

U.G. 3rd Semester Examination-2019

PHYSICS

[HONOURS]

Skill Enhancement Course (SEC)

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

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

PHYS(H)-SEC-01-A-T

(Physics Workshop Skills)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$
- a) Relative density of lead is 11.3 in C.G.S. system. Find the relative density in M.K.S. system.
 - b) Name the fundamental units of luminous intensity and electric current.
 - c) To measure the volume of water you are using a cylindrical glass beaker. You will point at the upper meniscus or the lower.

[Turn over]

- d) Name two alloys.
- e) In a p-n junction diode which side is donor and which side is acceptor?
- f) Can you check which is the n side and which is the p side of a diode by using a multimeter?
- g) The signals in the horizontal and vertical inputs of a CRO are

$$v_x = V_1 \sin \omega t,$$

$$v_y = V_2 \sin(\omega t + \phi)$$

when $\phi = 0^\circ$ and 180° , what will be the shape of Lissajous figure?

- h) Name a common use of pulley in a house (village house).

GROUP-B

2. Answer any two questions: 5×2=10

- a) What are the common materials used for manufacturing of steel? What is lubricating oil? Name two types of welding joints. 2+1+2
- b) In a vernier scale, 50 vernier divisions are equal to 49 main scale divisions. Calculate the vernier constant of the scale. Given the least main scale division is 0.5 mm. To measure the

- diameter of a wire you will prefer a slide calliper or a screw gauge, why? 3+2
- c) What is a regulated power supply and an unregulated power supply? Define percentage regulation. 3+2
- d) Write the working principle of power generating system. 5

GROUP-C

3. Answer any **two** questions: 10×2=20
- a) Give a block diagram of a general purpose CRO and explain the function of each blocks. 10
- b) Discuss with a diagram the use of a sextant to measure the height of a building. 10
- c) Write down the mechanism of gear system. Discuss how can you lift heavy weight using lever. 5+5
- d) Discuss the operation of an electronic switch using a transistor. What is a timmer? 5+5

OPTION-B
PHYS(H)-SEC-01-B-T
(Computational Physics Skills)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$
- a) Define algorithm. What are the necessities of algorithm in solving a problem?
 - b) Write down at least two internal and two external Linux commands.
 - c) Classify the Fortran constants with examples.
 - d) What are the valid integer variables in Fortran language of the following?
NURM, 2ND, K2MIN and INDX3
 - e) Write down at least four rotational operators available in Fortran.
 - f) $\begin{array}{l} \backslash \text{begin}\{equation\} \\ \backslash \text{dot}\{\rho\} + 3H\backslash \text{left}(\rho + p\backslash \text{right}) = 0 \\ \backslash \text{end}\{equation\}, \end{array}$
what is its equation form?
 - g) Name the use package to include mathematical symbols and graph in Latex.
 - h) What is the meaning of the following command?
gnu plot>plot[-5:5][-2:4]X**2.

GROUP-B

2. Answer any two questions:

$$5 \times 2 = 10$$

- a) Construct an algorithm and flowchart to read two numbers and determine the larger.

$$2 + 3 = 5$$

- b) How do you include a figure in TeX? How do you insert references in TeX and recall them?

$$2\frac{1}{2} + 2\frac{1}{2} = 5$$

- c) Write down a programme in Fortran:

Given, 'a' and 'b' are the sides of a triangle, θ is the angle between 'a' and 'b', the length of the remaining side is $\sqrt{a^2 + b^2 - 2ab\cos\theta}$ and

the area of the triangle is $\frac{1}{2}ab\sin\theta$. 5

- d) Convert the following structure into DO Loop:

X=1.0

10 IF (X.LE.10) THEN

$$Z = \frac{Z}{C}$$

P=C * * 2

X=X+1

GOTO 10

ELSE

PRINT *, P

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. $5 + 5 = 10$

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. $1\frac{1}{2} + 1\frac{1}{2} + 7 = 10$

c) Write down the programme 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}
\title {\Large\bf Summary of Differential
Equation}
\begin {document}
\maketitle
\section {Introduction:}
Let us consider the equation:
\begin{equation}\label{sd.eqn1}
X\frac{dX}{dY}+Y=0
\end{equation}
```


Equation (\ref {sd.equn1}) involves as well as derivative of the dependent variable y with respect to the independent variable x . Such an equation is called a differential equation.

In general, an equation involving derivative of the dependent variable with respect to independent variable is called differential equation.

\section {First order Differential equation:}

A first order-first degree differential equation is of the form

\begin {equation} \label {sd. equn2}

$$\frac {dx} {dy} = F(x,y)$$

\end {equation}

If $F(x,y)$ can be expressed as a product $g(x)h(y)$, where $g(x)$ is a function of x and $h(y)$ is a function of y , then the differential equation (\ref {sd.equn2}) is said to be of variable separable type. The differential equation (\ref {sd.equn2}) then takes the form after separating the variables and integrating as

\begin {equation} \label {sd.equn3}

$$\int \frac {dy} {h(y)} = \int g(x) dx \sim [\text{if } h(y) \neq 0]$$

\end {equation}

\end {document}

OPTION-C

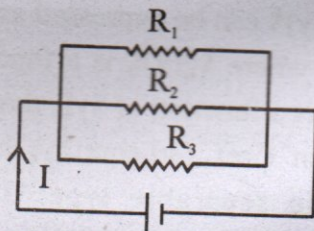
PHYS(H)-SEC-01-C-T

(Electrical Circuits and Network Skills)

GROUP-A

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

- a) Define the temperature coefficient of resistivity of a material. What is its unit?
- b) What do you mean by short circuit and open circuit?
- c) Find the current through the resistance R_1 , R_2 and R_3 of the following network in terms of I , R_1 , R_2 and R_3 .



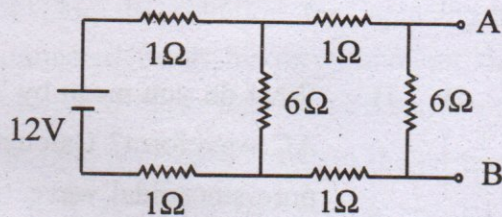
- d) Show that Kirchoff's voltage law is consistent with the principle of conservation of energy.
- e) State and explain the reciprocity theorem for electrical network.
- f) Draw circuit diagram of a full wave bridge rectifier.

- h) Draw the electrical schematic symbols of fuse, iron core inductor, autotransformer and rheostat.

GROUP-B

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

- a) i) State Thevenin's theorem.
ii) Determine Thevenin's equivalent circuit for the network given below at the terminals AB:



Also find the short circuit current through the terminal AB. 2+3

- b) i) What do you mean by power factor in an AC circuit? What is the value of power factor in a purely resistive ckt.?

- ii) An alternating emf of rms value 100 V and frequency 50 Hz is applied to a series ckt. consisting of an inductance of 10H and a resistance of $1000\ \Omega$. What will be the rms value of current flowing in the ckt. and its phase with respect to the emf? What is the power dissipated in the ckt.?

2+3

- c) i) Compare between generator and motor.
- ii) A single phase 50 kVA transformer has primary voltage of 6600 V and secondary voltage of 256 V and has 32 secondary turns. Calculate the number of primary turns and primary and secondary currents.

2+3

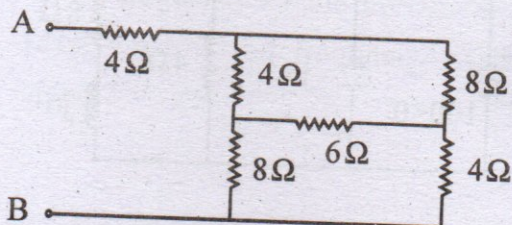
- d) i) What do you mean by 'form factor' of an AC waveform? Calculate its value for a pure sinusoidal wave.
- ii) Show that in the case of AC, the potential drop across an inductor leads the current by 90° and that across a capacitor lags the current by 90° .

2+3

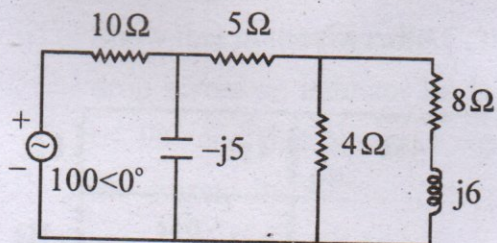
GROUP-C

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

- a) i) Describe the construction and working of a DC generator.
- ii) Find out the generated emf (emf equation) of a DC generator.
- iii) A four pole generator having wave-wound armature winding has 51 slots, each slot containing 20 conductors. What will be the voltage generated in the machine when driven at 1500 rpm assuming the flux per pole to be 7.0 mWb? $5+2+3$
- b) i) What do you mean by star and delta connection?
- ii) Develop the equation for replacing star connected mesh by its equivalent delta connected mesh and vice versa.
- iii) Find the resistance between the terminals A and B using the above results or otherwise.



- c) i) What is the general principle of induction motor or AC motor?
- ii) Explain the function of stator and rotor of an induction motor.
- iii) Two impedance $Z_1 = (8+j6)$ and $Z_2 = (3-j4)$ are in parallel. If the total current of the combination is 25A, find the current taken and power consumed by each impedance. 2+4+4
- d) i) What is the basic principle of a transformer?
- ii) Find the equation of induced emf in the secondary and voltage transformation ratio of a transformer.
- iii) Using suitable method, calculate the current through 4 Ohm resistance of the following network.



2+4+4

OPTION-D

PHYS(H)SEC-01-D-T

(Basic Instrumentation Skills)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$

- a) What types of errors can occur in an experiment?
- b) What is a multimeter?
- c) Classify different types of AC-millivoltmeter.
- d) What is a cathode ray oscilloscope?
- e) What are signals and wave-forms?
- f) What is Q-meter and mention its uses?
- g) Compare between analog and digital measuring instruments.
- h) A Lissajous figure, produced on a CRO screen and this pattern gives 4-tangencies with the vertical and 3-tangencies with the horizontal. If the frequency of the horizontal signal is 1 kHz, what is the frequency of the vertical signal?

GROUP-B

2. Answer any two questions: $5 \times 2 = 10$
- a) Compare between accuracy and precision of instruments. Explain different types of experimental errors. $2+3=5$
 - b) Explain the principles of voltage measurement by a electronic voltmeter. Briefly explain the principle and working procedure of a digital meter. $2+3=5$
 - c) What is a digital oscilloscope? And what are CRO probes? Briefly explain the working principle and draw a block diagram of a digital storage oscilloscope. $2+3=5$
 - d) What is a function generator? Design a circuit diagram of square wave generator. $1+4=5$

GROUP-C

3. Answer any two questions: $10 \times 2 = 20$
- a) Draw a block diagram of basic cathode ray oscilloscope (CRO). Explain briefly the basic construction of a cathode ray tube (CRT). Mention briefly the specifications of a CRO and their significances. What are the uses of a cathode ray oscilloscope? $2+3+3+2=10$

b) What is an impedance bridge? Draw a block diagram of a basic RLC bridge (balancing type). Explain briefly its working principle. What is digital LCR bridge? Mention its measurement guidelines. Mention the uses of basic RLC bridges. $1+2+2+1+2+2=10$

c) Draw a block diagram of a function generator and explain briefly its working principle. Mention the specifications of low frequency signal generators. What are the uses of distortion factor meter? How does a magnetic pulse generator work? $2+2+2+2+2=10$

d) Explain the working principle of a Q-meter with a block diagram. Mention the factors that may cause errors during measurements by a Q-meter. A $4\frac{1}{2}$ -digit voltmeter is used to measure voltage. Find

i) Resolution,

ii) How would 16.58 would be displayed on a 10 V range?

iii) How would 0.7254 be displayed on 1 V and 10 V range? Draw a block diagram of a digital multimeter.

$$3+2+3+2=10$$