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## DEPARTMENT OF SCIENCES, III SEMESTER M.Sc (PHYSICS)

## END SEMESTER EXAMINATIONS, NOVEMBER 2019

## SUBJECT: EXPERIMENTAL METHODS IN PHYSICS [PHY-5105] (REVISED CREDIT SYSTEM-2017)

Time: 3 Hours	Date: 20-11-2019	MAX. MARKS: 50					
Note: (i) Answer AL	L questions						
(ii) Draw diagra	ams, and write equations wherever necessa	ary					
Physical constants: sp	Physical constants: speed of light in vacuum $c=3x10^8$ m/s; electron charge = $1.6x10^{-19}$ C;						
Electron mass $= 9.1 x 1$	$0^{-31}$ Kg. Planck's constant = $6.63 \times 10^{-34}$ Js						

1.

- a) What are (a) systematic errors (b) Random errors? How do you distinguish them. Write a note on error propagation. [5]
- b) By the method of least square, fit a curve of the form  $y = ax^b$  to the following data: Calculate the uncertainty in the measurement of y. [5]

X	2	3	4	5
У	27.8	62.1	110	161

2.

- a) What are positive displacement pumps? With necessary diagrams, explain the working principle of rotary vane pump. [5]
- b) A bridge is balanced at 1000 Hz and has the following constants. AB, 0.2  $\mu$ F pure capacitor; BC, 500  $\Omega$  pure resistor: CD, unknown: DA, R=300  $\Omega$  in parallel with C=0.1  $\mu$ F. Find the R and C or L constants of arm CD, considered as a series circuit. [5]

3.	a)	Explain Hall effect and derive an expression for the Hall coefficient.	[5]
	b)	What is a strain gauge? For a metallic bonded strain gauge derive an expression the gauge factor.	for [5]
4.	a)	With a neat diagram, explain the working of a transmission electron microscop	e. [4]
	b)	Briefly explain the working principle of an atomic force microscope (AFM) an mention different modes of operation.	d [4]
	c)	AlK $\alpha$ photons were used for the photoelectric effect to find the maximum kin energy of the photoelectrons ejected from a gold metal. The binding energy of g 4f <sub>7/2</sub> is 84 eV. The work function of gold is 5.5 eV. Based on the parameters give	etic çold ven,

## 5.

a) Explain the working principle of a secondary ion mass spectroscopy. [4]

shell. The wavelength of AlKa radiation is 0.83 nm.

calculate the maximum kinetic energy of the photoelectrons ejected from the 4f

- b) Write a note on interaction volume. Mention the advantages of backscattered detector over the secondary electron detector in scanning electron microscope. [3]
- c) A diffraction pattern in transmission electron microscope is observed at  $(2\theta) = 20^{0}$ . Calculate the interplanar spacing associated with the diffraction spot. The electrons are accelerated with a potential of 60 kV. Assume the camera length (distance between the specimen and the focal plane) as 200 mm. [3]

[2]