

# Thariq Shanavas

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## Education

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2015 – Present Undergraduate, [Indian Institute of Technology – Bombay, India](#)  
Major in Electrical Engineering, Minor in Physics  
CPI – 9.03/10.0

## Publications

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Farsinezhad, S., **Shanavas, T.**, Mahdi, N., Askar, A. M., Kar, P., Sharma, H., Shankar, K. (2018).  
Nanotechnology, *Core-shell titanium dioxide–titanium nitride nanotube arrays with near-infrared plasmon resonances*. <http://doi.org/10.1088/1361-6528/aaad58>

## Honors and Fellowships

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- **Kishore Vygyanik Protsahan Yojana (KVPY)** 2015 – present  
Financial award by the Department of Science and Technology, India, for promotion of basic Sciences among high school students to approx. 1500 students in the country among 40,000 candidates.
- **National Talent Search Examination (NTSE)** 2013 – present  
Awarded by the National Council for Educational Research and Training as support for secondary education to approx. 1000 students in the country among 900,000 candidates.
- **Joint Entrance Examination** 2015  
Ranked 69 among 1.35 million candidates for admission to IIT Bombay, the premier technical university in the country.

## Key Research Experience

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- **Undergraduate Thesis – IIT Bombay** July 2018 – November 2018  
Magnetometry using Nitrogen-Vacancies in Diamond  
*Advisors: Dr Pradeep Sarin, Dr Kasturi Saha*
  - Involved in designing the experimental setup for sensing weak magnetic fields at micron-scale resolution using nitrogen-vacancy centers in diamond.
  - Using a microwave antenna, provided a uniform RF excitation to the diamond sample for performing rotations of the two-level system on the Bloch sphere.
  - Improvements in the microwave field delivery system led to 57 percent increase in usable nitrogen-vacancies as compared to the setup previously used in the group, corresponding to an expected shot-noise limited sensitivity improvement of 21 percent. [Report](#)
- **Tyndall National Institute, Ireland** May 2018 – July 2018  
Demonstration of 20Gbps communication over 10G-class optics enabled by machine learning  
*Advisors: Dr Cleitus Antony, Dr Paul Townsend*
  - Explored the use of neural networks for equalisation at the receiver end and pre-compensation at the transmitter end to compensate nonlinear effects of the channel
  - Integrated recurrent, convolutional and decision-feedback neural networks to a simulation testbed and real time experimental setup.
  - Demonstrated 20Gbps data transfer over 10G-class optics using a convolutional neural network at the receiver, within the acceptable error rate for Forward Error Correction. [Report](#)

- KEK, High Energy Accelerator Research Organisation, Japan** Nov 2017 – Dec 2017  
 FPGA based controller for self-triggered hybrid pixel detector  
*Advisors: Dr Manobu Tanaka, Dr Tetsuichi Kishishita*
  - Developed the FPGA framework for a hybrid pixel detector.
  - Characterised the field response of the analog front end ASIC chip, with test signals using the developed framework.
  - Examined proposed changes to the amplification stages of the ASIC chip, recommended the design with the least equivalent noise charge using Cadence.[Report](#)
- University of Alberta, Canada** May 2017 – July 2017  
 Modelling of Photonic nanotubes exhibiting near-infrared plasmon resonance  
*Advisor: Dr Karthik Shankar*
  - Analytically modelled and numerically simulated the optical properties of titanium dioxide nanotubes coated with Titanium Nitride.
  - Analytical predictions made by modifying Gans theory for a composite nanostructure led to accurate predictions of the plasmon excitation, results agreed with experimental result.
  - Set up and documented a finite element modelling testbed on the University of Alberta Supercomputing cluster using Comsol to support future work on plasmon resonance.

## Other Research Experience

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- Particle discrimination using machine learning and matched filtering** Mar 2018  
**Course Project, EE338: Digital Signal Processing**  
*Dr. V M Gadre, Department of Electrical Engineering, IIT Bombay*
  - Used logistic regression and matched filtering to discriminate pions and electrons in the signal from a scintillation detector.
  - Analytically modelled the detector output to compare against incoming signal for matched filtering, used the same model to generate training dataset for the ML classifier.
  - Achieved over 98 percent accuracy for both techniques under reasonable noise conditions.[Poster](#)
- Calibration of readout electronics for Silicon detectors** Jan 2017 – Apr 2017  
*Dr. Pradeep Sarin, Department of Physics, IIT Bombay*
  - Designed a portable GHz level pulse generator for the purpose of calibrating the electronic readout of Silicon and Diamond particle detectors.
  - Implemented a low noise transconductance amplifier circuit followed by an attenuator block to convert a voltage pulse into a micro ampere current pulse.
- Design of multicycle RISC Processor – Course Project, EE309: Microprocessors** Oct 2017  
*Dr. Virendra Singh, Department of Electrical Engineering, IIT Bombay*
  - Designed and simulated a multicycle RISC processor optimised for performance.
  - Implemented a Von Neumann architecture, used a shared data and instruction memory.
  - Implemented and verified the design on an FPGA.[Report](#)
- Image forgery Detection – Course Project, EE325: Probability and Random Processes** Nov 2017  
*Dr. Gaurav Kasbekar, Department of Electrical Engineering, IIT Bombay*
  - Used statistical analysis to detect copy-move forgery in digital images.
  - Images segmented to subcells, statistical moments extracted in the Fourier domain.
  - Comparing statistical measures, the degree of similarity between images was established.[Report](#)

- Matsya, Autonomous Underwater Vehicle | AUV-IITB** Oct 2015-Oct 2016  
*International RoboSub, AUVSI & US Office of Naval Research*
  - Part of a 30 member team aimed at developing unmanned AUVs. The team came second in the world at the international Robosub competition 2016, San Diego, California.
  - Developed the DC-DC boost converter, motor drivers, battery hot-swapping capability and water seepage detection modules.
- Simulation of Spiral RF inductors** Apr 2016 - June 2016  
*Dr. Dipankar Saha, Department of Electrical Engineering, IIT Bombay*
  - Studied and simulated Spiral RF inductors in the micron scale using finite element techniques.
  - Extracted the S-parameters as a function of the frequency of operation.
- Coverage Control of multi-agent robotic systems** Nov 2016 – Feb 2017  
*Dr. Sukumar Srikant, Systems and Control Engineering, IIT Bombay*
  - Proposed a decentralised controller for autonomous mobile robots, drawing inspiration from patterns observed in the seed distribution of a sunflower.
  - Proposed a Lyapunov-type proof for the stability and convergence of the designed controller.
  - Numerical simulations carried out for the proposed controller. Results found to agree very well with coverage objective. [Report](#)

## Leadership and Organisation

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- Manager, Maths and Physics Club, IIT Bombay** 2017 – 2018
  - As a junior undergraduate, I led a team of six sophomores to foster enthusiasm in mathematics and physics, tending to a community of 400 – 500 in campus.
  - Organised institute-wide quizzes, talks, group discussions and mentoring activities to promote interest in the fundamental sciences.
  - Introduced Scientific Computing Championship to promote interest in Numerical methods for scientific research, first ever conducted to this scale in campus.
  - Oversaw five times improvement in year-to-year participation in Summer of Science initiative, where the club matches senior students to mentor enthusiasts in an area of their interest. [Work Report](#)

## Technical Skills

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**Programming Languages** : C++, MATLAB

**CAD and Scientific Packages** : Eagle, Altium, SolidWorks, Cadence, Comsol, CST Microwave Studio

**Other software** : Atmel studio, Arduino, HTML, CSS, Latex, gnuradio, VHDL, Xilinx ISE

## Extracurricular Activities

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- Popular Talks-
  - Control loops and PID algorithm* - Robotics club, IIT Bombay. [Slides](#).
  - Particle Physics: Small detectors, Big questions* - Maths and Physics Club. [Slides](#).
- Completed a year-long course on playing the Keyboard.
- Participated in the Summer of Science initiative under an experienced senior mentor, on Cosmology under the Maths and Physics Club. [Report](#)
- Secured first prize in Electric Jhatka General Championship by the Electronics club, an institute-wide circuit design competition.

## References

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1. Prof. Pradeep Sarin  
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