

U.G. 4th Semester Examination - 2022

PHYSICS

[HONOURS]

Skill Enhancement Course (SEC)

Course Code : PHY-H-SEC-T-02(A-E)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer all the questions from selected Option.

OPTION–A

PHY-H-SEC-T-02A

(Weather Forecasting)

1. Answer any **five** questions: $2 \times 5 = 10$

- a) Explain Mie Scattering.
- b) Define Aura.
- c) What do you mean by weather map?
- d) What is Global warming potential?
- e) What is Acid rain?
- f) Define Easterly Jet Stream.
- g) What is Adiabatic Lapse Rate?
- h) What do you mean by Aerosols?

2. Answer any **two** questions: $5 \times 2 = 10$

- a) Give a tabular description of surface weather parameters with their corresponding measuring instruments.
- b) Describe the forces acting to produce wind.
- c) Describe the structure of the atmosphere based on temperature and composition profiles through a comprehensive schematic diagram.
- d) Briefly discuss about Hadley and Ferrel Cells. Highlight their importance in the global wind circulation pattern.

3. Answer any **two** questions: $10 \times 2 = 20$

- a) What are the different types of Climate? Explain the causes of Climate change.
- b) Describe Global wind systems. Explain tropical cyclone.
- c) Discuss the set criteria for Cyclogenesis in northern hemisphere.
- d) Give a schematic diagram of the cloud structure of a typical thunderstorm. Highlight the charge separation zone.

OPTION-B

PHY-H-SEC-T-02B

(Radiation Safety)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) Write down main characteristics of X-ray.
 - b) A radioactive source emits both α and β particles with 1600 years and 400 years as respective half-life. After what time would the one-fourth of the material remain undecayed?
 - c) What are long-range α -particle? What is their origin?
 - d) Can an Auger electron be emitted when a metal is bombarded with visible light?
 - e) What is Bremsstrahlung Process?
 - f) Find the Q-value of the reaction ${}^{14}_7N(\alpha, p){}^{17}_8O$. The mass of ${}^4_2He = 4.0026$ u, ${}^{14}_7N = 14.0031$ u, ${}^1_1H = 1.0078$ u, ${}^{17}_8O = 4.0026$ u and $1 \text{ u} = 931 \text{ MeV}$.
 - g) Distinguish between nuclear fission and fusion with example.
 - h) Write down the Principle of ICRP.

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) i) What is photoelectric effect?
Distinguish between internal conversion and photoelectric effect.
 - ii) If the maximum energy of the recoil electron be 1 MeV in the Compton scattering of a certain γ -ray, what is the energy of the photon? $1+2+2$
 - b) Explain how the stability of a nucleus can be studied with the help of graph drawn between the binding energy per nucleon and mass number. 5
 - c) Discuss the types of radiations and their ill-effects to health. 5
 - d) What is KERMA? How KERMA is different from absorbed dose? $2+3$

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) i) Explain principle, construction and working of ionization chamber.
 - ii) Differentiate between ionization chamber and GM counter.
 - iii) Explain, Dead time and Recovery time of a GM counter. $(2+2+2)+2+2$

- b) i) What is Nuclear Waste? Why nuclear waste management is important?

- ii) Write steps for radiation hazards evaluation and control. (2+3)+5

- c) i) Calculate the mass defect, binding energy and binding energy per nucleon for nickel nuclei. Given:

Mass of ${}^{64}_{28}\text{Ni}$ nucleus = 63.9126 a.m.u.,
 $m_p = 1.007285$ a.m.u., $m_n = 1.008665$ a.m.u. and 1 a.m.u. = 931 MeV.

- ii) Explain the terms absorbed dose, effective dose and equivalent dose.

1+2+1+2+2+2

- d) Explain briefly (with one example) for application nuclear techniques in

- i) Medical science

- ii) Archaeology

- iii) Crime detection

- iv) Mining

- v) Art 2+2+2+2+2

OPTION-C

PHY-H-SEC-T-02C

(Technical Drawing)

1. Answer any **five** questions: 2×5=10

- Define directing circle.
- Define trace of a line.
- What is the application of diagonal scale?
- The major and minor axes of an ellipse are 80 mm and 50 mm respectively. Construct the curve.
- What is RF?
- A vertex of a hyperbola is 50 mm from its focus. Draw two parts of the hyperbola; if the eccentricity is $3/2$.
- Draw the projections of a point A Which is at 40 mm above HP and 25 mm in front of V.P.
- What is a conic section?

2. Answers any **five** questions: 3×5=15

- Name the types of verniers. What are the differences between a vernier diagonal scale?
- Draw the involute of a semicircle of radius 25mm.

- c) Draw a parabola whose focus is at a distance of 50 mm from the directrix. Draw a tangent and normal at any point on it.
- d) Define orthographic projection. Describe briefly the method of obtaining an orthographic projection of an object.
- e) Explain clearly the difference between the first-angle projection method and the third-angle projection method.
- f) Draw the isometric view of a cone 40mm diameter and axis 55 mm long when its axis is horizontal. Draw to isometric scale.
- g) Define:
 - a) Ellipse,
 - b) Parabola,
 - c) Hyperbola.

3. Answer any **three** questions: $5 \times 3 = 15$

- a) The foci of an ellipse are 100 mm apart and the minor axis is 70 mm long. Determine the length of the minor axis and half the ellipse by concentric circles methods and the other half by oblong method. Draw a curve parallel to the ellipse and 25 mm away from it.

2+2+1

- b) Construct a conic when the distance between its focus and its directrix is equal to 60 mm and its eccentricity is one. Name the curve. Draw a tangent at any point on the curve. What is generating circle? 1+2+2
- c) Write down the advantages of CAD. Name two systems of projection. 3+2
- d) Draw a vernier scale of meters when 1mm represents 25cm and mark on it a length of 24.4cm and 23.1mm. Define vertical trace of a line. 3+2
- e) Define a Prism. A rectangular prism $30 \times 20 \times 60$ mm lies on HP on one of its largest faces with its axis parallel to both HP and VP. Draw its isometric projection. 2+3

OPTION–D

PHY-H-SEC-T-02D

(Renewable Energy and Energy Harvesting)

1. Answer any **five** questions: $2 \times 5 = 10$
- a) What are the Conventional and Non-conventional energy sources?
 - b) What is solar pond? Where first solar pond was established in India?
 - c) Differentiate between primary and secondary energy sources.
 - d) What are the main Components of tidal power plant?
 - e) What is meant by photovoltaic effect? Where photovoltaic energy is used?
 - f) Define Geothermal energy. What are geothermal resources?
 - g) Define Ocean Thermal energy conversion (OTEC).
 - h) What is biochemical conversion? Name two types of biomass.

2. Answer any **two** questions: $5 \times 2 = 10$
- a) Write need for use of renewable energy resources. 5
 - b) What do you mean by fossil fuels? Write the environmental impacts of burning them? 1+4
 - c) What is a Solar cell? Briefly explain how it works. Draw I-V characteristic of a Solar cell. 1+3+1
 - d) Briefly explain (qualitatively) piezoelectric effect by simple molecular model. How piezoelectric energy harvested from human motion? 3+2
3. Answer any **two** questions: $10 \times 2 = 20$
- a)
 - i) Explain action of Solar Cooker, Flat plate collector, Solar Green House.
 - ii) Write down advantage and disadvantage of solar energy. (2+2+2)+4
 - b)
 - i) Write down basic principle of wind energy conversion.
 - ii) Write down advantage and disadvantages of wind power energy.

iii) Derive the expression for wind power.

3+4+3

c) What is hydro energy? Discuss the impact of hydro power sources on the environment in detail.

2+8

d) i) Write application of piezoelectric energy harvesting.

ii) Write working principle of linear generator.

5+5

OPTION-E

PHY-H-SEC-T-02E

(Applied Optics)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$

- a) State Malus law.
- b) What is a negative crystal?
- c) What is bolometer and photo emissive detector.
- d) Give examples of gas laser and solid-state laser.
- e) What is meant by stimulated emission and stimulated absorption?
- f) What is holography and how is it different from photography?
- g) What is Fourier transform?
- h) How is holography used for character recognition?

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$

- a) Explain the characteristics of laser light.
What is population inversion? $3+2$

- b) Explain APD Photodiode in detail. Explain I-V characteristics of a LED. 3+2
- c) What is meant by numerical aperture and acceptance angle of an optical fibre? Find out the above quantities if the refractive indices for the core and cladding are 1.6 and 1.5, respectively. 2+3
- d) What is Fourier Transform Spectroscopy? Explain any one application of Fourier transform spectroscopy. 3+2

GROUP-C

Answer any **two** questions: 10×2=20

- 3. a) Describe with appropriate diagrams the main components of a laser system, and explain how they function.
- b) What is a metastable state, and why is it necessary for laser action?
- c) A 5mW gas laser emits a steady beam of 650nm photons. What is the number of photons emitted per second? 4+3+3

- 4. a) Distinguish between LASER and MASER.
- b) Define temporal coherence and spatial coherence.
- c) An atom has two atomic levels separated by 2.5eV. Calculate the ratio of the population of the upper level to that of the lower level at 400 K. At what temperature is this ratio 1:3? 3+3+4
- 5. a) Deduce an expression for the time taken by a signal to travel L distance through an optical fibre.
- b) What is meant by fibre optic sensors?
- c) How does Bragg fibre grating work? 4+3+3
- 6. a) Explain the principle, construction and production of interference fringes with Fabry-Perot interferometer.
- b) Discuss how transmission hologram is made.
- c) Discuss the basic principle of recording a hologram. 5+2+3
