



Reg. No. : .....

Name : .....

**Combined First and Second Semester B.Tech. Degree  
Examination, October 2014  
(2013 Scheme)  
13.102 : ENGINEERING PHYSICS (ABCEFHMNPRSTU)**

Time : 3 Hours

Max. Marks : 100

**PART – A**

Answer **all** questions. **Each** question carries **2** marks. **(10×2= 20 Marks)**

1. Obtain the differential equation of a simple harmonic motion.
2. Define divergence of a vector. What is its physical significance ?
3. What are Miller indices ?
4. Define the terms critical temperature and critical magnetic field for a superconductor.
5. A non-reflecting material is to be deposited on a glass surface. What would be the necessary thickness for zero reflection at 550 nm ? Refractive index of the material is 1.36.
6. Explain briefly Rayleigh's criterion for resolving power.
7. Distinguish between negative and positive crystals.
8. Obtain energy and momentum operators.
9. What are bosons and fermions ? Give examples.
10. Describe briefly population inversion and pumping with respect to a laser.

**PART – B**

Answer **one full** question from **each** Module. **Each** question carries **20** marks.

**Module – I**

11. a) Set up the differential equation for a forced harmonic oscillator and solve it.  
Explain the phenomenon of amplitude resonance. **10**
- b) Write down the three dimensional wave equation and obtain its solution. **8**
- c) Obtain the unit vector along the direction of propagation of a wave, the displacement of which is given by  $\psi(r, t) = a \cos(2x + 3y + 6z - 5t)$ . **2**

P.T.O.



12. a) Starting from the basic laws of electricity and magnetism, derive Maxwell's electromagnetic equations. 10
- b) Show that e.m. waves are transverse in nature. 8
- c) Show that the ratio of magnitudes of electric and magnetic vectors in a plane e.m. wave is a constant. 2

### Module – II

13. a) Define packing factor of a crystal. Obtain the values for simple cube, body centred cube and face centred cube. 8
- b) Sketch the crystal planes (100), (110), (111) and (112). 4
- c) Derive an expression for interplanar spacing in cubic crystal. 8
14. a) Explain the concepts of length contraction and time dilation. Obtain their expressions. 10
- b) Calculate the speed at which the mass of an object becomes three times its rest mass. 4
- c) Explain Meissner effect. Give some applications of superconductors. 6

### Module – III

15. a) Derive cosine law. Write down the conditions for brightness and darkness in the reflected system. 10
- b) The diameter of the 5<sup>th</sup> bright ring in Newton's ring experiment is  $4 \times 10^{-3} \text{m}$ . Find the radius of curvature of the lens used, if the wavelength of light is 589 nm. 2
- c) Explain the diffraction in a plane transmission grating. Obtain the grating equation. 8
16. a) What is double refraction ? Explain the construction and working of a Nicol prism. 10
- b) Describe the method of production of ultrasonic waves by a magnetostriction oscillator. 7
- c) Write a short note on non-destructive testing using ultrasonic waves. 3



**Module – IV**

- 17. a) Write down the Schrodinger equation for a particle in a box and obtain the energy eigen values and normalized wave functions. **10**
  - b) What is tunnel effect ? **2**
  - c) Give the postulates of Fermi-Dirac statistics. Obtain an expression for fermi energy. **8**
  - 18. a) Distinguish between spontaneous emission and stimulated emission. **4**
  - b) With a neat figure and energy level diagram, explain the working of a Helium-Neon laser. **10**
  - c) Explain the recording and reading of a hologram. **6**
-