U.G. 4th Semester Examination - 2021
PHYSICS
[PROGRAMME]
Skill Enhancement Course (SEC)
Course Code : PHY-G-SEC-T-2(A-G)

Full Marks : 20   Time : 1 Hour

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-G-SEC-T-2A
(Radiation Safety)

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

    i)   What is pair production?

    ii) What are auger electrons?

    iii) What do you understand by Cherenkov radiation?

    iv) What is linear attenuation coefficient?

    v)   Differentiate between *absorbed dose* and *equivalent dose*.

    vi) What is KERMA? What is its SI units?

    vii) How much energy is required to remove one neutron from O_8^{16}?

    viii) What is Bremsstrahlung?

2. Answer any **one** question: 5×1=5

    i)   Discuss the various techniques that are used in medical treatment and diagnosis.   5

    ii) Describe the basic principle and working of an ionization chambers. What are its limitations?   4+1

    iii) Give an outline of the Accelerator driven Sub-critical system (ADS)for waste management.   5

3. Answer any **one** question: 10×1=10

    i)   a)   How are the neutrons produced in the laboratory?

         b)   Write down illustrative nuclear reactions for their production and discuss the application of neutrons of different energies for effecting nuclear transmutations.

         c)   What are thermal neutrons?

         d)   What is Bethe-Bloch formula?
                    2+(2+2)+2+2

ii) a) What is photoelectric effect?

b) State and explain Einstein's equation of photoelectric effect.

c) The work functions of tungsten and barium are 4.52 and 2.5eV respectively. Calculate the wavelength of light which can just eject electrons from tungsten and from barium. Which metal would you select for a photocell for use with visible light?

2+(2+3)+3

iii) Write short notes on: 5+5

a) Safety and risk management of radiation.

b) Application of Nuclear techniques in industrial usages.

OPTION-B

PHY-G-SEC-T-2B

(Applied Optics)

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

i) What is coherence length?

ii) What are the characteristics of LASER light?

iii) What do you understand by multimode fibers?

iv) What is spatial frequency filtering?

v) What do you understand by temporal coherence?

vi) What is population inversion?

vii) What is the difference between holography and photography?

viii) Find the numerical aperture and acceptance angle of an optical fiber, if the refractive index for core and cladding are 1.48 and 1.46 respectively.

2. Answer any **one** question: 5×1=5

i) Describe briefly (giving a schematic experimental setup), how a fiber Bragg grating (FBG) can be used to compensate the +ve dispersion accumulated in a single mode fiber of length L and dispersion coefficient D. Obtain the relation between total dispersion accumulated and the key parameters of FBG used.

ii) Explain the behavior of light propagation in an absorption media based on the expression

$$E(x,t) = E_0 \exp\left[\left(-\frac{\alpha}{2}\right)x\right]\exp\left[i(nkx - \omega t)\right] \text{ where}$$

the terms have usual meanings.

iii) Draw the diagrams of different aperture which work as low pass, high pass and band pass filters.

3. Answer any **one** question: $10 \times 1 = 10$

i) a) Discuss briefly the application Fourier transformation Spectroscopy in absorption spectra and NMR spectroscopy.

b) Discuss the construction and working principle of Fabry-Perot interferometer.

c) What do you mean by stimulated and spontaneous emission? $4+4+2$

ii) a) What is the principle of LASER?

b) Explain the working of a He-Ne LASER.

c) What are the limiting factors on the output power of the Helium-Neon laser?

d) Find the ratio of the two states in the He-Ne Laser that produce light of wavelength 632.8 nm at 300K. $2+4+2+2$

iii) a) What are Einstein coefficients?

b) Consider the two-level system shown in Figure below with $E_1 = -13.6$ eV and $E_2 = -3.4$ eV. Assume $A_{21} \approx 6 \times 108_s^{-1}$. What is the frequency of light emitted due to transitions from E_2 and E_1? Assuming the emission to have only natural broadening, what is the *full width of half maximum* of the emission? What is the

population ratio N2/N1 at T = 300 K?
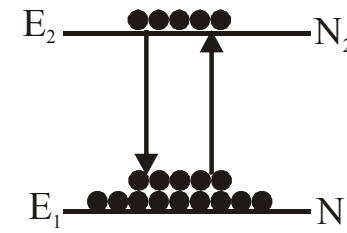
c) What is LDR? How does it work? What are its applications? $2+3+(1+2+2)$

OPTION-C

PHY-G-SEC-T-2C

(Basic Instrumentation Skills)

GROUP-A

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

a) What is a multimeter?

b) What is a signal generator?

c) What types of error can occur in an experiment?

d) What is the internal resistance of an ideal voltmeter?

e) Name any two types of wave generated by a pulse generator.

f) Write an equation of an a.c. current I with peak I_0 and angular frequency w_0.

g) What is Q meter?

h) In which instrument in your laboratory you can see a Lissajous figure?

GROUP-B

2. Answer any **one** question: 5×1=5

a) Give the block diagram of an a.c millivoltmeter.

b) Write about instrumental accuracy and sensitivity.

c) What is distortion factor? Discuss about it.

GROUP-C

3. Answer any **one** question: 10×1=10

a) Give the block diagram, explanation and specifications of low frequency signal generator.

b) Give the block diagram of bridge. What is the working principles of a basic balancing type RLC bridge? What is a digital LCR bridge?

c) What is the advantage of an electronic voltmeter over a conventional multimeter? Discuss rectifier-amplifier type and amplifier-rectifier type a.c. millivoltmeter.

OPTION-D
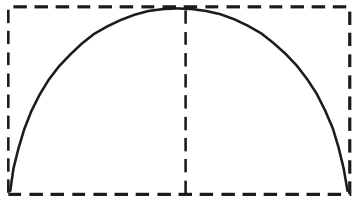
PHY-G-SEC-T-2D

(Technical Drawing)

GROUP-A

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

a) Name any two types of conic sections.

b) Name any two methods of projection.

c) Name any four drafting instruments. (Name only, no discussion)

d) Write the equation of an ellipse.

e) What is a straight line?

f) What is AUTOCAD?

g) What are the types of auxiliary planes?

h) What is dimensioning?

GROUP-B

2. Answer any **one** question: 5×1=5

a) Discuss the steps to inscribe a circle in a given triangle.

b) A line PQ 90mm long is in the H.P and makes an angle of 30º with V.P. Its end P is 25mm in front of V.P. Draw the projection.

c) Name any five fundamental commands to edit a drawing.

GROUP-C

3. Answer any **one** question: 10×1=10

a) Draw the development of lateral surface of a cylinder having a square hole in it.

b) The front view of a semi-circle whose surface is parallel to V.P is show in the figure. Draw the isometric view.

c) A triangular prism base 30mm and axis 50mm long is lying on the H.P. on one of its rectangular faces with its axis inclined at 30° to the V.P. It is cut by a horizontal plane at a distance 12mm above the ground. Draw the front view.

OPTION-E

PHY-G-SEC-T-2E

(Computational Physics Skills)

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

a) Write Latex Code to write (n×m) and (3.5=15).

b) What is the difference between constant and variables in fortran?

c) Write five common symbols of flow chart.

d) How do you read and write a file in fortran?

e) Write syntax for Do-Loop in fortran.

f) What is algorithm in computation?

g) Write Latex Code to write (a/3) and (b_3).

h) What is the main difference between Linux and Unix?

2. Answer any **one** question: 5×1=5

a) Use Gnuplot to plot the following functions,

$$f1(x) = \exp\left(-\frac{x^2}{2}\right) \text{ and } f2(x) = \frac{x^2}{16} \text{ over the}$$

range $x = -4 : 4$.

Set the x label and y label and also the title of the plot.

b) Write a Fortran Program to print even and odd numbers between 1 and 100.

c) Use Latex Code to write the following equation array:

a=b+c

=x-y

3. Answer any **one** question: $10 \times 1 = 10$

a) Write a program to create a data file for f(x)=cos(x) over the range $x = -\pi : \pi$. Now use gnuplot to plot the curve from the data file.

5+5

b) What are the advantages of flow Chart? Draw flow chart to calculate roots of a quadratic equation. What do you mean by conditional jump in a program? 3+5+2

c) Write Latex Code to write the following:

8+2

$$\sum_{y=1}^{y=5} x^y \text{ and } \int_{a}^{b} f(x)$$

How do you write Greek alphabet omega (Ω) and alpha (α) in Latex?

OPTION-F

PHY-G-SEC-T-2F

(Electrical Circuits and Network Skills)

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

i) Which information can you get from an Electrical Drawing?

ii) What are the basic components of an electrical circuit?

iii) a) When two parallel resistances R_1 and R_2 are connected with a third resistance R_3 in series, what will be the equivalent resistance?

b) If the rated voltage V and rated wattage W are given, then what will be the resistance of the material?

iv) a) A D.C generator is an electrical machine which converts _____ energy into electrical energy. (Fill in the blanks).

b) The principle of the transformer depends upon the _____ induction between two inductive coils linked by common magnetic flux. (Fill in the blanks).

v) What are the different types of electrical wiring?

vi) a) Which rule is used to know the direction of the motor?

b) Which type of poly phase system is mostly used?

vii) a) For which current Kirchhoff's law is valid?

b) The total opposition offered to the flow of alternating current is called _____ of the circuit . (Fill in the blanks).

viii) What is a solenoid?

2. Answer any **one**:   5×1=5

a) Write notes on the following:

   i) Diodes

   ii) Relays

   iii) Fuse

b) Describe the use of Multimeter and types of Multimeter.

c) Write short notes on:

   i) Resistors

   ii) Inductors

   iii) Capacitors

3. Answer any **one**:   10×1=10

a) Write short notes on:

   i) Analogue Multimeter

   ii) Digital Multimeter

b) Describe the general principle of Transformer and the uses of Transformer.

c) What is series LCR circuit. What is the resonance in it? Determine the condition of resonance. Find Quality Factor. What is the phase difference between voltage and current in this circuit.

OPTION-G
PHY-G-SEC-T-2G
(Physics Workshop Skill)
GROUP–A

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

a) Define "Resistance welding process".

b) Write the requirements of good pattern materials.

c) Density of mercury in C.G.S. unit is 13.6 gm.cm^{-3}. What is its value in S.I. unit?

d) What are various parameter of design of welded joint?

e) What are the functions of coating on electrode?

f) What is S.I unit of Power? Write its Dimension.

g) Define Vernier Constant of a Slide Calliper.

h) Define capacitance.

GROUP–B

2. Answer any **one** question: 5×1=5

a) Explain the mechanism of a Zener Diode as a voltage regulator.   5

b) Explain different types of PCB board.   5

c) What do you understand by drilling? Explain the different types of drilling mechanism.   1+4

GROUP–C

3. Answer any **one** question: 10×1=10

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 are the hazards involved in soldering of electrical circuit?

     ii) What is a relay? Explain the operation of a electronic switch using relay and npn transistor with proper circuit diagram.

     3+1+6

c) i) What is a Generator?

     ii) Explain the construction and working principle of a power generator.

     iii) What are the differences of AC and DC generators?   1+7+2

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