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Seat No. _______________

HB-003-1016033

B. Sc. (Sem. VI) (CBCS) (W.E.F. 2016) Examination

April - 2023

Physics : P-603

(Spectroscopy & Applied Optics)

(Old course)

Faculty Code : 003

Subject Code : 1016033

Time : $2\frac{1}{2}$ / Total Marks : **70**

Instructions :

(1) All questions are compulsory.

(2) Symbols have their usual meaning.

(3) Numbers on the right side indicate marks.

1 (a) Answer following objective questions : (1 mark each) **4**

(1) In normal Zeeman effect, π-component can be observed in parallel view (True/False)

(2) In Zeeman effect two ______ polarized line can be observed.

(3) Molecular state of spectral source gives _____ spectra.

(4) Heated spectral source gives discontinuous spectra.

(b) Answer any one question : **2**

(1) What is stark effect ?

(2) Explain space quantization.

(c) Answer any one question : **3**

(1) Explain spin quantum number.

(2) Explain Paschen-back effect.

(d) Answer any one in detail : **5**

(1) Write a note on vector atom model.

(2) Explain vector atom model and normal Zeeman effect.

2 (a) Answer following objective questions : (1 mark each) **4**

(1) In Raman spectra, when $\Delta\nu$ is positive such spectral line is known as ______ line.

(2) Rotational vibrational spectra, falls near infra-red radiation. (True/False)

(3) In Raman spectra, lines of same frequency as the incident beam is known as _____ lines.

(4) Raman shift depends upon incidence frequency. (True/False)

(b) Answer any one question : **2**

(1) Define stokes and anti-stokes line in terms of Raman shift.

(2) Give any two differences between Raman and Fluorescence spectra.

(c) Answer any one question : **3**

(1) Define the types of molecular spectra.

(2) Explain only experimental setup of Raman spectra with schematic diagram.

(d) Answer any one in detail : **5**

(1) Explain pure rotational spectra.

(2) Explain quantum theory of Raman effect.

3 (a) Answer following objectives questions : (1 mark each) **4**

(1) Spontaneous emission is dependent on incident light energy. (True/False)

(2) In stimulated emission, σ_{21} is known as ______

(3) He-Ne Laser is a solid state Laser (True/False)

(4) The process A+hf $\rightarrow$ A* is represents the _____ emission.

(b) Answer any one question : **2**

(1) Mention the three properties of LASER.

(2) What is metastable state ?

(c) Answer any one question : **3**

(1) Discuss the principle of Holography.

(2) Explain three level pumping scheme.

(d) Answer any one in detail : **5**

(1) Explain Stimulated emission.

(2) Derive the condition for stimulated emission to dominate spontaneous emission.

4 (a) Answer following objective questions : (1 mark each) **4**

(1) X-ray can be used to study crystal structures because wavelength of X-ray is of the order of ______.

(2) There are two types of X-rays produced in X-ray tube, _____ X-ray and ____ X-ray.

(3) Bragg's law is _______.

(4) Height of the peak ___ with increase in potential difference to produce continuous X-ray.

(b) Answer any one question : **2**

(1) Give four features continuous X-ray spectrum.

(2) Find out θ for first order X-ray reflection obtained with X-ray having $1\overset{o}{A}$ wavelength and interplanar spacing of $1\overset{o}{A}$ for particular sets of plane.

(c) Answer any one question : **3**

(1) Give the six important properties of X-rays.

(2) Explain characteristic X-rays.

(d) Answer any one in detail : **5**

(1) Explain Laue spot method.

(2) Explain Bragg's law.

5 (a) Answer following objective questions : (1 Mark each) **4**

(1) In Graded index fiber, path length of different modes is compensate by constant velocity of light within the different refractive index. (True/False)

(2) _____ decides light gathering ability of the optical fiber.

(3) Optical fiber is a cylindrical wave guide. (True/False)

(4) In order to guide light ray effectively through a fiber, what should be the value of Δ ?

(b) Answer any one question ; **2**

(1) What is fractional refractive index ?

(2) What is 'modes of propagation' ?

(c) Answer any one question : **3**

(1) Explain intramodal dispersion.

(2) Define numerical aperture and derive its expression.

(d) Answer any one in detail : **5**

(1) Derive expression of an acceptance angle of the optical fiber.

(2) Explain graded index fiber with its characteristics, advantages and disadvantages.