KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY (KNUST)

COLLEGE OF SCIENCE

FACULTY OF PHYSICAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF PHYSICS

END OF SEMESTER ASSIGNMENT, JUNE 2020

MET 254: FORTRAN FOR SCIENTIFIC COMPUTING

2ND YEAR BSc. METEOROLOGY AND CLIMATE SCIENCE

Time allowed: na Date: 19.06.2020

INSTRUCTIONS:

1. **Answer ALL questions. Please be BRIEF and CONCISE with your answers**.

2. Indicate your student details such as full name and Index number on your answer sheet.

3. **Academic integrity:**
   Plagiarism is a serious academic misconduct and you must adhere to the academic integrity policy of KNUST by presenting your own work. Students who present other people's work as their own together with students providing the answers, will be violating the academic integrity policy of the University and for that matter will receive no credits on their assignments and may well receive a failure grade. Note that each submitted assignment will be subjected to plagiarism test before assessment.

4. **Submission**: Submit the assignment via the email: eiyamba@knust.edu.gh. Deadline is **Friday 26th June, 2020 at 11:59 pm (+00 GMT)**.

5. **File type:** All the fortran and python codes should have extension .f90 and .py respectively. The plots should have png or jpg extension. Submit all the files in a single zipped folder. Make sure that the filenames reflects the questions for eazy identifcation. The zipped folder name should bear your name and index number.

Answer **ALL** questions [70 MARKS in all]
15 marks each for the codes (fortran and python) and 5 marks each for the graphs

Q.1) Monthly rainfall data observed from selected synoptic stations in the northern, transition and forest zones of Ghana have been provided. The data files are named Data1.txt, Data2.txt and Data3.txt and each span the period 1921 to 1950. Using the data, answer the following questions:

(a) Using fortran, calculate the monthly climatology of each dataset for the period 1921-1950. Using python, plot the seasonal timeseries of the calculated monthly climatology of the three datasets on the same graph. Provide the fortran code that calculated the climatology and the python code for the plots. [35 marks]

(b) Using fortran, calculate the annual rainfall seasonality index of each datasets from the expression:

$$SI_{(}i) = \frac{1}{R_i} \sum_{n=1}^{n=12} |X_{in} - \frac{R_i}{12}| \quad (1)$$

Where:
R_i is the total annual rainfall for a specific year i
X_{in} is the actual monthly rainfall for month n in the particular year under study and
$SI_{(}i)$ is the index of seasonality for each specific year (i)
Plot the annual seasonality index of all three datasets on one graph using python. Provide the fortran and python code that calculated and plotted the seasonality indices respectively. [35 marks]