2020

ELECTRONICS — GENERAL

Paper : SEC-A-1

(Computational Physics)

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 no. 1**, **any four** from **question no. 2** to **question no. 7** and
any four from **question no. 8** to **question no. 13**.

1. Answer **any ten** questions :　　　　　　　　　　　　　　　　　　　　　2×10

   (a) What is a flowchart?

   (b) What is vi?

   (c) What is a Linux shell?

   (d) What is meant by the Linux kernel?

   (e) Name two differences between Linux and MS Windows.

   (f) What is the use of the Linux shell command : pwd?

   (g) Name two relational operators in Fortran.

   (h) What is a subroutine in Fortran?

   (i) How do you comment a line in Fortran?

   (j) What is the preamble of a LaTeX document?

   (k) How do you write θ and × in LaTeX?

   (l) How do you write $\int_{-\infty}^{\infty} x \, dx$ using LaTeX?

   (m) What is meant by data visualization?

   (n) What is Gnuplot?

2. Draw a flowchart to depict the conversion from two-dimensional polar coordinates $\{r, \theta\}$ taken as inputs, to two-dimensional cartesian coordinates $\{x, y\}$, to be printed as outputs.　　　5

3. Draw a flowchart to describe the problem of reading in the elements of two 2×2 matrices, A and B, calculate their sum and print the elements of the resultant matrix.　　　5

Please Turn Over

4. What is the role of the following Linux commands?

   cp, du, ls, rm, cat. 1×5

5. What does the word FORTRAN stand for? Name a few versions of Fortran. Name the different data types in Fortran. 1+2+2

6. What is LaTeX? How is it different from MS Word? Explain with an example how you may write an equation in LaTeX. 1+1+3

7. What are the roles played by the plot and splot commands in Gnuplot? How do you set axes-ranges and axes-labels in Gnuplot? What is a Gnuplot script? 2+2+1

8. Write a Fortran program to find the two distinct roots of a quadratic equation $ax^2 + bx + c = 0$, where a, b, c are constants ($b^2 - 4cc > 0$). The values a, b, c are to be read in from the keyboard. 10

9. What are arrays in Fortran? How do you declare a two-dimensional real array in Fortran? Write a complete Fortran program, using an array to print all the elements of a 2×2 matrix on the monitor screen. 2+1+7

10. Write a complete Fortran program to print all odd numbers between and including 1 and 9. 10

11. Write a complete Fortran program to compute the mean and standard deviation of a given set of numbers. 5+5

12. Write blocks of LaTeX code to output the following expressions :

   (a) $\int_{2}^{5} \frac{x^2}{2} dx$ and

   (b) $f(x) = \sum \left(ax^3 + bx^2 \right)$. 5+5

13. Write the Gnuplot source code to :

   (a) Plot the data in the 2nd column versus the data in the 3rd column residing inside an existing data file using dashed lines and points.

   (b) Also plot alongside (on the same screen) the function $f(x) = 2*\sin(x)$ between -1 and $+1$.

   (c) Insert a title-name and the axes labels in the plotted graph.

   (d) Save the plotted graph as an image file. 3+3+2+2

———————