U.G. 5th Semester Examination - 2024
PHYSICS
[PROGRAMME]
Skill Enhancement Course (SEC)
Course Code : PHY-G-SEC-T-03(A-G)

[New Syllabus]

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-03

(Radiation Safety)

GROUP–A

1. Answer any **five** of the following questions:

$2 \times 5 = 10$

   a) What is 'mirror nuclei'? Explain with example.

   b) What is bremsstrahlung process?

   c) What is meant by Derived Air Concentration (DAC)?

   d) Give two examples of man-made sources of radiation.

   e) What is Cherenkov radiation?

   f) What do you mean by the radiation hazards?

   g) Define KERMA.

   h) What are Auger electrons?

[Turn over]

GROUP-B

2. Answer any **two** of the following questions:

$$5 \times 2 = 10$$

a) i) What happens to the atomic nucleus $^{210}_{84}Po$ when it undergoes successively α and γ decay?

ii) Explain the phenomena fluorescence and thermoluminescence. $\qquad$ 2+3=5

b) i) What do you mean by pair Production?

ii) An x-ray photon of initial frequency 3×10^{19} Hz collides with an electron and scattered through an angle 90°. Find its new frequency. $\qquad$ 2+3=5

c) Explain the phenomena nuclear fission and fusion. $\qquad$ 5

. d) Describe one major application of nuclear techniques in each of the following purposes– A) medical sciences, B) industry, C) archaeology, D) art and E) crime detection.

$$5$$

GROUP–C

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

a) i) What is photoelectric effect? Explain the phenomenon on basis of quantum theory.

ii) The work function of tungsten is 5.4 eV. What is the maximum wavelength of light that will cause photoelectrons to be emitted from tungsten surface? What wavelength of light must be required to emit electrons of maximum kinetic energy 1.7 eV?

$$(2+4)+4=10$$

b) i) What is meant by the binding energy of a nucleus? Which nucleus would you expect to be more stable ^7_3Li or ^8_3Li ?

ii) The helium isotope ^6_2He is unstable. What kind of decay would you expect it to undergo?

iii) Ordinary boron is a mixture of the $^{10}_5B$ and $^{11}_5B$ isotopes and has a composite atomic mass of 10.82 u. What percentage of each isotope is present in ordinary boron? $(2+3)+2+3=10$

c) i) What are the main sources of radioactive waste? Briefly discuss some of the general approaches for dealing with radioactive waste.

ii) What is accelerator driven sub-critical system (ADS)? $(2+6)+2=10$

d) i) What is meant by exposure, absorbed dose, equivalent dose and annual limit of intake?

ii) Describe the operation of a Geiger-Muller counter. $4+6=10$

OPTION-B

PHY-G-SEC-T-03

(Electrical Circuits and Network Skills)

GROUP–A

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

   a) What are the materials used for wiring?

   b) What is peak inverse voltage of a diode?

   c) What are protective relays?

   d) State Kirchhoff's voltage law and explain.

   e) What are shot circuit and open circuits?

   f) What do you mean by step-down transformer?

   g) Show that in case of a pure resistance current and voltage are in same phase.

   h) What do you mean by power factor of an electrical circuit?

GROUP–B

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

   a) State the maximum power transfer theorem. An alternating voltage is given by $V = 220 \sin(100t)$. Calculate (i) frequency, (ii) maximum value, (iii) average value of the above mention voltage.

   $1+4$

b) · Explain with the help of relevant circuit diagram, how an analog multimeter can be used as a dc voltmeter, dc ammeter and ohm meter.

2+2+1

c) Find the values of different voltages that can be obtained from a 12V battery with the help of voltage divider circuit having three resistances 4Ω, 3Ω. and 1Ω.   5

d) Explain briefly the working principle of miniature circuit breakers (MCBs) and their advantages in electrical protection.   5

GROUP–C

3. Answer any **two** questions: $10\times2=20$

a) What do you mean by high pass and low pass filters? Write down the working principle of a shunt capacitor filter. A capacitor C is connected with a sinusoidal voltage. Find out the instantaneous current. Draw and explain the phasor diagram.   2+3+3+2

b) Draw a half wave rectifier circuit. Explain the operation of the circuit and plot output waveforms. Find the efficiency of this circuit.

1+2+2+5

c) In an ac circuit the complex impedance is Z=1+2j and complex current is −4+7j V. Find the complex current in the circuit. What are two phase and three phase generators? What are the various types of drawing used for electrical wiring? Explain in detail. 2+3+5

d) Explain the various methods of electrical wiring system. Draw a neat diagram of an A.C generator. Explain the principle of action of the generator. 4+2+4

OPTION-C
PHY-G-SEC-T-03
(Technical Drawing)
GROUP–A

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

    a) Define dimensioning as per ISI 696-1972.

    b) What do you mean by lettering?

    c) Write down the full form of RF? Explain with examples.

    d) A vernier calipers has a main scale with the smallest division of 0.5 mm. The vernier scale has 25 divisions that correspond to 24 divisions on the main scale. Determine the vernier constant of the vernier scale.

    e) What do you mean by the least count of an instrument?

    f) A distance of 600 km on the Earth is shown as 1.2 cm on the map. Find out the R.F.

    g) Write down the full forms: RF, CAD, HP, VP.

    h) Write down the names of two drafting instruments in technical drawing.

GROUP–B

2. Answer any **two** questions: 5×2=10

    a) Define projection and describe the types of projections.   1+4=5

b) Draw the involute of a semicircle of radius 5 cm.   5

c) A railway map represents a distance of 300 km as 5 cm. Determine the RF of the map. Draw a diagonal scale to show kilometers and indicate distances of 50 km, 150 km, and 250 km on it.   5

d) What is lettering? Explain its significance in engineering drawings. Write down the Cartesian equations of a ellipse, and parabola.   1+2+2=5

GROUP–C

3. Answer any **two** questions;   10×2=20

a) To draw a parabola with the distance of the focus from the directrix at 50mm. Discuss the importance of orthographic projection in engineering drawings.   5+5=10

b) Draw a straight line of length 12 cm. Divide the line into six equal parts. Why is consistent and clear lettering important in engineering drawings? Describe the method of proper care and handling of drafting instruments.   6+2+2=10

c) What is Computer-Aided design (CAD) and how does it differ from traditional drafting methods? How are basic 2D and 3D drawings created using AutoCAD? Discuss three advantages of 3D modeling in CAD compared to 2D drafting.

3+3+4=10

d) A cone (base diameter 50 mm and height 70 mm) is placed on a cylinder (base diameter 60 mm and height 40 mm). Draw the front view showing the interpenetration line. Explain the relevance of surface development in sheet metal work.

6+4=10

OPTION-D

PHY-G-SEC-T-03

(Basic Instrumentation Skills)

GROUP–A

1. Answer any **five** from the following questions:

    $2 \times 5 = 10$

    a) What do you mean by the term "accuracy"?

    b) What should be the internal resistance of an ideal ammeter and ideal voltmeter?

    c) What do you mean by "measurement"?

    d) Write down the SI unit and dimension of electric field.

    e) How do you check the type of a transistor by using multimeter?

    f) Write down the full form of DVM and ADC.

    g) Write down the advantages of Digital voltmeter.

    h) What is the use of "distortion meter"?

GROUP–B

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

    $5 \times 2 = 10$

    a) What do you mean by resolution of a Digital multimeter? Distinguish between digital and analog instruments.

    $2 + 3$

    b) Discuss about the working principle of CRO. 5

c)   Write down the steps for measuring ac voltage and resistance of a wire by a digital multimeter.

5

d)   What do you mean by distortion factor? Discuss shortly on it.

5

GROUP–C

3.   Answer any **two** from the following questions:

$10×2=20$

a)   What is the significance of ADC in a DVM? What is meant by "persistence of phosphor"? The expected value of current in a circuit is 1 amp but connected ammeter showing 0.85 amp., calculate the absolute error, percentage error and relative accuracy. $3+2+5$

b)   Define and explain the type of errors occur in a measurement. What are the ways to reduce measurement errors ? Discuss how a digital frequency counter is used to measure i) frequency, ii) period, iii) time interval and iv) ratio of frequencies. $3+2+5$

c)   Write short note on AC milivoltmeter and signal generator. $5+5$

d) .   What is digital storage oscilloscope? What is function generator? What must be done to obtain a steady oscillogram? How the electron beam is deflected in a CRT? $2+2+3+3$

OPTION-E

PHY-G-SEC-T-03

(Renewable Energy and Energy Harvesting)

GROUP–A

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

   a) What are the differences between renewable and non-renewable energy?

   b) Calculate the optimum wavelength of light for photovoltaic generation in GaAs cell of energy band of 1.43 eV.

   c) What are clean energy sources?

   d) Write down the advantages and limitations of fossil fuel.

   e) What are the primary and secondary energy sources? Give examples.

   f) Why Ocean Bio-mass is considered to be a renewable energy source?

   g) What is meant by artificial piezoelectric material?

   h) Differentiate a Non-Convective Solar Pond from a Shallow Solar Pond.

GROUP–B

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

   a) Draw a neat diagram explain the working of box type solar cooker. $2+3$

b) Write down the applications of piezoelectric energy harvesting. 5

c) What is a solar cell? Give the basic construction and working principle of a solar cell. 2+3

d) What is the basic principle of Ocean Thermal Energy Conversion (OTEC)? Determine the efficiency of an OTEC plant if warm water temperature is 27°C and cold-water temperature is 7°C. Assume the relative efficiency factor of 0.5. 2+3

GROUP–C

3. Answer any **two** questions: 10×2=20

a) i) What does energy harvesting mean? Why is energy harvesting important? State the principle of electromagnetic energy harvesting.

ii) Define tip speed ratio (TSR) of a wind turbine. 2+2+4+2

b) i) What are the main components of a battery? What is the basic difference between a primary battery and a secondary battery? Discuss the factors affecting the battery's performance and life.

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ii) Discuss the basic principle on which all electromagnetic generators work.

(2+2+3)+3

c) i) Write the basic principle of wind energy conservation.

ii) Discuss construction and working of a turbine. 5+5

d) Write short notes on (any **two**): 5+5

i) Greenhouse effect

ii) Osmotic power

iii) Solar distillation.

OPTION-F

PHY-G-SEC-T-03

(Applied Optics)

GROUP–A

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

   a) Write down the full form of LASER. Give one example of gas LASER.

   b) What do you mean by the visibility of fringes in an interferometer?

   c) Define the term optical pumping.

   d) Explain briefly how holography can be used in interferometry.

   e) If following two SHMs, $\sin(\pi x)$ and $\sin(3\pi x)$ combine. Determine the resultant frequency.

   f) How is holography different from photography?

   g) What do you mean by Fourier transformation? Explain with suitable example.

   h) Write down the full forms of the following terms: FTS and LED.

GROUP–B

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

   a) With the help of a suitable diagram, explain the action of a Gas Laser. 5

b) Write down the full form of LDR. With the help of suitable circuit diagrams, explain the working principle of an LDR. Write down one use of an LDR. 1+3+1=5

c) Explain briefly different types of losses caused in optical fibre communication. 5

d) With the help of suitable diagram explain light ray propagation in graded and step-index fibre. Why is optical fibre so important in communication? 2+3=5

GROUP–C

3. Answer any **two** questions: 10×2=20

a) Explain the method of determining the angle of polarization of a LASER light using a polarizer and analyzer in the laboratory. Write a short note on – Fourier optical filtering. 5+5=10

b) Explain the terms light amplification and stimulated emission in a laser system. With the help of a suitable diagram, explain how population inversion is achieved in a two-level laser system. Define Einstein's A and B coefficients; establish the relations between them. 2+2+6=10

c)   With the help of a suitable diagram, explain the terms core and cladding in optical fibre. What do you mean by the acceptance angle and numerical aperture of an optical fibre? Derive the expression for the numerical aperture of an optical fibre. Find the numerical aperture of a step-index fibre when the refractive index of the core is 1.6 and that of the material used for cladding is 1.5.   3+3+4=10

d)   Write a short note on Fourier Transform Spectroscopy (FTS). Write down the application of holography in interferometry.   5+5=10

OPTION-G

PHY-G-SEC-T-03

(Weather forecasting)

GROUP–A

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

   a)   What do you mean by Aerosols[3]e

   b)   What is solar constant?

   c)   What do you mean by EL-NINO?

   d)   What is global warming potential?

   e)   What are Van Allen Belts?

   f)   Define Easterly Jet Stream.

   g)   What is Adiabatic Lapse Rate?

   h)   What is the difference between meteor, meteoroid and meteorite?

GROUP–B

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

   a)   Give a schematic diagram of inversion of temperature. What is catabetic wind?

   b)   Describe the forces acting to produce wind.

   c)   What is air parcel? Calculate the virtual temperature of air at 1000 milibar level at 300K. temperature (Vapour pressure 13.7 milibar).

                                                   2+3

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d) Briefly discuss the problems of weather forecasting.

GROUP–C

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

a) What is DALR? Compute the relation between DALR and SALR.

b) Describe global wind systems. Explain tropical cyclone.

c) Discuss the climatological significance of SST.

d) Give a schematic diagram of the cloud structure of a typical thunderstorm. Highlight the charge separation zone.

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