

**U.G. 3rd Semester Examination-2021**

**PHYSICS**

**[HONOURS]**

**Skill Enhancement Course (SEC)**

**Course Code : PHY-H-SEC-T-01(A,B,C&D)**

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-H-SEC-T-01-A**

**(Physics Workshop Skill)**

**GROUP-A**

1. Answer any **five** questions:  $2 \times 5 = 10$
- a) Find out the Vernier constant of a slide caliper having 100 Vernier divisions in Vernier scale. One main scale division is 0.05 cm.
  - b) What is SI unit of pressure? Convert it in CGS unit.
  - c) What is metal casting?

- d) What are the advantages of a Digital Multimeter?
- e) What are the basic differences of three types of Lever?
- f) What are the differences between alloy and composites?
- g) What is the mechanical advantage of a pulley to lift a mass of 15 kg using pulley?

**GROUP-B**

2. Answer any **two** questions:  $5 \times 2 = 10$
- a) What do you understand by an electrical relay? Explain different types of Gear depending upon their axle's position.  $1+4$
  - b) What is Sextant? What is its principle? Explain the theory to measure the height of a building using sextant.  $1+1+3$
  - c) What is soldering? What is a PCB board? Explain the two types of PCB board.  $1+1+3$
  - d) What are the advantages of laser beam welding over arc welding? Give some specific application of laser beam welding?  $3+2$

### GROUP-C

3. Answer any **two** questions:  $10 \times 2 = 20$
- a) i) Explain the construction of a Slide Calliper with proper diagram. How will you measure the volume of a cylindrical beaker using slide calliper?  
ii) Find out an expression of electrostatic deflection sensitivity of cathode ray tube.  $3+2+5$
- b) i) Write down the configuration of basic machine tools (with schematic diagram) and their uses.  
ii) Write down some application of laser beam welding.  $8+2$
- c) i) Explain the operation of a transistor as a switch with proper circuit diagram.  
ii) What are the hazards involved in soldering of electrical circuit?  
iii) Explain the difference between mechanical and Hydraulic braking system.  $4+3+3$
- d) i) Write short notes on Continuous Casting and Resistance welding.  
ii) What are the differences between Avalanche and Zener breakdown?  $4+4+2$

### OPTION-B

#### PHY-H-SEC-T-01-B

#### (Electrical Circuits and Network Skills)

1. Answer any **five** questions:  $2 \times 5 = 10$
- a) Define the power factor of an A.C electrical circuit.
- b) A conductor material has a free-electron density  $10^{24}$  electrons per cubic meter. When a voltage is applied, a constant drift velocity of  $1.5 \times 10^{-2}$  meter/second is attained by the electrons. If the cross-sectional area of the material is  $1 \text{ cm}^2$ . Calculate the magnitude of current. ( $e = 1.6 \times 10^{-19}$  Coulomb).
- c) For an A.C circuit show that average power of the circuit is  $I_{rms}^2 \cdot R$ .
- d) What do you mean by back E.M.F?
- e) What is the necessity of circuit breaker in electrical wiring?
- f) What is the necessity of conduit connection in household?
- g) The maximum flux-density in the core of a 250/3000-volts, 50 Hz single phase transformer is  $1.2 \text{ Wb/m}^2$ . The emf per turn is

8 volt, determine the primary and secondary turns of the transformer.

- h) A coil consists of 2000 turns of copper wire having a cross-sectional area  $0.8\text{mm}^2$ . The mean length per turns is 80 cm and the resistivity of copper is  $0.02 \mu\Omega\text{-m}$ . Find the resistance of the coil and power absorbed by the coil when connected across 110V d.c. power supply.

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

- a) Write a short note on three-phase alternating current source. What is phase sequence? What are the advantages of  $3\phi$  system?  $3+1+1$
- b) What is house wiring? What type of wire is used in a house? Write a notes on industrial wiring?  $2+1+2$
- c) Write a note on electrical safety.
- d) What are the basic concepts of household wiring and explain?
- e) What do you mean by (i) Surge protection (ii) ground fault protection?  $2\frac{1}{2}+2\frac{1}{2}$

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

- a) Write a comparison between basic principles of generator and motor action. A 220 Volt d.c.

machines has an armature resistance of  $0.5\Omega$ . If the full-load armature current is 20 A, find the induced e.m.f when the machine acts as (i) generator (ii) motor. Write some applications of d.c. motors.  $4+4+2$

- b) Explain the various methods of electrical wiring system. Write a block diagram of electrical wiring explaining the connection of a lamp, a fan with dimmer and a motor with safety measures. What are the materials used for electrical wiring?  $4+4+2$
- c) Explain the construction, working principle of single phase Induction motor. Explain the tests on a single phase transformer and develop an equivalent from the above tests. Explain the working principle of a full wave rectifier constructed with four PN-junction diodes.  $3+4+3$
- d) What is peak inverse voltage? What is an ideal diode? Draw the V-I characteristics of an ideal diode. Explain with neat diagram and mathematical deduction how an A.C. current does grow in a series Resistance-Inductor electrical circuit.  $2+2+2+4$

- e) What are the basic principles of induction motor. What are the functions and basic differences of Relay, Fuse and disconnect switches. Explain the basic construction of extension board with necessary diagrams.  
3+4+3

**OPTION-C**

**PHY-H-SEC-T-01-C**

**(Basic Instrumentation Skills)**

1. Answer any **five** questions:  $2 \times 5 = 10$
- a) What are the basic differences between Accuracy and Precession of a measurement?
  - b) What is multimeter?
  - c) Mention different type of Cathod Ray Tube?
  - d) What is loading effect?
  - e) Write down the full form of DAC and ADC?
  - f) What are the differences between Digital and Analog instruments?
  - g) Why do we use digital RLC meter?
  - h) What are the uses of Wave Analyser?

2. Answer any **two** questions:  $5 \times 2 = 10$
- a) Write down the basic principle of DVM. Draw the block diagram of it.  $2+3$
  - b) What is the function generator? Draw the basic block diagram of signal generator.  $2+3$
  - c) Explain the following terms as applied to digital display:
    - i) Resolution, ii) Sensitivity  $5$
  - d) Explain how frequency is measured using the digital frequency counter.  $5$
3. Answer any **two** questions:  $10 \times 2 = 20$
- a) What is digital storage oscilloscope? Draw and explain the block diagram of Digital Storage Oscilloscope. What are the applications of digital storage oscilloscope?  $2+6+2$
  - b) Draw the block diagram of an AC millivoltmeter. Write down its specifications and their significance. What is amplifier-rectifier type AC millivoltmeter?  $4+3+3$
  - c) What do you mean by Impedance Bridge? Write down the working principle of RLC bridge. What is the specification of digital LCR meter?  $2+5+3$

- d) Draw a block diagram of distortion factor meter and explain its operation. How do you measure resistance by using multimeter?

4+3+3

**OPTION-D**

**PHY-H-SEC-T-01-D**

**(Computational Physics Skills)**

**GROUP-A**

1. Answer any **five** questions: 2×5=10
- a) Define Algorithm. Why algorithm is necessary in solving any problem?
- b) Write down at least two internal and two external Linux commands.
- c) Classify the Fortran constants with examples.
- d) Out of the following, what are the valid integer variables in Fortran language?  
NISHI, KARJ, STV, ABC5, 2IND, IR6
- e) Write down arithmetic, relational, logical and assignment operators (at least one of each) available in Fortran.
- f) What is the equation form of the following Latex commands?  
 $\begin{equation}$

$$R = \frac{1}{\sqrt{AB}} \left( \frac{\ddot{A}}{A} + 2\frac{\dot{A}}{A} \frac{\dot{B}}{B} + \frac{\ddot{B}}{B} \right)$$

- g) Name the use package to include mathematical symbols and graph in Latex.
- h) What is the meaning of the following command?  
gnuplot> plot [-10:10][ -2:2] 2\*sin(3\*x)

**GROUP-B**

2. Answer any **two** questions: 5×2=10
- a) Construct an algorithm and flowchart to find the sum and product of a finite series. 2+3
- b) How do you include a figure in Tex? How do you insert references in Tex and recall them?  
 $2\frac{1}{2} + 2\frac{1}{2}$
- c) Write down a programme in Fortran language to print out all natural even/odd numbers between given limits. 5
- d) Convert the following structure into DO loop:  
x=1.0. z=0.0  
10 IF (X.LE.10) THEN  
Z = Z + X\*\*2

```

X=X+1
GOTO 10
ELSE
WRITE(*.*) Z
END IF

```

### GROUP-C

3. Answer any **two** questions:  $10 \times 2 = 20$
- a) Prepare a flowchart to find the roots of a quadratic equation. Write down the algorithm for plotting lissajous figures.  $5+5$
- b) What is Gnuplot? What is Linux? Describe how will you plot the trajectory of a particle projected making an angle with the horizontal direction using Gnuplot.  $1 \frac{1}{2} + 1 \frac{1}{2} + 7$
- c) Write down a programme in Fortran language to find maximum, minimum and range of a given set of numbers.  $10$
- d) Write down the following LaTeX snippet;
- ```

\documentclass[ 11pt, a4] { article }
\usepackage [amsmath]
\begin{document}
\title{Viscosity}
\maketitle

```

\section{ Introduction: }

Whenever there is a difference in velocity between the different layers of a flowing fluid,  $\{\text{it internal friction}\}$  between the layers will be called into play. The faster moving layer will tend to increase the velocity of the slower moving layer while the latter would tend to retard or drag back the faster moving one.  $\{\text{it This internal friction that tends to destroy the relative motion between the different layers of a moving fluid is called}\}$   $\text{\textbf{viscous force}}$   $\{\text{it and the property, the}\}$   $\text{\textbf{viscosity}}\}.$

So,  $\text{\textbf{viscosity}}$  may be defined as the property of a fluid by virtue of which it opposes a relative motion of its layers}.

\section{Newton's law Coefficient of viscosity}

According to Newton. the tangential force of internal friction due to viscosity operating between any two layers of a fluid in streamline motion is directly proportional to the area of the layers and the velocity gradient between them. Thus,  $\$F \propto A\$$ ; Also.  $\$F \propto \frac{dv}{dz}\$$

\begin{equation} \label {eqn 1}

\text {Therefore,} \hspace{ 0.5 cm}  $F = \eta$   
 $A \frac{dv}{dz},$   
\end{equation}

where  $F$  is the tangential viscous force  
across the area  $A$ .  $\frac{dv}{dz}$  the velocity  
gradient and  $\eta$  the proportionality  
constant.\

The constant  $\eta$  is a characteristic of the  
fluid and is called the coefficient of viscosity.

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