

The M Sc-2 Year Programme at IIT Kanpur

**Recommendations of the
Fifth Academic Programme
Review Committee**

May 2013

Executive Summary

•**Credit system and registration:** The Academic Programme Review Committee proposes a completely credit-based system. In this system, the course credits will be computed based on the student-time required per week for the course using the following formula.

$C = L + T + P + SS$, where C is the number of credits, L is the number of lecture hours, T is the number of tutorial hours, P is the number of laboratory hours, and SS is the number of self-study hours given by the following formula with A representing the additional number of hours needed for assignments and projects, as decided at the time of approval of the course.

$$SS = 2L + T + A$$

There is no discussion hour in any course. The overall credit formula then becomes $C = 3L + 2T + P + A$. The normal load of a typical student is 50 credits per semester. A student may register for 40-65 credits in a semester. The credit system is discussed in detail in Section 2.1.

•**Grading scales:** Added a new grade A* with same equivalent points as A grade to recognize excellence on transcripts. The grading scales are discussed in detail in Section 2.3.

•**Electives:** The Academic Review Committee proposes increased flexibility for students through an increase in the elective component of the curriculum. Of the total credits required for graduation, 40-50 credits must be from elective courses. The elective slots may be prescribed as combinations of Open and Department electives, by the concerned Department. HSS courses may also be credited as Open Electives.

•**Project:** At least 10% of the mandatory department credits, must constitute the M Sc project..

•**Graduation requirements:** 185-215 credits are required for graduation with a Masters' degree. The exact course requirements will be specified for each programme. The students in the M Sc programme have already obtained a Bachelor's degree. Therefore, unlike in the BTech/BS programme where the student can graduate once he/she has collected all the credits prescribed for that programme, the students will be required to have additional performance criterion to graduate. The students must secure a 'C' grade or better in at least 50% of the credits they collect, to be eligible for graduation. Distinction will be awarded to students who score a CPI ≥ 8.5 .

•**APEC rules:** The normal academic load, for the purpose of evaluating performance, is 50 credits per semester. A student goes on probation if s/he fails to accumulate 'C' or higher grade in at least 30% of the cumulative credits, with normal academic load, up to that point. The programme of the student is terminated if s/he is on probation and fails to accumulate at least 20% of the cumulative normal load up to that point with 'C' grade or better. The semesters that the student may be on leave are excluded from the computation.

•**Dual Degree:** Students may upgrade their programme to a M Sc-PhD dual degree programme. They may apply for this change anytime after spending two semesters in the programme. The scholarship/assistantship can start immediately following the change of programme. The Departments may also admit students to a M Sc-PhD dual degree programme.

•**Examinations:** One mid-semester and one end-semester examination.

•**Modular courses:** A modular course can be offered for half a semester with only one examination at the end aligned with the mid-semester examination schedule. Modular courses open up the option of offering an elective course only during one half of a semester. This will bring enormous flexibility in the system.

•**Core programme:** For increased efficiency in teaching and for increased interactions amongst students of different departments, certain common courses across various departments may be conducted as core courses.

•**Communication skill:** The communication skills can be acquired by a student through either a web-based course, a course module taught by a professional, or a seminar course. This is a 2-5 credit, Pass/Fail course. See Section 2.2 and Appendix II for further detail.

•**Transfer of credits from outside IIT Kanpur:** In general, transfer of credits are not permitted in this programme. The SUGC may discuss special cases.

•**Admissions:** To improve the selection process, a change in the format of the selection process is recommended. An interview is desirable.

1. Introduction

It is nearly 50 years since the Indian Institute of Technology Kanpur (IITK) was established. This is the first time that the Institute is conducting a review of its M Sc-2 Year programme.

The programme:

The Institute runs several programmes that lead to a Masters degree. The 2-Yr M Sc is a programme available to students who have obtained a Bachelor's degree elsewhere. (It is noted that another Masters programme in Science:MS is available to students admitted to the BS/B Tech programme in the Institute).

Currently, the Institute offers programmes in Physics, Chemistry, Mathematics and Statistics. Perhaps, a few other departments may wish to offer such a programme as well. For example, to begin with the Department of Humanities and Social Sciences might consider working out the details of a programme in a few disciplines.

The success of the programme hinges on the right combination of (a) bright and motivated students (b) a vibrant and challenging academic environment (c) a rich and flexible curriculum (d) state-of-the-art research infrastructure and (e) inspiring mentors.

2. Proposed Curriculum

In the following, the recommendations of the fifth academic programme review committee for the curriculum are discussed in detail.

2.1. Credit System and Registration

The fifth academic programme review committee proposes a fully credit-based curriculum. Every academic activity will be evaluated in terms of credits. Academic load is directly converted to credits, as opposed to going through a non-linear mapping. Credits (C) explicitly reflect contact and self-study (SS) hours. The formula for computing credit is given by $C = L + T + P + SS$. Here, $SS = 2L + T + A$, where A indicates additional work. The courses for this programme use the same credit formula as UG courses.

1. The normal academic load for students is 50 credits per semester.
2. A student may register for 40-65 credits in a regular semester.

2.2. Communication Skills

The committee feels that there is a need to expose all the students to a course focused on Communication Skills. This will be a Pass/Fail course with credits in the range of 2-5 and is in addition to the credits for other course work (outlined in section 2.7). The committee proposes the following three models, one of which may be adopted by the Departments.

Web based: This course has been successfully running for the UG students. It is suggested that a similar course can be run for the PhD students as well. It can be offered to the students in the summer session, so that it does not interfere with their regular course-work in the first year. Details are in Appendix II.

Course module taught by a professional: Professionals from outside the Institute may be invited and to teach this course. This course can take care of skills related to (non-technical) presentations, verbal communications, writing (like synopsis/abstraction etc.). Some of the salient features of this course can be, how to write and structure the content of reports, how to structure an organized thesis, etc. This could also be assisted by a *Language lab*, which would be run by professional(s) and needy students can seek its help as and when required. There are also resources within the Campus to run a *Writing Help Desk*. This may be explored. The number of students is so large that the logistics requirement for these being mandatory is prohibitive.

Seminar courses: It was opined that any course on communication skills that drains on too much faculty resource might not succeed. Perhaps a worthwhile model is that each department offers seminar course with several sub-groups. Each sub-group can have 20-30 registered students and headed by a faculty member. This should be Pass/Fail course where an S/X grade is awarded. The students would take turns to deliver a seminar every week and the mentoring is done by the faculty member.

2.3. Grading Scales

The fifth academic programme review committee recommends the introduction of an A* grade carrying the same level of points as an A grade. However, the A* grade is intended to recognize and encourage outstanding performance in a class. This grade should be used sparingly. The description of the various letter grades is:

Grade	Weight	Description
A*	10	Outstanding
A	10	Excellent
B	8	Good
C	6	Fair
D	4	Pass
E	2	Fail/Exposure
F	0	Fail

2.4.Examinations

As in the UG programme, it is proposed to hold one mid-semester and one end-semester examination.

2.5.Modular courses

A modular course can be offered for half a semester with only one examination at the end aligned with the mid/end semester examination schedule. Modular courses open up the option of offering an elective course only during one half of a semester. This will bring enormous flexibility in the system. A student registering for a modular course earns half the credits (rounded to the next highest integer) that of a regular course that runs for a full semester.

2.6. Electives

Of the total credits required for graduation, 40-50 credits must be from elective courses. The elective slots may be prescribed as combinations of Open and Department electives, by the concerned Department. HSS courses may also be credited as Open Electives.

2.7. Projects

Projects should be encouraged. It is suggested that 5-10% of the credits should preferably be earned through projects.

2.8. APEC rules

The normal academic load, for the purpose of evaluating performance, is 50 credits per semester. A student goes on probation if s/he fails to accumulate 'C' or higher grade in at least 30% of the cumulative credits, with normal academic load, up to that point. The programme of the student is terminated if s/he is on probation and fails to accumulate at least 20% of the cumulative normal load up to that point with 'C' grade or better. The semesters that the student may be on leave are excluded from the computation.

2.9. Graduation Requirements

185-215 credits are required for graduation with a Masters' degree. The exact course requirements will be specified for each programme. The students in the M Sc programme have already obtained a Bachelor's degree. Therefore, unlike in the BTech/BS programme where the student can graduate once he/she has collected all the credits prescribed for that programme, the students will be required to have additional performance criterion to graduate. The students must secure a 'C' grade or better in at least 50% of the credits they collect, to be eligible for graduation.

2.10. Distinction

To motivate students and to recognize excellence, distinction will be awarded to students who score a CPI ≥ 8.5 .

3. Admissions

The admissions in the programme are, at present, based on the score in the Joint Admissions in M Sc Programmes (JAM). To improve the selection process, a change in

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the format of the selection process is desirable. Either an interview may be conducted, or the written examination has to be redesigned to filter the right kind of students.

Report of the committee constituted by ARC to review the M.Sc. 2 year programs

Members: Dr. Debasis Kundu (Convener), Dr. Mohua Banerjee (MTH), Dr. Manoj Harbola (PHY), Dr. Satyajit Banerjee (PHY), Dr. V. Chandrasekhar (CHM), Dr. K. Srihari (CHM), Dr. Harish Karnick (CSE), Dr. Somesh Mathur (HSS), Dr. Surajit Sinha (HSS).

The committee members met on (i) 10-08-11, (ii) 23-08-11 and (iii) 29-09-11 and discussed various issues related to 2-year existing M.Sc. programs. At present there are four M.Sc. 2 year programs: (i) M.Sc. (Mathematics), (ii) M.Sc. (Statistics), (iii) M.Sc. (Physics) and (iv) M.Sc. (Chemistry).

The committee members discussed the feedback of their respective departments on the following specific points:

(a) Any weakness of their existing programs and do we need more flexibility?

Both the Physics and Chemistry departments felt that their 2-yr M.Sc. programs are running quite well. About the flexibility, it is felt that the core courses should not be disturbed, but more open electives may be offered.

Department of Mathematics and Statistics have two programs: M.Sc. Mathematics & M.Sc. Statistics. The M.Sc. Statistics program is going well but not the M.Sc. Mathematics program. Both the programs are not able to motivate students to pursue Ph.D. in their Department. About the flexibility the Department felt that both the programs are quite flexible at this moment. No more flexibility is needed. Both the programs offer up to 3 open electives.

The committee members in general felt that the students are not able to take open electives from the other Departments because in most of the cases they do not have enough background.

(b) Do we need JAM?

All the three departments felt that JAM is not serving its purpose. Physics and Chemistry Departments felt that interview should be taken before the final selection.

Department of Mathematics and Statistics is not in favor of taking the interview mainly due to the volume of students appearing for JAM. But felt that more subjective questions should be provided.

(c) Possibility of dual degree programs.

Physics Department in general gave a positive opinion about the dual degree programs. Chemistry department is divided in this respect. Department of Mathematics and Statistics is against this opinion. The Mathematics and Statistics Department only supports the idea of M.Sc. and Ph.D. dual degree program in the same Department.

The committee members felt that the possibilities should be looked at carefully.

Student's Survey

The Mathematics and Statistics Department has conducted the students' survey regarding current M.Sc. (2yr) program. Many students felt that there should be joint (a) M.Sc. (Statistics) - MBA program (3 yr), (b) M.Sc. (Mathematics) - Ph.D. (Mathematics) program, (c) M.Sc. (Statistics) - Ph.D. (Statistics) programs (d) Three year program MS (Mathematics) by research.

The Physics and Chemistry departments did not receive enough students' responses.

The committee's Proposals

Templates: The new templates of the four programs have been enclosed.

Grades: The possible grades should be A+, A, B, C, D, E and F.

APEC Rules:

The committee members discussed in details about the possible APEC rules. It has been felt that although BS/BTech program has the passing CPI 4.0, the same should not be kept for M.Sc. (2 yr) program, mainly due to the fact that M.Sc. program is a more specialized program and it is not the 1st degree.

Requirements The minimum residence requirement is four (04) regular semesters and maximum duration is six (06) regular semesters. A student is required to complete successfully all the courses of the curriculum prescribed for his/her M.Sc. (2 yr) program and attain a minimum level of academic performance i.e: obtain a minimum CPI 5.0.

Warning A student is placed on warning if his/her SPI at the end of a regular semester is $4.0 \text{ SPI} < 5.0$.

Termination The program of a student may be terminated by Senate if

- (a) he/she is under warning for two consecutive semesters or
- (b) his/ her CPI < 4.0 in any semester.

The committee felt that the replacement of D grade should be allowed only to graduate and it should be allowed only after completion of all the course requirements. To help a student to graduate he/ she may be allowed to replace simultaneously the courses in which he/ she has F, E and D grades provided the pre-requisite conditions are satisfied.

Proposed template for the 2 year Msc programme in Mathematics

YEAR I				YEAR II			
Semester I		Semester II		Semester III		Semester IV	
Course	L-T-P-A[C]	Course	L-T-P-A[C]	Course	L-T-P-A[C]	Course	L-T-P-A[C]
MTH201	3-1-0-0[11]	MTH308	3-1-0-0[11]	MTH305	3-1-0-0[11]	OE-2	3-0-0-0[09]/ 3-1-0-0[11]
MTH204	3-1-0-0[11]	MTH421	3-1-0-0[11]	MTH403	3-1-0-0[11]	OE-3	3-0-0-0[09]/ 3-1-0-0[11]
MTH301	3-1-0-0[11]	DE-1	3-0-0-0[09]/ 3-1-0-0[11]	OE-1	3-0-0-0[09]/ 3-1-0-0[11]	OE-4	3-0-0-0[09]/ 3-1-0-0[11]
MTH409	2-1-1-0[09]	DE-2	3-0-0-0[09]/ 3-1-0-0[11]	DE-4	3-0-0-0[09]/ 3-1-0-0[11]	DE-6	3-0-0-0[09]/ 3-1-0-0[11]
MTH428	3-1-0-0[11]	DE-3	3-0-0-0[09]/ 3-1-0-0[11]	DE-5	3-0-0-0[09]/ 3-1-0-0[11]	DE-7	3-0-0-0[09]/ 3-1-0-0[11]

GROUP ELECTIVES			
Group A		Group B	
Course	L-T-P-A[C]	Course	L-T-P-A[C]
MTH304	3-1-0-0[11]	MTH424	3-1-0-0[11]
MTH404	3-1-0-0[11]	MTH523	3-1-0-0[11]
MTH405	3-1-0-0[11]	MTH???	3-0-0-2[11]

Note: As a part of the departmental elective (DE) courses, a student must take all the three courses from either Group A or Group B.

MTH201 Linear algebra

MTH204 Algebra I

MTH301 Analysis I

MTH304 Topology

MTH305 Several variable calculus and differential geometry

MTH308 Principles of numerical computation

MTH403 Complex analysis

MTH404 Analysis II

MTH405 Functional analysis

MTH409 Computer programming and data structures

MTH??? Introduction to mathematical modelling (new course)

MTH421 Ordinary differential equations

MTH424 Partial differential equations

MTH428 Mathematical methods

MTH523 Fluid mechanics

Proposed template for the 2 year M Sc programme in Statistics

YEAR I				YEAR II			
Semester I		Semester II		Semester III		Semester IV	
Course	L-T-P-A[C]	Course	L-T-P-A[C]	Course	L-T-P-A[C]	Course	L-T-P-A[C]
MSO202 A	3-1-0-0[06]	MTH***	3-1-0-0[11]	MTH412	3-1-0-0[11]	MTH511	3-1-0-0[11]
MTH???	3-1-0-0[06]	MTH416	3-1-0-0[11]	MTH515	3-1-0-0[11]	MTH514	3-1-0-0[11]
MTH301	3-1-0-0[11]	MTH418	3-1-0-0[11]	MTH517	3-1-0-0[11]	MTH516	3-1-0-0[11]
MTH409	2-1-1-0[09]	MTH513	3-1-0-0[11]	DE/OE	3-0-0-0[09]/ 3-1-0-0[11]	DE/OE	3-0-0-0[09]/ 3-1-0-0[11]
MTH415	3-1-0-0[11]	DE/OE	3-0-0-0[09]/ 3-1-0-0[11]	DE/OE	3-0-0-0[09]/ 3-1-0-0[11]	DE/OE	3-0-0-0[09]/ 3-1-0-0[11]
MTH417	3-1-0-0[11]						

List of courses

MSO202a Complex analysis (module)

MTH??? Distribution theory (module, new course)

MTH301 Analysis I

MTH409 Computer programming and data structures

MTH412 Stochastic processes

MTH415 Matrix theory and linear estimation

MTH416 Regression analysis

MTH417 Sampling theory

MTH*** Probability theory (new course)

MTH418 Inference I

MTH511 Statistical simulation and data analysis

MTH513 Analysis of variance

MTH514 Multivariate analysis

MTH515 Inference II

MTH516 Non-parametric inference

MTH517 Time series analysis

Proposed template for the 2 year M Sc programme in Chemistry**M.Sc. II Year Template**

No. of credits in brackets and total semester credits
in the last row

SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV
CHM 401 (09)	CHM 402 (09)	CHM 503 (06)	CHM 700 (27)
CHM 421 (09)	CHM 422 (09)	CHM 611 (09)	DE - 4 (09)
CHM 423 (06)	CHM 442 (09)	CHM 621 (09)	DE - 5 (09)
CHM 441 (09)	CHM 443 (06)	CHM 664 (09)	
CHM 521 (09)	CHM 481 (09)	DE / OE - 2 (09)	
	DE / OE - 1 (09)	DE - 3 (09)	
42	51	51	45

- CHM 401: Organic Chemistry I
- CHM 421: Physical Chemistry I
- CHM 423: Physical Chemistry Lab
- CHM 441: Inorganic Chemistry I
- CHM 521: Mathematics for Chemistry
-
- CHM 402: Organic Chemistry II
- CHM 422: Physical Chemistry II
- CHM 442: Inorganic Chemistry II
- CHM 443: Inorganic Chemistry Lab
- CHM 481: Biosystems
- DE/OE - 1 : Departmental/Open Elective
-
- CHM 503: Organic Preparations Lab
- CHM 611: Physical Organic Chemistry
- CHM 621: Chemical Binding
- CHM 664: Modern Physical Methods in Chemistry
- DE/OE - 2 & 3: Departmental/Open Electives
-
- CHM 700: Project/Thesis
- DE - 4 & 5: Departmental Electives

CHEMISTRY

PROPOSED TEMPLATE FOR 2-YEAR M.Sc.

FIRST	SECOND	THIRD	FOURTH
PHY 401	PHY 412	PHY 552	PHY524/DE
PHY 421	OE	PHY 563	PHY526/DE
PHY 431	PHY 432	PHY 565	PHY 566
PHY 441	PHY 462	DE	PHY 568
PHY 461	PHY 473	PHY543/DE	DE
Credits: 52	47	53 / 51	51 / 53

Any two out of the three courses (PHY543, PHY524, PHY526) must be completed, one may be substituted by a DE.

DE courses to be compulsorily floated:

Even Semester : PHY422, PHY553

Odd Semester : PHY407

Minimum Credit Requirement : 200

(Maximum overload: 64 credits in a semester)

PROPOSED TEMPLATE FOR M.Sc-PhD Dual Degree.

FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
PHY 400	PHY 412	PHY543 / DE	PHY524 / DE	PHY599	PHY422 / 692
PHY 401	PHY 432	PHY 552	PHY526 / DE	PHY599	PHY 599
PHY 421	PHY 461	PHY 462	PHY502	PHY599	PHY 599
PHY 431	PHY 473	PHY 501	OE	DE	PHY 599
PHY 441	PHY 500			OE	DE
Credits: 49	50	39 / 37	40 / 38	45	47

Any two out of the three courses (PHY543, PHY524, PHY526) must be completed, one may be substituted by a DE.

NOTES:

- 1.PHY400 (S/X grades only) (1-0-0-2) has 5 credits. It is a seminar course with a weekly seminar given by a Faculty member and 2 hours are devoted for self study and writing a mandatory 1-page report on the weekly seminar.
- 2.PHY500, PHY501, and PHY502 all have 9 credits each.
- 3.One DE slot in the fifth semester is converted to an OE slot.
- 4.Each PHY 599 has 9 credits.
Total 27 credits (per semester) is equivalent to current 12 units.
- 5.Criteria for migration to the PG part of the program: The student should have completed all the compulsory courses till the 4th semester including two out of (PHY 543, PHY524, PHY526) as well as satisfying CPI requirements.

Appendix II: Course on Composition (Communication Skills)

This course is based on a lot of on-line exercises. It consists of one lecture per week which is to initiate the students into the subject matter to be covered during the week. In addition there is to be a two hour lab every week where exercises are to be administered on a computer. An instructor and several tutors will be required to run the lab. After the practice session, students are to be given assignments on the subject matter covered in the laboratory. Evaluation is to be based on an online half-hour test at the end of each module. As suggested in the ARC report, the course is supported by a parallel help desk where students can go and seek assistance.

(i) It is suggested that senior PhD students from all the departments be involved in running the lab as they also stand to benefit from this.

(ii) It may not be possible to run the course for the entire batch in one semester due to logistic reasons. So the senate may consider offering the course in the third and the fourth semester.

Course structure:

Module 1 - Introduction to words: word derivation; context sensitivity in word meaning; synonyms and antonyms; homonyms; homophones; pronunciation of same spelling words according to the context; vocabulary building techniques; using a thesaurus for choosing a proper word; euphemistic words and collocations; using idiomatic expressions (3 lab sessions)

Module 2 - Introduction to sentences: constructing grammatically correct sentences; use of appropriate articles, tenses, parallelism, agreement and modifiers; correcting incorrect sentences; use of active, passive, direct and indirect speech; improving a sentence with an alternate word or an alternate structure; simplifying and building complex sentences (3 lab sessions)

Module 3 - Mind mapping and idea organisation: reading skills and techniques; reading comprehension; deciphering an idea - may include giving title to a written paragraph; identifying thematically incoherent sentences in a paragraph; rewriting a paragraph in one's own words (paraphrasing); organising and presenting ideas in a logical sequence; understanding structure of arguments; common flaws in argumentation; coherence of composition; correcting jumbled paragraphs (3 lab sessions)

Module 4 - Paragraph writing: Guided composition; writing within a word/sentence limit; Editing with alternate words/phrases; situational writing; developing appropriate arguments in composing a paragraph (3 lab sessions)

Module 5 - Story/ Essay/Thematic/Narrative/Scientific writing (2 lab sessions)

Total number of labs = 14

Statistics for the M.Sc.-Ph.D. Dual degree programme in Physics

Year	No. of Students Registered	No. of Students who completed the M. Sc. Program	Students who withdrew from the program or the program was terminated	Students who migrated to Ph.D part of the Dual Degree Program	Termination /Withdrawal from the PhD Program	Students who completed the Ph.D program	Students Registered in the PhD program
2001	9	8	1	8	0	8	Nil
2002	8	8	0	8	0	8	Nil
2003	7	4	3	4	0	4	Nil
2004	11	5	6	5	0	2	3
2005	9	9	0	9	1	2	6
2006	7	4	3	4	0	0	4
2007	7	5	2	5	2	0	3
2008	8	7	1	7	1	0	6
2009	10	10	0	10	0	0	10
2010	12	9+3*	3*	9	0	0	9
2011	14	14*	0	0	0	0	0
2012	13	13*	0	0	0	0	0

*: Students have not Migrated till now and are still in the M.Sc. Programme

In view of the fact that the M.Sc.-Ph.D. Dual Degree Programme in Physics attracts a reasonable number of students each year and many of them successfully complete the doctoral programme, it is recommended that this programme be continued. Other departments may also wish to consider starting such a programme.

Appendix IV: The committee members

Dr. Sanjay Mittal, AE, Chairperson
Dr. Peeyush Mehta*, IME
Dr. CS Upadhyay, AE
Dr. K. Subramaniam, BSBE
Dr. V. Chandrasekhar*, CHM
Dr. Goutam Deo, CHE
Dr. M.S. Kalra, ME
Dr. Rajiv Shekhar*, MME
Dr. Partha Chakraborty, CE
Dr. A.K. Chaturvedi, EE
Dr. Mainak Chaudhuri, CSE
Dr. Debasis Kundu, MTH
Dr. Manoj Harbola, PHY
Dr. Suchitra Mathur, HSS

*In view of these members being on leave from the Institute, they nominated the following members:

Dr. Raghu Nandan Sengupta, IME
Dr. Anish Upadhyay, MSE
Dr. K. Srihari, CHM

Dr. PK Saini, AR(AA), Secretary