

U.G. 3rd Semester Examination-2020

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 Skills)

GROUP-A

1. Answer any **five** questions: $2 \times 5 = 10$
- a) What do you understand by metal casting?
 - b) What is S.I. unit of power? Find its dimension.
 - c) What do you understand by Laser welding?
 - d) Define capacitance.
 - e) Find out the least count of a screw gauge having screw pitch 2 mm. The total number of division in circular scale is 100.

[Turn over]

- f) Classify the manufacturing process.
- g) Define Mechanical advantage of a Lever.
- h) What do you understand by a PCB board?

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$
- a) Draw and explain the pin out diagram of a 555 timer. $1+4$
 - b) A Slide Calliper has 100 Vernier divisions in Vernier scale. The main scale is a centimeter scale with 1 m.s.d.= 0.1 cm. Find its Vernier constant (V.C.). Explain how will you measure the volume of a cylindrical block using a Slide Calliper? $2+3$
 - c) What are the advantages of laser beam welding over arc welding? Give some specific application of laser beam welding. $1+4$
 - d) Explain the construction and working principle of a power generator. $2+3$

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) i) What are the different steps involved in making a casting?

- ii) What are the advantages of metal casting?
 iii) Write down some application of Metal Casting. $5+2\frac{1}{2}+2\frac{1}{2}$
- b) i) Explain the operation of a transistor as a switch.
 ii) What are the uses of a digital multimeter?
 iii) What do you understand by avalanche breakdown and zener breakdown of a Zener diode?
 iv) Draw the I-V characteristics of Zener diode. $4+2+3+1$
- c) i) What is a Sextant? Explain it with a schematic Diagram.
 ii) A see saw is 30 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?
 $2+4+4$
- d) i) What is a lever? Explain the three types of lever with proper example.
 ii) What are the functions of brakes?
 $2+5+3$

OPTION-B

PHY-H-SEC-T-01-B

(Electrical Circuits and Network Skills)

1. Answer any **five** questions: $2 \times 5 = 10$
- a) What do you mean by the resistance of an electrical circuit?
 b) State Ohm's Law in terms of electrical conductivity.
 c) Calculate the equivalent resistance of a circuit if 4Ω , 6Ω and 19Ω resistances are connected in parallel to each other?
 d) What do you mean by transient response in an A.C circuit?
 e) What is Ladder diagram in electrical circuit?
 f) What do you mean by impedance and reactance of the circuit element?
 g) What is the necessity of Conduit wiring in the electrical circuit?
 h) What is the circuit breaker in the electrical circuit?

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

a) Write down the names of three main electrical circuit elements. Why no transient response can be observed in pure resistive circuit? Calculate the phase difference between input A.C sinusoidal current and output A.C voltage in a pure inductive circuit. $1+2+2$

b) What are the electrical Fuses? What do you mean by the Fuse rating-Explain with the example? $2+3$

c) What is P-N junction diode? Draw the current voltage relationship of a P-N junction diode. How can you make a full-wave rectifier using the P-N junction diode-Explain its operation. $1+1+3$

d) 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. $1+2+2$

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

a) Explain how does a capacitor can transmit the current through it? Why complex number is required to express the A.C current? Calculate the phase difference between input A.C

sinusoidal current and output A.C voltage in a pure capacitor circuit. Calculate the output current if a sinusoidal voltage $v(t) = A \sin(\omega t + \phi)$ is applied across the terminals of circuits having resistance R and capacitance C connected in series.

$2+2+2+4$

b) Draw the circuit diagram of a control circuit to glow up three bulbs of 220V, two sockets, and a contactor in a two phase electrical circuit. What is the three phase A.C current source? Draw the schematic diagram of a three phase A.C source. What is power factor?

$4+2+2+2$

c) What is an A.C generator? What is motional emf and steady emf? Draw a neat diagram of an A.C generator. Explain the principle of action of the generator. What is alternator?

$2+2+2+3+1$

d) Explain the working principle of a transformer? What is the step-up and stepdown conformation of the transformer? What is control Raleys? Draw the circuit diagram of a control Raley. What is the difference between the Raleys and contractors in an electrical circuit?

$3+2+1+2+2$

OPTION-C
PHY-H-SEC-T-01-C
(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) By default, in implicit typing of Fortran language, identify which are integer or real variables out of the following?
NLIST, KIRC, STM, ABCD2, IND1, POOL5
 - 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?
$$\begin{equation} R = \frac{2}{N^2} \left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B} \right) \end{equation}$$

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

GROUP-B

2. Answer any **two** questions: 5×2=10
- a) Construct an algorithm and flowchart to read two numbers and determine the larger.
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 find the roots of a quadratic equation. 5
 - d) Convert the following structure into DO loop:
I=1, ISUM=0
10 IF (I.LE.10) THEN
ISUM=ISUM+I
I=I+1
GOTO 10
ELSE
WRITE(*,*) ISUM
END IF 5

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) Prepare a flowchart for calculation of $\sin(x)$ as a series. Write down the algorithm for product of two matrices. $5+5$
- 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 the sum and product of a finite series. 10
- d) Write down the following LaTeX snippet:
- ```
\documentclass[11pt, a4]{article}
\usepackage{amsmath}
\begin{document}
\title{Simple Harmonic Motion}
\maketitle
\section{Introduction:}
In Simple harmonic motion, restoring force acting on the particle is always directed towards a fixed point known as equilibrium position and the magnitude of force is directly proportional to the displacement of particle from the equilibrium position.
\section{Equation of motion:}
```

Let us suppose a particle of mass  $m$  is executing SHM. If  $x$  be its displacement at any instant from the equilibrium position, then the restoring force is  $F = -kx$ .

From Newton's law, the equation of motion is

```
\begin{equation}
```

$$m \frac{d^2x}{dt^2} = -kx$$

```
\end{equation}
```

```
\begin{equation}\label{diffeqn}
```

$$\text{or, } \frac{d^2x}{dt^2} + \omega^2 x = 0,$$

```
\end{equation}
```

where  $\omega^2 = k/m$ . Equation [\eqref{diffeqn}](#) is the differential equation of motion of a simple harmonic oscillator.

```
\section{Solution:}
```

The general solution of equation [\eqref{diffeqn}](#) is

```
\begin{equation}\label{sol}
```

$$x = a \sin(\omega t + \phi)$$

```
\end{equation}
```

```
\end{document}
```

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**OPTION-D**

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

**(Basic Instrumentation Skills)**

1. Answer any **five** questions:  $2 \times 5 = 10$
- a) Explain what do you mean by “measurement”?
  - b) How the accuracy can be specified for a particular instrument?
  - c) What are the main parts of Cathode Ray Tube?
  - d) What is “persistence of phosphor”?
  - e) Draw the basic block diagram of signal generator.
  - f) Which of the following signal are generated by Wein- bridge oscillators?
    - i) Square wave,
    - ii) Sine wave,
    - iii) Triangular wave,
    - iv) Pulse wave.
  - g) Compare analog multimeter with digital multimeter.
  - h) What is the use of “distortion meter”?

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

- a) Discuss few advantages of digital voltmeter over analog type. Explain the following terms as applied to digital meters.
  - i) Resolution, ii) Sensitivity, iii) Accuracy specifications.  $2+3$
- b) The table shows the set of 5 measurement recorded in a laboratory. Calculate the average value for the set of measurement and the precision of the 3rd measurement.  $5$

| Measurement number | Value of measurement |
|--------------------|----------------------|
| 1.                 | 49                   |
| 2.                 | 51                   |
| 3.                 | 52                   |
| 4.                 | 50                   |
| 5.                 | 49                   |

- c) State and explain various front panel controls of a simple CRO.  $5$
- d) Draw and explain the basic block diagram of digital multimeter.  $5$

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

- a) 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.  $3+2+5$
- b) Write short notes on i) Pulse Generator and  
ii) Function generator.  $5+5$
- c) Draw the block diagram of basic CRO. Explain the functions of various blocks. What is digital storage oscilloscope?  $3+5+2$
- d) What is *Q-meter*? Present a neat diagram of *Q-meter* circuit. Write down the working principle of *Q-meter* circuit. What do you mean by wave analyser? Give any two applications of wave analyser.  $1+3+2+2+2$
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