15U607 (Pages: 2) Name: …………..……….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH 2018
(CUCBCSS-UG)
CC15U PH6 B11 - SOLID STATE PHYSICS, SPECTROSCOPY AND LASER PHYSICS
Physics - Core Course
(2015 Admission)

Time: Three Hours   Maximum: 80 Marks

Section A
(Answer in one or phrase each)
Answer *all* questions. Each question carries **1** mark.

1. Effective number of atoms per unit cell of BCC lattice are ------------------
2. Unit cell of NaCl is ------------------ cubic
3. Methyl fluoride is a ------------------ symmetric top molecule
4. Raman effect is an optical analog of ------------------
5. Pumping inside a ruby laser is ------------------

Question numbers 6-10, state whether true or false:

6. Rotational energy of a molecule is greater than its vibrational energy.
7. Divergence is one property of a LASER beam.
8. Braggs law is a consequence of a specific property of x ray.
9. Raman stokes lines are having longer wavelength than antistokes lines.
10. Superconductors can carry persistent currents.

(10x1= 10 Marks)

Section B
(Answer in two or three sentence each)
Answer *all* questions. Each question carries 2 marks.

11. What is a unit cell?
12. What if meant by coordination number.
13. Distinguish between Type I and Type II superconductors.
14. Why x-rays are used for studying crystals.
15. Discuss how intensity of lines vary in Raman Spectra.
16. What is resolving power of a spectrometer.
17. Explain the anharmonic nature of molecules.

(7x2= 14 Marks)

Section C
(Answer in a paragraph of about half a page to one page each)
Answer any *five* questions. Each question carries 4 marks.

18. Explain the terms lattice, basis and crystal structure. How are they related?
19. Identify the seven crystal systems.

20. Write a note on crystal structure determination using X rays.

21. What are cooper pairs. How are they formed in superconductors?

22. Describe the factors influencing the intensity of spectral lines.

23. Explain the effect of isotope on the energy levels and rotational spectrum of a diatomic molecule.

24. Explain the advantages of four level Lasers over three level Lasers.

(5x4= 20 Marks)

Section D

(Problems: write all relevant formula, all important steps carry separate marks)
Answer any *four* questions. Each question carries 4 marks.

25. Prove that c/a ratio for an ideal HCP structure is 1.663

26. Calculate the packing factor for FCC lattice.

27. The atomic radius of molybdenum atom is 0.1363nm. compute the interplanar spacing for (111) set of planes in the crystal. The crystal structure is BCC. What is the interplanar spacing for (220) set of planes.

28. Lead in superconducting state has a critical temperature of 6.2K at zero magnetic field and a critical field of 0.624T at 0K. Determine field at 4K.

29. Light of wavelength 1.5 micrometre incident on a material with a characteristic Raman Frequency of $20X10^{12}$ Hz results in a stokes line. What is the shift in wavelength of the stokes line.

30. The average line spacing between successive rotational lines of CO molecule is 3.8626 cm^{-1} . Determine the transition which give the most intense line.

31. Estimate whether amplification and hence laser action is possible using a radiation of wavelength 600nm irradiated on medium at a temperature of 400K.

(4x4= 16 Marks)

Section E

(Essays: answer in about two pages each)
Answer any *two* questions. Each question carries 10 marks.

32. What are Miller indices? Explain their importance. How the orientation of a plane is specified by Miller indices.

33. What is superconductivity? Discuss the salient features superconductivity. Mention two important applications of superconductivity.

34. Discuss the principle , construction and working of ruby laser.

35. Discuss the theory to determine rotational constant from the P and R contour of the IR spectra o a diatomic vibrating rotator.

(2x10= 20 Marks)

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