

B.Sc. Semester - 6 (CBCS) Examination

March/April -2020

SPECTROSCOPY AND APPLIED OPTICS (CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
 2. Figures to the right indicate marks.
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1. (a) Answer any one question: 07
- (1) Explain classical interpretation of normal Zeeman effect.
 - (2) Write a note on "Paschen – Back Effect".
- (b) Attempt any one: 04
- (1) The radiation given off by excited Hg atoms returning to their ground state gives a spectral line at $2537 \text{ \AA}$. Find the corresponding photon energy.
 - (2) Explain space quantization.
- (c) Attempt any three: 03
- (1) When a single spectral line is split up into three components is known as _____ Zeeman effect.
 - (2) Write the wavelength range of visible spectrum.
 - (3) A free atom is normally in its higher energy state. (True/False)
 - (4) In a _____ effect, the effect of electric field on spectral lines is studied.
 - (5) _____ quantum number is denoted by l .
2. (a) Answer any one question: 07
- (1) Explain classical theory of Raman effect.
 - (2) Explain the theory of pure rotational spectra.
- (b) Attempt any one: 04
- (1) The moment of inertia of the CO molecule is $1.46 \times 10^{-46} \text{ kg m}^2$. Calculate the energy in eV. ($m_r = 1$)
 - (2) Give the application of Raman effect.
- (c) Attempt any three: 03
- (1) _____ is the most complex of molecular spectra.
 - (2) Raman spectrum consists _____ line when $\Delta\nu$ is negative.
 - (3) The rotational spectra are observed for _____ di-atomic molecules.
 - (4) Raman shift is given by $\Delta\nu =$ _____.
 - (5) In rotational vibrational spectra, near infrared radiation is absorbed. (True/False)
3. (a) Answer any one question: 07
- (1) Explain construction and working of He-Ne laser.
 - (2) Explain with neat diagram absorption, spontaneous emission and stimulated emission of radiation.
- (b) Attempt any one: 04
- (1) Discuss: Laser in industry.
 - (2) Explain: Recording of hologram.

- (c) **Attempt any three:** 03
- (1) In Ruby laser, active centres are _____ ions.
 - (2) Nd-YAG laser is gas laser. (True/False)
 - (3) In which process light amplification occur?
 - (4) What is output frequency of Ruby laser?
 - (5) Laser light is said to be _____, which means that the wavelengths of the laser light are in-phase.
4. (a) **Answer any one question:** 07
- (1) Explain: Brillouin zones.
 - (2) With neat diagram, explain Bragg's spectrometer.
- (b) **Attempt any one:** 04
- (1) Find the wavelength of 2nd order X-rays by NaCl crystal at an angle of 5°. The grating element of NaCl crystal is 2.81 Å
 - (2) Write the properties of X-rays.
- (c) **Attempt any three:** 03
- (1) Write equation of Bragg's law.
 - (2) X-rays doesn't produce chemical effect on photographic plate. (True/False)
 - (3) The intensity of reflected beam increases as the order of spectrum increases. (True/False)
 - (4) In Coolidge tube, a block of _____ metal is used as a target.
 - (5) Who discovered X-rays?
5. (a) **Answer any one question:** 07
- (1) Explain single mode fibre, step index and graded index multimode fibre.
 - (2) Derive an expression for acceptance angle of the optical fibre.
- (b) **Attempt any one:** 04
- (1) Calculate the numerical aperture of an optical fibre, with a clad index of 1.50 and core index of 1.55.
 - (2) Give medical applications of optical fibre.
- (c) **Attempt any three:** 03
- (1) The innermost cylindrical region of optical fibre is known as _____.
 - (2) Optical fibre works on the principle of _____.
 - (3) Numerical aperture decides light gathering ability of the optical fibre. (True/False)
 - (4) _____ converts a non-electrical message into an electrical signal.
 - (5) The angle of incident for which the angle of refraction is 90°, is called _____.
