'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 4th Semester 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) Write the differences between a voltmeter and an ammeter.

   (b) Explain the term 'precision' of a measuring instrument with proper example.

   (c) What are the main components used to design the probe for cathode ray oscilloscope?

   (d) Differentiate between amplifier-rectifier ac millivoltmeter and rectifier-amplifier ac millivoltmeter.

   (e) What do you mean by propagation error in any experiment?

   (f) Why the permanent magnet moving coil is unable to detect ac voltage?

GROUP-B

Answer any *four* questions from the following 6×4 = 24

2. (a) Explain the working principle of a basic dc voltmeter. 4+2

   (b) What do you mean by loading effect of a voltmeter?

3. (a) What is the time base in a CRO? Why is it so called? 2+2+2

   (b) What do you mean by deflection sensitivity of a cathode ray tube?

4. Describe the operation of a half wave rectifier circuit and hence derive the expression of ripple factor. 3+3

5. How can you design a pulsed wave signal generator? Write with proper circuit diagram. 3+3

6. Discuss the dual trace mechanism of CRO. 6

7. Draw the block diagram and describe the working principle of a digital multimeter. 6

GROUP-C

Answer any *two* questions from the following 12×2 = 24

8. What is digital storage oscilloscope? Draw the block diagram of a digital storage oscilloscope and explain the working principle of it. 2+(3+4)+3

   Mention some applications of digital storage oscilloscope.

9. Draw the block diagram and explain the working principle of a *Q*-meter. (3+3)+(3+3)

   How can you measure the inductance and capacitance by a *Q*-meter?

10. Draw the block diagram of a (balancing type) RLC bridge and explain the working principle of this bridge. (3+6)+3

    What do you mean by digital LCR bridge?

11. (a) Discuss different types of systematic errors in measurement of a physical quantity. 6+3+3

    (b) Write down the differences between an analog and a digital instrument.

    (c) How the range of an ammeter can be extended?

SEC-2B

RENEWABLE ENERGY AND ENERGY HARVESTING

GROUP-A

1. Answer any ***four*** questions from the following: 3×4 = 12

   (a) What is meant by non-conventional energy source? What are the advantages of non-conventional energy sources? $1\frac{1}{2}+1\frac{1}{2}$

   (b) What is geo-thermal energy? List some geo-thermal energy sources. 3

   (c) Suggest two methods to harvest Piezoelectric energy. 3

   (d) What do you understand by the term ‘green house gases’? Name two of them. 3

   (e) Discuss the impact of burning fossil fuel to the environment. 3

   (f) Why is solar cell called photo-voltaic? 3

GROUP-B

Answer any *four* questions from the following 6×4 = 24

2. Discuss the working principle of solar cooker. 6

3. (a) Discuss the potential of ocean energy against wind and solar energy. 2+4
   (b) Discuss the limitations of nuclear energy.

4. (a) What are the primary requirements for site selection of hydropower plant? 2+4
   (b) Classify the water turbines used in a hydropower plant.

5. What are linear generators? Mention their applications. 2+4

6. What are the three main types of tidal technologies? 6

7. What is Horizontal Axis Wind Turbine? Explain various parts of it with the help of suitable diagram. 6

GROUP-C

Answer any *two* questions from the following 12×2 = 24

8. (a) What is a solar collector? 2+(4+2)+4
   (b) Discuss the construction and working principle of a flat-plate solar collector. Draw the necessary diagram.
   (c) Solar radiation is incident on a flat-plate collector at a rate of 800 W/m^2. The collector with a surface area of 30 m^2 supplies hot water to a facility at a rate of 0.1 kg/s, cold water enters the collector is 70%, determine the temperature of hot water provided by the collector.

9. (a) What do you mean by Ocean Thermal Energy Conversion (OTEC)? 2+(3+4)+3
   (b) Explain with a neat diagram the operation of OTEC plants.
   (c) What are the main advantages of OTEC system?

10. (a) What is piezoelectric effect? 2+(3+5)+2
   (b) Explain the working principle of piezoelectric generator with a neat and clean diagram.
   (c) Where are piezoelectric generators used?

11. Write a short note on: 6+6
   (a) Osmotic power
   (b) Carbon Captured technologies.

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