U.G. 6th Semester Examination - 2021

PHYSICS

[PROGRAMME]

Skill Enhancement Course (SEC)

Course Code : PHY-G-SEC-T-04(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-04A

(Physics Workshop Skill)

GROUP–A

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

a) What are the common systems of units for describing measurements? Obtain Dimension of Energy.

b) Density of mercury in C.G.S. unit is 13.6 $gm.cm^{-3}$. What is its value in S.I unit?

c) What are various parameters of design of welded joint?

d) What is deflection sensitivity of a CRO?

e) Write the requirements of good pattern materials.

f) What are the functions of coating on electrode?

g) Find out the Vernier constant of a slide caliper having 100 Vernier divisions in Vernier scale. One main scale division is 0.05 cm.

h) Define Least Constant and Screw pitch of a Screw gauge.

GROUP–B

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

a) A Screw gauge has 100 division in circular scale. The circular scale moves along the linear scale 0.2 cm in one full rotation. Find its least constant (L.C.). Explain how will you measure the diameter of a wire using screw gauge. What is zero error in screw gauge? 1+2+2

b) Explain different types of PCB board. 5

c) What do you understand by drilling? Explain the different types of drilling mechanism. 1+4

d) Explain the mechanism of a Zener Diode as a voltage regulator. 5

GROUP–C

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

a) i) What are the five welding defects? Mention the causes and remedies of all these defects.

ii) Give some specific application of laser beam welding. 5+5

b) i) What are the hazards involved in soldering of electrical circuit?

ii) What is a relay? Explain the operation of a electronic switch using relay and npn transistor with proper circuit diagram. 3+1+6

c) i) What is a Gear?

ii) Explain the different types of gear system.

iii) What are the differences of AC and DC generators? 2+6+2

d) i) Explain different components of a CRO with schematic diagram.

ii) A seesaw is 35 ft long with a fulcrum in the middle of the board. If a 70 pound child sits 5 ft. from the fulcrum, what is the lowest weight that will lift the child? 6+4

OPTION-B

PHY-G-SEC-T-04B

(Electrical Circuits and Network Skills)

GROUP–A

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

a) What is resistivity? What is its unit in S.I. system of units?

b) Explain the effect of temperature on resistance.

c) What is capacitance and inductance?

d) Show that the phase difference between voltage and current is $\pi/2$ when an AC voltage is applied to a pure inductor.

e) What is the rms value of a sinusoidal alternating current? What is form factor?

f) What are short and open circuits?

g) What are the losses in a DC generator?

h) What is a step-up and step-down transformer?

GROUP–B

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

a) The total current drawn by a circuit consisting of three resistors connected in parallel is 12A.

The voltage drop across the first resistor is 12V, the value of second resistor is 3Ω and the power dissipation of the third resistor is 24W. What are the resistances of the first and third resistor? What are the characteristics of a circuit containing resistances connected in series and parallel? 3+2

b) Calculate the equivalent capacitance when the capacitances are connected in series and parallel. Describe the working principle of a transformer? 3+2

c) What will happen when DC voltage applied to a series CR circuit? Explain the general principle of a dc generator. 3+2

d) Calculate the rms value, average value and form factor of a half-wave rectified alternating current. 2+2+1

GROUP–C

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

a) i) What is a voltmeter and ammeter?

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

ii) What is a Ladder diagram? 4+4+2

b) i) What are the differences between a DC motor and DC generator?

ii) What is back-emf in a DC motor?

iii) Calculate the condition for maximum power developed by a DC motor?

iv) What are the advantages and disadvantages of induction motor. 3+2+2+3

c) Three sinusoidally alternating currents of rms values 5, 7.5 and 10 A are having same frequency of 50 Hz, with phase angles of 30^o, -60^o and 45^o.

i) Find their average values.

ii) Write equations for their instantaneous values.

iii) Draw waveforms and phasor diagrams taking first current as the reference.

iv) Find their instantaneous values at 100 msec from the original reference. 2+2+3+3

d) i) Describe star and delta connections with figures in an electrical wiring system.

ii) What are the differences between single phase and three phase power supplies?

iii) Three 100Ω non-inductive resistances are connected in (a) star (b) delta across a 400V, 50Hz, 3-phase mains. Calculate the power taken from the supply system in each case. 3+3+4

OPTION-C

PHY-G-SEC-T-04C

(Computational Physics Skills)

GROUP–A

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

a) Explain the common approaches used in designing an algorithm.

b) Explain O-notation with an example.

c) What are the steps involved in Object-Oriented Analysis?

d) What is a virtual desktop?

e) What is Type declaration?

f) What is the purpose of a header file? Is the use of header file absolutely necessary?

g) What does the function REAL(x) do?

h) Explain the syntax of GOTO statement.

i) What do you mean by module in FORTRAN?

j) Why is FORTRAN faster than C? Explain.

k) What is the difference between a Subprogram and a Subroutine?

l) How do you compile a LaTeX file? How do you change the type style in LaTeX?

GROUP–B

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

a) Why do we use flowcharts? What are the five properties of algorithm? Design an algorithm with a natural number, n, as its input which calculates the following formula and writes the result in the standard output. 1+2+2

b) Write an algorithm to determine a student's final grade and indicate whether it is passing or failing. The final grade is calculated as the average of four marks. 5

c) Design an algorithm for plotting of a trajectory of a projectile thrown at an angle θ with the horizontal. 5

d) Write an algorithm and draw a flowchart that will calculate the roots of a quadratic equation:

$$ax^2 + bx + c = 0$$ 5

e) Write a C program to find the integral using Simpson's one-third rule

$$\int_0^{0.8} log\, x + sin(2x) + x^2 dx$$ 5

f) Write a program to solve and plot the output for visualization of the following differential equation:

$$6x^2 - 17x + 12 = 0$$ 5

GROUP–C

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

a) What is difference between algorithm and pseudo code? Explain steps involved in drawing of a flowchart. Write an algorithm that reads three numbers and prints the value of the largest number. Also draw the flowchart for it. 2+3+2+3

b) The number of permutations of n objects, taken r at a time is:

$$P_{n(r)} = \frac{n!}{\langle n-r \rangle !}$$

Write a program which sets up a rank one array to hold the values 1, 2, 3, ..., 10.

Using the intrinsic function PRODUCT() (which returns the product of all array elements passed to it) and various array sections, calculate:

i) The number of permutations n=5 people may pose for a photo standing in r=1 rows.

ii) The number of permutations n=8 students may sit in a row of r=4 front row desks. 4+3+3

c) Write a program to find a transpose of a matrix.
Write short notes on:

i) Call statement

ii) Save statement. 4+3+3

d) Type the 2nd page of this question paper in your answer script using LaTeX command.

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OPTION-D

PHY-G-SEC-T-04D

(Radiation Safety)

GROUP–A

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

a) Give examples of non-ionizing and ionizing radiation.

b) Write the names of the man-made radionuclides.

c) State the properties of α ray.

d) What is Compton scattering?

e) What is CT-CAT scan?

f) Explain the sources of radioactivity which is present in the food.

g) Show that nuclear matter density is constant. Write its order of magnitude.

h) Give some uses of beta radiation.

GROUP–B

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

a) What is the use of medical Dosimeter? Define ALI and DAC terms.

b) Draw the graph between the binding energy per nucleon (E) and atomic mass number (A). The value of binding energy for $_1H^2$, $_2He^4$, $_{28}Fe^{56}$, $_{92}U^{235}$ is 2.22, 2.83, 492 and 1786 units respectively. Which are stable nuclides? Explain.

c) How the frequency of X-rays varies with the atomic number of the target of the X-ray tube? What is the cut-off wavelength? Explain how intensity of the X-rays varies.

d) Write the relation of work function with the threshold frequency for photoelectric effect. Suppose two metals X and Y have work functions 2eV and 4eV respectively. Which metal has a lower threshold wavelength?

GROUP–C

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

a) Discuss three major ways for radiation safety.

b) What is the purpose and principle of G.M counter? What is called Dead time of G.M counter?

c) Explain nuclear fission process. Give examples.

d) Define average life and activity of a radioactive material. Suppose the half life of a radioactive element P is the same as mean life of another radioactive element Q. If initially they have same numbers of atoms, then which element P or Q will decay faster?

OPTION-E

PHY-G-SEC-T-04E

(Technical Drawing)

GROUP–A

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

   a) What do you mean by conic section?

   b) What is AUTOCAD?

   c) Write the equation of a circle.

   d) What is a pyramid?

   e) Name any two drafting instrument.

   f) What is auxiliary plane?

   g) What are the full forms of H.P and V.P.?

GROUP–B

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

   a) A line AB inclined at 40º to the V.P. has its end 30mm and 20mm above the H.P. The length of its front view is 65mm and its V.T. is 10mm above H.P. Determine the free length of AB.

   b) Construct a vernier scale of R.F. = 1/80 to read inches and to measure up to 13 yards.

   c) Name any five fundamental commands.

   d) Draw the projection of a circle 50mm diameter having its plane vertical and inclined at 30º to the V.P. Its centre is 30mm above the H.P. and 20mm in front of V.P.

GROUP–C

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

   a) What is the principle of projection? What is orthographic projection? A point P is 25mm above H.P. and 30mm in front of V.P. Draw the projection. 2+2+6

   b) What is isometric drawing? Draw the isometric view of a circle of a given diameter around a given point. 2+8

   c) Draw the development of lateral surface of a cylinder having square hole in it. 10

   d) A vertical cone base 80 mm diameter axis 100 mm long is penetrated by a horizontal cylinder of 40 mm diameter, the axis of which is 25 mm above the base of the cone, parallel to V.P. and 6 mm away from the axis of cone. Draw the projections. 10

OPTION-F

PHY-G-SEC-T-04F

(Weather Forecasting)

GROUP–A

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

   a) What is Aurora?

   b) Define Nowcasting.

   c) What do you mean by Inversion Layer?

   d) What is the theoretical value of Adiabatic Lapse Rate?

   e) Explain Mie Scattering.

   f) Name two successful weather prediction models used in India.

   g) What is Global Warming Potential?

   h) What is Easterly Jet Stream?

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

   a) Describe the structure of the atmosphere based on temperature and composition profiles through a comprehensive schematic diagram.

   b) Briefly discuss about Hadley and Ferrel Cells. Highlight their importance in the global wind circulation pattern.

   c) Give a tabular description of surface weather parameters with their corresponding measuring instruments.

   d) Write about the major goals of two such International Conventions constituted to control climate change.

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

   a) Describe the impact of vertical atmospheric temperature profile on atmospheric stability.

   b) Discuss the set criteria for Cyclogenesis in northern hemisphere.

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

   d) Describe different types of weather forecasting methods with example.

OPTION-G

PHY-G-SEC-T-04G

(Renewable Energy & Energy Harvesting)

GROUP–A

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

   a) Give two examples of Biomass and write down one advantage of Biomass energy.

   b) Write down the name of different types of renewable energy resources.

   c) What is meant by photovoltaic effect?

   d) Define the term 'solar constant'.

   e) What is piezoelectric energy harvesting?

   f) What is solar cell?

   g) Define geothermal energy and its resources.

   h) What is the main disadvantage of hydro power?

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

   a) The sun is the ultimate source of energy. Explain.

   b) Write down the factors which influence output of wind energy converter. Explain briefly working principle of a wind turbine.

   c) Mention briefly the environment impact of hydropower source.

   d) What is the basic principle of ocean thermal energy conversion (OTEC)? Where are OTEC plant located?

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

   a) Explain the different applications of renewable energy.

   b) Write short notes on (i) Sustainability and (ii) Environmental issues and renewable sources of energy.

   c) Describe the precautions to establish nuclear power plant and mention the advantages of nuclear energy.

   d) Write short notes on (i) Solar green house and (ii) Electromagnetic energy harvesting.

OPTION-H

PHY-G-SEC-T-04H

(Basic Instrumentation Skills)

GROUP–A

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

   a) Write down the unit of 'self inductance' and 'magnetic field'.

   b) What is "measurement"?

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

   d) Write down the types of ac mill voltmeter.

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

   f) Distinguish between digital and analog instruments.

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

   h) What do you mean by resolution of a digital multimeter?

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

   a) Discuss the working principle of a Q-meter. 5

   b) What is function generator? How the electron beam is deflected in a CRT? 3+2

   c) Write short note on digital multimeter. 5

   d) Write down the steps for measuring ac voltage and resistance of a wire by a digital multimeter. 5

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

   a) Draw the basic block diagram of a DVM. What is the significance of ADC in a DVM? What is the significance of Max hold button in a digital multimeter? (5+3)+2

   b) 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

   c) Write short note on:

      i) CRO and

      ii) ac millivoltmeter. 5+5

   d) Draw a neat diagram of a CRT and discuss the significance of its each component. Write down the working principle for measuring voltage by a electronic voltmeter and also discuss its advantages for measuring voltage over conventional multimeter. (2+3)+(3+2)

OPTION-I

PHY-G-SEC-T-04I

(Applied Optics)

GROUP–A

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

   a) What do you mean by spatial frequency filtering?

   b) With the help of suitable diagram show the ray paths in a graded index fibre and step index fibre.

   c) What do you mean by transmission and reflection type holograms?

   d) Write down two applications of LASER.

   e) Write down the full forms of the following: NMR, FTS.

   f) Explain briefly how haplography can be used in microscopy.

   g) What do you mean by splice loss in optical fibre?

   h) Explain the terms 'Spontaneous' and 'stimulated' emissions.

GROUP–B

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

   a) Write a short note on Fourier Transform Spectroscopy. 5

   b) Write down the full form of LDR. With the help of suitable circuit diagram draw the intensity versus resistance characteristics of a LDR. State and explain two applications of LDR. 1+2+2=5

   c) With the help of a suitable diagram explain the action of a semiconductor laser. 5

   d) What are the major advantages and disadvantages of optical fibre compared to other modes of communication? 5

GROUP–C

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

   a) Explain briefly the basic principle of holography. Write down the names of different types of holograms. Write down the application of holography in microscopy. What is Fibre Bragg Grating? 3+2+3+2=10

   b) Describe how a transmission hologram is made. What is fibre optic sensor? Discuss the concept of spatial frequency filtering. Show

that a thin lens can be used as a Fourier Transformer. 3+2+2+3=10

c) Explain the terms Einstein's A and B coefficients. What is population inversion and how it is achieved in a two level laser system? Derive relations between A and B coefficients. 2+3+5=10

d) What do you mean by acceptance angle and numerical aperture in an optical fibre? Find the numerical aperture of a step-index fibre when the r.i. of the core is 1.51 and that of the cladding material is 1.47; also calculate the angle of acceptance of the fibre when it is placed in the air. 2+2+(3+3)=10

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