



'সমানো মন্ত্র: সমিতি: সমানী'

UNIVERSITY OF NORTH BENGAL
B.Sc. Honours 4th Semester Examination, 2022

SEC1-P2-PHYSICS

Time Allotted: 2 Hours

Full Marks: 60

*The figures in the margin indicate full marks.
All symbols are of usual significance.*

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) Define the terms accuracy and precision in any experiment.
 - (b) What is a Shunt? What is the purpose of use of it?
 - (c) State the advantages of digital instruments over analog instruments.
 - (d) How can you construct a square wave signal generator?
 - (e) What are the differences between a moving coil and a moving magnet galvanometer?
 - (f) State the advantages of an ac R-L-C bridge over a dc R-L-C bridge.

GROUP-B

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

2. Describe the principle of measurement of resistance by a multimeter. What may be the sources of error in such a measurement? 4+2
3. (a) Explain how frequency can be measured by a CRO. 3
- (b) The pattern on a CRO is stationary and has 5 horizontal and 2 vertical tangencies. If the frequency of the horizontal input is 1000 Hz, find the frequency of the vertical input. 3
4. Describe the operation of a full wave rectifier circuit and hence calculate its ripple factor. 4+2
5. With the help of a block diagram explain the operation of a function generator. 2+4

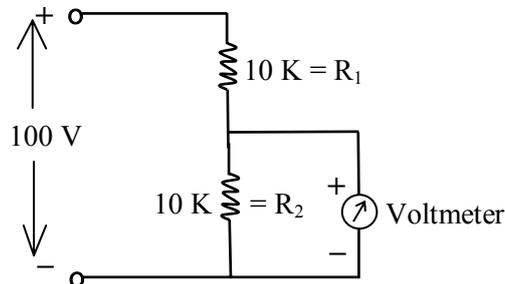
6. (a) Derive the general equation of balance for an ac bridge. 4
 (b) Why is it preferable in bridge circuits, that the equations of balance should be independent of frequency? 2
7. (a) What do you mean by sensitivity of an electrical instrument? Explain the advantages of electronic voltmeter over conventional type voltmeter with respect to sensitivity. 1+3
 (b) Explain, how can one construct a voltmeter using an ammeter? 2

GROUP-C

Answer any two questions from the following

12×2 = 24

8. (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
9. (a) Explain the term 'loading effect'. 3
 (b) Referring to the following figure if the voltage across R_2 is to be measured by voltmeters having a sensitivity of (i) $1000 \Omega/V$ and (ii) $20,000 \Omega/V$, which will give accurate reading and why, assuming both the meters are used on 50 V range. 5



- (c) What do you mean by a filter circuit? What is the difference between a high and a low pass filter? 4
- 10.(a) A four arm ac bridge a-b-c-d has the impedances as: 4
 $ab, z_1 = 200 \angle 60^\circ \Omega$; $ad, z_2 = 400 \angle -60^\circ \Omega$;
 $bc, z_3 = 300 \angle 0^\circ \Omega$ and $cd, z_4 = 600 \angle 30^\circ \Omega$
 Determine whether it is possible to balance the bridge or not.
- (b) Describe how one can convert a square wave signal to a triangular wave signal. 4
 (c) Explain the special features of a dual trace CRO. 4
- 11.(a) Describe with a diagram the operation of a half wave rectifier type ac voltmeter. 6
 (b) Briefly explain instrumental error, random error and probable error. 6

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 are Fossil fuels? How the uses of such fuels affect the environment? | 1+2 |
| (b) | What are the differences between renewable and non-renewable energy? | 3 |
| (c) | Define bio-mass. Mention the sources of Ocean bio-mass. | 1+2 |
| (d) | Briefly discuss the main hurdles in the development of Tidal energy. | 3 |
| (e) | What do you mean by a linearly cycle power plant? How does it generate electricity? | 1+2 |
| (f) | What is the basic principle of carbon-capture technology? Mention its importance. | 2+1 |

GROUP-B

Answer any *four* questions from the following

6×4 = 24

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|----|--|-----|
| 2. | (a) Derive an expression of power output from a windmill. | 3 |
| | (b) What are the most favourable sites for installing wind turbines? | 2 |
| | (c) Write down the principle of wind energy conversion. | 1 |
| 3. | Draw a neat diagram of a solar water heater. On what parameters the efficiency of a solar water heater depends? | 4+2 |
| 4. | (a) What are the salient characteristics of an ocean wave? | 3 |
| | (b) Write a short note on Tidal current. | 3 |
| 5. | (a) What is a solar pond? What are the advantages of using of a solar pond in modern power production technologies? | 2+2 |
| | (b) What do you mean thermoelectric modules? | 2 |
| 6. | (a) What do you mean greenhouse effect? What are the impacts of the interaction between oceans and greenhouse gases? | 2+2 |
| | (b) Define osmotic power. Mention two practical methods for this. | 2 |
| 7. | (a) Explain the basic principle of an electromagnetic energy harvesting generator. | 3 |
| | (b) What is geothermal energy? Justify, why is it a renewable energy? | 1+2 |

GROUP-C

Answer any two questions from the following

12×2 = 24

8. (a) What is a solar cell? Give the basic construction and working principle of a solar cell. 1+4
- (b) A single solar cell of area 100 cm^2 produces a voltage of 0.5 V and a current up to 2.5 A. If the amount of solar radiation on a unit horizontal surface of the cell over a specified time is 800 W/m^2 , calculate the efficiency of the cell. 4
- (c) What do you mean by one-axis sun tracking? Name two collectors requiring for that. 3
9. (a) Define the term 'piezoelectricity'. What are its characteristics? What do you mean by piezoelectric energy harvesting? 1+3+3
- (b) Draw a neat diagram of a hydroelectric power plant and explain its working. 5
- 10.(a) Briefly explain, how does a nuclear reactor produce energy? 3
- (b) A nuclear reactor produces nuclear energy at a rate of 32 MW. How many atoms of U-235 are required for this purpose? Given that the energy released a U-235 = 200 MeV and $1 \text{ MeV} = 1.6 \times 10^{-13} \text{ J}$. 4
- (c) Discuss the impact of hydropower sources on the environment in detail. What do you mean by tidal barrage? 4+1
- 11.(a) Briefly discuss the working of different geothermal power plants. 4
- (b) What are wave energy devices? How do they work in the sea? 2+2
- (c) A certain dam has a height of 200 m. It generates electricity by taking water from a depth of 150 m at a flow rate of $650 \text{ m}^3/\text{s}$. Determine the power of this flow. 4

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