2022/TDC (CBCS)/EVEN/SEM/
PHSDSE–601T (A/B)/120

TDC (CBCS) Even Semester Exam., 2022

PHYSICS

(6th Semester)

Course No. : PHSDSE–601T

$\dfrac{Full\ Marks : 70}{Pass\ Marks : 28}$

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Candidates have to answer *either* Option A
or Option B

OPTION—A

Course No. : PHSDSE–601T (A)

(Astronomy and Astrophysics)

SECTION—A

Answer any *twenty* of the following as directed :

1×20=20

1. What is the declination of north celestial pole?

2. What will be the colatitude for the latitude ϕ?

3. Name the points of intersection of the ecliptic and the celestial equator.

(*Turn Over*)

(2)

4. What is the duration of sidereal day in solar time?

5. What will be the hour angle of a star when it is on the observer's meridian?

6. What does the light gathering power of a telescope depend on?

7. What is the wavelength range of optical window?

8. What are the two factors in determining the magnification of a telescope?

9. What is f-ratio of a telescope?

10. Give one example of space telescope.

11. What is the value of solar radius?

12. What is the surface layer of the sun called?

13. What is the approximate temperature of the sunspot?

14. Which solar planet has the largest mass?

15. Which solar planet has the shortest period of revolution?

16. What is the radius of Milky Way?

(3)

17. What is the approximate distance of our solar system from the centre of our galaxy?

18. What are lenticular galaxies?

19. What is the inclination of the plane of Milky Way galaxy to the celestial equator?

20. The stars found in the disc of the Milky Way are mostly population I stars.

(State True or False)

21. What is the latest measured value of Hubble's constant?

22. The brightness of Cepheid variable stars is a periodic function of time.

(State True or False)

23. Name one Cepheid variable star.

24. Dark matter shows itself up only through the gravitational effect.

(State True or False)

25. Write one use of Cepheid variables.

SECTION—B

Answer any *five* of the following questions : 2×5=10

26. Define equation of time.

27. What is a spherical triangle?

28. Define resolving power of a telescope.

29. Write two uses of detectors when they are used with telescopes.

30. Define sunspot.

31. What is the effect of superposition of tidal forces?

32. Distinguish between stars of population I and II.

33. What is the nature of rotation of the Milky Way disc?

34. State the virial theorem.

35. What is dark matter?

SECTION—C

Answer any *five* of the following questions :   8×5=40

36. *(a)* Draw the celestial sphere and label—zenith, nadir, celestial poles, celestial meridian, celestial equator and ecliptic.   3

    (b) Explain briefly the equatorial coordinate system.   5

(Continued)

37. *(a)* Define local sidereal time, apparent and mean solar time.   3

    (b) Calculate local sidereal time (LST) of Silchar on 23rd March, 2022 at 8 p.m. Given longitude of Silchar = 92°47′29″ E.   5

38. Discuss focal arrangement for different reflecting telescopes with the help of diagrams.

39. What are the two principal types of telescope mounting? Discuss with the help of a diagram the equatorial mounting.

40. Discuss in brief the solar atmosphere.

41. What is H–R diagram? Explain why the H–R diagram is the single most important diagram for studying stars in astronomy.   2+6=8

42. Describe Hubble's morphological classification of galaxies.

43. Describe the three parts of the Milky Way galaxy.

44. Explain how the Cepheid variables are used to find distances of nearby galaxies.

45. Write short notes on the following :   4+4=8

    (a) Hubble's law

    (b) Big Bang theory

(Turn Over)

(6)

OPTION—B

Course No. : PHSDSE–601T (B)

(Nanomaterials and Applications)

SECTION—A

Answer any *twenty* of the following questions :

1×20=20

1. How many nanometers are there in one meter?

2. What is quantum confinement effect in nanomaterials?

3. Give an example of naturally occurring nanostructure.

4. What was the title of Richard Feynman's famous speech given on December 29, 1959?

5. What is the size of a DNA molecule?

6. Give an example of bottom-up method used in the synthesis of nanoparticles.

7. What ratio defines the efficacy of nanomaterials?

8. Write one advantage of spray pyrolysis technique.

(Continued)

(7)

9. What is lithography?

10. What is the name of most commonly used 'wet chemical process' for the fabrication of nanoparticle?

11. What is the full form of TEM, an instrument used for imaging nanoparticle?

12. What is a buckyball?

13. Write Debye-Scherrer formula used for the calculation of crystallite size.

14. Write the full form of AFM.

15. Write one objective of nanotechnology.

16. What do you mean by 'red shift' in nanoscience?

17. What is photoluminescence?

18. Write one property of carbon nanotube.

19. Give an example of quasi particle.

20. What do you mean by magnetic nanoparticle?

21. Mention one application of quantum well.

(Turn Over)

(8)

22. What is an electronic nose (E-nose)?

23. Mention one negative effect of nanoparticle.

24. Give one example of photonic device.

25. Write one application of carbon nanotube (CNT).

SECTION—B

Answer any *five* of the following questions : 2×5=10

26. Define nanoscience and nanotechnology.

27. Explain how the band gap of a material changes when taken from bulk to nano-structure.

28. Write the difference between top-down and bottom-up approaches for the fabrication of nanoparticle.

29. What is the difference between chemical vapor diposition (CVD) and physical vapor diposition (PVD)?

30. What do you mean by characterization of nanoparticle? Give examples of any two characterization techniques.

(9)

31. What do you mean by direct and indirect band gap semiconductor nanocrystals?

32. Explain Bragg's law in case of X-ray diffraction.

33. What is molecular manufacturing?

34. What is an optical switch? Mention one of its uses.

35. How is nanoparticle used for the treatment of cancer?

SECTION—C

Answer any *five* of the following questions : 8×5=40

36. What are nanoparticles? Classify different nanostructures based on their quantum confinement and briefly explain each of these types.   2+6=8

37. (a) Explain the difference among conductor, semiconductor and insulator based on band theory of solid.   4

(b) Explain with suitable examples the presence of nanoscience in nature.   4

(10)

38. *(a)* Describe in detail any one of the bottom-up technique used for the synthesis of nanoparticle. 4

(b) Describe in detail any one of the top-down method for the preparation of nanoparticle. 4

39. Write the names of three different electron microscopy techniques used for the characterisation of nanoparticles. Describe any one of them. 3+5=8

40. Discuss various crystal defects with necessary diagram. Write two importances of crystal defect. 6+2=8

41. *(a)* Explain in detail the different properties of nanoparticle. 4

(b) Explain the working principle of AFM with a suitable sketch. 4

42. *(a)* Explain how different optical parameters of nanomaterials can be calculated using absorption spectroscopy. 4

(b) What do you mean by diffusion? Explain different types of diffusion. 1+3=4

(11)

43. Write short notes on the following : 4+4=8

(a) Solar cell

(b) Photodiode

44. *(a)* Discuss the applications of nanotechnology in various photonic devices. 4

(b) Explain the negative effects of nanotechnology for the environment. 4

45. "There is plenty of room at the bottom." Explain the meaning of this statement with reference to the lecture given by Richard P. Feynman.

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