Question bank on Atomic and Molecular spectroscopy
(5th semester KNU)

Short questions:
1. Determine the values of J for S=1 and L=3.
2. Define quantum state of an electron.
3. What do you mean by pure rotational spectrum of a molecule?
4. What are Stoke's and anti-Stoke's line in Raman effect?
5. Give any two limitations of Bohr's theory.
6. Define reduced mass of a diatomic molecule.
7. Write down the names of molecular spectra.
8. Define multiplicity of an atomic state.
9. Why is the sodium D-line is a doublet?
10. Why do molecules show band spectra rather than line spectra?
11. Why is pure vibrational spectra observed only in liquids?
12. Explain the meaning of different quantum numbers which specify the state of an electron in an atom.
13. Give any two applications of Raman spectroscopy.
14. State and explain Pauli's exclusion principle.
15. What do you mean by Larmour precision?
16. Define Bohr magneton.
17. What does the acronym LASER stand for?
18. What are the differences between laser light and normal light?
19. What do you mean by spontaneous emission and stimulated emission?
20. What is population inversion?

Broad answer type questions:
1. Obtain an expression for the rotational level of a rigid diatomic molecule.
2. Show that the vibrational energy levels of a diatomic molecule are given by an expression
   $E_v = (v+\frac{1}{2})\frac{h}{2\pi}\sqrt{\frac{k}{\mu}}$, where the symbols have their usual meanings.
3. Distinguish between Raman and Rayleigh lines.
4. Explain with vector diagrams L-S coupling scheme for two valence electron system using neat vector diagram.
5. What are selection rules? Describe selection rules in connection with different quantum numbers and mention uses of selection rules.
6. Describe the experimental arrangement to describe Raman spectra.
7. If L=2 and S=1/2 then write the atomic states.
8. Discuss the concept of space quantization and draw the vector diagram of space quantization of orbital angular momentum for l=4.
9. Discuss the principle of operation of a He-Ne laser. Explain the role of metastable state in any laser system.
10. Draw a neat sketch of Ruby laser. Discuss the operation of a Ruby laser with the help of energy level diagram. Mention some important uses of Ruby laser.
11. What are Einstein's A and B co-efficients? Find their relation. Why is population inversion required in laser action?