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B.SC DEGREE EXAMINATIONS SECOND SEMESTER 2017/2018 ACADEMIC SESSION

**COURSE CODE: PHY 412**

**COURSE TITLE: ATOMIC AND MOLECULAR SPECTROSCOPY**

**DURATION: 1 HR: 30 minutes**

**ANSWER THREE (3) QUESTIONS ONLY.**

**HOD's SIGNATURE**

**Question one.**

- (i) Explain four postulates of Bohr's theory of atomic structure?
- (ii) Derive an expression of the radius of the permitted orbit  $r = \epsilon n^2 h^2 / \pi m e^2$ .

**Question two**

(i) Briefly describe the Sommerfeld's extension of Bohr theory of atom?

(ii) Hydrogen atom in its ground state is excited by means of a monochromatic radiation of wavelength  $970.6 \text{ \AA}$ . How many different wavelengths are possible in the resulting emission spectrum? Find the longest wavelength amongst these.

**Question three**

- (i) Describe two types of nuclear effects that produces hyperfine structure of spectral lines when examined under instruments of highest possible resolution.
- (ii) On the basis of vector atom model show that the possible values of the total angular momentum of f electron are  $3\sqrt{7}/2 h/2\pi$  and  $\sqrt{35}/2 h/2\pi$

**Question four**

- (i) Explain both the longitudinal and transverse views of Zeeman effect?
- (ii) Show that the normal Zeeman splitting of the line  $6438 \text{ \AA}$  in a magnetic field of  $0.5 \text{ T}$  is  $0.097 \text{ \AA}$ .

**Question five**

- (i) What is optical pumping?
- (ii) Describe optical resonators with suitable diagram.