P346/745 : Physics Computer Lab

Credit : **6** (Int-MSc Sem-**V**)

Credit : **4** (Int-MSc-PhD Sem-**III**)

Classes : **LH-1** every Wednesday & Thursday @ 2:30 pm

Programming language : **Python**, **C/C++** only

- *Programming language(s) will not be taught in this course*
- *Must bring laptop in class for code writing*
- *Allowed usages of Jupyter notebook, Github*
- All assignments, DIY, Midsem and Endsem codes and reports (if asked) should be uploaded in the Google classroom

Marks distribution : Assignments 40, Midsem 15,

DIY 15, Endsem 30

Teaching Assistant : Indrajit Paul (indrajit.paul@niser.ac.in)

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Assignments	• One assignment for each topics discussed including one warm-up assignment. • Must be submitted within due date and time, else 20% marks will be deducted. • If suspected of copying, assignment(s) will be awarded **zero** to all parties involved without giving a chance to defend.
Midsem	• Lab courses usually do not have Midsem but you will have one on the first Lab class after Midsem recess.
DIY	• Problems to be offered before Midsem recess and submitted (both codes and report) before Endsem
Endsem	• Full syllabus and mandatorily using own library functions (not system-built)

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Grading : You may find it controversial

2021 : 48 out of 53 students got $\geq 75/100$
AA (6) in 96 – 100, **AB** (7) in 91 – 95,
BB (15) in 86 – 90, **BC** (14) in 81 – 85 etc.

2020 : 47 out of 49 students got $\geq 75/100$
AA (7), **AB** (14), **BB** (15), **BC** (7) etc.

The statistics in 2022 is not expected to be very different from the past two years. Therefore, the same grading scheme will be followed this year too, unless some drastic shifts happen.

But grading scheme may be different (absolute ?) for Int. MSc-PhD because of different credit requirement.

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Syllabus :

- Random number generation
- Gauss-Jordan elimination – solving linear algebraic equations, inverse, determinant
- LU decomposition – solving linear algebraic equations, inverse
- Jacobi or Gauss-Seidel – iterative solution of the above
- Root finding – Regula falsi, Newton-Raphson, Laguerre's method
- Numerical Integration – Midpoint, Trapezoidal, Simpson, Monte Carlo
- Ordinary differential equation – Euler, Predictor-Corrector, Runge-Kutta (both initial and boundary value problems)
- *PDE if time permits*
- Least square fitting

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Programming practices :

1. Each code should have a comment header explaining the purpose of the program.
2. Input should NOT be interactive or *hardwired*. All input must be read from external file(s), whether it is matrix dimension(s) or precision or characters/strings for file name or any other sorts of numbers.
3. All the output should be given in a separate file(s) and must be exactly the same that the code will generate. Without output, the problem will be considered incomplete. Additional comments (if any) must be appended after the output and clearly separated from the actual output itself.
4. Codes should contain decent amount of comments explaining the computing steps (not too many nor too few), which will help others to follow the code.

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Programming practices contd. ...

5. Initialization must be done in loop when needed such as reading a matrix or a series of coefficients etc.
6. Each routines or functions like your own random number generator or LU decomposition or RK4 MUST be in a single library file (which obviously will grow in size as you put more and more functions) and NOT in the main front code.
7. The main body of the code or the front code will only involve I/O, allocation of memories, opening of files etc. and call to routines or functions.
8. No system-built routines, like Numpy, Scipy etc., of the major algorithms can be used. For instance, `random` or `inverse` function cannot be called. But, of course, you can use stuff like `sqrt()`, `sin()` or `log()` etc.