# Computational Physics Lab

(PH49012)

Spring-2021, IIT KGP

Assignment 04

---

**Q1.** Write a program to determine the machine precision $\epsilon_m$ of your computer system within a factor of 2. A sample pseudocode is:

```
eps = 1
begin do N times
      eps=eps/2
      one = 1+eps
end do
```

Write the number of loops after which eps does not have any effect on one.
*(Source: Computational Physics, Third Edition by Rubin H. Landau, Manuel J. Páez and Cristian C. Bordeianu)* (10 points)

**Q2.** Generate an array of length 3n filled with the cyclic pattern 1,2,3.
Source: https://faculty.math.illinois.edu/ shahkar2/cbmg/numpy-exercises.html (10 points)

**Q3.** Create a 10 × 10 array of zeros and then 'frame' it with a border of ones.
Source: https://faculty.math.illinois.edu/ shahkar2/cbmg/numpy-exercises.html (10 points)

**Q4.** Consider a potential

$$U(x, y) = \frac{1}{2}(x^2 + y^2)$$

Compute its gradient (don't need to do this within your code) and plot it on top of the contours of the potential. Show five such contours. It should be clearly shown in the plot that the gradient is normal to the equipotential lines.
*(Source: Introduction to Mechanics, Second Edition by Mahendra Verma)* (10 points)

**Q5.** Two infinitely long wires running parallel to the $x$ axis carry uniform charge densities $+\lambda$ and $-\lambda$

(a) Find the potential at any point $(x, y, z)$, using the origin as your reference.

(b) Write a code to generate the contours of the equipotential lines on $x = 0$ plane. Show 100 such contours in your plot. Take $\lambda = 1$ (20 points)

*(Source: Part (a) is form Introduction to Electrodynamics, Fourth Edition, David J. Griffiths)*