D 6729 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2016

(CUCSS)

Physics

PHY 3E 07—EXPERIMENTAL TECHNIQUES

(2012 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*
Each question carries 1 *weightage.*

1. Give an account of thermal evaporation in vacuum.
2. What is meant by adiabatic demagnetization ?
3. What is cyclotron ? Explain the term cyclotron frequency.
4. What are O rings ? Explain its use.
5. Explain the basic principles in the working of diffusion pump?
6. What are magnetic thermometers ? Write its principle.
7. Explain the principle of phase stability in Synchro-Cyclotron.
8. Discuss briefly the hot cathode ionization gauge. Mention its uses.
9. Briefly explain the principle and operation of Kammerlingh Onne's helium liquifier.
10. Explain how a resonance nuclear reaction is useful for depth profiling.
11. Give an account of negative TCR in metallic thin films.
12. Discuss the principle behind ^{3}He-^{4}He dilution refrigeration.

(12 × 1 = 12 weightage)

Section B

Answer any **two** *questions.*
Each question carries 6 *weightage.*

13. Explain in details, the working of a molecular pump and compare it with oil diffusion pump. What is the ultimate pressure obtained by using diffusion Pump ? Suggest the gauges to be used to measure the pressure in this range.
14. What are primary and secondary thermometers ? Give examples. Describe a constant gas volume thermometer and the corrections to be applied to its readings to convert them to the thermodynamic scale.

Turn over

15. Discuss the basic principles of operation of cyclotrons, synchro-cyclotron and synchrotrons. What are the essential differences among them ? What limits the maximum energy obtainable from each ?

16. Explain in details, the principle behind PIXE technique. Discuss the PIXE Instrumentation. Also explain the merit and limitations of this techniques.

(2 × 6 = 12 weightage)

Section C

Answer any **four** *questions.*
Each question carries 3 *weightage.*

17. A calibrated leak of 3×10^{-2}torr/s is admitted into vacuum system. If the Pressure achieved after an extended period of pumping is 5×10^{-5}torr, what is the pumping speed of the pump ?

18. In a thin film of indium tin oxide having a thickness of 50nm, the surface resistance is 40 Ohms if both electrodes were of length 5mm and the distance between the electrodes was 10mm, then calculate the surface receptivity.

19. Find the minimum energy in the laboratory system that a neutron must have in order to initiate the reaction :

$${}_0{}^1n + {}_8{}^{16}O + 2.20MeV \rightarrow {}_6{}^{13}C + {}_2{}^4He.$$

20. A 6MeV alpha particle is scattered by a mercury atom nucleus (Atomic weight = 80) at 120C. Find the minimum approach of the particle to the nucleus and the corresponding kinetic energy of the particle.

21. White light is incident normally on a thin film of refractive index 1.5 and thickness 500nm. At what wavelength(s) in the range 400 to 700 nm will the intensity of the reflected light be maximum.

22. Describe the methods for the liquefaction of hydrogen and helium.

(4 × 3 = 12 weightage)