

**U.G. 4th Semester Examination - 2021**

**PHYSICS**

**[HONOURS]**

**Skill Enhancement Course (SEC)**

**Course Code : PHY-H-SEC-T-2(A-G)**

Full Marks : 20

Time : 1 Hour

*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-2A**

**(A) (Renewable Energy and Energy Harvesting)**

1. Answer any **five** questions: 1×5=5
  - a) Define Geothermal source.
  - b) Name the various models of biogas plants.
  - c) What are the main applications of a solar pond?
  - d) What are the conventional and non-conventional energy sources?
  - e) Differentiate between primary and secondary energy sources.
  - f) What are the main components of a tidal power plant?

- g) Define altitude angle.
  - h) What are the factors which determine the output of a wind energy converter?
2. Answer any **one** question (symbols have their usual meanings): 5×1=5
  - a)
    - i) What are the main types of OTEC power plants?
    - ii) Describe their working in brief. 2+3
  - b) With the help of a neat sketch, describe a solar heating system using water heating solar collectors. 2+3
  - c)
    - i) Differentiate between nuclear fusion and fission.
    - ii) What is the main advantage of D-D reaction?
    - iii) What do you mean by isotopes? Give examples. 2+1+2
3. Answer any **one** question (symbols have their usual meanings): 10×1=10
  - a)
    - i) Estimate the energy and power in the double basin tidal system.
    - ii) The basin area of a tidal power plant is  $20 \times 10^6 \text{ m}^2$ . The tidal range is 8 m, calculate the energy generation in kWh. 6+4

[Turn over]

- b) i) Obtain the equations for the voltages and power output of an MHD generator.
- ii) An MHD generator has the following parameters:  
 Plate area =  $0.20 \text{ m}^2$ ,  
 Distance between plates =  $0.4 \text{ m}$ ,  
 Flux density =  $2 \text{ Wb/m}^2$ ,  
 Average gas velocity =  $1000 \text{ m/s}$ ,  
 Conductivity of the gas =  $10 \text{ mho/m}$ .  
 Calculate the open circuit voltage and maximum power output. 6+4
- c) i) How biomass conversion takes place?  
 ii) Explain the process of "Photosynthesis".  
 What are the conditions, which are necessary for it?  
 iii) What is wet and dry fermentation?  
 iv) What materials can be used for biogas generation? 2+4+2+2

**OPTION-B**

**PHY-H-SEC-T-2B**

**(B) (Renewable Energy and Energy Harvesting)**

**GROUP-A**

1. Answer any **five** questions: 1×5=5
- a) What is meant by photovoltaic effect? Where photovoltaic energy is used?
- b) What is carbon capture technology? Write down two advantages of carbon capture technology.
- c) Define Osmotic Pressure and Ocean Biomass.
- d) What is solar pond? Where first solar pond was established in India?
- e) Write down working principle of a wind turbine.
- f) Define fossil fuel with example. Write down two limitations of fossil fuel.
- g) What is biochemical conversion? Name two types of biomass.
- h) Define Geothermal energy. What are geothermal resources?

### GROUP-B

2. Answer any **one** question:  $5 \times 1 = 5$
- a) Define Conventional and Non-conventional form of energy. Write down all major differences between them.  $2+3$
- b) What is a solar cell? Briefly explain how it works. Draw I-V characteristics of a solar cell.  $1+3+1$
- c) Define Ocean Thermal energy conversion (OTEC). Explain by one method how does ocean thermal energy generate electricity?  $2+3$

### GROUP-C

3. Answer any **one** question:  $10 \times 1 = 10$
- 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) Write short notes on (any **two**):  $5+5$
- i) Environmental issue and Renewable sources.
- ii) Basic Principle of Linear Generator

- iii) Ocean energy potential against wind and solar
- iv) Tidal Energy
- c) i) Write down basic principle of wind energy conversion.
- ii) Write down advantages and disadvantages of Wind power energy.
- iii) Derive the expression for wind power.  $3+4+3$

### OPTION-C

#### PHY-H-SEC-T-2C

#### (Radiation Safety)

### GROUP-A

1. Answer any **five** questions:  $1 \times 5 = 5$
- a) The work function of zinc is 3.6 eV. The Threshold frequency for the metal is  $9 \times 10^{14}$  Hz. Find the value of Planck's Constant.
- b) Define range of  $\alpha$  particle. On what factor does range depend?
- c) Explain with example, the terms 'Isotope', 'Isobar', 'Isotone' and 'Mirror Nuclei'.
- d) What are Auger Electron?

- e) What is Bremsstrahlung Process?
- f) Write two biological effects of ionizing radiation.
- g) Write down main characteristics of x ray.
- h) What is nuclear fission? Give one example.

**GROUP-B**

2. Answer any **one** question: 5×1=5
- a) Define
    - i) KERMA
    - ii) Derived Air Concentration (DAC) related to Radiation.  $2\frac{1}{2}+2\frac{1}{2}$
  - b) i) Explain the term ‘mass defect’ and ‘binding energy’ of a nucleus.
  - ii) The mass of hydrogen atom and neutron are 1.008142 and 1.008982 amu respectively. Calculate binding energy per nucleon of Boron -10 ( mass=10.01612 amu) 2+3
  - c) Briefly explain operation of Geiger-Muller Counter (GM). What is meant by ‘dead time’ of a GM counter. 4+1

**GROUP-C**

3. Answer any **one** question: 10×1=10
- a) i) Distinguish between nuclear fission and Fusion with example.
  - ii) How can the energy release in these processes be explained qualitatively with the help of packing fraction curve?
  - iii) Name different type of nuclear reactions.
  - iv) Explain what is meant by Q -value of a nuclear reaction.
  - v) Give one example each for proton and  $\alpha$  particle induced reaction. 2+2+2+2+2
  - b) 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
  - c) i) Write down Einstein’s photoelectric equation and explain photoelectric effect.
  - ii) What is Compton effect? Deduce the relation between the increase in wavelength and the angle scattering. (1+4)+(1+4)

**OPTION-D**  
**PHY-H-SEC-T-2D**  
**(Applied Optics)**

**GROUP-A**

1. Answer any **five** questions: 1×5=5
- a) Name two laser pumping technique.
  - b) Draw a schematic for ray propagation in
    - i) Step index fiber
    - ii) graded-index fiber.
  - c) Give one example of a gas laser and one example of solid-state laser.
  - d) Describe how a transmission hologram was made.
  - e) Show that a two-level system cannot act like a laser.
  - f) Mention any two important characteristics of a laser.
  - g) Describe with energy level diagrams the phenomena of stimulated emission, and stimulated absorption in a two-level system.
  - h) What is meant by splice loss in an optical fiber?

**GROUP-B**

2. Answer any **one** question: 5×1=5
- a) Explain the principle of Holography. Mention the name of the different types of holograms. What is a white light reflection hologram?  
2+2+1
  - b) What is meant by the numerical aperture of an optical fiber? What factors does it depend on? Name the two semiconductors which are extensively used in semiconductor lasers.  
2+1+2
  - c) Show at thermal equilibrium, the ratio (R) of the number of spontaneous and stimulated emission is given by  $R = (\exp(h\nu/k_B T) - 1)$ . Mention some important applications of lasers.  
3+2

**GROUP- C**

3. Answer any **one** question: 10×1=10
- a) Discuss the concept of spatial frequency filtering. Show that a lens can be used as a Fourier Transformer. A Gaussian function is  $f(x) = C \exp(-ax^2)$ , where C and a is a constant, calculate its Fourier transform (F(k)). Plot F(x) and F(k) and explain the differences.  
3+3+2+2

- b) What is a heterostructure semiconductor laser? Draw the energy band diagram corresponding to the three regions of double-heterostructure laser i) when they are in contact with no bias, and ii) under forward bias.

Derive relations between Einstein's A and B coefficients. 1+2+2+5

- c) Show that the time taken by a pulse to traverse a length L of the fiber is given by  $\tau = L/v_g = L/c [n(\lambda_0) \lambda_0 dn/d\lambda_0]$ . What is fibre optic sensors? How does Bragg fiber grating work? 5+3+2

### OPTION-E

#### PHY-H-SEC-T-2E

##### (A) (Weather Forecasting)

1. Answer any **five** questions: 1×5=5
- a) What is atmospheric window?
  - b) Define thermal equator?
  - c) What is acid rain?
  - d) What do you mean by saturated vapour pressure?
  - e) Define the term humidity.
  - f) What is Solar Constant?
  - g) What is Hadley Cell?
  - h) What are 'Aerosols'?

2. Answer any **one** from the following questions:

5×1=5

- a) Explain the relationship between pressure belts and planetary winds.
- b) Discuss the Different weather forecasting Method.
- c) Describe the origin and characteristics of tropical cyclones.

3. Answer any **one** from the following question:

10×1=10

- a) Write a short note – Weather map, Radiation law, Geotropic wind, Global warming.
- b) Describe and account for the general wind circulation. Identify major jet streams and mention in brief their impact on surface weather condition.
- c) What is Weather forecasting? Describe the historical background of development of forecasting.

**OPTION-F**

**PHY-H-SEC-T-2F**

**(B) (Weather Forecasting)**

**GROUP-A**

1. Answer any **five** questions:  $1 \times 5 = 5$
- a) Name the instrument by which speed of wind is measured. What is the normal unit of wind speed?
  - b) Define emissive power and Absorptive power in radiation.
  - c) Write down name of all the layers by which our atmosphere is composed of.
  - d) State Kirchhoff's law of radiation.
  - e) Write down percentage composition of gas in atmosphere.
  - f) Atmospheric temperature is governed by which factors?
  - g) Define aerosol. How are they formed?
  - h) How does temperature vary in Troposphere?

**GROUP-B**

2. Answer any **one** question:  $5 \times 1 = 5$
- a) Define Coriolis Force. Explain how it influence wind.  $2+3$

- b) Name different type of Temperature Sensor. Briefly discuss how they work.  $2+3$
- c) State and Prove Stefan Boltzmann law of radiation.  $1+4$

**GROUP-C**

3. Answer any **one** question:  $10 \times 1 = 10$
- a) Write short notes on:  $5+5$ 
    - i) Ozone Depletion
    - ii) Acid Rain
  - b) i) Explain cause and effect of global warming.
    - ii) How we can control global warming?
    - iii) Define aerosol. Explain how it formed.  $4+2+(2+2)$
  - c) i) What are the different methods of weather forecasting?
    - ii) What are the factors should be considered during selection of meteorological station?
    - iii) Define Geostationary and Polar Orbiting Weather satellite.  $2+4+4$

**OPTION-G**

**PHY-H-SEC-T-2G**

**(Technical Drawing)**

**GROUP-A**

1. Answer any **five** questions:  $1 \times 5 = 5$
- a) What is full form of CAD? Define AutoCAD.
  - b) Draw the locus of a point P equidistant from a fixed straight line AB and a fixed point F.
  - c) Name drawing instrument and accessories required for technical drawing.
  - d) What are the function of GRID and SNAP command used in AutoCAD?
  - e) Write name of two terms each, used in projection of line and planes.
  - f) Write two command for internet collaboration with AutoCad. What is the most effective command used to draw symmetrical object using AutoCAD?
  - g) Define eccentricity of a conic. What is the locus traced by a point moving along a pendulum, from one end to another, when the pendulum oscillates about an end .

- h) What are application of following lines
  - i) Projection line
  - ii) Construction line
  - iii) Centre lines
  - iv) Short Break Line?

**GROUP-B**

2. Answer any **one** question:  $5 \times 1 = 5$
- a) What are the advantages of CAD?  $5$
  - b)
    - i) Name different methods used to construct ellipse.
    - ii) Draw an ellipse using Eccentricity Method if distance of focus from the directrix is 70mm and eccentricity is  $3/4$ .  
 $2+3$
  - c)
    - i) Define Plane of Projection (POP)
    - ii) Explain Isometric and oblique parallel projection of solid.  $1+4$

**GROUP-C**

3. Answer any **one** question:  $10 \times 1 = 10$
- a)
    - i) Write down principle of projection in technical drawing.



- ii) Explain Orthographic projection of solids.
  - iii) Name different method used in technical drawing for construction of Parabola and Hyperbola.
  - iv) Define Cycloidal curves        2+2+4+2
- b) i) Mention the function of following eight AutoCAD command
- L ; C ; PL ; REC ; POL ; CO ; REG ; SC
- ii) How do you make a 3d drawing in 2d in AutoCAD?
  - iii) What are dimensioning tools in AutoCAD?
  - iv) Draw following circle using AutoCAD command. Centre (95,52) and radius =16 units.                                4+2+2+2
- c) Write down uses of following Drafting instrument
- i) T-square
  - ii) Set-square
  - iii) Roller Scale
  - iv) Circle Template
  - v) Lettering Template.                2+2+2+2+2

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