

## Assignment Physics Paper 302

### Unit – 1

#### Atomic Molecular Spectra

1. Discuss the salient features of pure rotational spectra.
2. Describe a suitable experimental arrangement for the study of pure rotational spectra of a diatomic molecule.
3. Explain how the moment of inertia of the molecule may be determined from such studies.
4. Discuss the molecular requirement for rotational spectra.
5. Discuss the salient features of vibrational rotational spectra.
6. Discuss the study of vibrational spectrum of diatomic molecules unable to determine anharmonicity constants.
7. Discuss the vibrational frequency and force constant for anharmonic oscillator.
8. Discuss in detail how the fine structure of infrared spectra can be explained by considering molecule as vibrating rotator.

### Unit – 4

#### Solid State Physics

##### Chapter : Elastic constants and Elastic waves

1. Define stress, strain and elasticity. Write their unit and dimension. Explain stress and strain components for cubic crystals. Write the equation for elastic stiffness constants  $C_{ij}$  and elastic compliance constants  $S_{ij}$ .
2. Consider three orthogonal vectors embedded in a solid body. Write the expressions for new vectors after deformations in the terms of old vectors, and deformation co-efficient. Explain with necessary expressions, the displacement of deformation and hence obtain the expressions for dilation in terms of strain components.
3. Obtain expression of Elastic energy density for cubic crystal.
4. Write the stress components of a homogeneous continuous elastic medium as linear functions of strain components. Prove with the help of elastic energy density and symmetry arguments that for a cubic crystal 36 elastic stiffness constants reduce to three independent ones.
5. Obtain the equations of motion of an element of volume in the crystal in terms of elastic stiffness constants. (b) Obtain the solution of this equation for the wave propagating along [100] direction. (c) Discuss elastic waves propagating along [110] direction.
6. Write Short Note On (a) Dilation. (b) Bulk Modulus.
7. Derive wave equation for elastic waves propagating in cubic crystals.
8. Derive wave equation for elastic waves propagating along [100] direction in a cubic crystal. Derive wave equation for elastic waves propagating along [110] direction in a cubic crystal.

## Assignment Questions (1 Marks) T.Y.B.Sc. Paper - 302

### Unit – 1

#### Chapter - 1

##### Types of Molecular Energy States and Molecular - Spectra.

- Give the name of types of molecular spectra.
- In which region pure-rotational spectra is produced?
- What is the spectral range of far infrared region?
- Which molecules give pure rotational spectra?
- In which region vibrational rotational spectra is produced?
- Which molecules give vibrational Rotational spectra?
- How many types of electronic spectra?
- In which region electronic spectra are produced?
- What is band-head?
- Which molecules give electronic spectra?
- When absorption electronic spectra is produced?
- When emission electronic spectra is produced?

#### Chapter - 2

##### Pure-Rotational Spectra.

- What is electric dipole moment?
- Why heteronuclear diatomic molecules gives pure-rotational spectra?
- Which quantity gives the value of moment of inertia and internuclear distance of the molecules?

#### Chapter - 3

##### Vibrational - Rotational Spectra

- Why homonuclear diatomic molecules not gives vibrational - rotational spectra.
- Which quantity is necessary for an interaction with the oscillating electric field of radiation.
- What is 'null line' or 'zero gap'?
- What is 'electrical anharmonicity'?
- What is 'mechanical anharmonicity'?
- Give the expression of classical frequency.
- What is vibrational constant?
- Mention anharmonicity constant.
- Write the equation of classical vibrational frequency for a harmonic oscillator.
- What is  $W_e$  ? Or which quantity represents the vibrational frequency.

From which motion, we can obtain force-constant  $k$ ?

What is selection rule?

When we get R-branch?

When we get P-branch?

What is 'band-origin'?

## **Unit - 4**

### **Chapter - Elastic constants & Elastic waves**

- Explain meaning of homogeneous medium
- Give few applications of elastic waves in study of solid state physics.
- What happens to solids when suitable forces are applied on them?
- What is meant by elasticity?
- By which two physical quantities we can explain property of elasticity easily?
- Define stress.
- Define strain.
- Define Dilation.
- State Hook's law.
- Explain tensile & shearing stress.
- What is bulk modulus?
- Give unit of bulk modulus.
- Give dimensions of elastic compliance constants.
- Give dimensions of elastic stiffness constants.
- What is elastic energy density?