

U.G. 3rd Semester Examination - 2020**PHYSICS****[PROGRAMME]****Skill Enhancement Course (SEC)**

**Course Code : PHY-G-SEC-T-1(A), (B), (C), (D),
(E), (F), (G), (H) & (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-1(A)****(Physics Workshop Skills)****GROUP-A**

1. Answer any **five** questions: $2 \times 5 = 10$
- What is meant by soft soldering?
 - What is an integrated circuit?
 - What are the SI and CGS units of density? How are they related?

- Name the two gases associated with gas welding.
- Explain gear ratio with a suitable example.
- What is a bench vice? What is it used for?
- What is meant by a PCB?
- What is least count of a screw gauge?

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- Describe the construction of a sextant. How can the height of a building be measured with it? $2.5 + 2.5$
 - Describe two methods of producing a hole in a sheet metal. $2.5 + 2.5$
 - Describe the principle of operation of a vernier caliper. How can the volume of a cylindrical beaker be measured? $3 + 2$
 - Illustrate the process of making a funnel from sheet metal with suitable diagrams. 5

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) What is a regulated power supply? Describe the construction of a regulated power supply with suitable circuit diagrams. $3+7$
- b) Describe the working principle of a cathode ray oscilloscope. How can the amplitude and frequency of a waveform be measured with it? $5+5$
- c) Describe different methods of power generation. What are the uses of a multimeter? How can capacitance be measured with a multimeter? $5+2+3$
- d) Explain the working principle of a lathe. What are the various work holding devices used in milling? Explain their relative applications and disadvantages. $5+2+3$

OPTION-B

PHY-G-SEC-T-1(B)

(Electrical Circuits & Network Skills)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) Draw electrical symbol of a zener diode and variable resistor.
- b) Define power factor.
- c) Give one example each of electrical components which obey and disobey Ohm's law.
- d) Define efficiency of a motor.
- e) What is reverse saturation current of a diode?
- f) Define form factor of AC waveform.
- g) State Kirchoff's voltage law.
- h) Define rectification efficiency of a rectifier circuit.

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) State and explain: $3+2$
- i) Maximum power transfer
- ii) Reciprocity theorem.

- b) Explain the steps for converting practical voltage source into practical current source. 5
- c) Establish relation between values of resistors of star and delta connections. 5
- d) If $Z_1 = 5 + j7$ and $Z_2 = 10 - j15$ are connected in parallel, find the equivalent impedance of combination. 5

- d) Explain the working principle of a DC motor. Three resistances $30\ \Omega$, $45\ \Omega$, $38\ \Omega$ are connected in star circuit. Determine its equivalent delta circuit. 5+5

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) Explain the basic principle and working of three phase motor. Define speed of AC motor. What does it depend on? What are the advantages of polyphase motor? $5 + (1 + 2 + 2)$
- b) Compare MCB and RCCB. Write down the advantages of these circuit breakers over the fuse element. Determine Bandwidth and Quality factor (Q) for the series LCR circuit. $(3 + 2) + 5$
- c) Compare series and parallel LCR circuits. A coil has resistance of $4\ \Omega$ and an inductance of 10 mH. Calculate (i) Reactance (ii) The impedance (iii) The current taken from 220 V, 50 Hz supply. 5+5

OPTION-C

PHY-G-SEC-T-1(C)

(Computational Physics Skills)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) Write an algorithm to find average age of a group of 10 players.
 - b) Draw a flowchart to find the area of a circle of radius r .
 - c) Write the common programming languages which are used for science.
 - d) What are the basic components of Linux? How to copy file in Linux?
 - e) What is a virtual desktop?
 - f) What is the purpose of a header file? Is the use of header file absolutely necessary?
 - g) What is the difference between DO, DO WHILE and IF, GOTO Loops?
 - h) What does the function REAL(x) do?
 - i) What is the difference between a Subprogram and a Subroutine?
 - j) What is LaTeX?
 - k) How do you compile a LaTeX file? How do you change the type style in LaTeX?

GROUP-B

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

$5 \times 2 = 10$

- 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) Design an algorithm for plotting of a trajectory of a projectile thrown at an angle θ with the horizontal. 5
- c) What is MBR in Linux? What is the difference between C and C++? $2+3$
- d) Write a C program to find the integral using Simpson's one-third rule 5

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

- e) Explain the structure of Fortran coding sheet. 5
- f) Write a program to solve and plot the output for visualization of the following differential equation:

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

GROUP-C

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

$$10 \times 2 = 20$$

- a) What is difference between algorithm and pseudo code? Explain steps involved in drawing of a flowchart. Write an algorithm to calculate even numbers between 0 and 99. Also draw the flowchart for it. $2+3+2+3$
- b) Write algorithm to this problem: Ramshewak goes to market for buying some fruits and vegetables. He is having a currency of Rs.500 with him for marketing. From a shop he purchases 2.0 kg Apple priced Rs.50.0 per kg, 1.5 kg Mango priced Rs.35.0 per kg, 2.5 kg Potato priced Rs.10.0 per kg, and 1.0 kg Tomato priced Rs.15 per kg. He gives the currency of Rs.500 to the shopkeeper. Find out the amount shopkeeper will return to Ramshewak. and also tell the total item purchased. Is there any difference between UNIX and LINUX? Write a C program to draw a random sample of size n from gamma distribution with parameter θ . Also find its mean and variance. $4+2+4$

- c) Write a program to find matrix multiplication using subroutine. $2+8$
- d) Write a program to find a transpose of a matrix. Write short notes on:
i) Call statement
ii) Save statement. $4+3+3$
- e) Type the 1st page of this question paper in your answer script using LaTeX command. 10

OPTION-D

PHY-G-SEC-T-1(D)

(Basic Instrumentation Skills)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) Write down the unit of electric field and magnetic field.
 - b) Mention the different types of CRO.
 - c) What do you mean by loading effect?
 - d) Write down the full form of CRO and CRT.
 - e) Write down the full form of DVM and ADC.
 - f) Distinguish between digital and analog instruments.
 - g) How do you check continuity of a circuit by using multimeter?
 - h) What do you mean by the term 'sensitivity' of a measuring instrument?

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) Describe the electron gun of a CRT. What type of electron emission is employed in CRT? $3+2$
 - b) How is the electron beam deflected horizontally and vertically in a CRT? Distinguish between electrostatic and magnetic deflections. $3+2$
 - c) Write short note on signal generator. 5
 - d) Write down the steps for measuring AC and DC voltage by using multimeter. 5

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) Draw the block diagram of a general purpose CRO and indicate its basic components. Write short note on pulse generator. $(3+2)+5$
 - b) What must be done to obtain a steady oscillogram? How can you measure the frequency of a signal voltage by means of a CRO? The electron beam in a CRT enters a magnetic deflection system after being

accelerated through a potential difference of 1 kV. The deflection system employs a magnetic field of 150 Gauss acting over an axial length of 1 cm. Find the deflection of the spot on the fluorescent screen placed at a distance of 20 cm from the centre of the deflection system. What is the magnetic deflection sensitivity?

3+3+(2+2)

- c) Write down the advantages of electronic voltmeter over conventional multimeter for measuring voltage. How do you measure DC voltage by using electronic voltmeter? Write down the steps for measuring resistance of a resistor by using multimeter. 3+4+3
- d) 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

OPTION-E

PHY-G-SEC-T-1(E)

(Technical Drawing)

GROUP-A

1. Answer any **five** questions: 2×5=10
- a) What is the use of T-square?
 - b) What is AUTOCAD?
 - c) Write the equation of a circle.
 - d) What is a pyramid?
 - e) Name any two methods of projection.
 - f) What is a tangent?
 - g) Name any two 3D solids.

GROUP-B

2. Answer any **two** questions: 5×2=10
- a) Top view of a rectangle has a length 50 mm and breadth 30 mm, the surface of which is horizontal. Draw the isometric view.
 - b) An equilateral triangle of 50 mm side has its V.T. parallel to and 25mm above xy-plane. It has no H.T. Draw the projection when one of its sides is inclined at 45° to the V.P.

- c) Draw a perpendicular to a given line from a point within it.
- d) Discuss the steps to inscribe a circle in a given triangle.

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 50 mm from both the reference planes. Draw the projection in all possible positions. 2+2+6
 - b) The front view of a semicircle (diameter = 50 mm) whose surface is parallel to V.P. Draw the isometric view. 10
 - 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-1(F)

(Radiation Safety)

GROUP-A

1. Answer any **five** questions: 2×5=10
- a) Explain the production of X-rays.
 - b) Differentiate between α - and β -decays.
 - c) What is nuclear fusion?
 - d) What is binding energy of an atom?
 - e) Give the definition of half-life of a radioactive element with example.
 - f) What do you understand by the term 'Radiation Detector'? Give examples.
 - g) What is the role of moderator in a nuclear reactor?

GROUP-B

2. Answer any **two** questions: 5×2=10
- a) State the laws of radioactive decay. Obtain an expression for mean-life of a radioactive element. 2+3

- b) What is Compton scattering? Explain the phenomenon of pair production. $2\frac{1}{2}+2\frac{1}{2}$
- c) Discuss Annual Limit of Intake (ALI) and Derived Air Concentration (DAC). $3+2$
- d) What are the nuclear wastes? How the nuclear wastes are managed to prevent harm? $2+3$

GROUP-C

3. Answer any **two** questions: $10\times 2=20$
- a) Explain Cherenkov radiation. Discuss the interaction of neutrons with matter. What are thermal neutrons and how they are produced in a nuclear reactor? $2+4+4$
- b) Discuss the biological effects of ionizing radiation. What are ICRP principles? $6+4$
- c) Explain different applications of nuclear techniques. 10
- d) Write short notes on: $5+5$
- i) Photoelectric effect.
- ii) Geiger Müller counters.

OPTION-G

PHY-G-SEC-T-1(G)

(Applied Optics)

GROUP-A

1. Answer any **five** questions: $2\times 5=10$
- a) Explain the terms 'spontaneous' and 'stimulated emissions'.
- b) What do you mean by optical pumping and population inversion?
- c) What do you mean by spatial frequency filtering?
- d) What do you mean by mono mode and multimode optical fibre?
- e) Differentiate between transmission and reflection type holograms.
- f) Explain briefly how haplography can be used in microscopy.
- g) What is splice loss in optical fibre?
- h) Give one example for each of the following:
Gas laser and solid-state laser.

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) What are the major advantages and disadvantages of optical fibre? 5
 - b) With the help of a suitable diagram explain briefly the action of a He-Ne laser. 5
 - c) "FTS is a powerful method for measuring emission and absorption spectra"— explain. 5
 - d) Write down the full form of LED. Draw the I-V characteristics of a LED. What are common uses of LED? $1+2+2=5$

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) What are Einstein's A and B coefficients? With the help of a suitable diagram explain how population inversion is achieved in a two level laser system. Establish the relations between A and B coefficients. $2+3+5=10$
 - b) With the help of suitable diagrams derive the expressions for acceptance angle and numerical aperture of an optical fibre. Find the numerical aperture of a step index fibre when the refractive

index of the core is 1.51 and that of the material used for cladding is 1.47. $6+4=10$

- c) Explain briefly the basic principle of holography. Write down the names of different types of holograms. With the help of suitable circuit diagram explain briefly how V-I characteristic curves of a LDR can be obtained using a laser. $3+2+5=10$
- d) Discuss the concept of spatial frequency filtering. Show that a thin lens can be used as a Fourier Transformer. Write a short note on Fibre Bragg Grating. $2+3+5=10$

OPTION-H

PHY-G-SEC-T-1(H)

(Weather Forecasting)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) Write the names of the components of air.
 - b) How the air is polluted?
 - c) What do you understand by atmospheric pressure?
 - d) What is latent heat of vaporization?
 - e) State the laws of radiation of heat.
 - f) What are the harms of Ozone layer depletion?
 - g) Write the causes of the flow of heat waves.

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) Discuss the variation of pressure and temperature with height.
 - b) What are the causes of climate change and Ozone depletion?

- c) Discuss the Satellite observations in weather forecasting.
- d) Differentiate between tornadoes and hurricanes. What are the origins of these two?

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) Discuss the compositional layering of the atmosphere. What are the temperature sensors? Discuss its working principles. $5+2+3$
 - b) What do you understand by absorption and emission of radiation? What is the relation between absorptive and emissive powers of a body? $6+4$
 - c) What is weather forecasting? Discuss different methods of weather forecasting. $4+6$
 - d) Write short notes on: $5+5$
 - i) Jet streams
 - ii) Environmental issues related to climate.

OPTION-I

PHY-G-SEC-T-1(I)

(Renewable Energy & Energy Harvesting)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) Write down the advantages and limitations of fossil fuel.
 - b) What are the main applications of solar pond?
 - c) How is energy obtained from tides?
 - d) Define geothermal energy and its resources.
 - e) Give two examples of Biomass and write down one advantage of Biomass energy.
 - f) What is meant by photovoltaic effect?
 - g) What are carbon capture technologies? Write down two advantages of it.

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) What are conventional and nonconventional sources of energy? Write down all major differences between them. $2+3$

- b) Draw a neat diagram of a solar cell. Write down working principle of it. Draw I-V characteristics of it. $1+3+1$
- c) Write down the factors which influence output of wind energy converter. Explain briefly working principle of a wind turbine. $2+3$
- d) What is the basic principle of Ocean Thermal Energy Conversion (OTEC)? Where are OTEC plant located? $3+2$

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) i) What do you mean by piezoelectric effect? Write down names of two naturally occurring piezoelectric materials.
 - ii) Explain piezoelectric effect by simple molecular method.
 - iii) How piezoelectric energy harvested from human motion? $(2+1)+4+3$
 - b) i) Write down environmental impacts of hydropower sources.
 - ii) Describe briefly how hydroelectric power is generated.

- iii) Write down main advantages of hydropower. 3+4+3
- c) i) Write down basic principle of wind energy conversion.
- ii) Obtain the expression for the power development due to wind.
- iii) Wind at 1 standard atmospheric pressure and 15°C has velocity 15m/s. The turbine has diameter 130m and operating speed 45 r.p.m. at maximum efficiency. Calculate total power produced. 3+4+3
- d) Write short notes on (any **two**): 5+5
- i) Environmental issues and Renewable sources of energy.
- ii) Electromagnetic energy harvesting.
- iii) Solar Green House
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