

13th - 1st half.

599/Phs.

UG/4th Sem./PHY-G-SEC-T-02(A-I)/24

U.G. 4th Semester Examination - 2024

PHYSICS

[PROGRAMME]

Skill Enhancement Course (SEC)

Course Code : PHY-G-SEC-T-02(A-I)

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-G-SEC-T-02A

(Radiation Safety)

GROUP-A

1. Answer any five questions: 2×5=10
 - a) What are KERMA?
 - b) What is linear attenuation coefficient?
 - c) What is gamma ray? Which substance can shield it?
 - d) What does the Q value of a nuclear reaction signify?
 - e) What is pair production?
 - f) Define Annual Limit of Intake (ALI).

[Turn over]

- g) What do you understand by Cherenkov radiation?
- h) What is meant by Derived Air Concentration (DAC)?

GROUP-B

2. Answer any two questions: $5 \times 2 = 10$
- a) What are the chief sources of radiation? What is meant by exposure, absorbed dose and equivalent dose? $2+3$
- b) What is Fission and Fusion? Give example. 5
- c) What happens to the atomic number and mass number of a nucleus when it emits an (i) alpha particle (ii) emits a positron (iii) emits an electron (iv) emits γ radiation (v) capture an electron? 5
- d) Cl-33 decays by positron emission with a maximum energy 4.3 Mev. Calculate the radius of the nucleus from this data. 5

GROUP-C

3. Answer any two questions: $10 \times 2 = 20$
- a) i) What is Compton effect? Find the expression of change in wavelength of a photon in Compton scattering.
- ii) Define energy straggling and range straggling.

- iii) The maximum wavelength for photoelectric emission in copper is 273 nm. Find the maximum energy of photoelectron when the surface of copper is illuminated with light of frequency $1.5 \times 10^{15} \text{ Hz}$. $(1+4)+2+3$

- b) Write a short note on:
- i) Photoelectric effect
- ii) Ionization Detector. $5+5$
- c) What is the nature of nuclear force? Discuss Liquid drop model. $4+6$
- d) What is binding energy of a nucleus? Calculate the binding energy per nucleon for ^{63}Cu .
Given, mass (^{63}Cu) = 62.91367u, mass (proton) = 1.00728u, mass (neutron) = 1.00867u. $2+8$
- e) i) Define decay constant and half-life of a radionuclide. Find the relation between them.
- ii) If the half-life of radon is 3.82 days then how long does it take for 60 percent of a sample of radon to decay.
- iii) In nuclear fission or fusion large amount of energy release – What is the source of this energy? $(1+3)+3+3$

OPTION-B

PHY-G-SEC-T-02B

(Electronic Circuit and Network Skills)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$
- What are the losses in a DC generator?
 - What do you mean by the term 'Impedance' Reactance and Power factor of an AC circuit?
 - State Kirchhoff's current law and explain.
 - What is the full form of P.V.C cable?
 - What are the basic components of an electrical circuit?
 - What are the materials used for wiring?
 - Show that the quantity CR has dimension of time.
 - What is the circuit breaker in the electrical circuit?

GROUP-B

2. Answer any two questions: $5 \times 2 = 10$
- Show that the power of an AC circuit is $I_{rms} \times V_{rms} \times \cos\theta$ where $\cos\theta$ is the power factor. 5
 - What is house wiring? What type of wire is used in a house? What is meant by industrial wiring? 2+1+2
 - What is series LCR circuit? What is the phase difference between voltage and current in this

circuit? Determine the condition of resonance in this circuit. 1+3+1

- d) What is cut-in voltage in PN junction diode? Draw the current voltage relationship of a PN junction diode. Explain how a PN junction diode use as a full wave rectifier? 1+1+3

GROUP-C

3. Answer any two questions: $10 \times 2 = 20$
- Draw a neat diagram of an A.C motor. Explain the construction of AC motor and briefly explain its working principle. 2+4+4
 - What are electrical fuses? What do you mean by the fuse rating? Explain with example. Give the principle of operation of fuses. Give advantage and disadvantages of rewirable fuses. 2+3+3+2
 - What is an A.C generator? What is motional emf and study emf? Draw a neat diagram of an A.C generator. Explain the principle of action of the generator. 2+2+2+4
 - State Thevenin's Theorem. Explain the procedure to convert a practical Voltage source into an equivalent current source. 2+3
Why ground fault protection is needed? What is isolated ground? Draw the wiring diagram of a simple extension board with two switches and two sockets. 1+1+3

OPTION-C
PHY-G-SEC-T-02C
(Weather Forecasting)

GROUP-A

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

- a) What is Acid rain?
- b) What do you mean by particulate matters?
- c) Define Aura.
- d) How satellites are useful in weather forecasting?
- e) What are Van Allen Belts?
- f) Explain Mie Scattering.
- g) What is catabetic wind?
- h) What is Adiabatic Lapse Rate?

GROUP-B

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

- a) Give a tabular description of surface weather parameters with their corresponding measuring instruments.
- b) Draw a diagram of temperature variation up to 100 km altitude.
- c) Explain the Electron density profile of

ionosphere. How would you do the mapping of wind speed? 3+2

- d) What is climate change? Describe how climate is changed over a period of time in a particular region. 2+3

GROUP-C

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

- a) What are the different types of Climate? Explain the causes of Climate change.
- b) What is the importance of measuring meteorological parameters? Describe medium range weather forecasting. 5+5
- c) What are the different methods of weather forecasting? Explain.
- d) Give a schematic diagram of the cloud structure of a typical thunderstorm. Highlight the charge separation zone.

OPTION-D
PHY-G-SEC-T-02D
(Basic Instrumentation Skills)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) Write an equation of an ac. current I with peak I_m and angular frequency. $3+2$
 - b) What is the internal resistance of an ideal voltmeter? $3+2$
 - c) What is a multimeter? $3+2$
 - d) Write down the unit of electric field and magnetic field. $3+2$
 - e) Write down the full form of CRO and CRT. $3+2$
 - f) Distinguish between digital and analog instruments. $3+2$
 - g) Write down the full form of DAC and ADC. $3+2$
 - h) Write down the unit of Capacitance and Inductance. $3+2$
 - i) What do you mean by the term 'sensitivity' of a measuring instrument? $3+2$

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) Discuss the working principle of a frequency counter. 5
 - b) What is function generator? How the electron beam is deflected in a CRT? $3+2$

- c) Draw the block diagram of a CRT and indicate each component. $3+2$
- d) Write down the Colour code for measuring resistance of a resistor. Explain briefly with a suitable example for measuring resistance of a resistor by colour code. $2+3$

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) Draw a block diagram of a basic cathode ray oscilloscope (CRO). What is electrostatic focusing? What is time base operation? Name any two uses of CRO. $3+2+3+2$
 - b) Draw the block diagram of a basic RLC bridge and indicate its each component. Write down the working principle of RLC bridge. What is digital LCR bridge? $(3+2)+3+2$
 - c) Draw the basic block diagram of a digital voltmeter (DVM). Write down the working principle of a DVM. What is the significance of ADC in DVM? $3+5+2$
 - d) Write down the working principle for measuring time period, frequency by a frequency counter. Define the type of errors arise in a measurement. $(3+3)+4$

OPTION-E
PHY-G-SEC-T-02E
(Computational Physics Skills)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$
- a) What is algorithm in computation?
 - b) Write syntax for Do-Loop in fortran.
 - c) What is the main difference between Linux and Unix?
 - d) Classify the Fortran constant with examples.
 - e) Name the usepackage to include mathematical symbols and ghrph in latex.
 - f) What is virtual desktop?
 - g) What does the function REA(x) do?

GROUP-B

2. Answer any two questions: $5 \times 2 = 10$
- a) What is MRB in Linux? What is the difference between C and C++? $3+2$
 - b) Explain the structure of Fortran coding sheet. 5
 - c) Write a program to find fractional of a given number using Function. 5
 - d) Write a C program to find the integral using Simpon's one-third rule. 5

GROUP-C

3. Answer any two questions: $10 \times 2 = 20$
- a) Write a program to find a transpose of a matrix.
Write short note on:
 - i) Call statement
 - ii) Save statement $4+3+3$
 - b) Type the 1st page of this question paper in your answer script using LaTeX command. 10
 - c) What are the advantages of flow chart? Draw flow chart to calculate roots of quadratic equation. What do you mean by conditional jump in a program? $3+5+2$
 - d) Write a program to create a data file for over the range -10 to 10. Now use the GNUPLOT to plot the curve from the data file. $7+3$

OPTION-F

PHY-G-SEC-T-02F

(Renewable Energy and Energy Harvesting)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$
- a) What is renewable Energy?
 - b) What do you mean by commercial Energy?
 - c) Define solar constant and declination angle.
 - d) What are clean energy sources?
 - e) Define geothermal drilling.
 - f) What are the advantages of fossil fuel?
 - g) What is wind turbine?
 - h) What is green house effect?

GROUP-B

2. Answer any two questions: $5 \times 2 = 10$
- a) Nuclear energy is clean source of energy. - Explain.
 - b) Wind turbine produces electromagnetic interference. - Discuss.
 - c) Discuss the production of electricity by dry stream power plant.

- d) Briefly discuss the origin and nature of geothermal energy.

GROUP-C

3. Answer any two questions: $10 \times 2 = 20$
- a) What is osmotic power? Can it be harnessed? Calculate the efficiency of an OTEC plant of warm water and cold water temperature of 25°C and 5°C respectively (Relative efficiency factor is 0.5). $2+3+3+2$
 - b) What is wind turbine? Discuss construction and working of a turbine. $2+4+4$
 - c) What is Hydroelectricity? Explain the origin of hydroelectricity and its advantages. $2+4+4$
 - d) Write short notes on (any two) $5+5$
 - i) Ocean energy
 - ii) Solar pond
 - iii) Fossil fuel

OPTION-G
PHY-G-SEC-T-02G
(Applied Optics)
GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) What is spontaneous emission in lasers?
 - b) Define Einstein's coefficients in the context of laser action.
 - c) Describe the basic principle of a semiconductor laser.
 - d) What is the function of an LDR?
 - e) Explain the concept of spatial frequency filtering in Fourier optics.
 - f) What is the numerical aperture of an optical fibre?
 - g) Describe the principle of light propagation through an optical fibre.
 - h) What are the types of holograms?

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) Explain the theory of laser action and describe the characteristics of the He-Ne laser. 5
 - b) What are the major advantages and disadvantages of optical fibre compared to other modes of communication? 5

- c) Describe the Fourier transforming property of a thin lens and its application in optical image processing. 5
- d) Explain the working principle of a Michelson interferometer and its applications. 5

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) Define graded and step-index fibre. Describe how a transmission hologram is made. Write a short note on the application of holography in microscopy. $2+3+5=10$
 - b) Define Einstein's A and B coefficients. Establish the relations between A and B coefficients. Explain briefly how population inversion is achieved in a LASER system. $2+5+3=10$
 - c) What do you mean by acceptance angle and numerical aperture in an optical fibre? With the help of suitable diagrams derive the expressions for acceptance angle and numerical aperture of an optical fibre. An optical fiber has a core refractive index of 1.48 and a cladding refractive index of 1.46. Calculate the numerical aperture and the acceptance angle of the fiber. $2+4+4=10$
 - d) Write down the basic principle of holography. Write down the names of different types of holograms. Describe the characteristics and applications of Fiber Bragg Grating sensors. What is a fiber optic sensor? $3+2+3+2=10$

OPTION-H

PHY-G-SEC-T-02H

(Physics Workshop Skills)

GROUP-A

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

- a) Define capacitance.
- b) Covert 5 N into dyne.
- c) What is a slide caliper? What is vernier constant?
- d) What is IC?
- e) Why third class lever is used?
- f) Write the use of Zeener diode.
- g) What is oscilloscope?

GROUP-B

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

- a) Write a short note on Relay circuit.
- b) Draw the diagram of Sextant indicating all the components. How Sextant is used to measure height?
- c) How casting of alloy and welding of metals are done? Explain briefly.

GROUP-C

Answer any two questions:

$10 \times 2 = 20$

- 3. Write the basic components in a Multimeter. Why soldering of electrical circuit is necessary? What do you mean by active and passive components in a circuit? What necessary precautions should be taken for cutting the metal sheet by the blade?
- 4. What is Lever? Classify Lever. Explain the principal action of each category lever. How a heavy weight is lifted using lever and pulley?
- 5. What is braking system? Why is it necessary? Write a short note on drilling of holes. How transistor can be used as switch?

OPTION-I
PHY-G-SEC-T-02I
(Technical Drawing)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$
- a) What is vernier scale? Define least count of a vernier scale.
 - b) Write down the dimensions of A1 paper and A2 paper.
 - c) Write down the different scales used for technical drawing.
 - d) What are the two systems of placing dimensions on a drawing?
 - e) Determine the length of the circumference of a 75 mm diameter circle.
 - f) Construct an ellipse.
 - g) What are the limitations of manual drawing?
 - h) What is Auto.CAD?

GROUP-B

2. Answer any two questions: $5 \times 2 = 10$
- a) Define orthographic projection. Describe briefly the method of obtaining an orthographic projection of an object. $1+4$

- b) Explain clearly the difference between the first-angle projection method and the third-angle projection method. 5
- c) Draw the isometric view of a square prism, side of the base 20 mm long and the axis 40 mm long, when its axis is (i) vertical and (ii) horizontal. 5
- d) Draw a scale of 1:60 to show metres and decimetres and long enough to measure upto 6 metres. 5

GROUP-C

3. Answer any two questions: $10 \times 2 = 20$
- a) Write short notes on: Reference planes; Reference line; Projector; Front view; Ground line. $2+2+2+2+2$
 - b) i) The distance between Mumbai and Pune is 180 km. A passenger train covers this distance in 6 hours. Construct a plain scale to measure time upto a single minute. The R.F. of the scale is $\frac{1}{200000}$. Find the distance covered by the train in 36 minutes.
 - ii) Construct a right angle PQR. Describe a circle of 20 mm radius touching the sides PQ and QR. $5+5$

- c) What is CAD? What are the advantages of CAD? What are the disadvantages of CAD?

2+4+4

- d) Explain two different methods with examples to draw a circle and an ellipse in Auto CAD?

5+5
