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UG/4th Sem/PHY/19

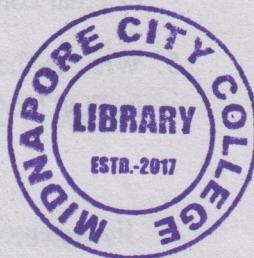
2019

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 ]



( 2 )

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

( 3 )

**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

[ Turn Over ]



( 4 )

3. Answer any *one* question :  $1 \times 9 = 9$

- (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  $1\text{ M}\Omega$  resistors connected in series and supplied by a source of  $150\text{V}$ . A multimeter having sensitivity  $20\text{ K}\Omega/\text{V}$  is used to measure voltage across one of the resistors. The scale range used is  $50\text{ V}$ . 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  $0.5\text{ mm/V}$ . The deflecting plates are  $3\text{ cm}$  long and  $6\text{ mm}$  apart. The distance of the screen from the centre of the plates is  $20\text{ cm}$ . Calculate the necessary voltage to be applied to the final accelerating anode.  $1+5+3$

( 5 )

### Renewable Energy and Energy Harvesting

1. Answer any *three* questions  $3 \times 2 = 6$

- (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  $2 \times 5 = 10$

- (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 ]



( 6 )

**Group - C**

**Answer any one questions (1×9=9)**

3. (a) Draw equivalent 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

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**Applied Optics**

**Group - A**

**Answer any three questions (2×3=6)**

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

( 7 )

- (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 spectroscopy (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

[ Turn Over ]



$$n^2(r) = n_0^2 \left[ 1 - (r/a)^2 \right] \quad |x| > a \quad 1+1+4$$
$$= n_2^2 \quad |x| < a$$

- (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  $15.2 \times 10^{-19} \text{J}$ , how much minimum pumping energy is needed for it? 7