



**RZ-003-1016033**

Seat No. \_\_\_\_\_

**B. Sc. (Sem. VI) (CBCS) Examination**

**March - 2019**

**Physics : 603**

**(Spectroscopy & Applied Optics)  
(New Course)**

**Faculty Code : 003**

**Subject Code : 1016033**

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

- Instructions :** (1) All questions are compulsory.  
(2) Numbers on right side indicate marks.  
(3) Symbols have their usual meanings.

- 1 (a) Answer following objective questions : (1 mark of each) **4**
- (1) Emission spectra are divided in two types namely (i) \_\_\_\_\_ and (ii) \_\_\_\_\_.
  - (2) Higher the principle quantum number means lesser the binding energy of an electron. (true/false)
  - (3) In a stark effect, the effect of \_\_\_\_\_ on spectral lines is studied.
  - (4) In Paschen-Back effect, weak magnetic field is used (true/false).
- (b) Answer any **one** question : **2**
- (1) The series limit wavelength of Balmer series of hydrogen spectrum is  $3636 \text{ \AA}$ . Calculate the value of Rydberg constant.
  - (2) Under uniform magnetic field of 4 webers/metre<sup>2</sup> find  $\Delta v$  for normal Zeeman splitting.
- (c) Answer any **one** question : **3**
- (1) Explain a spin quantum number.
  - (2) Draw the experimental arrangement for studying Zeeman effect.

- (d) Answer any one in detail : 5
- (1) Explain magnetic moment of an atom and Lande's g factor.
  - (2) Explain vector atom model and normal Zeeman effect.
- 2 (a) Answer following objective questions : (1 mark of each) 4
- (1) A vibrational rotation band arises due to transition between two vibrational levels of the same electronic level. (true/false).
  - (2) In rotational vibrational spectra, near infra-red radiation is absorbed (true/false).
  - (3) In Raman spectra, lines of same frequency as the incident beam is known as \_\_\_\_\_.
  - (4) The intensity of stokes and anti-stokes lines can be explained on the basis of classical theory. (true/false).
- (b) Answer any one question : 2
- (1) Vibration transition occurs with energy change of  $1.6 \times 10^{-20}$  erg/mole, calculate the frequency of radiation [ $h = 6.6 \times 10^{-34}$  m<sup>2</sup> kg/s,  $c = 3 \times 10^8$  m/s].
  - (2) The exciting line in Raman spectra is  $5480 \text{ \AA}$  and stokes line is at  $5530 \text{ \AA}$ . Find out the Raman shift.
- (c) Answer any one question : 3
- (1) Give salient features of rotational vibrational spectra.
  - (2) Give the difference between Raman spectra and fluorescence spectra.
- (d) Answer any one in detail : 5
- (1) Explain pure rotational spectra.
  - (2) Explain classical theory of Raman effect.

- 3 (a) Answer following objective questions : (1 mark of each) 4
- (1) What are the three basic radiation processes?  
(i) \_\_\_\_\_ (ii) \_\_\_\_\_ and (iii) \_\_\_\_\_.
  - (2) In stimulated emission,  $\sigma_{21}$  is known as \_\_\_\_\_.
  - (3) He-Ne Laser is a solid state Laser (true/false).
  - (4) In ND:YAG Laser, YAG stands for \_\_\_\_\_.
- (b) Answer any one question : 2
- (1) Find the approximate area of laser spot with wavelength  $\lambda = 5 \times 10^{-5}$  cm, focal Length 10 cm and radius of lens is 5 cm [area =  $\pi(\lambda f/a)^2$ ]
  - (2) If laser beam area is  $7.85 \times 10^{-3}$  cm<sup>2</sup> and luminous flux is 0.16 lumens then find out brightness of laser beam.
- (c) Answer any one question : 3
- (1) Explain electrical pumping.
  - (2) Explain principle of Holography.
- (d) Answer any one in detail : 5
- (1) Explain semiconductor laser.
  - (2) Explain Ruby laser.
- 4 (a) Answer following objective questions : (1 mark of each) 4
- (1) X-ray can be used to study crystal structures because wavelength of x-ray is of the order of \_\_\_\_\_.
  - (2) Deacceleration of electron produces x-rays. (true/false).
  - (3) Bragg's law is \_\_\_\_\_.
  - (4) In a powder method, polycrystalline powder sample is used (true/false).
- (b) Answer any one question : 2
- (1) Calculate the minimum voltage that must be applied to produce x-rays of  $2\text{\AA}$  wavelength.
  - (2) Find out  $\theta$  for x-ray diffraction pattern obtained with x-ray having  $1\text{\AA}$  wavelength and interplanar spacing of  $2.35\text{\AA}$  for particular sets of plane.

- (c) Answer any one question : 3
- (1) Give the few important properties of x-rays.
  - (2) Explain diffraction of x-rays.
- (d) Answer any one in detail : 5
- (1) Explain powder diffraction method.
  - (2) Explain rotating crystal method.
- 5** (a) Answer following objective questions : (1 mark of each) 4
- (1) Optical fibre works on principle of total internal reflection. (true/false).
  - (2) \_\_\_\_\_ decides light gathering ability of the optical fibre.
  - (3) Write down Snell's law.
  - (4) In order to guide light ray effectively through a fibre, what should be the value of  $\Delta$ ?
- (b) Answer any one question : 2
- (1) Calculate numerical aperture of an optical fibre with a refractive index of core 1.6 and cladding 1.56.
  - (2) Find out the propagation angle of an optical fibre having refractive index of core and cladding 1.6 and 1.56, respectively.
- (c) Answer any one question : 3
- (1) Explain multimode step index fibre.
  - (2) Give merits of optical fibre.
- (d) Answer any one in detail : 5
- (1) Derive expression of an acceptance angle of the optical fibre.
  - (2) Explain attenuation in optical fibre.