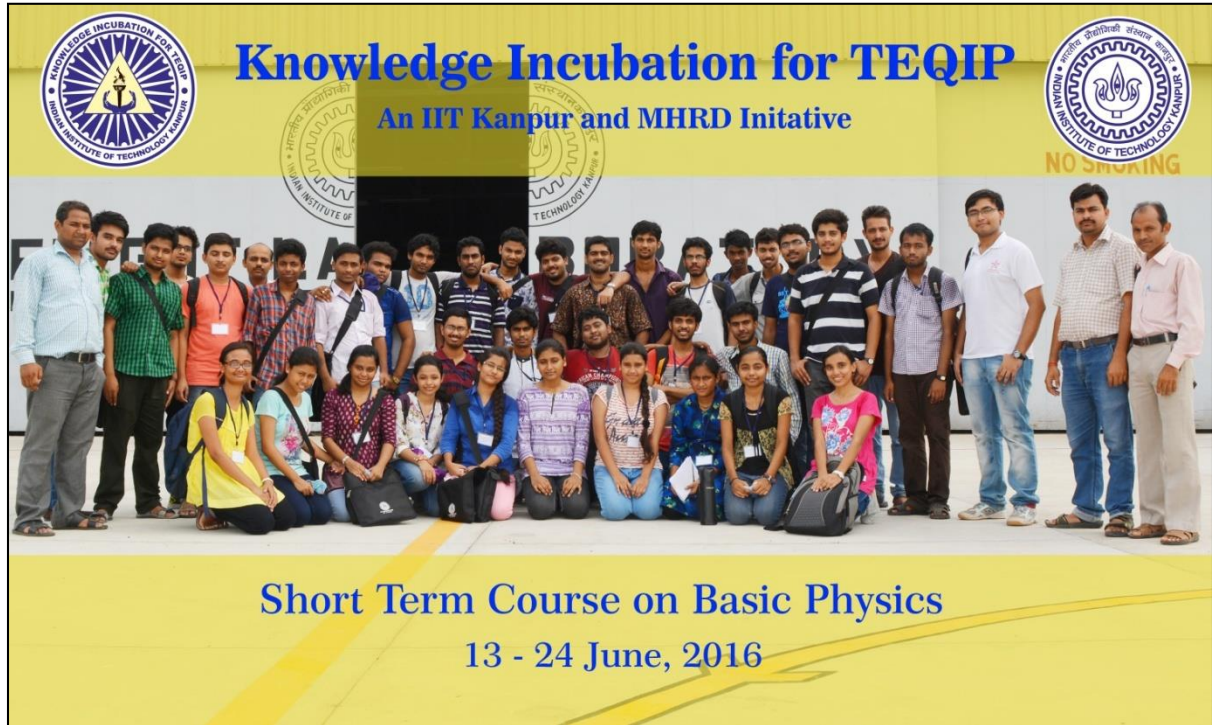




KNOWLEDGE INCUBATION FOR TEQIP, IIT KANPUR

TEQIP Short Course on Basic Physics

June 13- 24, 2016



After the success of Basic Physics Course 2015, this course was organized again in 2016 by Prof. H. C Verma for B.Sc. students. This is a two week course open for students going to 2nd year of B.Sc. Program. The experiments and lectures conducted during this course sparked interest in the subject. It aimed at motivating students to learn various connections between physics and its engineering applications.

The program had following components:

- Lectures by working scientists, mostly from IIT Kanpur, on areas like Quantum Mechanics, Optics, and Electrodynamics.
- Experimental demonstrations.
- Short experiments were conducted.
- Lab sessions.

Topics Discussed

- Speed of light
- ED and Optics
- Lagrangian/ Hamiltonian description of mechanics
- Gravitational waves
- Early Universe
- Basics of Quantum Mechanics
- Quantum Entanglement
- Black holes
- Ion Beam Accelerators
- Lasers: Modern Usages
- Lab sessions with related subject

List of Speakers

- Prof. H. C Verma
- Dr. Sagar Chakraborty
- Dr. Suratna Das
- Dr. Anantha Ramakrishna
- Dr. Kaushik Bhattacharya
- Dr. Amit Agrawal
- Dr. H. Wanare
- Dr. Anand Jha
- Dr. Tapobrata Sarkar
- Dr. Anurag Tripathi
- Dr. J Ramkumar
- Mr. Anurag Pandey

PARTICIPATING INSTITUTES

Institute	Number of Participants
Jadavpur University	25
Fergusson College, Pune	2
Poorna Prajna College, Udupl(kar)	1
Govt.(Auto) college Bhawanipatna Kalahandi Odisha	1
Catholicate College Pathanamthitta Kerala	1
Banaras Hindu University Varanasi	1
Int. School of Photonics, cochin university	1
D B S (PG) College Dehradun	1
Dept. of Physics, Panjab University Chandigrah -14	1
Jai Hind College, Churchgate.	1
MES Degree College, Malleswaram Bengaluru	1
St Stephen's College Delhi	2
Sri Venk.teswara CoLlese New Delhi	1
Total	39

Workshop Schedule

June 13, 2016

Time	Event
8:30 – 9:30 AM	Registration
9:30 – 10:30 AM	Inauguration
10:30 – 11:00 AM	High Tea
11:00 – 11:50 AM	Introduction with Participants <i>Prof. H C Verma</i>
12:00 – 1:00 PM	Measuring speed of light: Historical Perspective <i>Prof. H C Verma</i>
1:00 – 2:15 PM	Lunch Break
2:15 – 5:00 PM	Making a microscope <i>Ranjit Kumar</i>

June 14, 2016

Time	Event
8.50 – 10:15 AM	ED and Optics <i>Dr Anantha Ramakrishna</i>
10.25 – 11:50 AM	Lagarangian/Hamiltonion description of mechanics <i>Dr Sagar Chakraborty</i>
12:00 – 1:00 PM	Sopan Introduction <i>Mr Anurag Pandey</i>
1:00 – 2:15 PM	Lunch Break

2.15 – 5:00 PM	UG Lab Experiments <i>Mr. A.S Rathaur</i>
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June 15, 2016

Time	Event
8.50 – 10:15 AM	ED and Optics <i>Dr Anantha Ramakrishna</i>
10.25 – 11:50 AM	Lagarangian/Hamiltonion description of mechanics <i>Dr Sagar Chakraborty</i>
12:00 – 1:00 PM	Gravitational waves <i>Dr Suratna Das</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	UG Lab Experiments <i>Mr. A.S Rathaur</i>

June 16, 2016

Time	Event
8.50 – 10:15 AM	ED and Optics <i>Dr Anantha Ramakrishna</i>
10.25 – 11:50 AM	Lagarangian/ Hamiltonion description of mechanics <i>Dr Sagar Chakraborty</i>
12:00 – 1:00 PM	Small Expt.: Big Learning <i>Sopan Science Cell</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	UG Lab Experiments

June 17, 2016

Time	Event
8.50 – 10:15 AM	ED and Optics <i>Dr Anantha Ramakrishna</i>
10.25 – 11:50 AM	Lagarangian/Hamiltonion description of mechanics <i>Dr Sagar Chakraborty</i>
12:00 – 1:00 PM	Small Expt.: Big Learning <i>Sopan Science Cell</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Optics Experiments <i>Dr Saikat Ghosh</i>

June 18, 2016

Time	Event
8.50 – 10:15 AM	ED and Optics <i>Dr Anantha Ramakrishna</i>

10.25 – 11:50 AM	Lagarangian/Hamiltonion description of mechanics <i>Dr Sagar Chakraborty</i>
12:00 – 1:00 PM	Small Expt. :Big Learning <i>Sopan Science Cell</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Optics Experiments <i>Dr Ananth Ramakrishna</i>

June 19, 2016

Time	Event
8.50 – 10:15 AM	Basics of Quantum Mechanics <i>Dr Amit Agrawal</i>
10.25 – 11:50 AM	Lagarangian/Hamiltonion description of mechanics <i>Dr Sagar Chakraborty</i>
12:00 – 1:00 PM	Early universe <i>Dr Kaushik Bhattacharya</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Optics <i>Dr Ananth Ramakrishna</i>

June 20, 2016

Time	Event
8.50 – 10:15 AM	Basics of Quantum Mechanics <i>Dr Amit Agrawal</i>
10.25 – 11:50 AM	Quantum Entanglement <i>Dr Anand Jha</i>
12:00 – 1:00 PM	Lasers: Modern Usages Dr H Wanare
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Ion Beam Accelerators <i>Dr Aditya Kelkar</i>

June 21, 2016

Time	Event
8.50 – 10:15 AM	Basics of Quantum Mechanics <i>Dr Amit Agrawal</i>
10.25 – 11:50 AM	Quantum Entanglement <i>Dr Anand Jha</i>
12:00 – 1:00 PM	Blackholes <i>Dr Tapobrata Sarkar</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Workshop Practices <i>Dr J Ramkumar</i>

June 22, 2016

Time	Event
8.50 – 10:15 AM	Basics of Quantum Mechanics <i>Dr Amit Agrawal</i>
10.25 – 11:50 AM	Quantum Entanglement <i>Dr Anand Jha</i>
12:00 – 1:00 PM	Granular Materials <i>Dr Anurag Tripathi</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Workshop Practices <i>Dr J Ramkumar</i>

June 23, 2016

Time	Event
8.50 – 10:15 AM	Basics of Quantum Mechanics <i>Dr Amit Agrawal</i>
10.25 – 11:50 AM	Quantum Entanglement <i>Dr Anand Jha</i>
12:00 – 1:00 PM	Small Expt. :Big Learning <i>Sopan Science Cell</i>
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Workshop Practices <i>Dr J Ramkumar</i>

June 24, 2016

Time	Event
8.50 – 10:15 AM	Basics of Quantum Mechanics <i>Dr Amit Agrawal</i>
10.25 – 11:50 AM	Quantum Entanglement <i>Dr Anand Jha</i>
12:00 – 1:00 PM	Closing of academic sessions
1:00 – 2:15 PM	Lunch Break
2.15 – 5:00 PM	Airstrip visit/Wind tunnel

Summary of Feedback

Workshop

<i>Questions</i>	<i>Excellent</i>	<i>Good</i>	<i>Ordinary</i>
Clarity of communication about workshop	25	12	02
Organization of the sessions	30	09	00
Quality of lectures	32	07	00
Quality of posters	15	19	2
Effectiveness of discussions	17	22	00
Effectiveness of learning experience	19	20	00
	<i>Appropriate</i>	<i>Short</i>	<i>long</i>
Duration of workshop	19	18	02
	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to have more such sessions?	38	00	00
Would you like e-lectures by experts on special topics?	37	02	00

Suggest specific topic that you would like additional expert lectures on

- Machine.
- Special theory of relativity.
- Electrodynamics.
- Optics: Quantum and mechanics.
- Electromagnetism.
- Quantum mechanics, optics.
- Chaos and non-linear dynamics.
- Thermodynamics, applications of physics in daily life, physical interpretation of quantum mechanics phenomenon.
- Mathematical methods of physics.
- Quantum Entanglement, cosmology, 4-D
- Thermal Physics, Computational Physics.
- Astrophysics, thermal physics computational physics.
- Quantum mechanics & nonlinear dynamics.
- Some type of application of physics in daily life to understand more.
- Black holes, astronomy, astrophysics.
- Energy nuclear physics.
- Gravitational Waves, Ion beam accelerator
- Stochastic Analysis
- Theory of relativity.
- Black holes
- Universe, Astrophysics.
- Gravitational Waves.
- Nonlinear dynamics.
- Information Theory, recent discoveries.
- Numerical Analysis and computing
- Polarization, Particle Physics, GTR, STR

<p>Additional Suggestions</p>	<ul style="list-style-type: none"> • Time duration for the short course should be increased. • More lab experiments and more newly discovered matter. • The lectures on quantum mechanics could have been better and mechanics, more comprehensive. • Students should have been from more diverse locations. Too many students from Jadavpur University spoils the environment for learning a new thing together and creates group in the class. • Study materials of basic experiments. • E-lectures should be provided. • Number of lectures should be increased. • More practical classes should be held. Students should join for different projects in this short course and they should be inspired to make new things like mobile microscope. • More fine-tuned lectures, open ended labs • There must be some classes about some recent research area like cosmology. • More make discussion talk about some additional research areas. • If there will be more lectures on nuclear physics & particle physics it will be helpful to us. • Would like to have more laboratory session ‘small experiment big learning’ sessions were excellent • The lecture would have been more attractive. • More lectures on every topic. • UG lab sessions can be increased. • The duration of the session should be enlarged, so that for one topic we got more classes.
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Learning

<i>Questions</i>	<i>Yes</i>	<i>No</i>
Do you get enough class projects?	23	15
Is the learning adequate?	31	07
Do you have sufficient resources for laboratory courses?	33	04

What is your area of specialization	<ul style="list-style-type: none"> • Electronics and Optics • Classical Mechanics • Electrodynamics • Theoretical Physics. • Nuclear Physics. • Astrophysics. • Heat and Thermodynamics • Electricity and magnetism • Experimental Physics. • High Energy Physics. 		
	<i>Sufficient</i>	<i>inadequate</i>	
Is the library/journal support/e-connection adequate?	29	07	
	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to have common (TEQIP) repository of course material?	34	04	00
Would you like to visit IITK to attend specialized courses?	37	02	00
Would you like MOOCS/e-resources based courses?	26	09	00

How can TEQIP help improve your learning?

- By arranging such more camps.
- By organizing some camp like this which can increase our knowledge.
- Introducing to some special topics of physics and interested lab experiments which I have never done in my B.Sc. syllabus.
- More stress on experiment aspect on physics in the lab; short research projects in specialized areas may be.
- May be the duration of course was very short, we can have more lectures-if duration of course is lengthen.
- By more labs.
- By giving another opportunity.
- By giving class notes and videos, slides.
- By holding such short courses on physics per year. We will join these types of courses definitely. The lab facilities are pretty good here. I would like to peruse my research-degree at IITK if offered.
- TEQIP is very much helpful to us. The e-learning, lectures of various professors was very good.
- By sharing the slides, lecture notes and classroom videos on website.
- Giving brief knowledge from a good faculties.
- Make short duration but very effective.
- By sharing lecture notes, study material and lecture videos.
- More courses on basic concepts
- TEQIP gave the opportunity to meet several professors of different fields. Communicating with them, helped me to improve my knowledge. Rather the labs of IITK are excellent.
- Enhancing the duration of the course and arranging more camps.
- Giving more classes on small exp. & big learning.

Research

<i>Questions</i>	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to visit an IIT for a short visit /internship/post- doctoral stint, if offered (via TEQIP)?	36	03	00
Would you like to share/use research infrastructure at IITK, if made available?	38	01	00
Would you like to conduct collaborative research with IITK faculty?	37	01	00
Would you like lectures by experts (Indian and international) on niche research areas/topics?	34	03	00
Do you want special-topic conferences?	34	03	00

<p>How can TEQIP help improve your research?</p>	<ul style="list-style-type: none"> • By giving opportunity to work in good research centre. • By organizing such camps and giving study materials, lodging, boarding, Wi-Fi facilities, interact with lecturers. • Giving short research projects maybe on specialized and some faculty to work with on. • I would like to do some internship in my fields of specialization in the summer vacations. • Lab time should be increased. • We went to UG lab optics lab, workshops. The lab facilities are very nice. The teachers are also very helpful and friendly to us. If I can get an opportunity I will surely come to IITK lab for research. • The TEQIP team is very good. It can help us to improve in our research. If this allow us to visit IITK's labs when we need. If they can be in contact with e-mail, it will be very much helpful to us. • By reaching us and helping us connect with the teachers of IITK and sharing classroom videos. • Connecting with universities. • Giving or providing a practical support or guidance from expert. • Some additional topic in which include research topic. • Video lectures. • May be by collaborating with the universities, and arranging more seminars on recent fields of physics. • By conducting as many such courses as possible. • By conducting more summer camps. • By providing with good infrastructure like at IITs. • By giving the opportunity to connect with IITK. • IITK has excellent lab facility. It will help anyone seeking or good research. Giving the opportunity to visit IITK labs. TEQIP helped me a lot. • TEQIP can arrange short research courses like this course and enhance the interests for physics more. • Giving more opportunity to do something new in the lab like making microscope. • TEQIP can improve research by giving opportunity to visit laboratories. • Teaching how to write proper research papers. • By more exposure to research labs and new developing topics in science. • TEQIP can offer facilities for research at IIT Kanpur for my area of specialization in Bio photonics. • Contact every university centres and shift syllabus to IIT syllabus. And made more exams by that made more chances to Indian students.
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Outcome

This course was organized for the second time this year. Feedback from the students were excellent and encouraging us to organize more courses for under graduate students. Because of this course students learnt the basic beauty of physics and did practical experiments in a very easy manner. Students were also encouraged to formulate new problems.

- This course gave much needed boost to UG students to learn Physics in an innovative way.
- Experimental demonstrations showed how learning Physics is not limited to text books and exams.
- It motivated students to learn about Physics beyond the region of examination based studies.
- Encouraged students to become good Physics teachers and scientists.

Organizer's Report on the course on Basic Physics organized by TEQIP, IIT Kanpur

Background

This special course was designed to give our students pursuing BSc program in universities an exposure of real science being done by expert scientists at IIT Kanpur. 24 students were selected from Jadavpur University and 15 from the toppers of National Graduate Examination in Physics conducted by Indian Association of Physics.

Academic Programs

(a) Extended Course

Four major topics were chosen for an extended exposure to the students. These were:

Electrodynamics including Optics : Dr S A Ramakrishna

Quantum Mechanics : Dr Amit Agrawal

Classical Mechanics : Dr Sagar Chakraborty

Quantum Entanglement : Dr Anand Jha

In each of these 5 to 6 lecture of 85 minutes duration was given by the instructor. A flavor of modern perspective of the topics was given which made it different from normal textbook training. Special mention should be made for Quantum Entanglement course, which is a pretty advance research topic but Dr Anand Jha tuned it very nicely for the BSc students.

(b) Physics beyond textbook

This was a series on 1 hour lectures on various interesting developments and physics. This was to give them exposure of interesting research going on in Physics or realization of Physics in everyday life. This included:

Detection of Gravitational waves, Black holes, evolution of universe, Modern usage of Lasers, and Physics of granular materials. Besides Shiksha Sopan gave sessions on Learning Physics through Simple experiments.

(c) Lab activities

Six afternoon session of about 165 minutes was devoted to some doing experiments. Experiments were done in IIT Kanpur UG Labs. All students learned the measurement techniques, handled modern equipment and practiced data analysis during these sessions.

(d) Visits to advance Labs

Visits were arranged to some top end experimental facilities. These were:

- Ion-Beam Laboratory headed by Dr Aditya Kelkar
- National Wind Tunnel Facility
- Flight Lab at Airstrip

(e) Making apparatus

Physics is a wonderful mix and experiment and theory. To do physics experiments equipment are used. Often great insight can be achieved with simple equipment that can be fabricated easily if one has some practice of mechanical workshop tools such as drilling, cutting welding etc. Students were given chance to learn these tools in IIT Kanpur Tinkering Lab. The 3-afternoon course was designed under the guidance of Dr J Rmkumar. One special session was given to make a microscope and study diffraction from that.

2 of the students had health problems and had to leave the course in between.

The course was very useful as expressed by all students during corridor interactions and during the feedback session.