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**L—238—2019**

**FACULTY OF SCIENCE**

**M.Sc. (First Year) (First Semester) EXAMINATION**

**MARCH/APRIL, 2019**

**(CBCS Pattern)**

**CHEMISTRY**

**Paper IV (CH-414)**

**(Physical Methods in Chemistry—I)**

**(Monday, 29-4-2019)**

**Time : 10.00 a.m. to 1.00 p.m.**

*Time—3 Hours*

*Maximum Marks—75*

*N.B. :— (i) Attempt All questions.*

*(ii) Use of calculator and logarithm table is allowed*

1. Attempt any *three* of the following : 15
  - (a) Give an account of symmetry elements with examples.
  - (b) Explain RAM and ROM.
  - (c) Explain algorithms by using chemical concepts.
  - (d) Write down the Miller indices for the plane having intercepts to the crystal axes as :
    - (i)  $(\infty a, -3b, c)$
    - (ii)  $(-3a, 2b, c)$ .
  - (e) Write the character table of  $C_{3v}$  point group.
2. Attempt any *three* of the following : 15
  - (a) State and explain Great Orthogonality theorem.
  - (b) Write down the computer programming for radioactive decay.
  - (c) Calculate the wavelength of X-rays scattered from the sodium chloride crystal with the interplanar spacing 2.821 Å that gives first order reflection at an angle of 20°.
  - (d) Elucidate the structure of simple gas phase molecules with suitable examples using electron diffraction technique.
  - (e) Explain the scattering of neutrons by solids and liquids.

P.T.O.

3. Attempt the following :

(a) How will you develop the programme involving the simple formulation related to :

(i) pH-titration

(ii) Lattice energy of metal halide. 8

Or

Give different steps involved in data processing. Give an account of secondary storage devices.

(b) Explain the Schoenflies symbols for different point groups such as  $C_n$ ,  $C_{nv}$ ,  $C_{nh}$ ,  $D_{nh}$  with suitable examples. 7

Or

Construct character table of  $D_5$  and  $C_{2r}$  point group.

4. Attempt the following :

(a) Explain the structural features of Windows operating system. Write the various commands used in UNIX operating system. 8

Or

Describe Debye-Scherrer method for the structural analysis of crystals using X-rays diffraction. Derive  $n\lambda = 2d \sin \theta$ .

(b) How will you identify unit cells from systematic absences in diffraction pattern ? 7

Or

Explain Wierl equation. Calculate the wavelength of electron beam accelerated by potential difference 20 kilo-volts to produce a diffraction pattern :

$$h = 6.626 \times 10^{-34} \text{ Js, } m_e = 9.1 \times 10^{-31} \text{ kg,}$$

$$\text{Charge of electron} = 1.6 \times 10^{-19} \text{ Coulombs.}$$

5. (A) Select the *correct* alternative from the following MCQs : 5

(i) Cubic point groups are :

(a)  $O, O_h$

(b)  $I, I_h$

(c)  $T, T_d$

(d) All of the above

- (ii) A computer cannot boot if it does not have the :
- (a) Compiler
  - (b) Loader
  - (c) Operating system
  - (d) Assembler
- (iii) The short wavelength region of 62 kV X-ray tube is :
- (a) 0.2 nm
  - (b) 0.02 nm
  - (c) 0.6 nm
  - (d) 0.06 nm
- (iv) The diffraction of electrons by gaseous molecules depends upon the :
- (a) distance between the atoms in a molecule
  - (b) spacing between the layers
  - (c) orientation of electron beam
  - (d) All of the above
- (v) The typical wavelength of neutrons that have reached thermal equilibrium with their surrounding at 373 K is :
- (a) 125 pm
  - (b) 226 pm
  - (c) 300 pm
  - (d) 356 pm

(B) Write notes on any *two* :

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- (i) Input devices
- (ii) Conjugacy relation and classes
- (iii) Magnetic scattering.