B.Sc. Semester-III Examination, 2022-23

PHYSICS [Honours]

Course ID : 32415 **Course Code : SH/PHS/305/SEC-T-1&2**

Course Title : Computational Physics

OR

Renewable Energy and Energy Harvesting

Time : 2 Hours Full Marks : 40

The figures in the right-hand margin indicate marks.

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

(Computational Physics)

UNIT-I

1. Answer any **five** of the following questions: 2×5=10

a) Describe the Fortran statement IMPLICIT NONE.

b) Write down few characteristics of algorithm.

c) Give the FORTRAN expression corresponding to the algebraic expression

$$\log_e \sqrt{a^2+b^2} + e^{-|x^2-y^2|} + \tan\alpha$$

d) Write down the Gnuplot commands to (i) change x-axis range to (1:100), ii) set log scale for all the axes.

e) Write down the LaTeX command to create an ordered list having two list items.

f) What are internal command in linux? Give example.

g) Draw the flowchart symbols for terminal, connector, process and decision.

h) What is function subprogram? Explain.

UNIT-II

2. Answer any **four** of the following question: 5×4=20

a) Draw a flowchart to calculate the following series: 5

$$\sin(x) = \frac{x^1}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots\ldots\ldots\ldots$$

b) Write down the Gnuplot command to plot the function $f(x) = \frac{\sin x}{x}$ in the range $-25 < x < 25$, label x- and y-axis of the plot as 'x' and 'f(x)', respectively and save the plot as 'figure.eps' file. 5

c) What do you mean by control statement? Explain if-then-else statement with an example. 2+3

d) Write the syntax of two Nested Block IF statement in FORTRAN. Give an example. 5

e) Give the LaTeX command to write the following: $2\frac{1}{2}+2\frac{1}{2}=5$

i) $\lim_{h\to 0}\frac{f(y+h)-f(y)}{h}$,

ii) $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$.

f) What is 'arithmetic IF' statement? Write a FORTRAN program to find the sum of all natural odd numbers between 0 and 100. 1+4=5

UNIT-III

3. Answer any **one** of the following questions: 10×1=10

a) Describe any five features of gnuplot. Describe the use of multiplot statement in gnuplot with examples. 5+5=10

b) i) What do you mean by (a) change of control statement, and (b) loop statement in FORTRAN? Explain. 3

ii) A particle of unit mass moves in a central force field given by $F(r)=-\frac{1}{r^2}$ where $r^2=x^2+y^2$. Write a program in FORTRAN to obtain the position coordinates (x, y) of the particles at a time interval dt=0.1s over a period of time t = 5000s and save the obtained (x, y) data set in a file. Plot the data from the file using Gnuplot. It is given that the initial position coordinates of the particle at time t = 0s are x = 0, y = 2 and intial velocity components along x- and y- directions are V_x = 1 ms^{-1} and V_y = 0 ms^{-1} respectively. 5+2=7

(Renewable Energy and Energy Harvesting)

UNIT-I

1. Answer any **five** of the following questions: 2×5=10

a) Name four solar energy operated devices.

b) Write down two ways to reduce the amount of greenhouse gas.

c) What do you mean by tidal energy?

d) Define the conversion efficiency of a fuel cell.

e) What are flat plate solar collectors?

f) What is hydraulic turbine?

g) Mention two important factors to be considered for proposing a wind power site.

h) What is piezoelectricity?

UNIT-II

2. Answer any **four** of the following question: 5×4=20

a) Give a brief description and principle of operation of a solar pond. 2+3

b) Explain neap tides and spring tides. What are the limitations of tidal energy generation? 3+2

c) Describe the basic components of wind energy conversion system. 5

d) What is geothermal energy? Write a short note on the prospect of geothermal energy in India. 1+4

e) What do you mean by calorific value of fuel? Write down the difference between conventional energy resources and non-conventional energy resources. 2+3

f) Write short notes on any one of the following: (i) Ocean biomass (ii) Global warming 5

UNIT-III

3. Answer any **one** of the following questions: 10×1=10

a) What is biogas? Briefly explain its production process in biogas plant with diagram. Write the advantages and disadvantages of using biogas. 2+4+(2+2)

b) What is electromechanical coupling factor? Explain how piezoelectricity can be utilized with proper examples. Why fossil fuel is still the dominant energy supplier compared to the different sources of renewable energy sources? Explain the socio-economic impact of fossil fuel. 2+3+3+2

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