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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, MAY 2020

Fourth Semester

Faculty of Science

Branch II—Physics—Pure Physics—Open Elective

PH 40 E3/PH 4M E4—Paper IV—THIN FILM AND NANOSCIENCE

(Common with Branch D—M.Sc. Physics—Material Science)

(2012 Admission onwards)

Time : Three Hours Maximum Weight : 30

Part A (Short Answer Questions)

Answer any **six** *questions.*
Weight 1 *each.*

1. What is a Thin Film ? How thin films are different from bulk materials ?
2. What are the steps involved in thin film growth ?
3. What are the *three* different growth modes ?
4. Give *one* example each of zero, one and two-dimensional nano-materials.
5. What type of growth condition favour uniform sized nano-particles ?
6. What is template-directed self-assembly ?
7. What are the merits and demerits of bottom-up and top-down techniques ?
8. Differentiate between Chemical vapour deposition and physical vapour deposition.
9. Discuss the variation of pumping speed with pressure for a rotary pump.
10. What is principle in crystal oscillators thickness monitor ?

(6 × 1 = 6)

Part B (Short Essay/Problems)

Answer any **four** *questions.*
Weight 2 *each.*

11. Explain the principle and working of a turbo molecular pump.
12. What is RF sputtering ? Explain it.

Turn over

13. Describe the optical properties of nano-particles lattices in colloidal suspensions.

14. Differentiate between nucleation stage and epitaxial stage.

15. Compare the particle beam lithography and probe lithography.

16. What are the advantages and disadvantages of solid-state reaction route and sol-gel route ?

(4 × 2 = 8)

Part C (Essay Type Questions)

Answer **all** *questions.*
Weight 4 *each.*

17. Explain Longmuir theory of condensation.

Or

Describe the experimental set-up, for the measurement of electrical conductivity of thin film. Define thermopower and its utility.

18. What is meant by Sputtering ? Describe the different sputtering technique useful for thin film preparation. Explain one such method in detail, giving a neat diagram.

Or

Explain with neat diagram the ellipsometry method to measure the thickness of film.

19. (i) Classify Nano-materials on the basis of shape and size.

(ii) Describe Sol-gel technique for synthesis of nano-materials.

Or

(i) What are Nanotubes ? Describe the Nanotubes.

(ii) Describe the monolayer and multilayer of thin film.

20. Write different pattern replication techniques used in the synthesis of nano-materials.

Or

Write different pattern transfer, enhancement and growth techniques of nano-materials.

(4 × 4 = 16)