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Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2023

(CBCSS)

Physics

PHY3E 05—EXPERIMENTAL TECHNIQUES

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

Section A

Answer **all** *questions, each carries weightage* 1.

1. Explain what is meant by oil suck back in a rotary pump.
2. What are the limitations of RBS technique ?
3. Define thermoelectric power. How is it useful.
4. Explain the principle used in a Tandem Van de Graaff accelerator.
5. Draw the diagram of Pirani gauge and label its parts.
6. Explain laser evaporation technique in thin film deposition.
7. What are the main applications of accelerators ?
8. Write a short note on PIXE.

(8 × 1 = 8 weightage)

Section B

Answer any **two** *questions, each carries weightage* 5.

9. Describe the powder method for X-ray diffraction. Discuss the formation of diffraction pattern on the photographic film.
10. Draw a neat diagram of an oil sealed rotary vacuum pump. Explain the principle and working. Explain the function of the oil.

Turn over

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11. Explain in detail : (a) The principle behind the PIXE technique ; (b) Discuss the instrumentation ; and (c) The merits and limitations of this technique.

12. Discuss what are multi-layer optical filters. Describe their structure and applications.

(2 × 5 = 10 weightage)

Section C

Answer any **four** *questions, each carries weightage* 3.

13. Describe the four probe method to find the thickness of thin films. Obtain the expression for thickness in terms of resistivity.

14. Discuss the principle and working of Cold Cathode Ionization Gauge.

15. The utilized reflecting plane of a lithium fluoride crystal has an inter-planar distance of 2.5 A°. Calculate the wavelength of the 2nd order line which has a glancing angle of 60°.

16. A synchro-cyclotron meant for accelerating deuterons (mass = 2.01478 amu) has a magnetic flux density of 1.43 T and 1.5 T at the orbit and at the centre respectively. Calculate the maximum frequency of the dee voltage and the energy gained by the deuterons. Assume that the dee-voltage frequency is modulated between this maximum and a minimum of 10 MHz.

17. A beam of 10 MeV neutrons is incident on a ^{19}F target producing the nuclear reaction $^{19}F\ (n, p)\ ^{19}O$. If the Q-value of the reaction is – 3.7 MeV, find the energy of the protons that are emitted at 90° to the direction of the incident n-beam.

18. Derive expression connecting impact parameter and angle of scattering in Rutherford scattering process.

19. A proton accelerator consists of 200 drift tubes. The rf electric field has a frequency of 500 MHz. The average potential when the protons cross the accelerating gap is 1.5×10^3 kV. If the protons are injected into the machine at 2 MeV energy, calculate the final energy and the length of the last drift tube.

(4 × 3 = 12 weightage)