



বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

B.Sc. Honours Examination 2021

(CBCS)

4th Semester

PHYSICS

PAPER—SEC2T & SEC2P

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

SEC2T : COMPUTATIONAL PHYSICS

Answer any *one* question.

1×15

1. (a) Discuss the basic data types in Fortran.
- (b) What is a subprogram in Fortran? Write down the basic differences between function and subroutine in Fortran.
- (c) Explain different types of operators in Fortran. 5+(2+3)+5

2. (a) What is Latex? Explain Latex document structure.
- (b) What is the command for Latex? Give two examples.
- (c) Write down syntax for generating table of contents in Latex.
- (d) Discuss the functionality of Gnuplot. $(2+5)+(1+1)+2+4$
3. (a) What is an array in Fortran? Write down the syntax of array statement.
- (b) What is the purpose of “do loop” statement in Fortran? Write down the syntax of do loop.
- (c) Discuss the file handling statements in Fortran.
- (d) Write down an algorithm to check whether a number is prime or not. $(2+1)+(2+1)+4+5$

Answer any *one* question.

1×10

4. (a) What is Linux?
- (b) Write down Linux commands to
- (i) Display current working directory
 - (ii) List all files in the current directory
 - (iii) Create a directory
 - (iv) Copy the contents of file1 to file2
 - (v) Delete a file.
- (c) How to plot 2-D functions and data in Gnuplot? How to print out graphs in Gnuplot? $2+(1+1+1+1+1)+(1+2)$

5. (a) What is Fortran? Write down the advantages of the Fortran programming language.
- (b) What is variable? Write down the syntax of variable declaration in Fortran.
- (c) Explain the “implicit none” statement in Fortran. (2+4)+(1+1)+2

PRACTICAL : SEC2P

Answer any *one* question. 1×15

1. (a) Write a Fortran program to evaluate $1/2 + 1/4 + 1/6 + \dots + 1/100$.
- (b) Write a Fortran program to find Fibonacci series. 5+10
2. (a) Write a Fortran program to print out all odd numbers between 50 and 100.
- (b) Write a Fortran program to calculate the mean and standard deviation of the following numbers: 5, 13, 7, 31, 50, 18, 99. 5+10
3. (a) Write a Fortran program to find the largest number from a set of five numbers.
- (b) Write a Fortran program to find the product of two 2×2 matrices. 5+10

[Internal assessment - 5]

[Attendance - 5]

SEC2T : BASIC INSTRUMENTATION SKILLAnswer any *one* question.

1×15

1. Draw a neat and labeled diagram showing the essential features of a single beam CRO. Explain how the brightness and focusing of electron beam are controlled. Why is a fluorescent screen used in CRT?
8+5+2
2. (a) Discuss the working principle of any basic (balancing type) RLC bridge in detail with the help of necessary diagram.
- (b) A Maxwell Bridge is used to measure inductive impedance. At balance, the bridge constants are $C_1 = 0.01 \mu\text{F}$, $R_1 = 470 \text{ k}\Omega$, $R_2 = 5.1 \text{ k}\Omega$, $R_3 = 100 \text{ k}\Omega$. Find the series equivalent of unknown impedance.
- (c) Explain the working principle of a pulse generator with the help of a block diagram.
6+4+5
3. (a) What are the advantages of using digital instruments over analog instruments?
- (b) Draw the basic circuit diagram for a Q-meter. Explain its operation and write the equation for Q factor.
- (c) How can you measure capacitance of a capacitor by a Q-meter?
5+5+5

Answer any *one* question.

1×10

4. (a) Explain accuracy, precision and sensitivity of an instrument.
- (b) A set of independent voltage measurement taken by four observers was recorded as 105.02V, 105.11V, 105.08V and 105.03V. Calculate average voltage and average deviation.
5+5

5. (a) How is an electronic voltmeter better than a conventional voltmeter? Explain it in terms of input impedance and sensitivity.
- (b) Explain the working principle of an AC millivoltmeter.
- (c) Calculate the value of resistance on the 10 V range of a DC voltmeter that uses a 200 μ A meter movement with an internal resistance of 1k Ω . 4+4+2

PRACTICAL : SEC2P

Answer any *one* question. 1×15

1. Discuss the loading effect of a multimeter while measuring voltage across a low resistance and a high resistance. 15
2. Explain the method of measurement of voltage, frequency, time period and phase angle using a CRO. 15
3. Explain the theory and procedure of measurement of R, L and C using a LCR bridge / universal bridge. 15

[Internal assessment - 5]

[Attendance - 5]

SEC2T : RENEWABLE ENERGY & ENERGY HARVESTINGAnswer any *one* question.

1×15

1. (a) Discuss the problems associated with existing fossil fuel energy.
(b) Give a brief account of non-conventional energy resources.
(c) Describe shortly the process of energy generation from bio-mass.
5+6+4
2. (a) What do you mean by solar cell? Explain how solar energy can effectively be converted into electrical energy in a solar cell.
(b) Write a brief note on solar cooker.
(c) Discuss on the applications of solar pond and solar energy.
6+5+4
3. (a) Discuss about the wind turbines.
(b) Mention different hydropower resources.
(c) Briefly describe the impact of hydro-energy on environment.
(d) Describe the proper technologies for harvesting energy from ocean tide.
3+3+4+5

Answer any *one* question.

1×10

4. Discuss on various resources of geothermal energy and also discuss the allied technologies for effective energy harvesting. 10
5. Give a comparative discussion about ocean energy and wind energy. 10

PRACTICAL : SEC2PAnswer any *one* question.

1×15

1. Describe neatly the experimental process and typical outcome of solar energy conversion.
2. Describe the experimental process to convert vibrational energy into voltage using piezo-materials.
3. Describe the experimental procedure to get voltage from thermal energy using thermoelectric modules.

[Internal assessment - 5]**[Attendance - 5]****SEC2T : APPLIED OPTICS**Answer any *one* question.

1×15

1. Explain the Characteristics of Laser light. What is the principle of generation of radiation in a laser? What is the difference between stimulated and spontaneous emission of radiation? Explain the working principle of He-Ne Laser. 2+4+4+5
2. (a) What is the basic principle of optical fibres; discuss the mechanism of propagation of light in an optical fibre.

(b) What do you mean by numerical aperture and acceptance angle of an optical fibre?

- (c) Find the numerical aperture and acceptance angle of an optical fibre with the refractive indices of core and cladding are 1.5 and 1.48 respectively.
- (d) With schematic of the refractive index profile discuss step and graded index fiber.
- (e) Write down the working principle of an intensity based fiber optic sensor. 2+4+3+(2+2)+2

- 3.** (a) Discuss the principle of recording of a hologram and show how the phase information of the light beam scattered from the object is recorded.
- (b) How holography is used in the field of precession microscopy?
- (c) What are the basic criteria based on which material is to be chosen for fabricating a semiconductor laser. Give some examples with their emission wavelength.
- (d) Write a short note on fiber Bragg Grating. 6+3+3+3

Answer any *one* question. 1×10

- 4.** (a) What are the spatial frequencies of an optical beam?
- (b) How can you filter out a band of spatial frequencies from an optical beam?
- (c) What are the differences between conventional photography and Holography?
- (d) What are the characteristic properties of a laser beam? 2+3+3+2

5. What are the main components of a laser? Derive the expression of Einstein's A and B coefficients. 4+6

PRACTICAL : SEC2P

Answer any *one* question. 1×15

1. How can you measure width of a thin wire using laser diffraction?
- (a) Principle and Working formula
- (b) Procedure
- (c) Precautions
- (d) Comment on how accurate the method is. 5+6+2+2
2. (a) What is a polarizer?
- (b) Describe with schematic diagram how polarization state of a laser beam be analyzed using a polarizer analyzer combination. 3+12
3. Study the V-I characteristics of a light emitting diode in forward biased condition.
- (a) Apparatus required 2
- (b) Theory 6
- (c) Circuit diagram 3
- (d) Typical characteristic 4

[Internal assessment - 5]

[Attendance - 5]