

**R15**

Code No: 121AD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, May - 2016

ENGINEERING PHYSICS

(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, ETM, MMT, AE, AME,  
MIE, PTE, CEE, MSNT)

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART- A****(25 Marks)**

- 1.a) What do you understand by the term Vander Walls force? [2]
- b) Draw the following planes of (1 1 2), (2,0 0), (1 0 1). [3]
- c) Mention the properties of matter waves. [2]
- d) Write short notes on effective mass of an electron. [3]
- e) Define polarization vector and electric displacement vector. [2]
- f) Explain Meissner effect. [3]
- g) What is meant by pumping and mention different methods of it. [2]
- h) Mention conditions to satisfy the total internal reflection. [3]
- i) Out of LED and LCD, which is more advantages? Why? [2]
- j) Explain quantum confinement in nanomaterials. [3]

**PART-B****(50 Marks)**

- 2.a) Derive an expression for the cohesive energy in an ionic crystal. [3]
- b) Tabulate the characteristics of unit cells of different crystal systems. [4]
- c) Copper has FCC structure and its lattice parameter is  $3.6\text{\AA}$ . Find the atomic radius. [3+3+4]

**OR**

- 3.a) Explain the Laue method of determining the crystal structure. [3]
- b) Derive Bragg's law of diffraction of X-rays by crystals. [4]
- c) Mention the differences between edge and screw dislocations. [3+4+3]

- 4.a) Explain the de-Broglie hypothesis. [3]
- b) Derive time independent Schrödinger's wave equation for a free particle. [3]
- c) Calculate the de-Broglie wavelength corresponding to the root mean square velocity of hydrogen molecule at  $27^{\circ}\text{C}$ . [3+3+4]

**OR**

- 5.a) Explain the Maxwell-Boltzman distribution. [3]
- b) Discuss the salient features of Kronig-Penny model of a crystal. [3]
- c) Define density of states with an example and state its importance. [3+3+4]

- 6.a) Explain Clausius-Mosotti relation in dielectrics subjected to static fields.  
b) Explain electronic polarization. Derive an expression for electronic polarizability.  
c) Write a short note on piezoelectricity. [3+4+3]

**OR**

- 7.a) What are paramagnetic materials? Explain.  
b) Obtain an expression for paramagnetic susceptibility ( $\chi$ ). How does the Paramagnetic susceptibility of a material vary with temperature?  
c) A paramagnetic material has  $10^{28}$  atoms per  $m^3$ . Its susceptibility at 350 K is  $2.8 \times 10^{-4}$ . Calculate the susceptibility at 300 K. [3+3+4]

- 8.a) Explain the phenomenon of interference of light.  
b) Describe the Fraunhofer diffraction at double slit.  
c) In a Newton rings experiment, the diameter of the 5<sup>th</sup> ring 0.30cm and the diameter of the 15<sup>th</sup> ring is 0.62cm. Find the diameter of the 25<sup>th</sup> ring. [3+3+4]

**OR**

- 9.a) What are the characteristics of LASERS?  
b) Derive expression for numerical aperture and the fractional index change of an optical fiber.  
c) A fiber has the core and cladding refractive indices 1.45 and 1.44 respectively. Find the relative refractive index difference. [3+3+4]

- 10.a) Derive an expression for the carrier concentration in n-type semiconductors.  
b) Derive Sabine's formula for reverberation time.  
c) Write a short note on solar cell. [3+3+4]

**OR**

- 11.a) Write a detailed note on nanoscience.  
b) Why nanomaterials exhibit different properties? Explain.  
c) Write the important applications of nanomaterials. [3+3+4]

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