Yaman Sanghavi

Junior Undergraduate, IIT Kanpur
yamansan@iitk.ac.in

Education

2019 Expected	Bachelor of Science, IIT Kanpur Major: Physics CPI: 8.8	2014	Shiv Jyoti School, Kota RBSE Board: 75.20/100
		2012	New Look Central School, Sagwara CBSE Board: 9.4/10

Achievements

2015 Secured an **All India Rank of 231** in JEE Advanced, 2015 given by about 200,000 students.
2015 Secured an **All India Rank of 1066** in JEE Mains, 2015 given by about 1,500,000 students.
2015 Secured an **All India Rank of 118** in VITEEE, 2015 given by about 200,000 students.
2014 Secured an **All India Rank of 599** in NEST, 2014 given by about 20,000 students.

Projects

May-July 2017 | Quantum Optics
Summer Project under Prof. A.K. Jha

- Sharpened the concepts of Fourier optics.
- Attempted to theoretically calculate the efficiency of coupling efficiency independent of the radial index of a Single Mode Optical Fibre.
- Familiarized with the workings of Spatial Light Modulators.

Oct-Nov 2017 | Acousto-Optics: Speed of Sound in Different Liquids Using Diffraction of light
Course Project under Prof. Rajeev Gupta

- Using the idea of Raman-Nath model to produce ultrasonic sound waves in a liquid column to produce a phase grating which diffracts incoming light.
- Deducing the speed of light in different liquids like water, glycerol, ethanol etc. using the diffraction patterns obtained.

Oct 2016 | Fresnel Zone Plates
Course Project under Prof. S.A. Ramakrishnan

- Demonstrated the working of Fresnel Zone Plates i.e. focussing of a light beam at multiple locations without any lens but only zone plate i.e. by means of pure diffraction effects.
- Verified the theoretical relation between focal lengths and radii of rings of the plate.

Theoretical Research Works

May-Jul 2017 | Developed Calculus of Variations Independently

- Developed some **special integrals** to work on kinematics of **continuum objects,** which could be further extended in optimization of functions.
- Used the above idea to push the idea of derivatives for calculating the derivative of a **functional** with respect to a **function** and found out a one more approach using Dirac Delta functions to calculate the derivative of **functionals** .
- Solved the Brachistochrone problem and generalized the idea into something, which is known as Euler-Lagrange Equation.

Jul-Sep 2016

Magnetic Fields: Pseudo Vector to a Real Tensor

- Constructed a **real mathematical object** instead of a *pseudo vector* for dealing with **magnetic field** in all dimensions using a concept, which I call **Field of Presence**
- Came up independently with a theorem, which is called as **Reynold's Transport Theorem,** in fluid mechanics, which I used later to prove **Ampere's Circuital Law**.
- Derived a law analogous to **Ampere's Circuital Law** for this new magnetic field tensor using the concept of Lagrangian perspective on fluids and using Reynold's Transport Theorem.

Jun-Jul 2016

Geometric Elements in Tensor Notations & Generalization of Vector Calculus

- Redefined **area vector** to area tensor to deal in all dimensions; because area can't be dealt as a vector in 4 or higher dimensions.
- Generalized length, area, volume, hyper-volume etc. in two different and consistent ways in tensor forms.
- Extended the concept of **cross product** to all dimensions and not only for vectors but for any rank tensors using the idea of determinants and converted them to operators.
- Generalized fundamental theorems of vector calculus into tensor calculus using the newly defined geometric elements in all dimensions.

Nov-Dec 2015

Special Integrals of Curves, Surfaces & Volumes

- Developed some methods and propositions to solve many **scalar**, **vector** and **tensor** integrals on **curves** (both planar and non-planar), **curved surfaces** and **volumes** using static & dynamic problems on fluids.
- Made a proposition, which I am not able to prove yet, about **inverse powered electrostatic field** to explain whether a 1, 2 or 3-Dimensional (or perhaps generalized n-Dimensional) charged dielectric object can hold forces of its own charges that are distributed irrespective of the strength of dielectric material.

Special Differential Equations of Scalars & Vectors

- Came up independently for some methods for solving **linear first order partial differential equations**, which is called as method of characteristics, using concept of **electric field lines** & **potentials.**
- Developed some methods to solve some special **vector differential equations** inspired from the concept of motion of charges in magneto-static field.

Relevant Coursework:

Special Theory of Relativity
Mathematical Methods I *
Quantum Mechanics I *
Thermal Physics
Thermodynamics
Modern Physics Experiments *
Physics Laboratory

Mechanics
Classical Mechanics *
Electrodynamics
Linear Algebra & ODE
Fluid Mechanics & Rate Processes
Quantum Physics

Optics
Calculus & Real Analysis
Linear Algebra II *
Mechanics of Solids
Probability & Statistics
Quantum Chemistry

* ≡ Ongoing

Extra-Curricular:

- 1st Position in Duathlon (5km running+ 10km cycling), among fresher students.
- 1st Position in 10 x 400m relay race held on Udghosh, a sports festival.
- Made two robots with four bar gripping mechanism for gripping boxes and collecting them at a spot in a competition called Maneuver, held at a technical festival, Techkriti.