



'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 4th Semester [Special] Examination, 2023

SEC1-P2-PHYSICS

Time Allotted: 2 Hours

Full Marks: 60

The figures in the margin indicate full marks.

The question paper contains SEC-2A and SEC-2B. Candidates are required to answer any *one* from the *two* sections and they should mention it clearly on the Answer Book.

SEC-2A

BASIC INSTRUMENTATION SKILLS

GROUP-A

1. Answer any **four** questions from the following: 3×4 = 12
- (a) Draw the block diagram of AC millivoltmeter.
 - (b) Discuss the importance of 'Q-factor' in any RLC circuit.
 - (c) Define ripple factor and state its importance in rectifier circuit.
 - (d) What is a half-wave and a full-wave rectifier?
 - (e) What is a shunt? State one of its function.
 - (f) What are the differences between a moving coil and a moving magnet galvanometer?

GROUP-B

Answer any *four* questions from the following

6×4 = 24

2. With the help of a block diagram explain the operation of a function generator. 2+4
3. Derive the general equation of a balance for an AC bridge. Why is it preferable in bridge circuits, that the equation of balance should be independent of frequency? 4+2
4. Describe the operation of a full wave rectifier circuit and hence calculate its ripple factor. 4+2
5. Describe the working principle of permanent magnet moving coil voltmeter. Why this cannot be used to measure the AC voltage? 5+1
6. Describe the working principle of digital voltmeter. 6
7. Discuss the Wien bridge oscillator. Mention for what purpose the Wien bridge oscillator is used. 5+1

GROUP-C

Answer any *two* questions from the following

12×2 = 24

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| 8. | Describe the importance of different torques in indicating instruments. | 12 |
| 9. | Describe the different types of errors in experimental measurement with proper example. | 12 |
| 10.(a) | Describe with a diagram the operation of a multirange voltmeter. State its limitations. | 6+2 |
| | (b) Briefly characterize different types of analog voltmeter. | 4 |
| 11. | What are different types of analog ammeter? Describe each of them. | 2+10 |

SEC-2B

RENEWABLE ENERGY AND ENERGY HARVESTING

GROUP-A

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| 1. | Answer any <i>four</i> questions from the following: | 3×4 = 12 |
| | (a) What is the primary principle for generating nuclear energy? State some of its limitations. | 3 |
| | (b) What are the major challenges in harvesting wind energy? | 3 |
| | (c) Discuss various types of Geothermal resources. | 3 |
| | (d) Write a short note on osmotic pressure. | 3 |
| | (e) Distinguish between conventional and non-conventional energy sources with examples. | 3 |
| | (f) What do you mean by greenhouse gases? Name two of them. | 2+1 |

GROUP-B

Answer any *four* questions from the following

6×4 = 24

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| 2. | Describe briefly the working principle of a solar cooker. Write two disadvantages of using a solar cooker. | 4+2 |
| 3. | What are the environmental impacts of a hydropower plant? | 6 |
| 4. | Suggest two methods of harvesting Piezo-electric energy. | 6 |
| 5. (a) | What is biomass? Does it belong to renewable category? Justify. | 1+1 |
| | (b) Name the constituents of biogas. | 2 |
| | (c) Point out the factors affecting biogas generation. | 2 |

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| 6. (a) What is the electromagnetic energy harvesting? | 2 |
| (b) How does a linear electromagnetic generator work? | 3 |
| (c) What is the importance of Carbon Capture and Storage (CCS)? | 1 |
| 7. Write names of different wave energy devices. Discuss briefly any two of them. | 6 |

GROUP-C

Answer any two questions from the following

12×2 = 24

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| 8. (a) Draw a solar cell module equivalent. Find the expression for open circuit voltage of the module. | 6 |
| (b) If a solar cell absorbs only blue light of wavelength 4500-4900 Å, what could be the maximum output voltage? | 3 |
| (c) Describe briefly the main application of a solar pond. | 3 |
| 9. (a) Define wind power. What range of wind speed is considered favourable for wind power generation? | 2+1 |
| (b) Calculate the power extracted by a propeller type wind turbine using the following data:
Speed of wind = 20 m/s
Air density = 1.2 kg/m ³
Diameter of rotor = 80 m
Power Co-efficient = 0.5 | 4 |
| (c) Briefly discuss the shape of blade used in a windmill and why. | 5 |
| 10.(a) What is a solar collector? What is it used for? | 1+1 |
| (b) With the help of diagram discuss the construction and working principle of a flat-plate solar collector. | 6 |
| (c) Solar radiation is incident on a flat-plate collector at a rate of 800 W/m ² . The collector has a surface area of 30 m ² . This collector supplies hot water to a facility at a rate of 0.1 kg/s. If the temperature difference between the hot water provided by the collector and cold water entering the collector is 40°C, calculate the efficiency of the solar collector. Given specific heat of water is 4200 J/kg-K. | 4 |
| 11.(a) What do you mean by the Ocean Thermal Energy Conversion (OTEC)? | 2 |
| (b) What are the main advantages of OTEC system? | 3 |
| (c) Explain with a neat diagram the operation of OTEC plants. | 7 |

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