

2021

PHYSICS — HONOURS

(2018-19 Syllabus)

Paper : SEC-B-1

(Computer Algebra System and Figure Drawing Skill)

Full Marks : 80

The figures in the margin indicate full marks.

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

1. Answer **any ten** questions :

2×10

- (a) Explain the YACAS command $N(3/4)$.
- (b) In YACAS what gives the complex conjugate of Z ?
- (c) How is $\text{Sin}^{-1}X$ represented in YACAS?
- (d) Under which name Infinity is represented as a predefined constant in YACAS?
- (e) What does the command $3 : 4 : \{ \}$ do in YACAS?
- (f) Can you compute divergence of vector field in YACAS? Explain with example.
- (g) What would be the output of the YACAS command : Mod (-14, 3)?
- (h) What would be the output of the YACAS command : Difference ({1, 2, 3}, {5, 6, 7})?
- (i) What would be the output of the YACAS command : Identity (3)?
- (j) Write down the output of the YACAS command : Sqrt (-1).
- (k) Write down the output of the YACAS command : D (x, 2) { x, Cos (x), Sin (x)}?
- (l) What is Computer Algebra System?

Answer **any four** questions.

5×4

- 2. What is utility of spline curve in vector graphics?
- 3. What is the basic difference between bitmap and vector graphics?
- 4. Integrate the integral, $I = \int \text{Sin}^2 x \, dx$ using YACAS. Mention clearly the YACAS command.
- 5. Find the roots of polynomial $f(x) = ax^2 + bx + c$ using YACAS. Mention clearly the YACAS command.

Please Turn Over

6. Create a list of first 10 fibonacci numbers. Now take the sum of the numbers. Mention clearly the YACAS program.

7. Given that $\frac{d^2y}{dx^2} + 10y = 0$.

Solve the ODE using YACAS. Find the values of $y(x)$ at $x = 0.2, 0.3, 0.7$

Answer **any four** questions :

10×4

8. Find the sum of first 20 natural numbers. Write the program in YACAS.

9. Find the Taylor's expansion of the function $f(x) = \cos x$ upto first 5 terms. Mention clearly the YACAS command.

10. Construct a random polynomial of 5th order having coefficients in the range -7 to 7 . Now calculate the values of the polynomial at $x = 0.2, 0.3, 0.7$. Write down the YACAS commands.

11. Given that :

$$\vec{A} = 10\hat{i} + 20\hat{j} + 4\hat{k}$$

$$\vec{B} = 7\hat{i} + 19\hat{j} + 15\hat{k}$$

Evaluate the following : $\vec{A} \cdot \vec{B}$, $\vec{A} \times \vec{B}$ and $\frac{\vec{A} \cdot \vec{B}}{|\vec{A}| |\vec{B}|}$. Write down the YACAS commands and output.

12. Find the GCD and LCM of list of 7 numbers. Mention clearly the YACAS commands.

13. Create a list of 12 numbers. Now print them in reverse order. Partition the reverse list into sublists of length 3. Write the program in YACAS.

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PHYSICS — HONOURS

(2018-19 Syllabus)

Paper : SEC-B-2

(Renewable Energy and Energy Harvesting)

Full Marks : 80

The figures in the margin indicate full marks.

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

Answer **question nos. 1 and 2** and **any four** questions from the rest.

1. Answer **any ten** questions :

2×10

- (a) What is the major constituent of biogas?
- (b) What are greenhouse gases? Give two examples.
- (c) Write down the disadvantages associated with fossil fuels used.
- (d) Name four geothermal resources.
- (e) What are the disadvantages of renewable energy sources?
- (f) What are limitations of tidal power generation?
- (g) What is the main fuel used in a thermal power plant and why?
- (h) What are the main components of a solar cell?
- (i) Write down the advantages of flat plate solar collector.
- (j) Suggest two methods to harvest piezoelectric technology.
- (k) What do you understand by carbon capture technology?
- (l) Write down the working principle of box type solar cooker.

2. Answer **any four** questions :

- (a) What are the environmental impacts of hydropower plants? 5
- (b) What do you mean by efficiency of a solar cell? What are the factors which determine the efficiency of a solar cell? 2+3
- (c) What are linear generators? Mention their applications. 2+3
- (d) Discuss the advantages and disadvantages of horizontal axis wind turbines (HAWT). Draw a graph to show the variation of wind turbine power output with steady wind speed. 4+1

Please Turn Over

- (e) Define Osmotic power. Outline the underlying principle of photovoltaic solar cell. 2+3
- (f) What is greenhouse effect? Briefly discuss the consequences of global warming. 2+3
3. Draw a schematic diagram of a hydropower plant. Explain briefly how a hydropower plant works. Describe different types of turbines used for small scale hydroelectric plants. 3+4+3
4. Discuss : (a) Bio-diesel, (b) Producer gas.
Write down the bio-chemical process behind production of biogas from biomass by anaerobic digestion. What are the factors affecting performance of biogas digester? (2+2)+3+3
5. Briefly explain the principle of tidal power harnessing. What is solar pond? What are the major challenges in adopting solar power as a household power source? 6+2+2
6. Derive an expression for the power generated by a wind turbine. What is blade swept area? How can you increase the blade swept area? 6+2+2
7. Briefly describe all the types of geothermal resources. Mention their applications. Name the four basic groups of piezoelectric materials that are used for conversion of energy in generators. 6+2+2
8. What is ocean thermal energy? What is the basic extraction principle of that? What are the advantages of ocean energy over wind and solar energy? 3+3+4
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