U.G. 4th Semester Examination - 2020

PHYSICS

[PROGRAMME]

Skill Enhancement Course (SEC)

Course Code : PHYG-SEC-T-2(A-G)

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

PHYG-SEC-T-2A

(Radiation Safety)

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

   i) What do you understand by Cherenkov radiation?

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

   iii) What is linear attenuation coefficient?

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

   v) What are auger electrons?

   vi) What is Bremsstrahlung?

   vii) What is pair production?

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

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

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

   ii) What is Compton Effect? Obtain an expression for the Compton shift using non-relativistic mechanics only. What is Compton wavelength? 1+3+1

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

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

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

   i) Describe a Geiger Muller (GM) Counter and explain its operation. What is meant by ‘dead time’ of a GM counter? How does quenching is achieved in GM counter? (3+3)+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.

iv) 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

OPTION-B

PHYG-SEC-T-2B

(Applied Optics)

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

i) What do you understand by multimode fibers?

ii) What is population inversion?

iii) What do you understand by temporal coherence?

iv) 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.

v) What are the characteristics of LASER light?

vi) What is the difference between holography and photography?

vii) What is coherence length?

viii) What is spatial frequency filtering?

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

i) How to construct a spatial frequency filtering system optically and how the desired spatial frequencies can be filtered out by this system?

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

$$E(x,t) = E_0 \exp\left[\left(-\frac{\alpha}{2}\right)x\right]\exp\left[i(nkx-\omega t)\right]$$ where the terms have usual meanings.

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

iv) 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.

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

i) What is the fundamental principle of hologram? How is it produced and how is the image constructed from it? What the mail requirements for holography? 2+(3+3)+2

ii) a) What is the principle of LASER?

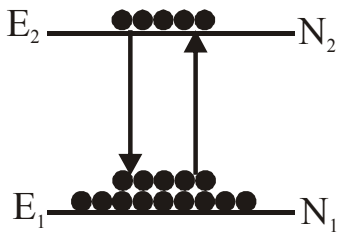
b) Explain the working of a He-Ne LASER.

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)

iv) 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

OPTION-C

PHYG-SEC-T-2C

(Basic Instrumentation Skills)

GROUP-A

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

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

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

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

   d) What is Q meter?

   e) What is a signal generator?

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

   g) What is a multimeter?

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

GROUP-B

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

   a) Explain the principles of voltage measurement (give block diagram).

   b) Write about instrumental accuracy and sensitivity.

   c) What is distortion factor? Discuss about it.

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

GROUP-C

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

   a) Draw a block diagram of a basic cathode ray oscilloscope (CRO). What is electrostatic focusing? What is time base operation? Name any two use of CRO.

   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.

   d) Give the block diagram, explanation and specifications of law frequency signal generator.

OPTION-D

PHYG-SEC-T-2D

(Technical Drawing)

GROUP-A

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

   a) Write the equation of an ellipse.

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

   c) What is AUTOCAD?

   d) What are the types of auxiliary planes?

   e) Name any two methods of projection.

   f) What is dimensioning?

   g) Name any two types of conic sections.

   h) What is a straight line?

GROUP-B

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

   a) Construct a scale of 1 : 4 to show centimeter and long enough to measure upto 5 decimeters.

   b) A line PQ 90mm long is in the H.P and makes an angle of 30^o 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.

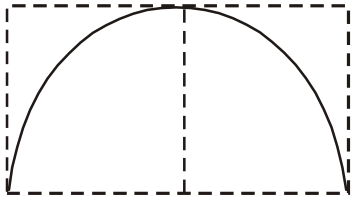
   d) Discuss the steps to inscribe a circle in a given triangle.

GROUP-C

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

   a) What is principle of projection? What is orthographic projection? A point A is 25mm above H.P. and 30mm in front of V.P. Draw the projection. 2+3+5

   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^o to the V.P. It is cut by a horizontal plane at a distance 12mm above the ground. Draw the front view.

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

OPTION-E

PHYG-SEC-T-2E

(Computational Physics Skills)

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

   a) Write five common symbols of flow chart.

   b) What is algorithm in computation?

   c) Write syntax for Do-Loop in fortran.

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

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

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

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

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

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

   a) Write a flow chart: Take the age of a person and check wheather he/she is eligible to vote or not (eligibility age is 18 yrs or more).

   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:

   $$a=b+c$$

   $$=x-y$$

   d) Use Gnuplot to plot the following functions,

   $f1(x)=\exp\left(-\frac{x^2}{2}\right)$ and $f2(x)=\frac{x^2}{16}$ over the range $x=-4:4$.

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

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

   a) Write a Fortran Program to find the sum of two matrices. Discuss about three types of operators (arithmetic, relational and logical) with example. Use relational operator to find the bigger number between two numbers A and B. 3+5+2

   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?

d) 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

OPTION-F

PHYG-SEC-T-2F

(Electrical Circuits and Network Skills)

1. Answer any **five**: 2×5=10

i) 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?

ii) 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).

iii) 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).

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

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

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

vi) What is a solenoid?

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

viii) What are the different types of electrical wiring?

2. Answer any **two**: 5×2=10

a) Explain with proper diagram the full wave rectification of Diode.

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

c) Write short notes on:

i) Resistors

ii) Inductors

iii) Capacitors

d) Write notes on the following:

i) Diodes

ii) Relays

iii) Fuse

3. Answer any **two**: 10×2=20

a) Four resistances of value 4, 8, 10 and 40 ohm respectively are joined in parallel and current of 40A is led into them. Determine the current through each resistance.

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.

d) Write short notes on:

i) Analogue Multimeter

ii) Digital Multimeter

OPTION-G

PHYG-SEC-T-2G

(Physics Workshop Skill)

GROUP–A

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

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

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

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

   d) Define capacitance.

   e) Write the requirements of good pattern materials.

   f) What are the functions of coating on electrode?

   g) Define "Resistance welding process".

   h) Define Vernier Constant of a Slide Calliper.

GROUP–B

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

   a) A Slide Calliper has 50 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 Slide Calliper? 2+3

   b) Explain different types of PCB board. 5

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

   d) Explain the mechanism of a Zener Diode as a voltage regulator. 4

GROUP–C

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

   a) i) What are the advantages of laser beam welding over arc welding?

      ii) Give some specific application of laser beam welding. 5+5

   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

d) 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

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