

## Department of Physics

### IIT Kanpur

#### Feedback on ARC from Department of Physics (March 2009)

These suggestions and views are based on the Minutes of the Special Faculty Meeting held on March 01, 2009, and subsequent discussion of ARC Special Group in physics to articulate the views of the Department.

##### 1. General Comments

- The effort of ARC was appreciated. The suggested reforms were generally considered to be in the right direction.
- The analysis in the first part is good, but it is unclear how those issues are addressed in particular in the later recommendations ! The changes required in the content are major and mere incremental changes may not be effective. The tuning of the structure alone is not enough to get the desired results.
- The 'Science based Engg. Education' may need a clearer articulation keeping the present context in mind, though there can be no going back on this.
- Flexibilities provided will work only if a) the exact target audience is identified; b) the fraction of students likely to benefit is estimated; c) conditions of access are laid down and d) responsibility for making the particular flexibility work is fixed.
- The flexibility of minors and second degree has the potential of changing the academic ambience by making disciplinary barriers porous and movements easier.
- Flexibility in duration may be desirable to account for large variation in speed and style of internalizing concepts. To reduce stress ceremonial aspects of awarding degree may be done away with !

##### 2. B.S. Degree Entrance Criteria

- The B.S. degree will be a non-standard degree to start with and prospective candidates at JEE counseling will not have clear ideas about its future and hence genuinely good students interested in Science degree may shy away. The degree may then be filled up with lower ranking students, especially in the face of competition in the environment from new Institutions and other Programmes.

##### 3. Graduation Criteria of CPI being 4.0 and above:

- The sharp numerical criteria of CPI less than 4.0 for termination will not work since in our system we are used to look at individual cases. In effect the AP cases will move to the CPI band 3-4. This may be invitation to many to habitually neglect studies only doing the minimum required to be in AP or just avoid AP.

##### 4. CORE Programme:

- The advantages of allowing a student in the core programme to choose sequencing of core courses at her own will were debatable. May be this option can be given to the Departments rather than individual students. Logistics of

offering each of the courses to number of students and half the batch doing at any time does not make it organizationally feasible either.

- Taking half-courses at the core stage was not favoured by many. This may be tied out in later int eh programme or in the PG part. The courses anyway give a dismembered view of a subject – half-courses would accentuate this undesirable feature. Half-courses can be of use to experienced people with maturity when the academic goals are sharpened so that they know what exactly they want and what for.

5. PROFESSIONAL Programme:

- Most people were not in favour of making Projects optional. An undergraduate programme should be capped by an integrating project. Our failure to regulate and administer projects should not lead us to abandon it. Instead more majors should be taken to streamline the project. In fact it should become one's best part of the UG programme.
- There is a difference between UG Research and UG Project. UG Research should be only for the highly motivated. Only a small fraction of the UG Projects would normally qualify as UG Research.
- Projects must carry letter grades and be compulsory. Project work should not be de-emphasized as suggested in the interim proposals.

6. Answers to Some Questions for the Department:

1. A Minor – an area of sub-specialisation – will consist of 27-36 credits. What Minors could your department offer? Please specify the ideal structure of the minor (courses and their order). What interdisciplinary minors could you offer in association with other departments? What would be their structure?

**See Below**

2. What would be the structure of 2nd B-Tech/B.S. degree (Major) in your department for students from other departments? Specifically, what should be the minimum number of credits for award of the 2nd degree? What should be the course / credit mix (choice of electives and core courses) for 2nd degree?

**See Below**

6. In what ways can your department integrate communication skills as a necessary evaluative criteria in some of your department courses?

*Through Presentations in Project Courses and Introduction to Department.*

7. Should we switch from the pattern of two midterm and one end-term exam to one midterm and one end-term exam for all courses?

*Most people seem to favour single Midsem Exam, though there are some who think tow midesems benefit students.*

## Suggested Course Structure for Second BS Degree (Physics Major)

=====

### Semester I

-----

Phy 401 (Classical Mechanics)  
Phy 461 (Experimental Physics I)  
Phy 552 (Classical Electrodynamics)  
\*\*\* / OE  
DE1 (Department Elective)

### Semester II

-----

Phy 412 (Statistical Mechanics)  
Phy 432 (Quantum Mechanics II)  
Phy 462 (Experimental Physics I)  
OE / \*\*\*  
DE2 (Department Elective)

### Note:

1) Most students going for a Physics Major will have probably taken Phy 431 (QM) earlier; if they have not, Phy 431 (Quantum Mechanics I) must be taken in the OE slot.

2) \*\*\* is one of Phy 407 / 524 / 543

### Suggested Physics Minors

=====

Astrophysics            305 (Physics of the Universe)  
                                 407 (Special and General Relativity)  
                                 CM/QM

Atomic Physics            QM  
                                 524 (Atomic and Nuclear Physics)  
                                 ???

Bio Physics                309 (Introductory Biophysics) / 310( Physics of Bio-materials)  
                                 617 (Physics of Natural Nanomachines) / 619 (Statistical Physics of Biomolecules and Cells) / 641  
(Elements of Bio-Medical Physics)

suitable elective (BSBE)

**Chemical Physics** QM

524 (Atomic and Nuclear Physics)

suitable elective (Chemistry)

**Computational Physics** 473 / 625 (Computational Methods in Physics)

627 (Computer Simulations in Physics) / ???

suitable elective e.g. on Fluid Dynamics (ME/AE)

**Condensed Matter Physics** QM

412 (Statistical Mechanics)

543/622/634/642/624 etc. (any Condensed Matter Physics course)

**Energy and Environment** 301 (Energy)

Sociology (HSS)

Environment (covering sensors) (CE)

**High Energy Physics** QM1

QM2

680 (Particle Physics)

**Laser Technology** 303 (Principles of Lasers and their Applications)

643 (Lasers and Laser Spectra) / 644 (Quantum Electronics)

elective (LTP)

**Low Temperature Physics** QM

634 (Low Temperature Physics)

Experiments in different laboratories

**Mathematical Physics I** ???

(Algebraic Topology ???

Differential Geometry) elective (MTH)

**Mathematical Physics II** QM

Mathematics and Philosophy 407 (Special and General Relativity)

612 (Group Theory)

**Materials Physics**      **QM**  
308 (Modern Theories of Material Design)  
suitable elective (MSP) / 621 (Electronic Structure of Materials)

**Nano Physics**      **QM**  
629 (Physics and Terchnology of Thin Fims) / 631 (Physics of Semiconductor Nanostructures) /  
617 (Physics of Natural Nanomachines) / suitable elective  
project (FIB/other lab)

**Non-Linear Dynamics**      306 (Order and Chaos)  
322 (Nonlinear Systems)  
elective on computations (e.g. ME)

**Nuclear Techniques**      **QM**  
543 (Condensed Matter Physics)  
638 (Nuclear Techniques in Solid State Studies)

**Physics and Philosophy**      305 (Physics of the Universe)  
**QM**  
Philosophy (HSS)

**Plasma Physics**      303 (Principles of Lasers and Applications)  
552 (Classical Electrodynamics I)  
690R (???)

**Quantum Information Theory** **QM**  
???  
elective (CSE)

**Quantum Optics**      **QM**  
307 (Modern Optics)  
646 (Coherence Optics) / ???

**Semiconductor Physics**      **QM**  
312 (Quantum Processes in Low-dimensional Semiconductors)  
628 (Topics in Semiconductor Physics) / 629 (Physics and Technology of Thin Films) / 631  
(Semiconductor Nanostructures) / MSP

Spectroscopy      QM  
NMR/EPR          ???  
elective (Chemistry)

Statistical Physics    412 (Statistical Mechanics)  
613 (Advanced Statistical Mechanics) / 615 (Non-equilibrium Statistical Mechanics)  
elective

---

Y. N. Mohapatra  
March 28, 2009