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DATE: 11-04-2017

**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27**

**Semester Exam (Supplementary), April 2017**

**M.Sc. Physics, IV Semester**

**PH 0113 - Experimental Physics**

**(*For supplementary candidates only)***

***Attach this question paper with the answer script***

**Note: The maximum marks for this question paper is 70. It will be converted to 100 marks and entered in the student's account.**

**Max. Time:2 Hours 30 Minutes Marks:70**

**This paper contains no parts and 2 printed pages.**

Answer any **7** questions. Each question carries **10** marks. **(7X10=70)**

Q1. a) In a simple cubic lattice, all the planes give diffraction peaks but in BCC and FCC crystalsonly some planes give diffraction peaks. Explain how is it determined that which planes will giverise to diffraction peaks.

b) A gas filled GM detector tube has a guaranteed lifetime of 1010 counts. For how many years will the counter work if it works 40 weeks a year and on an average 50 hours per week at a rate of 1000 counts per minute. (7+3)

Q2. Explain the performance characteristics of a grating monochromator. (10)

Q3. The actual observed Infra-red spectrum of a diatomic molecule deviates from the expected ideal spectrum of this molecule. How are the two spectra different? With theory,elaborate how the observed spectra was explained. (10)

Q4. a) Explain the construction and theory of interference filters.

b) Explain the working of deuterium lamps as a source of UV radiations. (5+5)

Q5. Draw a neat block diagram of a scintillation detector system and explain how electrons are produced due to the radiation from the radioactive source in the detector that you have used in your lab. (10)

Q6. a)Why are X-rays used for crystal structure analysis and not visible rays?

b) Will the characteristic X-ray spectrum of zinc in ZnO and ZnS be different? Explain.

c)With suitable selection rules, draw the energy level diagram and transitions for the characteristic X-ray spectrum for the first three sub-shells (K,L,M). (2+2+6)

Q7. Highlighting the drawbacks of classical theory, describe the classical and quantum theory of Raman scattering. (10)

PH-0113-A-17

Q8. a) Compare the various imaging modes of Atomic Force Microscope in terms of their mode of operation, the regime in which they operate, cantilever geometry, spring constant and probe tips.

b) Explain the lens system assembly used in Transmission Electron Microscope. (6+4)

Q9 a) What is the principle of working of Scanning Tunnelling Microscope? What are the factors on which tunnelling current depends?

b) How is the sample preparation done for non-conducting samples in Scanning Electron Microscope.

c) Why is lift height mode of scanning used in Magnetic Force Microscope?

(6+2+2)

Q10. a)A photometer with a linear response to radiation gave a reading of 498 mV with the solvent in the light path and 256 mV when the solvent was replaced by an absorbing solution. The photometer was set to zero with no light striking the detector. Calculate (a) the percent transmittance and absorbance of the absorbing solution (b) the expected transmittance if the concentration of absorber is one half that of the original solution.

b) A proton has resonance 90 Hz downfield from TMS when the field strength is 1.41 Tesla and the oscillator frequency is 60 MHz. What will be the shift in Hertz and in parts per million (δ) if the field strength is increased to 2.82 Tesla and oscillator frequency to 120 MHz? (5+5)