2019

B.Sc. (Hons)

4th Semester Examination

PHYSICS

Paper - SEC2T

Full Marks : 25 Time : 2 Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Computational Physics

Group - A

Answer any *three* questions (2×3=6)

1. What is GUI ?
2. What is swap space associated with Linux ?
3. Write Linux commands to
   (i) Create an empty file
   (ii) View the contents of a file 1+1

[Turn Over]

4. What are the basic differences between internal and external commands in Linux System ?

5. What is the purpose of computed GOTO statement in FORTRAN ?

Group - B

Answer any *two* questions (2×5=10)

6. Explain various types of constants in FORTRAN.

7. What is Gnu plot ? How would you define a function in Gnu plot ? Which platform supports Gnu plot ? 1+2+2

8. What is the difference between Latex and Tex ? How can you open a tex file ? Is Latex programmable ? 2+1+2

Group - C

Answer any *one* question (1×9=9)

9. Write a programme in FORTRAN with flow chart to multiply two matrices.

10. How will you create an Input Gnuplot file for plotting data for a projectile motion and save the output to view on the screen as an eps file and pdf file?

4+5

Basic Instrumentation Skills

1. Answer any *three* questions : 2×3

   (a) What do you mean by dual-trace and a double beam CRO ?

   (b) What is current sensitivity of a moving coil galvanometer ?

   (c) What is the time base in CRO ? Why is it so called ?

   (d) How can you increase the internal impedance of a voltmeter with help of any active device ?

   (e) Define pulse generator.

2. Answer any *two* questions : 5×2

   (a) What is a Q meter ? Discuss how the Q of a coil can be measured with Q meter. 1+4

   (b) Explain how the phase difference between two a.c voltages of same frequency can be measured by a CRO using Lissajous Figure. 5

   (c) Why do you use a sawtooth voltage in a CRO? How is such voltage generated ? 1+4

3. Answer any *one* question : 1×9=9

(a) (i) Draw the basic circuit used in a solid-state electronic d.c voltmeter.

Explain its action. How can you modify the circuit to measure ac voltage ? 2+2+2

(ii) Consider two 1 MΩ resistors connected in series and supplied by a source of 150V. A multimeter having sensitivity 20 KΩ / V is used to measure voltage across one of the resistors. The scale range used is 50 V. What will be the reading on the multimeter. 3

(b) What do you mean by deflection sensitivity ? Derive an expression for deflection sensitivity of a CRT using electrostatic deflection.

A CRT is designed to have deflection sensitivity of 0.5 mm/V. The deflecting plates are 3 cm long and 6 mm apart. The distance of the screen from the centre of the plates is 20 cm. Calculate the necessary voltage to be applied to the final accelerating anode. 1+5+3

Renewable Energy and Energy Harvesting

1. Answer any *three* questions 3×2=6

   (a) Define conventional and non-conventional energy source with examples.

   (b) What do you mean by greenhouse gases ? Name two of them.

   (c) How power of wind energy is related to the speed of wind ?

   (d) Write a short note on osmotic power.

   (e) What do you mean by Air Mass (AM) regarding solar irradiation ?

2. Answer any *two* questions 2×5=10

   (a) What is piezoelectric transducer ? Suggest two methods to harvest piezoelectric energy. 1+2+2=5

   (b) Write the names of different wave energy devices. Discuss briefly any two of them. 1+2+2=5

   (c) Discuss briefly working of the different kinds of geothermal power plant. 5

[Turn Over]

Group - C

Answer any *one* questions (1×9=9)

3. (a) Draw equivallent of a solar cell module. Find the expression for open circuit voltage of the module. 5

   (b) If a solar cell absorbs only blue light of wavelength 4500-4900 Å. What could be the maximum output voltage ? 2

   (c) Describe the working principle of non-convecting solar pond. 2

4. (a) Briefly discuss the principle of nuclear energy harvesting. Give associated nuclear reaction(s). 5

   (b) What are environmental impacts on hydropower plants. 4

Applied Optics

Group - A

Answer any *three* questions (2×3=6)

1. (a) What is spontaneous and stimulated emission of radiation ?

(b) What do you mean by attenuation in an optical fiber ? Give the reasons of attenuation.

(c) Draw schematically the energy level diagram of a He-Ne Laser.

(d) What do you understand by Coherence ?

(e) What is NMR spectroscopy and its use ?

Group - B

Answer any *two* questions (2×5=10)

2. (a) Define the Einstein A, B Coefficient. Establish a relationship between them. 2+3

(b) Explain the utility of Fourier transform spectrocopy (FTS) with some instances. 5

(c) What is reference wave of Holography ? Define how the resultant intensity of recording hologram depends on phase difference. 2+3

Group - C

Answer any *one* question (1×9=9)

3. (i) What is graded index fiber ? Discuss its advantages over a step index one. Prove that the ray path of a graded index fiber is sinusoidal, whose refractive index is given by

$$n^2(r) = n_0{}^2\left[1-(r/a)^2\right] \quad |x| > a$$
$$= n_2{}^2 \quad |x| < a$$

1+1+4

(ii) What are virtual and real images in relation to the reconstruction of the image from hologram ? Make a comparison between ordinary photography and a holography. 2+1

4. (i) Describe the working principle of He – Ne Laser. Why a narrow discharge tube is used here ? 6+1+2

(ii) A He – Ne Laser on transition from 3s to 2p level gives emission of wavelength 632.8 nm. If the 2p level has energy equal to 15.2×10^{-19}J, how much minimum pumping energy is needed for it ?