Reg. No. : ....

Name : ....

Combined First and Second Semester B.Tech. Degree Examination, May 2015

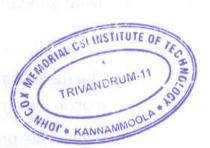## (2013 Scheme)

13.102 : ENGINEERING PHYSICS (ABCEFHMNPRSTU)

Time : 3 Hours   Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **2** marks.

1. Define simple harmonic motion.

2. Distinguish between longitudinal and transverse waves.

3. What are Miller indices ?

4. What is Meissner effect ?

5. Write an expression for the condition of minima in the case of interference in thin films in reflected system.

6. What is the criterion for diffraction to happen ?

7. Calculate the thickness of a quarter wave plate for a wavelength of 589 nm. The refractive indices for ordinary and extra ordinary rays are 1.544 and 1.554 respectively.

8. What is meant by de-Broglie's wave-particle duality ?

9. Define microstate and macrostate.

10. Explain the reconstruction process of a hologram.

PART – B

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

Module – I

11. a) Show that the displacement of a simple harmonic oscillator is given by $y = a \sin(\omega t - \phi)$ and explain the significance of a, ω and ϕ. 7

   b) Derive Maxwell's equations in differential form. 7

   c) What are forced vibrations ? Give three examples of forced vibrations. 6

12. a) Using Maxwell's equations establish the wave equation for electric and magnetic field in free space. 8

   b) Derive one dimensional wave differential equation. 8

   c) What is meant by resonance ? Give examples. 4

Module – II

13. a) The mean life of meson is 2×10^{-5} seconds. Calculate mean life of meson moving with a velocity 0.8 C. 5

   b) Explain the properties of Type I and Type II superconductors with suitable diagrams and examples. 7

   c) Find the packing fraction of a simple cubic lattice. Also find the ratio $d_{100} : d_{101} : d_{111}$ in a simple cubic lattice. 8

14. a) Write a note on :

   i) Critical temperature

   ii) High temperature super conductors

   iii) BCS theory of superconductivity. 7

   b) Define atomic packing factor. Find atomic packing factor for simple cubic, body centred cubic and face centred cubic crystals. 9

   c) What is the length of a one metre stick moving parallel to its length when its mass is 1.5 times of its rest mass ? 4

Module – III

15. a) Describe the construction and working of a Nicol prism. 7

b) Derive the grating equation. 4

c) Define piezo-electric effect. Describe the production of ultrasonic waves by piezo-electric method. 9

16. a) Derive an expression for fringe width in the case of Air-wedge using theory of thin film interference in reflected system. How do you determine the thickness of a human hair by Air-wedge method ? 12

b) Describe the construction and working of Quarter Wave Plate. 4

c) Distinguish between positive and negative doubly refracting crystals. 4

Module – IV

17. a) Describe the principle, construction and working of Helium-Neon laser. 8

b) State and explain Heisenberg's uncertainty principle in two forms. 4

c) Solve the Schrödinger equation for a particle enclosed in a one dimensional rigid box of side L. Obtain its Eigen values. 8

18. a) Explain meta-stable state, population inversion and optical pumping with reference to ruby laser. 6

b) Discuss energy distribution of free electrons in metals. Derive an expression for Fermi energy. 10

c) An electron has speed of 500m/s with an accuracy of 0.005%. Calculate the uncertainty with which we can locate its position.
$h = 6.624 \times 10^{-34}$ Js, and $m = 9.1 \times 10^{-31}$ kg. 4