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: 2×5=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: 5×2=10

a)   What do you understand by an electrical relay? Explain different types of Gear depending upon their axe'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: 10×2=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: 2×5=10

a) Define the power factor of an A.C electrical circuit.

$Power\,factor = \dfrac{VI\cos\phi}{VI} = \cos\phi$

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 1.5×10^{-2} meter/second is attained by the electrons. If the cross-sectional area of the material is $1\,cm^2$. Calculate the magnitude of current. (e=1.6×10^{-19} Coulomb).

$I = v_d\, e\, n\, A$

c) For an A.C circuit show that average power of the circuit is $I_{rms}^2 . R$.

https://www.toppr.com/ask/question/prove-that-for-ac-circuitpav-vrms-times-irms-cos/

When the armature of a DC motor rotates under the influence of the driving torque, the armature conductors move through the magnetic field and hence emf is induced in them as in a generator. The induced emf acts in opposite direction to the applied voltage V (Lenz's law) and is known as Back EMF or Counter EMF (Eb)

d) What do you mean by back E.M.F?

The fundamental function of circuit breakers is to constantly "verify" that the electrical charge does not exceed the safety limits and, if so, stop the operation of the electrical circuit automatically, in order to avoid damage to the electrical installation in general.

e) What is the necessity of circuit breaker in electrical wiring?

1)Protecting Wires From Damage For that reason, and where wiring needs to be protected from damage, there is another option 2)Styles Conduit comes in many styles and is used to run electrical wiring in exposed locations in and around your home. ... 3)Exterior Uses The conduit that is installed outdoors must be rated for exterior use.

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 Wb/m². The emf per turn is

$B \rightarrow$

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

b) A coil consists of 2000 turns of copper wire having a cross-sectional area 0.8mm². The mean length per turns is 80 cm and the resistivity of copper is 0.02 $\mu\Omega$–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: 5×2=10

a) Write a short note on three-phase alternating current source. What is phase sequence? What are the advantages of 3φ 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: 10×2=20

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

machines has an armature resistance of 0.5Ω. 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

Margin / reference notes:

Copper: Copper is the most commonly used material for electrical wiring due to its high conductivity, flexibility, and durability. It is used for both residential and commercial applications.

Aluminum: Aluminum is another popular material for electrical wiring, especially in commercial and industrial applications. It is less expensive than copper, but has lower conductivity and is more prone to oxidation.

Silver: Silver is an excellent conductor of electricity, but it is rarely used for wiring due to its high cost.

Gold: Gold is also an excellent conductor, but it is even more expensive than silver and is rarely used for wiring.

Steel: Steel wires are used in some specialized applications, such as for overhead power lines, due to their strength and durability.

3-Phase Power System In electrical engineering, 3-phase electric power systems have at least three conductors carrying alternating voltages that are offset in time by one-third of the period (Each phase is set at the same frequency and voltage amplitude but phase shifted by 120° allowing for constant power transfer during electrical cycles).

In a three-phase system, the order in which the voltages attain their maximum positive value is called Phase Sequence. There are three voltages or EMFs in the three-phase system with the same magnitude, but the frequency is displaced by an angle of 120 deg electrically.

1. Three-phase induction motors are self-starting whereas the single-phase induction motor is not self-starting. This means the 1 –phase motor has no starting torque and hence it needs some auxiliary means to start at the initial stage.
2. The three Phase Induction motors have higher power factor and efficiency than that of a single-phase induction motor.

House wiring is the process of connecting a house to the national electrical grid. This is done by installing electrical cables, conduit pipes, Distribution boards, light fittings, electrical wiring in the house and related important points.

1. Non-Metallic 2. Armored Cable 3. Metal-Clad Cable 4. THHN/ THWN Wire 5. Underground Feeder Cable

The design and installation of industrial wiring systems is typically governed by national and international electrical codes and standards, which are intended to ensure safety and reliability. It is important to have licensed and experienced electricians to design and install industrial wiring systems to meet these requirements.

Surge suppressors should be used as a matter of habit with all semiconductor-based electronic and computer hardware, including peripherals such as printers, monitors, external disk drives, and modems. But the suppressor should not be relied upon to provide protection against lightning-induced transients.
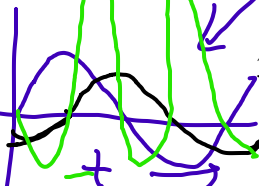
Ground-fault protection of equipment (GFPE) is defined in the National Electrical Code (NEC) in Article 100 as "a system intended to provide protection of equipment from damaging line-to-ground-fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit.

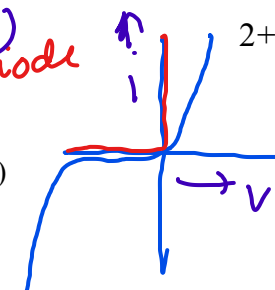In a diode, the peak inverse voltage (PIV) is the maximum voltage that can be applied across the diode in the reverse-biased direction without causing damage to the diode. When a diode is reverse-biased, the PIV is the voltage at which the diode will start to conduct in the reverse direction, allowing a reverse current to flow through the diode. Exceeding the PIV can result in breakdown of the diode, which can cause permanent damage to the device. The PIV rating of a diode

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Handwritten annotations:

$\frac{8n_1}{8n_2}$ n_1 n_2 n

$A = 0.8mm^2$
$l = 80\,cm \times 2000$
$\rho = 0.02$ $P = \frac{V^2}{R}$
$R = \rho\frac{l}{A}$ $P = 302.5$
$R = 40\Omega$

positive / negative

red for ideal diode
blue for normal diode

Voltage / Current / Power

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: 2×5=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?

The motor which works on the principle of electromagnetic induction is known as the induction motor. The electromagnetic induction is the phenomenon in which the electromotive force induces across the electrical conductor when it is placed in a rotating magnetic field.

When the three phase supply is given to the stator, the rotating magnetic field produced on it. The figure below shows the rotating magnetic field set up in the stator.

The polarities of the magnetic field vary by concerning the positive and negative half cycle of the supply. The change in polarities makes the magnetic field rotates.

The conductors of the rotor are stationary. This stationary conductor cut the rotating magnetic field of the stator, and because of the electromagnetic induction, the EMF induces in the rotor. This EMF is known as the rotor induced EMF, and it is because of the electromagnetic induction phenomenon.

The conductors of the rotor are short-circuited either by the end rings or by the help of the external resistance. The relative motion between the rotating magnetic field and the rotor conductor induces the current in the rotor conductors. As the current flows through the conductor, the flux induces on it. The direction of rotor flux is same as that of the rotor current.

Now we have two fluxes one because of the rotor and another because of the stator. These fluxes interact each other. On one end of the conductor the fluxes cancel each other, and on the other end, the density of the flux is very high. Thus, the high-density flux tries to push the conductor of rotor towards the low-density flux region. This phenomenon induces the torque on the conductor, and this torque is known as the electromagnetic torque.

The direction of electromagnetic torque and rotating magnetic field is same. Thus, the rotor starts rotating in the same direction as that of the rotating magnetic field.

The speed of the rotor is always less than the rotating magnetic field or synchronous speed. The rotor tries to the run at the speed of the rotor, but it always slips away. Thus, the motor never runs at the speed of the rotating magnetic field, and this is the reason because of which the induction motor is also known as the asynchronous motor

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

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

\end{equation}

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: 10×2=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{ lntroduction: }

Whenever there is a difference in velocity between the different layers of a following fluid, {\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. {\it This internal friction that tends to destroy the relative motion between the different layers of a moving fluid is called} \textbf{viscous force} {\it and the property, the} textbf{viscosity}.\\

So, \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. $F \propto dv/dz$

\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 $AS. dv/dz the velocity gradient and η the proportionality constant.\\

The constant η is a characteristic of the fluid and is called the coefficient of viscosity.

\end{document}   10

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