U.G. 3rd Semester Examination-2022

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

(Electrical Circuit and Network Skills)

GROUP–A

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

   a) Draw Electrical Symbols for a Zener Diode and a Fuse.

   b) What is peak inverse voltage of a diode?

   c) Show that the quantity L/R has the dimension of time.

   d) What are the advantages of 3 phase circuits over single phase circuits?

e) Define power factor of an AC circuit.

f) How can a multimeter be used to test a diode?

g) State Thevenin's Theorem.

h) What are protective relays?

GROUP-B

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

a) If $Z_1 = 3 + j7$ and $Z_2 = 12 + j16$ are connected in parallel, find the equivalent impedance of combination.

Derive the expression for resonance frequency for parallel LCR circuit. 2+3

b) Calculate the r.m.s. value and the form factor of a periodic voltage having the following values for equal time intervals changing suddenly from one value to the next: 0, 5, 10, 20, 50, 60, 50, 20, 10, 5, 0, -5,-l0 V etc. What would be the r.m.s value of sine wave having the same peak value? 4+1

c) An electric iron is rated 800W, 220V. Find the current drawn and resistance of the heating element.

A relay has an inductance of l0 H and resistance of 100Ω and operates with a current of 2 mA. How long will the relay take to operate when a pd of lV is suddenly applied across it? 2+3

d) Explain with the help of relevant circuit diagrams, how an analog multimeter can be used as a dc voltmeter, dc ammeter and ohm meter. 2+2+1

GROUP-C

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

a) Explain the various methods of electrical wiring system. What are the various types of drawing used for electrical wiring? Explain in detail. What is miniature circuit breaker? What are the advantages of MCB? 3+3+4

b) With a neat circuit diagram explain the construction and principle of operation of DC Motor. Define the speed of an ac motor. What does it depend on? A three phase 50 Hz 4 poles induction motor runs at 1460 rpm. Calculate the synchronous speed, slip and frequency of rotor, induced emf. 5+2+3

c) With a neat circuit diagram explain the construction and principle of operation of DC Generator. An alternating voltage is given by $V=220\sin(314t)$. Calculate i) frequency, ii) maximum value, iii) average value, iv) RMS value. Why no transient is produced in pure resistive circuit? 5+4+1

d) Explain the basic principle of a magnetic contactor. List the various parts of a transformer and write the emf equation involved. Write a short note on conduit wiring.

3+4+3

OPTION–B

PHY-H-SEC-T-01-B

(Basic Instrumentation Skills)

GROUP-A

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

a) What type of error can occur in an experiment?

b) What are the uses of CRO?

c) What do you mean by digital storage oscilloscope?

d) What are the essential components of Cathode Ray Tube?

e) Write down some uses of signal generators.

f) What is distortion factor meter?

g) What do you mean by accuracy and resolution of a digital multi-meter?

h) Explain what do you mean by impedance Bridge.

GROUP-B

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

a) Write down the basic principle of measuring dc voltage and ac voltage using conventional multi-meter. 5

b) Draw the basic block diagram of an electronic voltmeter and explain each block. 2+3

c) Write a short note on low frequency signal generator. What are the differences between signal generators and function generators? 3+2

d) Draw a diagram of Q-meter circuit. Write down the working principle of Q-meter circuit. 2+3

GROUP-C

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

a) Draw the block diagram of Digital Multi-meter (DMM). What are the specifications and the advantages of DMM? What is frequency counter? 3+5+2

b) Discuss accuracy, precession and resolution of an instrument used in some measurement. What do you mean by average deviation and standard deviation? A set of independent voltage measurement taken by four observers was recorded as 117.02 V, 117.11 V, 117.08 V and 117.03 V. Calculate average voltage and average deviation. 3+4+3

c) How is universal counter is used for time period measurement and present the block diagram for the measurement. Describe digital LCR meter using block diagram and explain its working principle of measuring L and C. 5+5

d) Discuss the working principle of Electronic Voltmeter. What are the advantages of Electronic Voltmeter over conventional Voltmeter? Why the input impedance of an electronic voltmeter is high? How many types of electronic voltmeters are available in the market? Draw a block diagram of AC voltmeter specifying clearly each block. 2+2+2+1+3

OPTION–C

PHY-H-SEC-T-01-C

(Physics Workshop Skills)

GROUP–A

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

   a) Find out the least count of a screw gauge having screw pitch 2 mm. The total number of division in circular scale is 100.

   b) Classify the manufacturing process.

   c) Define Mechanical advantage of a Lever.

   d) What do you understand by a PCB board?

   e) What do you understand by metal casting?

   f) What is S.I. unit of power? Find its dimension.

   g) What do you understand by Laser welding?

   h) Define capacitance.

GROUP-B

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

   a) What are the advantages of laser beam welding over arc welding? Give some specific application of laser beam welding. 1+4

   b) Explain the construction and working principle of a power generator. 2+3

c) Draw and explain the pin out diagram of a 555 timer. 1+4

d) 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

GROUP-C

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

a) 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

b) i) What is a lever? Explain the three types of lever with proper example.

ii) What are the functions of brakes? 2+5+3

c) 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. $5+2\frac{1}{2}+2\frac{1}{2}$

d) 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. $4+2+3+1$

OPTION–D

PHY-H-SEC-T-01-D

(Computational Physics Skills)

GROUP–A

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

a) Write down arithmetic, relational, logical and assignment operators (at least one of each) available in Fortran.

b) 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}
```

c) Name the usepackage to include mathematical symbols and graph in Latex.

d) What is the meaning of the following command?

```
gnuplot> plot [–10:10][–2:2] sin(x)
```

e) Define Algorithm. Why algorithm is necessary in solving any problem?

f) Write down at least two internal and two external Linux commands.

g) Classify the Fortran constants with examples.

h) 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

GROUP-B

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

a) Write down a programme in Fortran language to find the roots of a quadratic equation. 5

b) 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

c) Construct an algorithm and flowchart to read two numbers and determine the larger. 2+3

d) How do you include a figure in Tex? How do you insert references in Tex and recall them? $2\frac{1}{2}+2\frac{1}{2}$

GROUP-C

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

a) Write down a programme in Fortran language to find the sum and product of a finite series. 10

b) 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^2x = 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}
```

10

c) Prepare a flowchart for calculation of sin(x) as a series. Write down the algorithm for product of two matrices. 5+5

d) 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. $1\frac{1}{2}+1\frac{1}{2}+7$
