

# Atul Singh Arora

ətul sinh ərəʊra:

was born on November 20, 1991  
resides in 4317/3 Ansari Road Darya Ganj, New Delhi  
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toAtulArora@gmail.com  
<http://github.com/toAtulArora>

## Objective

- immediate Get a PhD position to explore Quantum Theory.
- general Contribute to expanding our knowledge of nature.

## Education

- 2016 **BS-MS Dual Degree**, Indian Institute of Science Education and Research, Mohali, CPI: 9.4/10.  
**Semester I:** (8.5/10) Mechanics, Chemistry of elements and chemical transformations, Cellular basis of life, Symmetry, Language Skills B, Introduction to Computers, Physics Lab I, Chem Lab I, Bio Lab I  
**Semester II:** (8.6/10) Electromagnetism, Atoms Molecules and Symmetry, Gene expression and development, Analysis in one variable, Hands-on electronics, History of science, Physics Lab II, Chemistry Lab II, Biology Lab II  
**Semester III:** (8.8/10) Waves and optics, Spectroscopic and other physical methods, Genetics and evolution, Curves and surfaces, Introduction to Astrophysics, Workshop Training, Physics Lab III, Chemistry Lab III, Biology Lab III  
**Semester IV:** (9.7/10) Thermodynamics and statistical physics, Energetics and dynamics of chemical reactions, Behaviour and ecology, Probability and statistics, Introduction to Quantum Physics, Philosophy of science, Physics Lab IV, Chemistry Lab IV, Biology Lab IV  
**Semester V:** (10/10) Classical Mechanics, Quantum Mechanics, Electrodynamics, Advanced Optics Lab, Reason and Rationality  
**Semester VI:** (9.6/10) Statistical Mechanics, Atomic and Molecular Physics, Quantum Computation, Advanced Electronics and Instrumentation Lab, Quantum Field Theory  
**Semester VII:** (9.4/10) Solid State Physics, Nuclear and Particle Physics, Nuclear Physics Lab, Physics of Fluids, Quantum Principles and Quantum Optics, Radiative Effects and Renormalization Group in Relativistic Quantum Field Theory  
**Semester VIII:** (9.5/10) Nonlinear Dynamics, Chaos and Complex Systems, Condensed matter Physics Lab, Computational Methods in Physics, Standard Model and beyond, Selected topics in classical and quantum mechanics  
**Semester IX:** (10/10): Ethics, MS Thesis - Research Project I  
**Semester X:** (10/10): Cosmology and Galaxy Formation, MS Thesis - Research Project II
- 2010 **CBSE 10+2**, Sardar Patel Vidyalaya, New Delhi, 80%.  
Physics, Chemistry, Math, Computer Science, English
- 2008 **CBSE X**, Sardar Patel Vidyalaya, New Delhi, 93%.  
Science, Maths, Social Science, English, Hindi, Information Technology

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## Experience (Academic)

- 2015-16 **Master's Thesis, Indian Institute of Science Education and Research, Mohali.**  
*Contextuality in a Deterministic Quantum Theory.* The thesis research was carried out under the guidance of Prof. Arvind where we reconsidered the no-go theorems on hidden variables and concluded that the notion of contextuality is not a necessary feature of quantum mechanics. We provided an alternative view, motivated by consistency requirements between Bohmian Mechanics and the said theorems. This was accomplished by identifying a new classical property, we call ‘multiplicativity’. We proposed a non-contextual hidden variable model, consistent with all predictions of QM (for discrete spaces). Advantages of this view have been illuminated by discussion of implications of non-multiplicativity to non-locality and its relation to contextuality.
- Summer **Intern, University of Siegen, Siegen, Germany.**  
2015 I had worked under the guidance of Dr. Ali Asadian and Prof. Otfried Guehne. We proposed a test of local realism based on correlation measurements of continuum valued functions of positions and momenta, known as modular variables. The Wigner representations of these observables are bounded in phase space and therefore, the associated inequality holds for any state described by a non-negative Wigner function. This agrees with Bell’s remark that positive Wigner functions, serving as a valid probability distribution over local (hidden) phase space coordinates, do not reveal non-locality. We constructed a class of entangled states resulting in a violation of the inequality and thus truly demonstrate non-locality in phase space. These states were realized through grating techniques in space-like separated interferometric setups. The non-locality is verified from the spatial correlation data that is collected from the screens.
- Summer **Intern, Indian Institute of Science Education and Research, Mohali.**  
2014 The objective was to device ways of using a universal quantum computer to perform simulations of quantum phenomena itself, with ‘practical’ resource requirements. The project involved reading of books and papers, followed by reproducing the results of a paper using a quantum computer simulator, which was written from scratch and an independent discovery of a simple quantum algorithm to simulate mixed states (this result was however already known). I was guided by Prof. Arvind and had helpful discussions with Dr. Sudipta Sarkar and Dr. Abhishek Choudhury.
- Winter **Intern, Indian Institute of Science Education and Research, Mohali.**  
2013 Studied Mechanics from Landau’s first volume (excluding the last chapter) and covered parts of Mathematical Methods from a book on the said topic by Dennery and Krzywicki. I was guided by Prof. Jasjeet Bagla and Prof. Sudeshna Sinha.
- Monsoon **School, National Centre for Biological Sciences, Bangalore.**  
2013 Participated in a Monsoon School on Physics of Life where we treated selected biological phenomena with physical rigour, headed by Dr. Mukun Thattai
- Summer **Intern, National Physical Laboratory, New Delhi.**  
2013 Worked on setting up an experiment to study dynamics of a two dimensional magnetic dipole lattice, with Dr. Ravi Mehrotra.
- Winter **Intern, Indian Institute of Science Education and Research, Mohali.**  
2012 Studied Quantum Mechanics from J.J. Sakurai, under the guidance of Prof. Jasjeet Bagla and created a corresponding report.
- Summer **Intern, Indian Institute of Science Education and Research, Mohali.**  
2012 Studied Group Theory and Linear Algebra for understanding Symmetry, under Prof. Kapil Hari Paranjape.  
A brief introductory understanding of the Knot Theory was also undertaken. LaTeX was learnt during this period, to be able to efficiently communicate via the internet.

Summer **Intern**, Indian Institute of Technology, Bombay.

2011 Worked on Image Recognition techniques using OpenCV, for Yarn Fault detection under the supervision of Prof. Anirban Guha.

This was an extension to an IIT alumni's Masters thesis. The work was done using Visual Studio, C++ and involved understanding of OpenCV and the idea behind various algorithms, to be able to solve the problem at hand.

## Publication (Academic)

2015 A. S. A, A. Asadian. *Proposal for a macroscopic test of local realism with phase-space measurements*. *Phys. Rev. A* **92**, 062107

2016 A. S. A, Arvind. *A non-contextual hidden variable model for quantum mechanics*. arXiv:1607.03498

## Teaching

2015 **TA**, Teaching Assistant. Classical Mechanics for undergraduates.

2016 **TA**, Teaching Assistant. Thermodynamics for undergraduates.

## Recognition

2016 Graduated with rank two in the Physics Department from IISER in 2016

2016 Top 5% percent in the Graduate Aptitude Test in Engineering (GATE) for Physics

2016 Obtained a 92.3 percentile in the national graduate physics exam, Joint Entrance Screening Test (JEST)

2015-16 Amongst the highest scorers in both semesters of the academic session 2015-16

2015 Awarded the Junior Research Fellowship from the Council of Scientific and Industrial Research, India (JRF-NET)

2015 Awarded a Certificate of Merit for the best academic performance in the second semester of the academic session 2014-15

2015 Was awarded the DAAD WISE fellowship for a summer internship in Germany

2015 Amongst the highest scorers in the first semester of the academic session 2014-15

2014 Amongst the highest scorers in the second semester of the academic session 2013-14

2014 Awarded a Certificate of Merit for the best academic performance in the first semester of the academic session 2013-14

2012 Capacitive touch won the Best Physics Demonstration, at the Science Day 2012, organized by IISER Mohali

2011 Was awarded the KVPY fellowship for my work on Stepper Motor control, Chatur Chaalak

2010 Was awarded the First position in Senior programming, with my Team member, in an inter-school programming competition, a part of Access, an annual Computer Symposium, Access, organized by Modern School

2010 Was selected as one of the participants for attending the Bright Green Youth, Denmark, an international climate summit for the youth, on the basis of my performance in the National Science Fair and a personal interview. In DK, our team made it to the top 14 projects

- 2009 The Robotic Rescue Vehicle was awarded the first position in the Delhi region and second position in the Northern region, at the National Science Fair, held at the National Science Centre, New Delhi
- 2005 ALive City won the first place in the open Software Display, at an inter-school Computer Symposium, Access, an annual event organized by Modern School, Barakhamba Road, New Delhi
- 2004 ALive City qualified the open Software Display, at the inter-school Computer Symposium, Access
- 2004 Displayed the Robotic Rescue Vehicle at an interschool competition and secured the third position, even though due to a component failure, the robot failed to work when it was judged
- 2003 Displayed the School Bell Scheduler at the National Convention 2003, Computer Society of India, IIT-Delhi

## Positions of Responsibility

- 2012-13 **CR**, Class Representative. Was responsible for setting up various batch-activities, Tutorial Assistance, Summer Project Talks, Origami Meets, The MS11 digest, to name a few. Various other student responsibilities, such as infrastructure feedback, mess issues, meeting with the dean etc., were simultaneously executed.
- 2012-13 **WD**, Web Designer. Was responsible for developing and maintaining the Opportunity Cell website, a link to which was added in IISER's official web page.

## Languages

Native	<b>Punjabi</b>	
Fluent	<b>English</b>	<i>Formally studied till Sem I, BS-MS</i>
Fluent	<b>Hindi</b>	<i>Formally studied till class X</i>

## Computer Skills

Familiar OSs	Windows: XP, Vista, 7, 8, 10; Linux: Ubuntu, Debian, OpenSuse, Slackware
Languages	Basic, C, C++, C#, Fortran, Python, Javascript, SQL, HTML, PHP, LaTeX, Octave/Matlab, Mathematica
Applications	Visual Studio, Emacs, Sublime Text, Microsoft Office (Word, Powerpoint, Outlook, OneNote, Excel), CorelDraw, Inkscape, Git, Sony Vegas, Autodesk Maya, GNU plot, SolidWorks, FL Studio, Sony Sound Forge, Cinelerra

## Projects

- Sem VI    **Drawdio**, What is Drawdio: "Imagine you could draw musical instruments on normal paper with any pencil (cheap circuit thumb-tacked on) and then play them with your finger. The Drawdio circuit-craft lets you MacGuyver your everyday objects into musical instruments: paintbrushes, macaroni, trees, grandpa, even the kitchen sink...". This project was originally created at the MIT Media Lab; I simply reproduced a version of this for the National Science Day, 2014.
- Summer    **Nazar Band**, A face recognition system built using OpenCV with the aim of automating the locking and unlocking of doors, eliminating the need of keys.

- Sem III **Opportunity Cell Website**, Team Project, A centralized web portal for the Opportunity Cell of IISER Mohali.
- 2012
- Sem III **Fly Count Assistant**, For easing the task of counting flies (Biology experiment),  
2012 this application was written in Python and used extensively. With just two buttons on the keyboard, and the voice support, the counting process was made much more efficient.
- Sem III **NaveenTantra**, Team Project, An Online Election system, based on a novel fraud prevention technique, created using Javascript, PHP and mySQL.  
2012
- Summer **Telescope**, Team Project, Newtonian Reflection Telescope for observing Transit of Venus.  
2012
- Sem II **Capacitive Touch Sensor**, Sensitive enough to measure changes in PicoFarads,  
2012 developed for the Science Day.
- 2010-11 **Chatur Chaalak**, Developed with the aim of application in robotics, this project was designed to control the torque and speed of stepper motors, with precision, independently. This was implemented using C as the language and Atmel AVR as the platform.
- 2010 **Live GSM**, This was an attempt at controlling a phone using a microcontroller, to be able to remotely control devices, using DTMF communication protocol over voice calls.
- Class XII **3D Modelling and Animation**, Imitated the ‘21st Century FOX’ animation and  
2010 customized it to read ‘XII class presents’, for a class presentation, using the popular 3D cinema creation software, Maya.
- Class XI-XII **Space Race**, This game was developed using OpenGL to ensure cross-platform support and as a transition to the open world. Apart from the 3D-graphics, this game had Newtonian physics implemented using a point particle approach, derived from an open-source game.
- Class XI **Robotic Rescue Vehicle (RRV)**, It was designed using auto-mobile parts such  
2009 as bicycle chains and sprockets, wiper motors, car batteries, a web-camera, and an ordinary PC, which gave it a unique look. It could be moved around wirelessly using a laptop which gave a live video feed from the robot, ideal for rescue operations.
- Class X **Math Project**, A calculator built using micro-controllers, to verify the property  
2008  $(a + b)(a - b) = a^2 - b^2$ . It was a battery operated device, with an LCD screen and used an 89S52 to process.
- Class IX **ALive City 2 - DirectX 9.0**, My second attempt at game making; this was developed  
2006 without using any game engines, while the game itself was controlled using a USB steering wheel, built by me, based on an open-source application.
- Class VIII **Motion Detection - Image Processing**, This program was developed to save  
2005 frames of a video feed, only when motion is detected, ideal for surveillance.
- Class VIII **ALive City - DirectX 8.0**, My first computer graphics 3D project, a simple racing game where the player could put his/her own picture, right on the car.  
2005
- Class VII **Edge Detecting Robot**, Built using stepper motors and a microprocessor, this  
2004 vehicle was programmed to detect edges of a table using infra red sensors and turn to avoid falling.

- Class VII **AT Keyboard Interface**, Built using the 8051 series of Microcontrollers and an LCD, this device was developed to serve as a low cost portable typing tutor for kids. It was programmed using Bascom, a basic compiler.
- Class VII **School Bell Scheduler 2**, This application was re-written in Visual Basic.NET to automate ringing of school bells, given the schedule, like it's first version. It used UART for securer communication and was installed in Srijan School, Model Town, New Delhi.
- Class VI **School Bell Scheduler**, A program, written in Visual Basic 6, for automating the ringing of school bells. The user simply needs to specify the schedule.

## Extra-Curricular Activities

- 2015 Tug of War: IISER M, Boys Tug of War Champions.
- 2013 Debating: Participated in the debating event of the in-house fest, Insomnia. The home team wasn't allowed to compete beyond a stage.
- 2012 Music Performance: Played the Guitar and composed the percussion electronically, with two friends, at the Cultural Evening of IISER.
- Current Interests Playing the Guitar, Tabla; Programming, Electronics, Robotics, Physical Fitness, Krav Maga, Taekwondo (Red I)

क्रम संख्या /  
S. No. SSE/ 2008/ 682787

# केन्द्रीय माध्यमिक शिक्षा बोर्ड

## Central Board of Secondary Education

D/08/65851/275676



सेकंडरी स्कूल परीक्षा, 2008

ALL INDIA SECONDARY SCHOOL EXAMINATION, 2008

यह प्रमाणित किया जाता है कि  
This is to certify that **ATUL SINGH ARORA**

अनुक्रमांक  
Roll No. **6186416** आपका/आपकी  
Son/Daughter of **XXXXX**

श्रीमती  
Smt. **TAJINDER ARORA**

एवं श्री  
& Shri **ASSA SINGH ARORA**

जिनकी जन्म तिथि  
Born on **TWENTY NOVEMBER NINETEEN HUNDRED NINETY ONE**

है, ने ३० द्वारा मार्च, 2008 में आयोजित सेकंडरी स्कूल परीक्षा  
passed the Secondary School Examination of the Board held in March, 2008

विद्यालय से  
from **SARDAR PATEL VIDYALAYA LODI ESTATE NEW DELHI**

निम्न विषयों में उत्तीर्ण की :-  
In the following subjects :-

ENGLISH COMM.

HINDI COURSE-A

MATHEMATICS

SCIENCE

SOCIAL SCIENCE

INTRODUCTORY I T

दिल्ली  
Delhi  
दिनांक  
Dated **29/05/2008**

*MCharyma*

परीक्षा नियंत्रक  
Controller of Examinations

टिप्पणी : संख्यात विद्यार्थी का संस्कृत भूगोल करते थम्य, सोर्ड द्वारा नियांत्रित विद्यालयीय भूगोल प्रभागपत्र का भी संज्ञान वालित है।  
NOTE : While judging regular students, it is expected that CERTIFICATE OF SCHOOL-BASED EVALUATION would be taken cognizance of.

# केन्द्रीय माध्यमिक शिक्षा बोर्ड

## Central Board of Secondary Education



सीनियर स्कूल सर्टिफिकेट परीक्षा, 2010

ALL INDIA SENIOR SCHOOL CERTIFICATE EXAMINATION, 2010

यह प्रमाणित किया जाता है कि  
This is to certify that ATUL SINGH ARORA,

अनुक्रमांक  
Roll No. 6278725  
आत्मज/आत्मजी  
Son/Daughter of

श्रीमती  
Smt. TEJINDER ARORA

एवं श्री  
& Shri ASSA SINGH ARORA

ने बोर्ड द्वारा मार्च, 2010 में आयोजित सीनियर स्कूल सर्टिफिकेट परीक्षा  
passed the Senior School Certificate Examination of the Board held in March, 2010

विद्यालय से  
from SARDAR PATEL VIDYALAYA LODI ESTATE NEW DELHI

मिन्न विषयों में उत्तीर्ण की :  
in the following subjects :

1 ENGLISH CORE

2 MATHEMATICS

3 PHYSICS

4 CHEMISTRY

5 COMPUTER SCIENCE

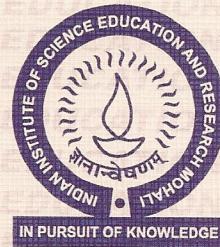
6 WORK EXPERIENCE

7 PHY &amp; HEALTH EDUCATION

8 GENERAL STUDIES

दिल्ली  
Delhi  
दिनांक  
Dated 21-05-2010

M. Chayma  
परीक्षा नियंत्रक  
Controller of Examinations



विद्वत्-परिषद् की अनुशंसा पर  
भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान मोहाली  
का

शासक मण्डल

अतुल सिंह अरोरा

को

वांछनीय योग्यता प्राप्त कर लेने पर  
मुख्य विषय भौतिक विज्ञान के साथ

विज्ञान निष्णात

की उपाधि प्रदान करता है।

मोहाली में वर्ष दो हज़ार सोलह के मई माह के चौबीसवें दिन प्रदत्त।

*The Board of Governors  
of the*

*Indian Institute of Science Education and Research Mohali*

*upon the recommendation of the Academic Senate hereby confers on*

*Atul Singh Arora*

*the Degree of*

*Master of Science*

*with a Major in Physics on having fulfilled the requirements.*

*Given at Mohali on the twenty fourth day of May two thousand and sixteen*

N. Soos  
Chairman  
Board of Governors

Registrar

N. Soos  
Chairman  
Academic Senate



Reg No. MS11003



## विद्वत्-परिषद् की अनुशंसा पर

भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान मोहाली

का

## शासक मण्डल

## अतूल सिंह अरोरा

क०

वांछनीय योग्यता प्राप्त कर लेने पर

### मात्रा विषय भौतिक विज्ञान के माध्यम

गुण विवर गारापन प्रवर्णन का सा

## विज्ञान स्नातक

की उपाधि प्रदान करता है।

जाप गोल्ड के पर्ट माइक्रो

मोहाली में वर्ष दो हज़ार सोलह के मई माह के चौबीसवें दिन प्रदत्त।

# *The Board of Governors*

of the

*Indian Institute of Science Education and Research Mohali*

**INDIAN** upon the recommendation of the Academic Senate hereby confers on

### *the Degree of*

# Bachelor of Science

**INDIAN INSTITUTE OF TECHNOLOGY**  
**INDIAN INSTITUTE OF TECHNOLOGY** with a Major in Physics on having fulfilled the requirements.

*Given at Mohali on the twenty fourth day of May two thousand and sixteen*

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## Registrar

## **Chairman Board of Governors**

N-fats

**Chairman  
Academic Senate**





भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान मोहाली  
(मानव संसाधन विकास मंत्रालय का एक स्वायत्त संस्थान, भारत सरकार के अधीन)  
सैक्टर—81, नॉले ज सिटी, पो० मनौली, एस.ए.एस.नगर, मोहाली, पंजाब-140 306

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH MOHALI  
(Estd. By Ministry of Human Resource Development, Govt. of India)  
Sector- 81, Knowledge City, P.O. Manauli, S.A.S.Nagar, Mohali, Punjab-140306

Dr. Ramandeep Singh Johal  
Dean Academics

E-mail: [deanacad@iisermohali.ac.in](mailto:deanacad@iisermohali.ac.in)

IISER/16/DOAA/62

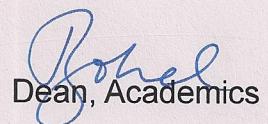
May 20, 2016

**To Whom it May Concern**

This is to certify that the Institute does not follow a formula for conversion from CPI to percentage. The CPI is, on the scale of 10, the credit weighted average of the grade points earned by the student:

CPI= Total of (credits x points) ÷ Total credits

The Institute issues degree certificates and grade cards to the graduating students. It does not issue any migration certificate. The medium of instruction is English language.

  
Dr. Ramandeep Singh Johal  
Dean, Academics



INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH MOHALI  
(Established by Ministry of Human Resource Development, Govt. of India)  
Sector 81, Knowledge City, SAS Nagar, 140306, Punjab, India

Five year BS-MS Dual Degree Programme  
Grade Card



Name of the student : Atul Singh Arora  
Registration No. : MS11003  
Year & Month of Completion : May 2016  
Cumulative Performance Index (CPI) : 9.4

Code	Title of the Course	Semester I	Cr	Gd	Code	Title of the Course	Semester II	Cr	Gd
BIO101	Cellular basis of life		3	A	BIO102	Gene expression & development		3	B
BIO111	Biology Lab I		1	B	BIO112	Biology Lab II		1	B
CHM101	Chemistry of elements & chemical transformations		3	D	CHM102	Atoms molecules & symmetry		3	B
CHM111	Chemistry Lab I		1	B	CHM112	Chemistry Lab II		1	B
HSS101	Language Skills		2	B	HSS102	History of science		2	B
IDC101	Introduction to computers		2	A	IDC102	Hands-on electronics		2	A
MTH101	Symmetry		3	A	MTH102	Analysis in one variable		3	B
PHY101	Mechanics		3	A	PHY102	Electromagnetism		3	A
PHY111	Physics Laboratory I		1	B	PHY112	Physics Laboratory II		1	A
		Semester III					Semester IV		
BIO201	Genetics & Evolution		3	A	BIO202	Behaviour & ecology		3	B
BIO211	Biology Laboratory III		1	A	BIO212	Biology Lab IV		1	A
CHM201	Spectroscopic & other physical methods		3	B	CHM202	Energetics & Dynamics of Chemical Reactions		3	A
CHM211	Chemistry Laboratory III		1	A	CHM212	Chemistry Lab IV		1	A
IDC201	Astronomy & Astrophysics		2	B	HSS202	Philosophy of Science		2	A
IDC211	Workshop Training		1	A	IDC206	Quantum physics for scientists		2	A
MTH201	Curves & Surfaces		3	A	MTH202	Probability & Statistics		3	A
PHY201	Waves & Optics		3	C	PHY202	Thermodynamics & Statistical Physics		3	A
PHY211	Physics Laboratory III		1	A	PHY212	Modern Physics Lab		1	A
		Semester V					Semester VI		
HSS632	Philosophy of Rationality		4	A	IDC352	Seminar (attending)		1	A
IDC351	Seminar (attending)		1	A	PHY304	Statistical Mechanics		4	A
PHY301	Classical Mechanics		4	A	PHY305	Atomic & Molecular Physics		4	A
PHY302	Quantum Mechanics		4	A	PHY312	Advanced Electronics & Instrumentation Lab		4	B
PHY303	Electrodynamics		4	A	PHY631	Quantum Computation & Quantum Information		4	A
PHY311	Advanced Optics & Spectroscopy Lab		4	A	PHY646	Field Theory		4	A
		Semester VII					Semester VIII		
IDC451	Seminar (delivering)		1	A	IDC402	Nonlinear dynamics, chaos & complex systems		4	A
PHY401	Nuclear & Particle Physics		4	A	IDC452	Seminar (delivering)		1	B
PHY402	Solid State Physics		4	B	PHY412	Condensed matter physics lab		4	A
PHY411	Nuclear Physics Lab		4	A	PHY422	Computational methods in physics		4	A
PHY638	Physics of Fluids		4	B	PHY659	Gauge Theories, the standard model & beyond		4	B
PHY656	Quantum Principles & Quantum Optics		4	A	PHY661	Selected topics in classical & quantum mechanics		4	A
PHY658	Radiative effects & Renormalization Group in Relativistic Quantum Field Theory		4	A			Semester X		
		Semester IX			PHY654	Cosmology & galaxy formation		4	A
HSS633	Ethics		4	A	PRJ502	Thesis Research		16	A
PRJ501	Thesis Research		16	A					

Date of Issue: May 20, 2016

Meaning of Grades: A=Excellent, B=Good, C=Average, D=Pass, F=Fail.

Points for Grades: A=10, B=8, C=6, D=4, F=0

CPI is the credit weighted average of points earned.

Cr: Credits; Gd: Grade

CPI =  $\frac{\text{Total of (Credits} \times \text{Points})}{\text{Total Credits}}$



Dean Academics