 15)

9. Write the inconsistency of Ampere's law. How the Ampere's law is modified by Maxwell with the concept of displacement current. Find the value of the constant, so that the following vector  $V$  is solenoidal :  $V = (x + 3y) + (y + 2z) + (x + az)$ .

$$(5 + 5 + 5 = 15)$$