REPORT OF THE UGARC IMPLEMENTATION COMMITTEE- PART I

(BT/BS first year template and courses and Two-Year MSc and MSc-PhD program templates)

June 3, 2022

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1.0 Background

The UGARC 20-21 Report was accepted for implementation in the 543rd special meeting of the Academic Senate of IIT Kanpur. Subsequently the UGARC implementation committee comprising of the following members was constituted by Chairman, Senate through office order DIR/IITK/2021/OO-52 dated October 21, 2021 (amended by OO-53).

Members:

Dr. Ashoke De, AE (Associate Dean of Academic Affairs)
Dr. Nisanth N. Nair, CHM, (Previous Associate Dean of Academic Affairs)
Dr. Anand Singh, CHM
Dr. Kumar Vaibhav Srivastava, EE
Dr. Vimal Kumar, ECO
Nominee of President Student Gymkhana
Dr. P. Venkitanarayanan, ME (Chairperson)

The UGARC implementation committee had several meetings to plan the implementation of the UGARC recommendations from the 2022-23-I semester onwards.

The recommendations of UGARC 20-21 are planned to be implemented in multiple stages.

1. BT/BS first-year: The tasks are:
    a. Preparation of first-year template
    b. Establishing English Language Cell (ELC) and developing the contents of the newly introduced English courses
    c. Revision of core courses as suggested by UGARC
    d. Development of contents for the newly introduced ethics course
    e. Course numbering to maintain distinctiveness
2. Two-year MSc programs: The tasks are:
    a. Revision of templates for the Two-year MSc programs in line with UGARC recommendations
3. Revision of department templates in line with the recommended credit ranges for various course baskets.
    a. Individual departments to design templates for BT/BS, BTH/BSH and BTM/BSM programs
    b. Interdepartmental programs
    c. Revision of department courses
4. Establishing Study Resource Centre (SRC)
5. Identifying courses in the management track for the BTM/BSM program
6. Identifying courses in the Economics, Management and Environment (EME) basket under Social sciences, Communication, Humanities and EME (SCHEME)
7. Reforms related to termination and implementation of exit program

This committee recommends to implement the UGARC 20-21 recommendations for the batch of BT/BS students and two-year MSc and MSc-PhD students joining the Institute from 2022-23-I semester.

This report presents the plan for implementing items 1 and 2. The implementation committee is yet to complete all the steps required for Items 3 to 6. The committee shall take up item 7 once items 3 to 6 have reached the stage for implementation.

2.0 First year template for the BT/BS programs

The template for the first year of the BT/BS programs is given in Table 1.

Table 1. Course template for first and second semesters for all BT/BS students			
Group 1		Group 2	
Semester 1	Semester 2	Semester 1	Semester 2
SCHEME-1 [9 credits] ELC111/ELC112/ELC113 *	ETH111 [3 credits] **	ETH111 [3 credits] **	SCHEME-1 [9 credits] ELC112/ELC113 *
MTH 111 [6 credits]	MTH 113 [6 credits]	MTH 111 [6 credits]	MTH 113 [6 credits]
MTH 112 [6 credits]	MTH 114 [6 credits]	MTH 112 [6 credits]	MTH 114 [6 credits]
PHY 11X [11 credits] §	PHY 11Y [11 credits] §	PHY 11X [11 credits] §	PHY 11Y [11 credits] §
PHY 111 [3 credits]	CHM 111 [3 credits]	CHM 111 [3 credits]	PHY 111 [3 credits]
TA 111 [9 credits]	ESC 111 [7 credits]	ESC 111 [7 credits]	TA 111 [9 credits]
CHM 112 [4 credits]	ESC 112 [7 credits] §§	ESC 112 [7 credits] §§	CHM 112 [4 credits]
CHM 113 [4 credits]	LIF111 [6 credits]	LIF111 [6 credits]	CHM 113 [4 credits]
PE111 [3 Credits]	PE112 [3 Credits]	PE111 [3 Credits]	PE112 [3 Credits]
Total = 55	Total = 52	Total = 52	Total = 55

* Please see details in the section on English courses.

** **UGARC originally proposed this as a 0-credit course, however the implementation committee after deliberations proposes 3 credits for this course. Please see the section on Practical ethics for details**.

§ The choice of PHY11X and PHY11Y for different departments is provided in Table 3.

§§ Or any other equivalent computing course offered by other departments.

Table 2. List of first year courses and credits			
Course No.	Title	Credits	Remarks
TA111	Engineering Graphics (IC)	2-0-3 [09]	Only number change
LIF111	Introduction to Biology (IC)	2-0-0 [06]	Circulated on May 21
PHY111	Physics Laboratory (IC)	0-0-3 [03]	Only number change
PHY112	Classical Dynamics (IC)	3-1-0 [11]	Circulated, with SUGC
PHY113	Classical Electrodynamics (IC)	3-1-0 [11]	Circulated, with SUGC
PHY114	Quantum Physics (IC)	3-1-0 [11]	Circulated, with SUGC
PHY115	Oscillations and Waves (IC)	3-1-0 [11]	Circulated, with SUGC
CHM111	Chemistry Laboratory (IC)	0-0-3 [03]	Only number change
CHM112	General Chemistry: Physical Chemistry (IC)	2-1-0 [08]	SUCG cleared
CHM113	General Chemistry: Inorganic and Organic Chemistry (IC)	2-1-0 [08]	SUCG cleared
MTH111	Single Variable Calculus (IC)	3-1-0 [06]	with SUGC
MTH112	Application of Single Variable Calculus and Several Variable Calculus (IC)	3-1-0 [06]	with SUGC
MTH113	Linear Algebra (IC)	3-1-0 [06]	with SUGC
MTH114	Ordinary Differential Equations (IC)	3-1-0 [06]	with SUGC
ESC111	Fundamentals of Computing -I (IC)	3-1-3 [07]	SUCG cleared
ESC112	Fundamentals of Computing -II (IC)	3-1-3 [07]	SUCG cleared
ESC113CHE	Computer Methods for Engineers	3-1-3 [07]	Circulated on 3rd June
ETH111	Practical Ethics (IC)	1-0-0 [03]	Circulated on 20th May
PE111	Morning Exercise (IC)	0-0-3 [03]	Only number change
PE112	Evening Exercise (IC)	0-0-3 [03]	Only number change
ELC111	English Language and Communication (Basic) (SCHEME)	2-1-1 [09]	Circulated on 20th May
ELC112	English Language and Communication (Intermediate) (SCHEME)	2-1-1 [09]	Circulated on 20th May
ELC113	English Language and Communication (Advanced) (SCHEME)	2-1-1 [09]	Circulated on 20th May

IC- Institute Core course, SCHEME – Social Sciences, Communication, Humanities, Economics, Management and Environment

2.1 Course numbering scheme

The following course numbering scheme is suggested for the first-year courses to ensure that they are distinct from those in the current template.

- For all existing first-year courses, the starting number "1" will remain the same. The middle number will be changed from 0 to 1, e.g., TA101A will become TA111, LIF101A will become LIF111 and so on.
- For new courses also the same scheme will be followed, however, the last digit will be sequentially incremented, e.g., MTH101A is split into two modules: MTH111 and MTH112 and so on.
- The English language courses will be numbered ELC111, ELC112 etc., as these courses will be handled by the English Language Cell (ELC) as proposed by UGARC' 20-21.

2.2 Grouping of students

The total sanctioned strength for 2022-23 Academic year for BT/BS program is 1210. All students have to take the English Diagnostic Test (EDT) conducted by ELC before the beginning of the first semester. Students will be assigned one course out of the three courses, ELC111, ELC112 and ELC113, based on their performance in the diagnostic test. The students will be divided into groups of equal strength as described below. All students who are assigned ELC111 will be in Group 1 and have to take ELC111 in their first semester. The remaining students in Group 1 will take the English course assigned to them (ELC112 or ELC113) in their first semester. Students in Group 2 will take the English course assigned to them (ELC112 or ELC 113) in their second semester.

3.0 First year courses

Mathematics:

- MTH101A and MTH102A, each has been split into two modular courses.
- MTH101A (11 credits) is split into two modules MTH111 and MTH112, each having 6 credits, and will be offered, respectively, in the first and second halves of the odd semester. The entire batch will take these courses in their first semester.
- MTH102A (11 credits) is split into two modules MTH113 and MTH114 each having 6 credits and will be offered, respectively, in the first and second halves of the second semester. The entire batch will take these courses in their second semester.
- In each semester, these courses will be offered in two different time slots with each slot having two parallel sessions.
- The course contents for these modular courses are provided in Appendix A1.

Chemistry:

- CHM102A (8 credits) is split into two modular courses, CHM112 and CHM113 each of 4 credits.
- Both CHM112 and CHM113 will be offered in both semesters by the Department of Chemistry
- The course contents for these modular courses are provided in Appendix A2.
- CHM101A, the laboratory course in Chemistry, will be renumbered as CHM111 without any change in course contents.

Physics:

- In place of the existing PHY102A and PHY103A each of 11 credits, the Department of Physics will offer four courses each of 11 credits numbered, PHY112, PHY113, PHY114 and PHY115 every semester.
- Departments will choose two out of these four courses for their students. The choice of departments and the student strength for each of the PHY courses are provided in Table 3.
- The contents of these courses are provided in Appendix A3.

- PHY101A, the laboratory course in Physics, will be renumbered as PHY111 without any change in course contents

Table 3. Distribution of PHY core courses across departments and their tentative semester-wise placement

Department	Strength	PHY112	PHY113	PHY114	PHY115
AE- Aerospace Engineering	69	II			I
BSBE- Bio Sciences and Bio Engineering	53	II			I
CE- Civil Engineering	148	I			II
CHE- Chemical Engineering	104	I	II		
CHM- Chemistry	49	I	II		
CSE- Computer Science and Engineering	129		II	I	
ECO- Economics	52	II			I
EE- Electrical Engineering	192		I	II	
ES- Earth Sciences	43	II			I
ME- Mechanical Engineering	149		I		II
MSE- Material Science and Engineering	85		II	I	
MTH- Maths and Scientific Computing	64			II	I
MTH- Statistics and Data Sciences	28			II	I
PHY- Physics	45	II	I		
Total	1210	563	753	498	606

Life Sciences:

LIF101A (6 credits), is being revised in line with the UGARC recommendation. The new course number will be LIF111. This course will be offered by the Department of Biological Sciences and Engineering. A sub-committee was constituted for revising this course and the report of the sub-committee and the revised course contents are provided in Appendix A4.

Core course in Computing:

- ESC101A (14 credits), is divided into two modular courses ESC111 and ESC112, each having 7 credits.
- ESC111 and ESC112 will be offered by the Department of Computer Science and Engineering in both semesters.
- ESC111 is compulsory for all students. For the remaining 7 credits, the students can opt either ESC112 or any 7-credit modular computing course (say ESC11X- 7 credits) offered by other departments. The details of these courses are provided in Appendix A5.

Core course on ethics:

UGARC has proposed a compulsory zero credit ethics course in the S or X mode for all students in their first year. The implementation committee proposes that this course be made a 3 credits course. A sub-committee was formed to draft the course contents and mode of conducting this course (see Appendix A6). The sub-committee has proposed this course to be a full semester course with two contact hours per week. Half of the entire batch will take this course in their first semester and the remaining students in their second semester. The sub-committee recommends conducting this course in multiple sessions with each session having about 30 students. Further details are provided in Appendix A6.

Compulsory English Language Course in the first year:

As per UGARC 20-21 recommendation, every student should take an English language course (6-9 credits) in the first year. These courses are to be offered by the ELC, which was established vide OO DIR/IITK/2022/OO/36, dated May 5, 2022. A sub-committee was constituted to draft the contents of courses offered by ELC (see Appendix A7). The sub-committee recommends conducting multiple sessions for the English courses with 45-50 students per session for ELC111

and about 100 students per session for ELC112 and ELC113. Further details of these courses are provided in Appendix A7.

Increase in IC credits: *Due to the modularization of existing 11 credit MTH courses, each MTH module will have 6 credits, resulting in a total of 24 credits for the MTH courses instead of existing 22. If the proposal of 3 credits for the ethics course is accepted, then the total IC credits will increase by 5.*

4.0 Two-Year MSc Program

The UGARC recommendations for the Two-year program are listed below.

i. The MSc two-year program in the Sciences is to be changed to a credit-based system, similar to the BS part of the BS-MS program.
ii. A compulsory English writing/communication course for the students of the MSc two-year program, offered by the Institute (via possibly the proposed Students Resource Centre) to be included.
iii. The DC component of the MSc two-year program be decreased, and possible significant overlaps of MSc level courses with those in BS/BSc programs are to be avoided to the extent possible.
iv. Interested students should be allowed to substitute DCs with more advanced level DE/OEs.
v. A finer grading system (10, 9, 8, ...) for all MSc two-year programs to be adopted.
vi. Termination criteria should be made similar to the BT/BS programs if the credit-based system is used.
vii. The sub-committee recommends the introduction of MSc-PhD dual degree programs in Math-Stats, similar to the existing program in Physics.
viii. The chemistry project should span over two semesters (either both 3rd and 4th semesters compulsory or 4th semester compulsory and 3rd semester optional).

4.1 Implementation of UGARC recommendations

- The UGARC implementation committee, after discussion with the members from Departments of Mathematics, Physics and Chemistry who were part of the UGARC sub-committee on Two-Year MSc program, suggested the following guidelines to implement the first three recommendations listed above.

    i. The OE component in the program should be at least 10% of the total credits
    ii. The DE component of the program should be at least 30% of the total credits
    iii. A compulsory English writing/Communication courses be introduced and it is suggested that the respective departments can offer the course to their students

- Based on the UGARC recommendation the two-year MSc program should be handled by the PG section, starting with the batch joining in 2022-23-I semester, the academic matters should be handled by DPGC/SPGC.

- The termination reforms suggested by UGARC (chapter 2) will be applicable to the two-year MSc program starting from the batch joining in 2022-23-I semester, however, there will be no exit option degree in this case.

4.2 Template for Two-year MSc program in Chemistry

New MSc template (as per the recommendation of the UGARC implementation committee).

Blue highlight is the change in the course numbers (courses with dual numbers) compared to old template.

Year I				Year II			
Semester I		Semester II		Semester III		Semester IV	
Courses	**L-T-P-D (C)**	**Courses**	**L-T-P-D (C)**	**Courses**	**L-T-P-D (C)**	**Courses**	**L-T-P-D (C)**
CHM401A	3-0-0-0 (9)	CHM402A	3-0-0-0 (9)	CHM611A	3-0-0-0 (9)	CHM700A	0-0-0-27 (27)
CHM321A	3-0-0-0 (9)	CHM322A	3-0-0-0 (9)	CHM621A	3-0-0-0 (9)	DE-3	3-0-0-0 (9)
CHM345A	3-0-0-0 (9)	CHM342A	3-0-0-0 (9)	CHM631A	3-0-0-0 (9)	DE-4	3-0-0-0 (9)
CHM503A	0-0-6-0 (6)	CHM443A	0-0-6-0 (6)	CHM699A/ 2 x DE	0-0-0-18 (18)	OE-2	3-0-0-0 (9)
CHM423A	0-0-6-0 (6)	DE-1	3-0-0-0 (9)	DE-2	3-0-0-0 (9)		
CHM521A	2-0-0-0 (6)	OE-1	3-0-0-0 (9)				
CHM361A	2-0-0-0 (6)						
Total credits: 51		Total credits: 51		Total credits: 54		Total credits: 54	

Details of new courses implemented in the template

CHM361A: Communication course

CHM699A: Non-compulsory project (3rd semester)

Note that several compulsory courses had dual number and the number system was used to identity whether the course is taken by BS or MSc students. In the new UGARC the number for such courses are fixed as per the number on BS template. See the course mapping below.

Course mapping

Couse number in the old MSc template	Couse number in the new MSc template
CHM421A	CHM321A
CHM441A	CHM345A
CHM422A	CHM322A
CHM442A	CHM342A

Credit distribution

	Credits requirement as per the new UGARC recommendation	Credits in the new template prepared
Department core (DC)	120-126	**138**
Department elective (DE)	60-63	**54**
Open elective (OE)	20-21	**18**
Total credit	200-210	**210**

List of compulsory courses as per the new MSc template

(in the increasing order of semesters)

CHM401A, 3-0-0-0 (9)	Organic Chemistry I
CHM321A, 3-0-0-0 (9)	Physical Chemistry I
CHM345A, 3-0-0-0 (9)	Inorganic Chemistry I
CHM503A, 0-0-6-0 (6)	Organic Preparations Lab
CHM423A, 0-0-6-0 (6)	Physical Chemistry Laboratory
CHM521A, 2-0-0-0 (6)	**Mathematics for Chemistry (Under revision for converting as a six-credit course)**
CHM361A, 2-0-0-0 (6)	**Chemistry Communication Skills (circulated for approval)**
CHM402A, 3-0-0-0 (9)	Organic Chemistry II
CHM322A, 3-0-0-0 (9)	Physical Chemistry II
CHM342A, 3-0-0-0 (9)	Inorganic Chemistry II
CHM443A, 0-0-6-0 (6)	Inorganic Chemistry Laboratory
CHM611A, 3-0-0-0 (9)	Physical Organic Chemistry
CHM621A, 3-0-0-0 (9)	Chemical Binding
CHM631A, 3-0-0-0 (9)	Application of Modern Instrumental Methods
CHM699A, 0-0-0-18 (18)	**MSc Project (circulated for approval)**
CHM700A, 0-0-0-27 (27)	MSc Project

List of all DE courses

CHM481A/CHM 481: Biosystems
CHM 600A: Mathematics for Chemistry
CHM 602/602A: Advanced Organic Chemistry
CHM 609/609A: Principles of Organic Chemistry
CHM 611: Physical Organic Chemistry
CHM 612: Frontiers in Organic Chemistry
CHM 614: Organic Photochemistry
CHM 616: Chemistry of Organometallic Compounds
CHM 621: Chemical Binding
CHM 622: Chemical Kinetics
CHM 626: Solid State Chemistry
CHM 627A: Methods of Electronic Structure Calculation
CHM629/CHM629A: Principles of Physical Chemistry
CHM 631/CHM631A: Application of Modern Instrumental Methods
CHM 632: Enzyme; reactions mechanism and kinetics
CHM 636/CHM636A: Physical photochemistry
CHM 637/CHM637A: Molecular Spectroscopy
CHM 645: Orbital Interactions in Chemistry
CHM 646/CHM 646A: Bio-inorganic Chemistry I
CHM 647: Macrocycles, Rings and Polymers
CHM 648/CHM648A: Chemistry of Metal Carbon Bond: Structure, Reactivity and Applications
CHM 649/CHM649A: Principles of Inorganic Chemistry
CHM 650/CHM650A: Statistical Mechanics and its applications to Chemistry
CHM 651/CHM651A: Crystal and Molecular Structure Determination
CHM 654/CHM 654A: Supramolecular Chemistry

CHM 656A: Organic Structure Determination by Spectroscopic Techniques
CHM 662/CHM 662A: Chemistry of Natural Products
CHM 664: Modern Physical Methods in Chemistry
CHM 667A: Quantum Dynamics in Chemistry (New ARC)
CHM 668: Advanced Main Group Chemistry
CHM 679: Molecular Reaction Dynamics
CHM 681: Basic Biological Chemistry
CHM 682A: Modern Chemistry and Applications of Lanthanides
CHM 683: Surfaces, Interfaces, Thin Films and Related Analytical Techniques
CHM 684: Computer Programming in Chemistry
CHM 685: Molecule Radiation Interactions
CHM 689: Nuclear Magnetic Resonance
CHM 691: Frontiers in Inorganic Chemistry
CHM 693: Chemical Synthetic Strategy of Advanced Materials
CHM 695: Molecular Modeling in Chemistry
CHM 696: Quantum Computing
CHM 698: Chemistry of Drug Design and Metabolism
CHM 699: Lasers in Chemistry and Biology (this course number is being revised as CHM697)

4.3 Template for Two-year MSc and MSc-PhD programs in Physics

MSc and MSc-PhD Template

*DE are 2 out of 5 courses for M.Sc.

PHY524, PHY526, PHY543, PHY6XX* (a course in soft matter), PHY681.

Green: modified part of template comparison to previous ARC.

MSc Template

1st	2nd	3rd	4th
PHY401 [11]	PHY412 [11]	OE-1 [9]	*DE-4 [11]
PHY421 [11]	PHY552 [11]	*DE-1 [11]	DE-5 [9]
PHY431 [11]	PHY432 [11]	DE-2 [9]	OE-2 [9]
PHY461 [8]	PHY462 [8]	PHY563 [9]	PHY566 [9]
PHY441 [11]	PHY473 [**11**]	PHY565/DE-3 [9]	PHY568/DE-6 [9]
		PHY400 [3]	
52	**52**	**50**	**47**

Credit distribution: DC=125, DE=58 ,OE=18 ,Total credits=201

MSc-PhD Template

1st	2nd	3rd	4th	5th	6th
PHY401 [11]	PHY412 [11]	OE-1 [9]	*DE-4 [11]	DE-PG-1 [9]	DE-PG-2 [9]
PHY421 [11]	PHY552 [11]	*DE-1 [11]	DE-5 [9]	OE-PG-2 [9]	OE-PG-2 [9]
PHY431 [11]	PHY432 [11]	DE-2 [9]	OE-2 [9]	PHY596 [9]	PHY597 [9]
PHY400 [3]	PHY461 [8]	PHY462 [8]	PHY502 [9]	PHY598 [9]	PHY599 [9]
PHY441 [11]	PHY473 [**11**]	PHY501 [9]	PHY422 [11]		
47	**52**	**46**	**49**	**36**	**36**

MSc Template

1st Semester

1.	PHY401[11]	Classical Mechanics
2.	PHY421[11]	Mathematical Methods I
3.	PHY431[11]	Quantum Mechanics I
4.	PHY461[11]	Experimental Physics I
5.	PHY441[11]	Electronics

2nd Semester

1.	PHY 412[11]	Statistical Mechanics
2.	PHY552[11]	Classical Electrodynamics I
3.	PHY432[11]	Quantum Mechanics II
4.	PHY462[11]	Experimental Physics II
5.	PHY473[11]	Computational Physics

3rd semester

1.	OE-1[9]	
2.	DE-1[11]*	Specified later
3.	DE-2[9]	4/5/6 level course
4.	**PHY563[9]**	**Project I (credit change)**
5.	**PHY 565/DE-3[9]**	**Project II (will be offer as DE)**
6.	**PHY 400[3]**	**Introduction to Profession and Communication Skills for Physicists**

4th semester

1.	DE-4[11]*	Specified later
2.	DE-5[9]	4/5/6 level course
3.	OE-2[9]	
4.	**PHY566[9]**	**Project III (credit change)**
5.	**PHY 568/DE-6[9]**	**Project IV (will be offer as DE)**

*** marked DE are 2 out of 5 courses for M.Sc.**

PHY 524: Intro to Atomic & Nucl Physics

PHY 526:Nuclear and particle Physics

PHY 543: Condensed Matter Physics I

PHY 6XX: A course on soft matter

PHY 681: Quantum Field Theory

MSc-PhD Template

1st Semester

1.	PHY401[11]	Classical Mechanics
2.	PHY421[11]	Mathematical Methods I
3.	PHY431[11]	Quantum Mechanics I
4.	**PHY400[3]**	**Introduction to Profession and Communication Skills for Physicists**
5.	PHY441[11]	Electronics

2nd Semester

1.	PHY 412[11]	Statistical Mechanics
2.	PHY552[11]	Classical Electrodynamics I
3.	PHY432[11]	Quantum Mechanics II
4.	PHY461[8]	Experimental Physics I
5.	PHY473[11]	Computational Physics

3rd semester

1.	OE-1[9]	
2.	DE-1[11]*	
3.	DE-2 [9]	
4.	PHY462[8]	Experimental Physics II
5.	PHY 501[9]	M.Sc. Review Project II

4th semester

1.	DE-4[11]*	
2.	DE-5[9]	
3.	OE-2[9]	
4.	PHY502[9]	M.Sc. Review Project III
5.	PHY 422 [11]	Mathematical Methods II

5th semester

1.	DE-PG-4[11]	
2.	OE-PG-2[9]	
3.	PHY 596[9]	M.Sc Research Project
4.	PHY598 [9]	M.Sc Research Project

6th semester

1.	DE-PG-2[9]	
2.	OE-PG-2[9]	
3.	PHY 597[9]	M S Research Project
4.	PHY599[9]	MSc Research Project

4.4 Template for Two-year MSc in Mathematics

Department of Mathematics and Statistics
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]
MTH201A	3-1-0-0 [11]	MTH204A	3-1-0-0 [11]	MTH403A	3-1-0-0 [11]	OE-2	3-0-0-0 [09]
MTH202A	3-1-0-0 [11]	MTH424A	3-1-0-0 [11]	DE-1	3-0-0-0 [09]	OE-3	3-0-0-0 [09]
MTH301A	3-1-0-0 [11]	MTH308B	3-0-1-0 [10]	OE-1	3-0-0-0 [09]	OE-4	3-0-0-0 [09]
MTH409A	2-1-1-0 [09]	MTH305A	3-1-0-0 [11]	DE-2	3-0-0-0 [09]	DE-4	3-0-0-0 [09]
MTH421A	3-1-0-0 [11]	MTH304A	3-1-0-0 [11]	DE-3/ MTH598A	3-0-0-0 [09]	DE-5/ MTH599A	3-0-0-0 [09]
ELC112	2-1-0-1 [09]						
	62		54		47		45

DC : 118 DE : 45 OE : 36 ELC : 09 TOTAL : 208

1. ELC112 : English language and communication (intermediate)
2. MTH201A : Linear algebra
3. MTH202A : Set theory and discrete mathematics
4. MTH204A : Abstract algebra
5. MTH301A : Analysis I
6. MTH304A : Topology
7. MTH305A : Several variable calculus and differential geometry
8. MTH308B : Numerical analysis and scientific computing I
9. MTH403A : Complex analysis
10. MTH409A : Computer programming and data structures
11. MTH421A : Ordinary differential equations
12. MTH424A : Partial differential equations
13. MTH598A : Project I
14. MTH599A : Project II

4.5 Template for Two-year MSc in Statistics

M.Sc Statistics (2 year) Curriculum

Semester I	Semester II	Semester III	Semester IV
MSO205A - Introduction to Probability Theory (3-1-0-0) **[11]**	MTH309A - Probability Theory (3-1-0-0) **[11]**	MTH441A - Linear Regression and ANOVA (3-0-1-0) **[10]**	MTH314A - Multivariate Analysis (3-0-1-0) **[10]**
(Modular – Part 1) MTH432A - Sampling Theory (3-1-0-0) **[06]**	(Modular – Part 1) MTH212A - Elementary Stochastic Processes I (3-1-0-0) **[06]**	MTH515A - Inference II (3-1-0-0) **[11]**	MTH312A - Data Science Lab 3 (1-0-2-0) **[05]**
(Modular – Part 2) MTH434A - Complex Analysis (3-1-0-0) **[06]**	(Modular – Part 2) MTH313A - Elementary Stochastic Processes II (3-1-0-0) **[06]**	MTH516A - Non-Parametric Inference (3-1-0-0) **[11]**	DE-2 **[09]**
MTH433A - Real Analysis (3-1-0-0) **[11]**	MTH418A - Inference I (3-1-0-0) **[11]**	DE-1 **[09]** / MTH 598A **[09]**	DE-3 **[09]**
MTH208A - Data Science Lab 1 (0-0-3-2) **[05]**	MTH210A - Statistical computing (3-0-1-0) **[10]**	OE-1 **[09]**	DE-4 **[09]** / MTH 599A **[09]**
MTH206A - Matrix Algebra and Linear Estimation (Module I) (3-1-0-0) **[06]**	MTH209A - Data Science Lab 2 (1-0-2-0) **[05]**		OE-2 **[09]**
MTH207A - Matrix Algebra and Linear Estimation (Module II) (3-1-0-0) **[06]**			
ELC112 (2-1-0-1) **[09]**			
60	49	50	51

Credits:
DC: 147
DE: 36
OE: 18
ELC: 09
Total: 210

APPENDIX

A1 MATHEMATICS

MTH111

Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: MTHXXX

2. Course Title: Single Variable Calculus

3. Per Week Lectures: 3 (L), Tutorial: 1 (T), Laboratory: 0 (P), Additional Hours: 0 (A),

Credits (3*L+2*T+P+A): 06

Duration of Course: Modular Semester: Odd (first half)

4. Proposing Department/IDP: Mathematics and Statistics

Other Departments/IDPs which may be interested in the proposed course: IC course

Other faculty members interested in teaching the proposed course : Mathematics faculty

5. Proposing Instructor(s): Nandini Nilakantan

6. Course Description:

A) Objectives: This course gives the student a foundation in Single variable calculus.

B) Contents (preferably in the form of 5 to 10 broad titles):

1. Real number system: Completeness axiom, density of rationals (irrationals) in R, (2 lectures)
2. Sequences (2 lectures)
3. Limits and Continuity and differentiability of functions (2 lectures)
4. Applications of Differentiation. (4 lectures)
5. Series (4 lectures)
6. Introduction to Riemann Integration, Integrability, The Integral existence theorem for continuous functions and monotone functions, Elementary properties of integral, (2 lectures)
7. Fundamental theorems of Calculus and Improper integrals of first and second kind, (2 lectures)

C) Pre-requisites, if any: None

D) Short summary for including in the Courses of Study Booklet:

Real number system: Completeness axiom, density of rationals (irrationals) in R, convergence of a sequence, Sandwich theorem, Monotone sequences, Cauchy Criterion, Subsequence, Every bounded sequence has a convergent subsequence, convergence of a sequence satisfying Cauchy criterion, Limits and Continuity of functions, Boundedness of a continuous function on [a, b], Existence of max of a continuous function on [a, b], Intermediate value property, Differentiability, Necessary condition for local maxima, Rolles theorem and Mean Value theorem, Cauchy mean value theorem, L `Hospital rule, Fixed point iteration method (Picard's method), Newton's method, Increasing and decreasing function, Convexity, Second derivative test for max and min, Point of Inflection, Curve Sketching, Taylor's theorem and remainder, Convergence of series, Geometric and Harmonic Series, Absolute convergence, Comparison test, Cauchy Condensation test. Ratio test, Root test, Examples, Leibniz' theorem, Power series, Radius of convergence, Taylor Series, Maclaurin Series, Introduction to Riemann Integration, Integrability, The Integral existence theorem for continuous functions and monotone functions, Elementary properties of integral, Fundamental theorems of Calculus, Trapezoidal approximation, Simpson's Rule, Improper integral of first and second kind, Comparison test, Absolute convergence.

7. Recommended books:

i. Thomas' Calculus, 12th edition.

8. Any other remarks:

Dated: 29.4.2022 Proposer: _____

Dated: 01 May 2022 DUGC Convener: Arijit Ganguly

The course is approved / not approved

Chairman, SUGC

Dated: _____

MTH112

Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: MTHXXX

2. Course Title: Applications of Single Variable Calculus and Several Variable Calculus

3. Per Week Lectures: 3 (L), Tutorial: 1 (T), Laboratory: 0 (P), Additional Hours: 0 (A),

Credits (3*L+2*T+P+A): 06

Duration of Course: Modular Semester: Odd (first half)

4. Proposing Department/IDP: Mathematics and Statistics

Other Departments/IDPs which may be interested in the proposed course: IC course

Other faculty members interested in teaching the proposed course : Mathematics faculty

5. Proposing Instructor(s): Nandini Nilakantan

6. Course Description:

A) Objectives: This course gives the student a foundation in Single variable calculus.

B) Contents (preferably in the form of 5 to 10 broad titles):

1. Application of definite integral (4 lectures)
2. Vector Calculus (3 lectures)
3. Functions of several variables (5 lectures)
4. Lagrange multipliers (1 lecture)
5. Double Integral and Triple Integral (3 lectures)
6. Surface integral and line integral (2 lectures)
7. Green's theorem, Stoke's theorem and divergence theorem (2 lectures)

C) Pre-requisites, if any: Single Variable Calculus

D) Short summary for including in the Courses of Study Booklet:

Application of definite integral, Area between two curves, Polar coordinates, Graphs of polar coordinates, Area between two curves when their equations are given in polar coordinates, Volumes by slicing, Volumes by Shells and Washers, Length of a curve, Area of surface of revolution, Pappus's theorem, Review of vector algebra, Equations of lines and planes, Continuity and Differentiability of vector functions, Arc length for space curves, Unit tangent vector, Unit normal and curvature to plane and space curves, Binormal, Functions of several variables, Continuity, Partial derivatives, Differentiability, Differentiability implies continuity, Increment theorem, Chain rule, Gradient, Directional derivatives, Tangent plane and Normal line, Mixed derivative theorem, Mean value theorem, Minima and Saddle point, Necessary and sufficient conditions for Maxima, minima and Saddle point, The method of Lagrange multipliers, Double Integral, Fubini's theorem, Volumes and Areas, Change of variable in double integral. Special cases: Polar coordinates, Triple integral, Applications, Change of variable in triple integral. Special cases: Cylindrical and Spherical coordinates, Surface area, Surface integral, Line integrals, Green's theorem, Vector fields Divergence and Curl of a vector field, Stoke's theorem, The divergence theorem.

7. Recommended books:

i. Thomas' Calculus, 12th edition.

8. Any other remarks:

Dated: 29-4-2022 Proposer: _____

Dated: 01 May 2022 DUGC Convener: Arijit Ganguly

The course is approved / not approved

Chairman, SUGC

Dated:_____

MTH113

Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: MTHXXX

2. Course Title: Introduction to Linear Algebra

3. Per Week Lectures: 3 (L), Tutorial: 1 (T), Laboratory: 0 (P), Additional Hours: 0 (A),

Credits (3*L+2*T+P+A): 06

Duration of Course: Modular Semester: Even (first half)

4. Proposing Department/IDP: Mathematics and Statistics

Other Departments/IDPs which may be interested in the proposed course: IC course

Other faculty members interested in teaching the proposed course : Mathematics faculty

5. Proposing Instructor(s): S Ghorai

6. Course Description:

A) Objectives: This course gives the student a foundation in linear algebra.

B) Contents (preferably in the form of 5 to 10 broad titles):

S. No	Broad Title	Topics	No. of Lectures
1	System of linear equations and matrices	Matrices, System of linear equations; Elementary matrices, Invertible matrices, Gauss-Jordon method for finding inverse of a matrix; Determinants, Basic properties of determinants, Cofactor expansion, Determinant method for finding inverse of a matrix, Cramer's Rule.	5
2	Vector spaces	Vector space, Subspace, Examples; Linear span, Linear independence and dependence, Examples; Basis, Dimension, Extension of a basis of a subspace, Intersection and sum of two subspaces, Examples.	4
3	Linear transformation	Linear transformation, Kernel and range of a linear map, Rank-nullity theorem; Rank of a matrix, Row and column spaces, Solvability of system of linear equations.	3
4	Inner product spaces	Inner product, Cauchy-Schwartz inequality, Orthogonal basis, Gram-Schmidt orthogonalization process; Orthogonal projection, Orthogonal complement, Projection theorem; Fundamental subspaces and their relations, Application (Least square solutions and least square fittings).	3
5	Eigenvalues and eigenvectors	Eigenvalues, Eigenvectors; Characterization of a diagonalizable matrix, Example, Diagonalization of a real symmetric matrix; Representation of a real linear maps by matrices (optional)	4

C) Pre-requisites: **Single Variable Calculus**

D) Short summary for including in the Courses of Study Booklet:

Systems of linear equations and matrices: Elementary matrices, Invertible matrices, Determinants, Cramer's Rule; Vector Spaces: Subspace, Linear span, Linear independence and dependence, Basis, Intersection and sum of two subspaces; Linear transformation: Kernel and range of a linear map, Rank-nullity theorem; Rank of a matrix, Solvability of a system of linear equations; Inner product spaces: Cauchy-Schwartz inequality, Gram-Schmidt orthogonalization process; Fundamental subspaces; Eigenvalues and eigenvectors: Characterization of a diagonalizable matrix, Diagonalization of a real symmetric matrix.

7. Recommended books:

i. G. Strang: Introduction to linear algebra.

ii. K. Hoffman, and R. Kunze: Linear Algebra.

8. Any other remarks:

Dated: 20-04-2022 Proposer: S Ghorai

Dated: 01 May 2022 DUGC Convener: Arijit Ganguly

The course is approved / not approved

Chairman, SUGC

Dated:_____

MTH114

Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: MTHXXX

2. Course Title: Introduction to Ordinary Differential Equations

3. Per Week Lectures: 3 (L), Tutorial: 1 (T), Laboratory: 0 (P), Additional Hours: 0 (A),

Credits (3*L+2*T+P+A): 06

Duration of Course: Modular Semester: Even (second half)

4. Proposing Department/IDP: Mathematics and Statistics

Other Departments/IDPs which may be interested in the proposed course: IC course

Other faculty members interested in teaching the proposed course : Mathematics faculty

5. Proposing Instructor(s): S Ghorai

6. Course Description:

A) Objectives: This course gives the student a foundation in ordinary differential equations (ODEs).

B) Contents (preferably in the form of 5 to 10 broad titles):

S. No	Broad Title	Topics	No. of Lectures
1	First-order ODEs	Introduction to differential equations, Concept of solution, Geometrical interpretations; Separable form, Reduction to separable form; Exact equations, Integrating factors [of the form ( ) and ( )]; Linear equations, Bernoulli equations, orthogonal trajectories; Picard's existence and uniqueness theorem (without proof), Picard's iteration method; Numerical methods: Euler's method, Improved Euler's method.	6
2	Second-order linear ODEs	Fundamental system and general solutions of homogeneous equations, Wronskian, Reduction of order; Characteristic equations: real distinct roots, complex roots, repeated roots; Non-homogeneous equations: methods of undetermined coefficients and variation of parameters; Extension to higher order differential equations, Euler-Cauchy equation, Qualitative properties of solutions, Sturm comparison theorem	6
3	Series solutions of ODEs	Ordinary points, Power series solutions; Regular singular points, Frobenius method; Legendre polynomials; Bessel functions.	3
4	Boundary value problems	Sturm-Liouville boundary value problems, Orthogonal functions.	1
5	Laplace transforms	Laplace and inverse Laplace transforms, First shifting theorem, Transforms of derivative and integral, Differentiation and integration of transforms; Unit step function, Second shifting theorem, Convolution, Solution of initial value problems.	3

C) Pre-requisites: **Applications of Single Variable Calculus and Several Variable Calculus; Introduction to Linear Algebra**

D) Short summary for including in the Courses of Study Booklet:

First-order ordinary differential equations (ODEs): Concept of solution, Geometrical interpretations, Separable form, Exact equations, Linear equations, Bernoulli equations, Picard's existence and uniqueness theorem, Numerical methods; Second-order linear ODEs: Solution of homogeneous equations, Solution by method of undetermined coefficients and variation of parameters, Euler-Cauchy equation, Qualitative Properties of Solutions; Series solutions of ODEs: Ordinary points, Power series solutions, Regular singular points, Frobenius method, Legendre polynomials, Bessel functions; Sturm-Liouville boundary value problems; Laplace and inverse Laplace transforms, Shifting theorems, Transforms of derivative and integral, Differentiation and integration of transforms, Convolution, Applications.

7. Recommended books:

i. G. F. Simmons: Differential equations with applications and historical notes.

ii. Shepley L. Ross: Introduction to ordinary differential equations.

iii. William E. Boyce and Richard C. DiPrima: Elementary differential equations and boundary value problems.

8. Any other remarks:

Dated: 20-04-2022 Proposer: S Ghorai

Dated: 01 May 2022 DUGC Convener: Arijit Ganguly

The course is approved / not approved

Chairman, SUGC

Dated:_____

A2. CHEMISTRY

CHM112

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: CHM102A
2. Course Title: General Chemistry: Physical Chemistry
3. Per Week Lectures: 2 (L), Tutorial: 1 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A), Credits (3 +1+0+0): 4

   Duration of Course: Modular
4. Proposing Department/IDP: Chemistry

   Other Departments/IDPs which may be interested in the proposed course: Core course

   Other faculty members interested in teaching the proposed course: All physical chemistry faculty members of department of chemistry
5. Proposing Instructor(s): All physical chemistry faculty members of department of chemistry
6. Course Description: The proposed core course is intended to give general introduction to chemistry for BS/BTech students.

A) Objectives: The course will focus on the basics of quantum mechanics and spectroscopy.

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Introduction to Quantum Theory	Introduction, Origin of Quantum Mechanics, Concepts of Wavefunction and Operators	3
2.	Quantum Mechanics of Simple Systems	Particle in 1D box, 2D box and 3D box, Harmonic Oscillator, Rigid Rotor	4
3.	Application of Quantum Mechanics	Hydrogen Atom, Many-Electron Atoms Molecular Orbital Theory	4
4.	Spectroscopy	Electronic and Vibrational Spectroscopy of Simple Molecules, Rotational Spectroscopy	3

C) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): None

D) Short summary for including in the Courses of Study Booklet: CHM102A is an introductory course on quantum mechanics and spectroscopy. Applications of quantum mechanics to model systems such as particle in a box, harmonic oscillator and rigid rotor will be introduced. Course will also include the

application of quantum mechanics to hydrogen atom, many electron atoms, molecular orbital theory, and introduction to spectroscopy.

7. Recommended books:

   Textbooks:
   [1] P. W. Atkins and Julio de Paula, Physical Chemistry
   [2] D. A. McQuarrie and J. D. Simon, Physical Chemistry A Molecular Approach
   [3] I. N. Levine, Quantum Chemistry

   Reference Books:

8. Any other remarks: None

Dated: 11/04/2022 Proposer: All physical chemistry faculty members of department of chemistry

Dated: 11/04/2022 DUGC Convener: Thiruvancheril G Gopakumar

The course is approved / not approved

CHM113

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: CHM103A
2. Course Title: General Chemistry: Inorganic & Organic Chemistry
3. Per Week Lectures: 2 (L), Tutorial: 1 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A),

   Credits (3 +1+0+0): 4

   Duration of Course: Modular
4. Proposing Department/IDP: Chemistry

   Other Departments/IDPs which may be interested in the proposed course: Core course

   Other faculty members interested in teaching the proposed course: All Inorganic & Organic Chemistry faculty members of department of chemistry
5. Proposing Instructor(s): All inorganic & organic chemistry faculty members of department of chemistry
6. Course Description: The proposed core course is intended to give general introduction to chemistry for BS/BTech students.

A) Objectives: The course will focus on the basics of inorganic & organic chemistry.

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Inorganic Chemistry: Theory and Fundamental Properties of Coordination Compounds	Crystal Field Theory and Structure of Coordination Complexes, Electronic Spectra, and Magnetism.	4
2.	Application 1: Catalysis	Fundamental Reactions, Hydrogenation, Hydroformylation, Monsanto Acetic Acid Process and Ziegler-Natta Polymerization	2
3.	Application 2: Metalloenzymes	Oxygen Transport Enzymes	1
4.	Organic Stereochemistry	Conformational Analysis of Alkanes and Cycloalkanes, Chirality	3
5.	Organic Reaction Mechanisms	Substitution and Elimination Reactions	3
6.	Biomolecules	Structure of Proteins, Carbohydrates, Lipids, and Nucleic Acids	1

C) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): None

D) Short summary for including in the Courses of Study Booklet: The course will cover the theory of coordination compounds, fundamental reactions related to catalysis, and applications of coordination complexes in biology. Students will be introduced to the concept of stereochemistry, reaction mechanisms and structure of biomolecules.

7. Recommended books:

Textbooks:
[1] Shriver and Atkins' Inorganic Chemistry
[2] J. E. Huheey, Inorganic Chemistry: Principles of Structure and Reactivity
[3] L. Wade, Organic Chemistry
[4] J. Clayden, N. Greeves, and S. Warren, Organic Chemistry
[5] E. L. Eliel, Stereochemistry
Reference Books:

8. Any other remarks: None

Dated: 11/04/2022 Proposer: All inorganic & organic chemistry faculty members of department of chemistry

Dated: 11/04/2022 DUGC Convener: Thiruvancheril G Gopakumar

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____

A3. PHYSICS

PHY112

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: **PHY 102 A**
2. Course Title: **Classical Dynamics**
3. Per Week Lectures: 03 (L), Tutorial: 01(T), Laboratory: 00 (P), Additional Hours[0-2]: (A), Credits (3*L+2*T+P+A): 11
4. Duration of Course: **Full Semester**
5. Proposing Department/IDP : **Physics**
   Other Departments/IDPs which may be interested in the proposed course: Other faculty members interested in teaching the proposed course:
6. Proposing Instructor(s): **Convener, DUGC**
7. Course Description: **Revised and modernized core course**

A)Objectives.

B)Contents (*preferably in the form of 5 to 10 broad titles*):

S. No	Broad Title	Topics	No. of Lectures
1.	Point mass dynamics	Review of Newton's laws of motion, transformations and symmetries, inertial versus non-inertial frames, conservative versus non-conservative forces, potentials. Newton's law in cylindrical and spherical polar coordinates, application of (momentum, energy, angular momentum) conservation laws: central force problem, collisions in two dimensions, Rutherford scattering.	10
2.	Lagrangian dynamics	Constrained motion and degrees of freedom in a system of particles, method of virtual work, d'Alembert principle, Lagrangian, introduction to partial derivatives, Euler—Lagrange equation, symmetry, cyclic coordinates, and conserved quantities.	08
3.	Oscillatory dynamics	Small oscillations in two degree of freedom systems, forced and damped oscillations, resonances, transition to higher degree of freedom systems and continuum.	05
4.	Rigid body dynamics	Angular momentum and torque (for non-fixed axis rotation), moment of inertia tensor, principal axes, Euler's equations, torque free precession (symmetric top).	07
5.	Phase space	Phase space, equilibrium and fixed points, first and second order autonomous systems: linear stability analysis and classification of fixed points, attractors, conservative versus	

	dynamics	nonconservative systems, quasiperiodicity.	
		Introduction to chaos: definition and demonstrations, chaos in conservative (e.g., double pendulum) and non-conservative (e.g., Lorenz) systems.	10
		Total number of lectures	40

C)Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*):Nil

D)Short summary for including in the Courses of Study Booklet:

Point mass dynamics: Newton's laws of motion, transformations and symmetries, conservation laws, central force problem, collisions and scattering; Lagrangian dynamics: method of virtual work, d'Alembert principle, Lagrangian, Euler-Lagrange equation, small oscillations, forced and damped oscillations; Rigid body dynamics: Euler's equations, torque free precession; Phase space dynamics: equilibrium and fixed points, linear stability analysis, conservative versus nonconservative systems, quasiperiodicity and introduction to chaos

8. Reference Books:

1. D. Morin, Introduction to Classical Mechanics: With Problems and Solutions, Cambridge University Press (2008).
2. D. Kleppner and R. Kolenkow, An Introduction to Mechanics, Mc Graw Hill Education (2017).
3. M. Harbola, Engineering Mechanics, Cengage Learning India (2012).
4. M. Verma, Introduction to Mechanics, Universities Press India (2016).
5. I. Percival and D. Richards, Introduction to Dynamics, Cambridge University Press (1982).
6. S. H. Strogatz, Nonlinear Dynamics and Chaos, Taylor & Francis (2014).
7. A. L. Fetter and J. D. Walecka, Theoretical Mechanics of Particles and Continua, Dover Publications (2004).
8. N. Rana and P. Joag, Classical Mechanics, McGraw Hill Education (2017).

Possible Demos:

Capstan problem (friction and tension in a rope), simple harmonic oscillator and resonance, resonance in wine glass, acoustic beating, coupled pendulum, Pohl's pendulum, double pendulum, conservation of angular momentum, gyroscope, tennis racket theorem (Intermediate axis problem), non-inertial frame (Coriolis force), oscilloscope and phase space plots (van der pol, Duffing and other oscillators) and Lissajious figures.

Any other remarks:

Dated: March 2022 Proposer: Dr Arijit Kundu (DUGC Convener)

Dated: March 2022 DUGC Convener:_____

The course is approved / not approved

Chairman SUGC

Dated:_____

PHY113

Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: **PHY 103 A**
2. Course Title: **Introduction to Electromagnetism**
3. Per Week Lectures: 03(L), Tutorial: 01(T), Laboratory: 00 (P), Additional Hours[0-2]: (A), Credits (3*L+2*T+P+A): 11
4. Duration of Course: **Full Semester**

5. Proposing Department/IDP : **Physics**
Other Departments/IDPs which may be interested in the proposed course:
Other faculty members interested in teaching the proposed course:

6. Proposing Instructor(s): **Convener, DUGC**
7. Course Description: **Revised and modernized core course**
A)Objectives:
B) Contents (preferably in the form of 5 to 10 broad titles):

S. no.	Broad Topics	Detailed Topics	No. of Lectures
1	***Electrostatics***	Vector calculus, Electrostatic with full use of vector calculus calculation of electric fields, Energy in electrostatics	18
		Electrostatic potential and Laplaces equation and uniqueness of its solution; Method of images	
		Introduction to multipole expansion, Dipole moment of a charge distribution, potential and field of a dipole, force and torque on a dipole in an electric field;	
		Electrostatics in a medium, Displacement vector and boundary conditions, linear dielectrics, force on a dielctric	
2	***Magnetostatics***	Magnetostatics with full use of vector calculus, introduction to vector potential; current densities, Lorentz force law, force and torque on a magnetic dipole in a magnetic field	10
		Magnetostatics in a medium, magnetization, bound currents, magnetic field H, boundary condition on B and H, magnetic susceptibility, ferro, para and diamagnetism.	
3	***Electrodynamics***	Faradays law, energy in magnetic field; displacement current; fields produced by time-dependent electric and magnetic fields within quasistatic approximation	12
		Maxwells equations in vacuum and conducting and nonconducting medium, Energy in electromagnetic field, Poynting vector	
		plane electromagnetic waves; Reflection and refraction of electromagnetic wave from a boundary, Brewsters angle.	
		Total number of lectures:	**40**

C) Pre-requisites, if any (examples: a- PSO201A, or b- PSO201A or equivalent): **None**
D) Short summary for including in the Courses of Study Booklet:

Vector Calculus, Electrostatics, Laplace equation and uniqueness of its solution, Method of images; Multipole expansion, potential and field of a dipole, force and torque on a dipole in an electric field; Electrostatics in medium, linear dielectrics; Magnetostatics, vector potential, force and torque on a magnetic dipole in a magnetic field; Magnetostatics in medium, magnetisation, bound currents, ferro, para and diamagnetism; Faraday's law, displacement currents, fields produced by time-dependent electric and magnetic fields within quasistatic approximation; Maxwells equations in vacuum and conducting and nonconducting medium, Energy in electromagnetic field, Poynting vector; plane electromagnetic waves, Reflection and refraction of electromagnetic wave from a boundary, Brewsters angle.

8. Recommended books:
1. David. J. Griffiths, Introduction to Electrodynamics
2. Edward M. Purcell and David J. Morin, Electricity and Magnetism

9. Any other remarks:

Dated: March 2022 Proposer: Dr Arijit Kundu (DUGC Convener)

Dated: March 2022. DUGC Convener:

The course is approved / not approved

Chairman, SUGC

Dated:_____

PHY114

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. CourseNo: **PHY 104 A**
2. CourseTitle: **Quantum Physics**
3. PerWeekLectures: 03 (L),Tutorial: 01(T), Laboratory: 00 (P),Additional Hours[0-2]: (A), Credits(3*L+2*T+P+A): 11
4. Duration of Course: **Full Semester**
5. Proposing Department/IDP: **Physics**
   Other Departments/IDPs which may be interested in the proposed course: Other faculty members interested in teaching the proposed course:
6. ProposingInstructor(s):**Convener, DUGC**
7. CourseDescription: **Revised and modernized core course**

A)Objectives:

B)Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Experimental basis of Quantum Physics	Failure of the classical theory : Black body radiation, photoelectric effect, Radioactivity, Compton effect, wave particle duality, de Broglie hypothesis, electron microscope, experiments with photons. Specific heat of solids.	08
2.	Theoretical foundations of quantumphysics	Postulates of quantum physics and mathematical background (complex numbers and Fourier analysis). Helmholtz wave equation from optics. The Schrodinger equation and its statistical interpretation. The wave function. Operators in quantum physics. Measurements and Heisenberg's uncertainty principle.	12
3.	Simpleexamples andapplications	Time independent Schrodinger equation in one dimension and stationary states. Simple examples may include the free particle, the wave packet, the infinite square well, and the step potential. Tunnelling and Alpha decay. Quantum rolor. Vibration and rotational energy levels of molecules. More recent applications may include : Laser physics, semiconductors, transistors and solar cells. Nuclear and electron spin and Stern Gerlach experiment. Nuclear magnetic resonance (NMR), magnetic resonance imaging (MRI).	12
4.	Basics of quantum computation	Linear algebra for two state systems. Qubits, and two level quantum gates. Basics of quantum computation and quantum cryptography	08
		Total number of Lecture	40

C) Pre-requisites, if any (*examples: a- PSO201A, or b- PSO201A orequivalent*):Nil

D) Short summary for including in the Courses of Study Booklet : The purpose of this course is to introduce the student to the fundamentals of quantum physics, and to highlight its relevance to present day science and technology. At the end of this course, the student will gain a broad perspective of quantum phenomena, and will be equipped with tools that will be useful for any future scientific or technological venture involving the subject. The course is designed in a way that it is not heavy in details, but at the same time covers the essentials of the quantum nature of matter, with several demonstrations which will give the student a feel for the nature of quantum effects in real life. It is aimed at explaining the foundational aspects of the subject, as well as its modern technological uses, in a way that is accessible to a beginning undergraduate. Emphasis is also placed on emerging branches of importance such as quantum computation and quantum cryptography.

8. RecommendedReference Books:

1.Eisberg and Resick,*QuantumPhysics of Atoms, Molecules, Solids, Nuclei and Particles* Wiley (2006)
2. D. J. Griffiths. *Introduction to QuantumI Mechanics.* Prentice Hall(1995)
3. Feynman , Leighton and Sands. *The Feynnman* Lectures on *Physics Volume 3.* Perasus (2012).
4. Nielsen and Chuang, Quantum *Computation and* Quantum *Information.* Cambridge (2000)
5. R Shankar, *Principles of quantum Mechanics 2nd Ed. (Only for mathematical background).* Plenum (1994).
6. Cohen-Tannoudji, Diu, Laloe, *Quantum Mechanics Volume 1 2nd Ed.* Wiley (2020)

Demos :

1. Wave particle duality with double slitexperiment.
2. Radioactivity.
3. Spectroscopicexample.
4. Tunnelling.
5. Solarcells.
6. Laserapplications.

9. Any otherremarks:

Dated:March , 2022 Proposer: Dr Arijit Kundu (Convener, DUGC)
Dated: March , 2022 DUGCConvener:

The course is approved / notapproved

Chairman, SUGC

Dated:

PHY115

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: **PHY 105 A**
2. Course Title: **Oscillations and Waves**
3. Per Week Lectures: 03(L), Tutorial: 01(T), Laboratory: _00 _(P), Additional Hours[0-2]: (A), Credits (3*L+2*T+P+A): 11
4. Duration of Course: **Full Semester**
5. Proposing Department/IDP : **Physics**
   Other Departments/IDPs which may be interested in the proposed course: Other faculty members interested in teaching the proposed course:
6. Proposing Instructor(s): **Convener, DUGC**
7. Course Description: **Revised and modernized core course**

A) Objectives:

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	***Oscillations***	Examples of oscillations in physics (e.g., solar cycle), chemistry (e.g., oscillating reactions), biology (e.g., circadian rhythms), ecology (e.g., predator-prey cycle), economics (e.g., business cycles: Goodwin's class struggle model), atmospheric science (e.g., weather cycle), etc.	06
		Simple harmonic motion, effect of damping, effect of external forcing, resonance, examples of resonances (e.g., atmospheric tide, NaCl crystal, swing).	
		Two coupled simple harmonic oscillators and normal modes (e.g., atoms in molecules, coupled electrical circuits, coupled pendula).	10
		Phase oscillators (examples from electronics, condensed matter physics, biology, mechanics), synchronization (e.g., firefly synchronization).	
		Harmonic analysis, nonlinear effects, examples of self-oscillations (e.g., van der Pol oscillator, firing of neurones, Tacoma Narrows disaster) and chaotic oscillations (e.g., elastic pendulum, double pendulum).	
		Many coupled particle oscillations and passage to continuum oscillating medium, one dimensional non-dispersive waves, 1st and 2nd order wave equations, damping of waves.	
		Longitudinal (e.g., acoustic waves) versus transverse waves (e.g., electromagnetic waves in	

2.	***Waves***	vacuum), polarised versus unpolarized waves, energy and momentum of waves.	14
		Reflection, refraction, and transmission in one dimensional waves; interference and diffraction.	
		Dispersion, phase velocity, group velocity, water waves (gravity and capillary), de Broglie waves, wave packets.	10
		Nonlinear waves, shocks, solitary waves, tsunami.	
		Total number of lectures	40

C)Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*):Nil

D)Short summary for including in the Courses of Study Booklet:- Examples of oscillations and waves, simple harmonic motion, effect of damping and external forcing, resonance, two coupled simple harmonic oscillators and normal modes, phase oscillators, harmonic analysis, effect of nonlinearity, examples of self-oscillations and chaotic oscillators, wave equations, damping, longitudinal vs. transverse waves, polarization, energy and momentum of waves, reflection, refraction, transmission, interference, diffraction, dispersion, nonlinear waves

8. Reference Books:

1. I. G. Main, *Vibrations and Waves in Physics*, Cambridge University Press (1994).
2. H. J. Pain, *The Physics of Waves and Vibrations*, JohnWiley and Sons (2005).
3. R. P. Feynman, R. Leighton, and M. Sands, *The Feynman Lectures on Physics*, Pearson Education (2012).
4. A. P. French, *Vibrations and Waves*, CBS Press (2003).
5. H. Georgi, *The Physics of Waves*, Prentice Hall (1993).
6. F. S. Crawford, *Waves,* McGraw Hill (1968).
7. S. H. Strogatz, *Nonlinear Dynamics and Chaos*, Taylor & Francis (2014).

Possible Demos:

Simple harmonic oscillator and resonance, resonance in wine glass, acoustic beating, coupled pendulum and normal modes, elastic pendulum; metronome synchronization, strings and waves, double pendulum and chaos, pendulum waves.

9. Any other remarks:

Dated:_March 2022 Proposer: Dr Arijit Kundu (DUGC Convener)

Dated: March 2022 DUGC Convener:

The course is approved / not approved

Chairman, SUGC

Dated:_____

A4 LIFE SCIENCES

Indian Institute of Technology Kanpur
Academic Affairs

A(U)/OO/UGARC/2022/
March 30, 2022

OFFICE ORDER

Sub: Sub-Committee for LIF101 Course (UGARC 2021-22)

As per the approval of the Chairperson, Senate, the following sub-committee is constituted for revision of LIF101 course:

1. Prof. Jonaki Sen, BSBE	Convener
2. Prof. Nitin Mohan, BSBE	Member
3. Prof. Ramesh Ramapanicker (CHM)	Member
4. Prof. Hamim Zafar (BSBE/CSE)	Member
5. Prof. Debashish Chowdhury (PHY)	Member
6. Prof. Sri Sivakumar (CHE)	Member
7. Prof. Vivek Verma (MSE)	Member
8. Prof. Shantanu Bhattacharya (ME)	Member
9. Prof. K.M. Sharika (CgS)	Member

Terms of Reference:

The above committee is constituted for revision of LIF101.

The committee is requested to submit its report within 15 days.

Shalabh 30/3/22
Shalabh
Dean, Academic Affairs

To: The Convener and the Members of the Sub-committee

Copy to:
1) The Chairperson, Senate
2) Convener, UGARC Implementation Group

Report of the Sub-Committee Constituted for Revision of the Curriculum of LIF101

A sub-committee was constituted by the Dean, Academic Affairs, with approval of the Chairperson, Senate, under the authority of the IIT Kanpur Office Order no. A(U)/OO/UGARC/2022, dated March 30, 2022, to revise the Curriculum of LIF101.

The Sub-committee comprised of the following members: Prof. Jonaki Sen, BSBE, (Convener), Prof. Debashish Chowdhury, PHY, (Member), Prof. Shantanu Bhattacharya, ME, (Member), Prof. Nitin Mohan, BSBE, (Member), Prof. Ramesh Ramapanicker, CHM, (Member), Prof. Vivek Verma, MSE, (Member), Prof. K.M. Sharika, CgS, (Member), Prof. Hamim Zafar, CSE/BSBE, (Member) and Prof. Sri Sivakumar, CHE, (Member).

The mandate of the sub-committee was to revise the curriculum of LIF101 in accordance with the following recommendation by the UGARC: "The course content of LIF101 core course requires major revision to emphasize more on Biology-Engineering interfaces".

The sub-committee had two meetings on 7th April, 2022 and on 6th May 2022. Feedback on revision of LIF101 curriculum was obtained from the BSBE Department. Based on the discussion in these meetings and the feedback obtained from BSBE department, the sub-committee has the following recommendations:

1. The curriculum of LIF101 has been revised to include more practical examples to demonstrate connections of the content to engineering where applicable.

3. The emphasis on certain topics already covered in school have been reduced and more emphasis laid on topics that were not covered in sufficient depth to permit the citation of examples that link to engineering.

4. Some new topics such as definition of living systems and theories of origin of Life on Earth have been included to provide holistic knowledge of living systems and to make students aware of their relevance in today's world.

Jonaki Sen Nitin Mohan Debashish Chowdhury Hamim Zafar

Ramesh Ramapanicker K.M. Sharika Sri Sivakumar Vivek Verma

Shantanu Bhattacharya

Indian Institute of Technology, Kanpur

1. Course No: LIF101

2. Course Title: Introduction to Biology

3. Per Week Lectures:_2__(L), Tutorial: __0_(T), Laboratory: __0__(P), Additional Hours[0-2]: 0
___(A), Credits (3*L+2*T+P+A): __6___ Duration of Course: √Full Semester / ~~Modular~~

4. Proposing Department/~~IDP~~ :
Biological Sciences and Bioengineering

Other Departments/IDPs which may be interested in the proposed course: This is a core course which is compulsory for all undergraduate students in the first year.

Other faculty members interested in teaching the proposed course: None

5. Proposing Instructor(s): two members of the faculty of Biological Sciences and Bioengineering Department. Dr. Jonaki Sen and Dr. Sai Prasad Pydi
6. Course Description: This is a course to introduce biological sciences to B.Tech. and B.S. students in the first year.

A) Objectives: The objective of this course is to introduce students to some basic concepts of Biological Sciences with examples of interface with engineering where applicable.

B) Contents (*preferably in the form of 5 to 10 broad titles*):

S. No	Broad Title	Topics	No. of Lectures
	Part I	**The molecular mechanisms and machines that make living systems function**	**14**
1.	Introduction	The importance and relevance of studying Biology	1
2.	Living Systems	Characteristics that distinguish living from non-living matter. Origin of life on Earth. Life's chemical basis: Chemical bonds and interactions in living systems. Water and its properties that are important for living systems.	1
3.	The molecules of life	Hydrocarbons and functional groups. Overview of the structure and function of the four classes of biomolecules namely carbohydrates, lipids, proteins and nucleic acids.	2
4.	Cells, the structural and functional unit of life	The bird's eye view of the internal structure and components of cells. The technology used to visualize cells and organelles in action (microscopy). Introduction to advances in imaging techniques such Cryo-EM, Super resolution microscopy etc. Citing specific examples to link to engineering.	2

5.	Components of cells and their functions I	The cell membrane and its functions. Communication and transport across the cell membrane through channels, transporters and receptors. Endocytosis, exocytosis and signal transduction mechanisms. Intracellular trafficking: delivery of proteins to specific locations within the cell and outside. Citing specific examples to link to engineering.	2
6.	Components of cells and their functions II	The cytoskeleton and its contribution to the both movement in the cell and movement of the cell. Role of intermediate filaments in transmission of force. Actin-Myosin based movement. Mechanism of molecular motors carrying cargo walking on microtubules. Citing specific examples to link to engineering.	2
7.	Organization of cells in organisms:	Structure of tissues, organs and organ systems. Cell-cell interactions, cell adhesion and cellular junctions. Function of the extracellular matrix and interactions of cells with ECM. Application in Tissue engineering. Citing specific examples to link to engineering.	1
8.	Introduction to metabolism	Pathways, energy transformation in living systems follow the laws of thermodynamics. Life at the expense of free energy. Enzymes as biocatalysts and regulation of metabolism. Citing specific examples to link to engineering.	1
9.	Energy Metabolism	Photosynthesis: production of food/fuel by plants to be used for energy release. Cellular respiration: mechanism through which cells release chemical energy Lessons from living systems for making efficient sources of renewable energy. Citing specific examples to link to engineering	2
	Part II	**Information processing in living systems**	**13**
10.	DNA structure and function	Chromosomes. Discovery of DNA as the genetic material. DNA structure and function. DNA replication and repair.	2
11.	From DNA to protein:	The central dogma: DNA to RNA to protein. The genetic code. Transcription and Translation.	3
12.	Control over genes	Gene expression in eukaryotes and outcome of gene regulation.	2
13.	How cells reproduce	Cell division (Mitosis), cell cycle, control of cell division and cancer.	1
14.	Meiosis and sexual reproduction	The importance of reductive division and how meiosis introduces variations in traits	1

15.	Patterns of inherited traits	Mendel's experiments with pea plants and the observed patterns of inheritance. Mendel's Law of Segregation and Law of Independent Assortment.	1
16.	Human inheritance	Human genetic analysis, autosomal inheritance patterns, X-linked inheritance patterns and epigenetics	1
17.	Biotechnology	Cloning DNA, DNA sequencing, Genomics, Genetic Engineering and Designer plants. Citing specific examples to link to engineering.	2

C) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): None

D) Short summary for including in the Courses of Study Booklet:

Part I: The molecular machines and mechanisms that make living systems function. The importance and relevance of studying Biology today. Distinguishing characteristics of living systems. Origin of life on Earth. Life's chemical basis. Water and its importance for life. Structure and function of carbohydrates, lipids, proteins and nucleic acids. Cells: The internal structure and components of cells. Visualizing cells and organelles in action using various microscopic techniques. Components of cells and their functions: the cell membrane and transport across it. Trafficking within the cells. The cytoskeleton and movement of cells and internal components of cells. Organization of cells into tissues, organs, organ system and organism. Introduction to metabolism: Life at the expense of free energy. Enzymes and their functions. Energy metabolism: Photosynthesis and Cellular respiration.

Part II: Information processing in living systems. DNA structure and function: Chromosomes. Discovery of DNA as the genetic material. DNA structure and function. DNA replication and repair. From DNA to protein: The central dogma: DNA to RNA to protein. The genetic code. Transcription and Translation. Control over genes: Gene expression in eukaryotes and outcome of gene regulation. Cell division (Mitosis), cell cycle, control of cell division and cancer. The importance of reductive division and how meiosis introduces variations in traits. Patterns of inherited traits: Mendel's experiments with pea plants and the observed patterns of inheritance. Human inheritance: Human genetic analysis, autosomal inheritance patterns, X-linked inheritance patterns and epigenetics. Biotechnology: Cloning DNA, DNA sequencing, Genomics, Genetic Engineering and designer plants.

Recommended books:
Textbooks: Biology: Concepts and applications by Cecie Starr, Christine A Evers and Lisa Starr 8th edition (Chapters 1-13 and 15)
Reference Books: None
Any other remarks: None

Dated: 20 th May 2022_Proposer: _____

Dated:_____DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____

A5 COMPUTING

ESC111

Revision of the course number: ESC101A (Modular first-half course)

Title of the course: Fundamentals of Computing I **Credit details: 3-1-3-0-[7]**

Objective of the course: To introduce basic concepts in and applications of imperative, procedural programming using the C programming language.

Specialized infrastructure requirement: Availability of sufficiently many PC systems to conduct laboratory sessions (e.g. at Core Labs or else allowing students to use their own laptops)

Instructional aspects:

Course content: Stored program concept, Standard I/O, Numerical data types (character, integer, floating point), Notion of variable and value (lvalue, rvalue), Expressions, Operators (unary, binary, ternary), Conditionals (if, else, nested conditionals), Loops (for, while, do-while, notion of loop invariants, nested loops; *Optional: notions of precondition and postcondition)*, Arrays (numerical arrays, strings, searching in arrays), Sorting (introduction using a simple algorithm such as bubble sort or some other), Functions (notion of argument and return value, pass-by-value with one or more numerical arguments), Finite representation of real numbers (overflow, underflow, errors due to finite representations).

Lecture-wise break-up: (please note that the duration of each lecture is 50 minutes)

Topic	**Suggested number of lectures**
Notion of variable and value, standard I/O, stored program concept	2
Expressions and operators (unary, binary, ternary), lvalue, rvalue	2
Numerical data types (character, integer, floating point), finite representation of real numbers, overflow, underflow errors	3
Conditionals (if, else, nested conditionals)	2
Loops (for, while, do-while), notion of loop invariants, nested loops	4
Arrays (numerical arrays, strings, searching in arrays)	4
Sorting (introduction using a simple example like bubble sort)	1
Functions (notion of argument and return value, pass-by-value with one	2

or more numerical arguments)	
Total number of lectures	**20**

Laboratory Sessions if any: Weekly laboratory sessions will involve students solving 2-3 programming problems on an online integrated development environment.

Suggested text and reference material:

1. Brian W Kernighan and Dennis M Ritchie, The C Programming Language,2nd Ed. ANSI C version, Pearson, 2006

Main differences suggested in this review: ESC101A was modularized into ESC101A and ESC102B. The current review rationalizes topics across the modules. No new topics have been introduced to or removed from the overall curriculum.

Purushottam Kar

Amey Karkare

Subhajit Roy

13-Feb-2022

Sanjeev Saxena

Nisheeth Srivastava

ESC112

Revision of the course number: ESC102B (Modular second-half course)

Title of the course: Fundamentals of Computing II **Credit details: 3-1-3-0-[7]**

Objective of the course: To introduce concepts and applications of structured programming, dynamic memory allocation, recursion, and file IO using the C programming language.

Specialized Infrastructure requirement: Availability of sufficiently many PC systems to conduct laboratory sessions (e.g. at Core Labs or else allowing students to use their own laptops)

Instructional aspects:

Course content: Pointers (notion of reference, pointer arithmetic, dynamic memory allocation/deallocation), User-defined data types (enum, struct), Functions (passing references, arrays, instances of user-defined data types as arguments), Examples of syntactic sugar in C (switch-case, subscription, member access), Dynamic data structures (lists, stacks, queues, trees), Sorting (efficient algorithms such as merge sort and/or others), Recursion, Notion of asymptotic complexity (motivation, big-Oh notation), File IO (elementary operations topics such as open/close, read/write, formatted IO, file positioning, operations on files, error handling, *Optional: reading from command line using cat, pipe; Optional: safeguards against buffer overflows*) Demonstration of problem solving using various applications (*Optional examples: root finding, solutions to systems of linear equations, integration, solution of ODEs, or others*).

Lecture-wise break-up: (please note that the duration of each lecture is 50 minutes)

Topic	Suggested number of lectures
Pointers (notion of reference, pointer arithmetic, dynamic memory allocation/deallocation)	3
User-defined data types (enum, struct)	1
Functions (passing references, arrays, user-defined datatypes)	3
Syntactic sugar (switch-case, subscription, member access)	2
Dynamic data structures (lists, stacks, queues, trees)	2

Sorting (efficient algorithms such as merge sort etc)	2
Recursion	2
Notion of asymptotic complexity (motivation, big-Oh notation)	1
File IO (elementary operations open/close, read/write, formatted IO, file positioning, operations on files, error handling)	2
Demonstration of problem solving using various applications	2
Total number of lectures	**20**

Laboratory Sessions if any: Weekly laboratory sessions will involve students solving 2-3 programming problems on an online-integrated development environment.

Suggested text and reference material:

1. Brian W Kernighan and Dennis M Ritchie, The C Programming Language,2nd Ed. ANSI C version, Pearson, 2006

Main differences suggested in this review: ESC101A was modularized into ESC101A and ESC102B. The current review rationalizes topics across the modules. No new topics have been introduced to or removed from the overall curriculum.

Purushottam Kar

Amey Karkare

Subhajit Roy

Sanjeev Saxena

Nisheeth Srivastava

A6 ETHICS

Indian Institute of Technology Kanpur
Academic Affairs

A(U)/OO/UGARC/2022/
March 30, 2022

OFFICE ORDER

Sub: Sub-Committee for Ethics course (UGARC 2021-22)

As per the approval of the Chairperson, Senate, the following sub-committee is constituted to propose the Ethics course (proposed credits=3):

1. Prof. Anjan Gupta, PHY	Convener
2. Prof. Vineet Sahu, HSS	Member
3. Prof. Lalit Saraswat, HSS	Member
4. Prof. Bushra Ateeq, BSBE	Member
5. President Student's Gymkhana or his Nominee	Member

The committee is requested to submit its report within 15 days.

Shalabh 30/3/22

Shalabh
Dean, Academic Affairs

To: The Convener and the Members of the Sub-committee

Copy to:

1) The Chairperson, Senate
2) Convener, UGARC Implementation Group

ETH111

Indian Institute of Technology Kanpur
Proposal for a New Course

1. Course No: ETH111, compulsory core

2. Course Title: Practical Ethics

3. Per Week Lectures: 0.5 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours: 1.5 (discussion)

Credits: (3*L+T +P+A): 3.0 credits (2 contact hours per week with one lecture every other week replacing a tutorial and 2 and 1 tutorial in alternative weeks; 7 lectures and 21 tutorials in a fourteen-week semester; some group projects can also be assigned.

Duration of Course: Full Semester Course

4. Proposing Department: Counseling Service (Study resource center)

Other Departments which may be interested: None

5. Proposing instructor: Head, counseling service as convener of a committee consisting of Anjan K. Gupta (Head, CS), Vineet Sahu, Bushra Ateeq, Lalit Saraswat and Saksham Pruthi (President Gymkhana nominee)

Level of the course: UG

6. Course Description: This course aims to sensitize a student about issues including, 0) Life and goals of a UG student, 1) the concept of right and wrong, 2) the implicit and explicit logic and principles behind various rules and laws, 3) personal development, integrity and conduct, 4) biases related to gender and other diversities, 5) judicious use of environmental resources, 6) parental and social expectations and constraints, 7) social issues and conflicts,

A) Objectives: To bring out ethical issues, biases and dilemmas among IITK UG students and discuss them logically through some local examples and case studies. The aim is to bring out the ethical and other dilemmas faced by a typical UG student in IITK and how to logically settle them rather than having an academic debate. Eventually the laws and rules laid out with some explicit and implicit logic have to be obeyed but often this logic is not so apparent.

B) Contents

S. No.	Broad title	Topics	No. of Lectures*
1	Life and goals of a UG student in IIT Kanpur	Understanding one's own goals of life; its impact on one's relationship with the society & environment; 'Thinking' as a skill - enhancing ability to think	1
2	Ethical behavior in student life and beyond: right versus wrong	cheating, bullying, plagiarism, corruption, cyber-crime. Perception about integrity, trust, and objectivity. Importance of personal integrity and conduct. Putting oneself in others shoes.	1
3	Personal conduct: The rules and laws around us	Personal versus collective wellbeing/progress; Why should we obey rules? Dissecting rules (HEC, WC, ICC, anti-ragging, clubs, hostels) around us. Examples of misconduct around us; bullying between friends;	1
4	Ethics in the area of a technological society	Moral principles that govern the technology usage. Accountability, digital rights, privacy, freedom, data protection, online behavior, etc.	1

5.	Sensitivity to Gender and other diversities	Diversities in our society: religion, caste, geography and language, rural versus urban, gender, sexual orientation. How to conduct oneself without biases?	1
6.	Self-development	Time management and procrastination, setting the priorities (sports, club, academics, festivals), peer competition; Dealing with lows (bereavement) and highs of life; Handling stress, pressures, assertiveness in oddities.	1
7.	Social structure around us	Human values; Child labor; literacy; Why do people believe and do weird things; Feeding the stray dogs;	1

List of some local examples: 1) A student negotiating passing grade with the instructor. 2) Students caught cheating in exam try to justify their act. 3) An instructor/TA getting biased by student's surnames, gender, etc. while grading an exam. 4) A male student stalking a girl who refuses his advancements. 5) Feeding of dogs in non-designated areas. 6) Mass cheating using social media getting caught leading to mass F-grades. 7) Cheating in HW due to lack of time or otherwise. 8) Substance abuse and trying to get your friends into it. 9) Misuse of funds by students in position (mess secy, cultural secy). 10) Pick some rules (HEC, Mess, elections, Clubs and facilities) and undertakings (anti-ragging, sexual-harassment, etc.) from within campus and decipher the logic behind them. 11) Spreading rumors or objectionable images about someone known on social media. 12) Behavior in a class: playing music, whistling, making noise, etc., 13) Why is SSAC needed?

C) Prerequisites: None.

D) Short summary for including in the Courses of Study Booklet: Life and goals of a UG student in IITK; ethical behavior in student life and beyond: right Vs wrong; personal conduct: The rules and laws around us; ethics in the area of a technological society Sensitivity to Gender and other diversities; self-development; Social structure around us. This is a tutorial heavy course guided by a few lectures and the role of a tutor is only that of a moderator. The tutorials are expected to run in a group discussion mode as a student needs to bring out his/her perspectives on the issues relevant to a typical IITK UG student and listen to those of the fellow students. Eventually, it is hoped that each student will determine a set of "logically thought guiding principles" that go beyond his/her personal interests and well-being.

7) Recommended textbooks: This is not a conventional course. So, no specific books can be recommended.

8) **Any other remarks:** None

Dated:19-05-2022 Proposer: Anjan Kumar Gupta

Dated:_____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____

A7 ENGLISH LANGUAGE COURSES

Committee for ELC courses

Indian Institute of Technology Kanpur
Academic Affairs

A(U)/OO/UGARC/2022/
March 30, 2022

OFFICE ORDER

Sub: Sub-Committee for the English Language course ECL10xx (UGARC 2021-22)

As per the approval of the Chairperson, Senate, the following sub-committee is constituted for evolving the ECL10xx basket, and the content of the courses:

1. Prof. G. Neelakantan, HSS	Convener
2. Prof. N. P. Sudharshana, HSS	Member
3. Prof. Lakshman Rao Pinnati, HSS	Member
4. Prof. Achla Raina, HSS	Member

Brief about the Programme:

The students who qualify EDT have to take an English Language Course (ECL10xx) (6-9 Credits) in their first year, half of them (around 650) in first semester and the remaining (around 650) in the second semester. A basket of ECL10xx courses needs to be identified. This basket can include existing courses and also new courses.

The committee is requested to submit its report within 15 days.

Shalabh 30/3/22
Shalabh
Dean, Academic Affairs

To: The Convener and the Members of the Sub-committee

Copy to:
1) The Chairperson, Senate
2) Convener, UGARC Implementation Group

Indian Institute of Technology Kanpur
Directorate

DIR/IITK/2022/OO/36
5th May 2022

Office Order

Sub: Constitution of English Language Cell

***

The UGARC 2020 in its report recommends that every BT/BS student should take an English course (as a part of the SCHEME basket) in their first year. The course level will be based on their performance in the English Diagnostic Test (EDT). In compliance to the recommendations of UGARC 2020 as approved by the Senate, the English Language Cell (ELC) is hereby constituted. The ELC will be housed in the office of Dean of Academic Affairs. The mandate of the ELC will be as under:

- Conduct EDT to determine the English proficiency of each of the newly admitted BT/BS students.
- Assign ELC courses based on their performance in EDT.
- Offer multiple skill-specific courses such as writing, verbal, communication, etc. Students should be allotted to these courses based on their performance in EDT so that they take the course which requires maximum help for enhancing their skills.
- Selection and assignment of suitable professionals, e.g., guest lecturers for teaching ELC courses in both semesters.
- Periodic review of the ELC course contents, conduct, and effectiveness.

ELC will be engaging guest lecturers on a suitable mode to teach the ELC courses. Associate Dean of Academic Affairs will serve as the Administrative Head of the ELC. Prof N P Sudharshana, HSS and Prof Lakshmana Rao Pinninti, HSS are hereby appointed as Coordinator and Co-Coordinator of the ELC for a period of 2 years.

A steering committee consisting of the following members is constituted:

Associate Dean of Academic Affairs	Convener
Prof N P Sudharshana, Coordinator	Member
Prof Lakshmana Rao Pinninti, Co-coordinator	Member
Prof G Neelakantan, HSS	Member
Prof Achla M Raina, HSS	Member

The term of the Steering Committee will be for a period of 2 years.

The role of the Steering Committee will be as under:

- Provide help in the recruitment of appropriate guest lectures, including deciding their qualification, workload, and remuneration, terms of appointment, mode of appointment, selection from the pool of applicants, etc..
- Provide timely recommendations and suggestions for the smooth operation of the cell.

This is for information and necessary action by all concerned.

Abhay Karandikar
Director & Chairperson Senate

To: All concerned

Copy to:

1) Deputy Director
2) All Deans
3) All IAC Members
4) All Head (s) of Departments/IDPs/Centres/Sections/Unit-in-Charges
5) Registrar
6) Web site through Web Master

ELC111

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: ELC 111
2. Course Title: **ENGLISH LANGUAGE AND COMMUNICATION (BASIC)**
3. Per Week Lectures: 2 (L), Tutorial:1 (T), Laboratory: 1 (P), Additional Hours: 0 (A), Credits (2L+1T+1P+0A): 9
4. Duration of Course: Full Semester ~~/ Modular~~
5. Proposing Department/IDP : HUMANITIES AND SOCIAL SCIENCES

   Other Departments/IDPs which may be interested in the proposed course: ELC teaching staff

   Other faculty members interested in teaching the proposed course: ELC teaching staff
6. Proposing Instructor(s): Drs Sudharshana N P and Lakshmana Rao Pinninti
7. Course Description:

A) Objectives: This course is designed for students with basic level of proficiency in English. It aims to develop all four language skills, namely, reading comprehension, writing, speaking and listening. Other key components, grammar and vocabulary, will be dealt with in context. Instruction is carried out in smaller groups of about 45-50 students each for effective individual attention. Students will comprehend various kinds of reading and listening texts and perform communicative tasks. Tutorials will be used to provide students with additional practice, specifically in grammar and vocabulary. A one-hour language lab session is meant to train the learners to improve their listening and speaking skills.

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Reading Comprehension Skills	• Reading description, narratives, process description and argumentative texts • Identifying main idea and details • Distinguishing between facts and opinions in simple texts • Reading for specific details and general understanding • Reading and comprehending texts from literature archives, popular media	10
2.	Writing Skills	• Constructing simple sentences • Understanding structure of a basic paragraph • Developing an expository essay on familiar topics • Writing strategies: clarity, unity and coherence	8

3	Listening-speaking	• Listening for specific details and general understanding • Listening to and comprehending a conversation • Listening to a lecture and taking notes • Describing, personal introductions, expressing personal opinion • Making short presentations	8
4	Grammar and vocabulary	• Tenses • Subject-verb agreement • Voice • Basic prepositions of space and time • Basic uses of definite and indefinite articles • Adjectives and adverbs • Common prefixes and suffixes	(to be dealt with in context of reading and listening texts)

(Weekly two lectures; assuming there are 12-13 weeks in a semester, the course is designed for 26 lectures)

A)Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): -----NA-----

B) Short summary for including in the Courses of Study Booklet

ELC 111 is a basic level English course for developing English language proficiency and communication skills. The aim here is to enable students comprehend reading passages and listening texts on familiar topics, communicate about self and familiar topics with a reasonable level of fluency and write short paragraphs on familiar topics.

8. Recommended books:

Sudharshana, N. P. & Savitha, C. (2018). *English for Engineers*. Cambridge University Press.
Raman, M. & Sharma, S. (2016). *Technical Communication*. Oxford University Press.
Department of English, Anna University (2012). *Mindscapes: English for Technologists and Engineers*. Orient Blackswan

8) Any other remarks: Students will be selected on the basis of their performance in the English Diagnostic Test.

Dated: April 23, 2022 Proposer: N.P. Sudharshana

Dated:_____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____

ELC112

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: ELC 112
2. Course Title: **ENGLISH LANGUAGE AND COMMUNICATION (INTERMEDIATE)**
3. Per Week Lectures:2 (L), Tutorial:1 (T), Laboratory: 0 (P), Additional Hours:1 (A), Credits (2L+1T+0P+1A): 9
4. Duration of Course: Full Semester ~~/ Modular~~
5. Proposing Department/IDP : HUMANITIES AND SOCIAL SCIENCES

   Other Departments/IDPs which may be interested in the proposed course: ELC teaching staff

   Other faculty members interested in teaching the proposed course: ELC teaching staff
6. Proposing Instructor(s): Drs Sudharshana N P and Lakshmana Rao Pinninti
7. Course Description:

A) Objectives: This course is designed for students with an intermediate level of English proficiency. It aims to develop all four language skills: listening, speaking, reading and writing. Other critical components of language proficiency —grammar and vocabulary—will be taught in context. Students will comprehend a variety of reading and listening texts and perform communicative tasks. Tutorials will be used to provide additional practice in language skills. A one-hour self-study session is meant to encourage students to read suggested texts and listen to recommended audio files.
The optimal student strength of a section in ELC112 is fixed at 100.

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Reading Skills	• Skimming for the main idea and scanning for specific details • Identifying author's purpose and tone • Distinguishing between facts and opinions in complex texts • Inferring unstated assumptions and conclusions • Evaluating arguments and evidence	10
2.	Writing Skills	• Structure of a paragraph: topic sentence, supporting sentences and concluding sentence • Writing coherently and cohesively • Types of writing: description, narration, analysis (e.g., Comparison, Cause and effect, Problem solution and Classification) and argumentation • Structure of an essay: Introductory paragraph, body paragraphs and concluding paragraph • Acknowledging sources	8

3	Listening-speaking skills	• Listening and identifying the main idea and specific details • Identifying speaker's purpose • Listening to debates and discussions and taking notes • Listening to and comprehending a presentation • Speaking: Narrating an event, presenting an argument • Group discussion, debate and interviews	8
4	Grammar and vocabulary	• Consistency in using tenses • Subject-verb agreement in complex sentences and questions • Complex prepositions • Quantifiers, demonstratives and articles • Linking words and phrases • Complex sentences • Noun-pronoun agreement • Comparative structure	(to be dealt with in context of reading and listening texts)

(Weekly two lectures; assuming that there are 12-13 weeks in a semester, the course is designed for 26 lectures)

A)Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): -----NA-----

B) Short summary for including in the Courses of Study Booklet

ELC 112 is an intermediate level English course for developing English language proficiency and communication skills. It aims to help students understand, organize and communicate ideas in academic contexts. The course focuses on training students to comprehend challenging reading and listening texts, write different types of essays typical of academic contexts and communicate ideas effectively.

8. Recommended books:

Alice Savage & Patricia Mayer (2012). Effective Academic Writing Second Edition: 2: Student Book: The Short Essay. Oxford University Press
Richards, J. C. (2015). Interchange Level 2. Cambridge University Press
Various contributors. (2012). Skills for Effective Writing Level 2 Student's Book. Cambridge University Press
Liz & John Soars (2012). New Headway 4th edn Pre-Intermediate. Oxford University Press
Liz & John Soars (2012). New Headway 4th edn Intermediate. Oxford University Press

8) Any other remarks: Students will be identified on the basis of their performance in the English Diagnostic Test.

Dated: April 23, 2022 Proposer: N.P. Sudarsanam

Dated:_____DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____

ELC113

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: ELC 113
2. Course Title: **ENGLISH LANGUAGE AND COMMUNICATION (ADVANCED)**
3. Per Week Lectures: 2 (L), Tutorial:1 (T), Laboratory: 0 (P), Additional Hours[0-2]: 1 (A), Credits (2L+1T+0P+1A): 9
4. Duration of Course: Full Semester / ~~Modular~~
5. Proposing Department/IDP : HUMANITIES AND SOCIAL SCIENCES
   Other Departments/IDPs which may be interested in the proposed course: ELC teaching staff
   Other faculty members interested in teaching the proposed course: ELC teaching staff
6. Proposing Instructor(s): Drs Sudharshana N P and Lakshmana Rao Pinninti
7. Course Description:

A) Objectives: This is an advanced level course in English that focuses on higher order skills and sub-skills of reading comprehension, writing, speaking and listening. Other key components such as accuracy and appropriacy will be dealt with in context. Students will comprehend various kinds of reading and listening texts and perform communicative tasks. Tutorials will be used to provide additional practice in writing and listening. A one-hour self-study session is meant to encourage students to read the suggested texts on their own and become independent learners. The optimal student strength of a section in ELC113 is fixed at 100.

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Reading Comprehension Skills	• Read and comprehend passages with complex organisation • Inferring meaning of unfamiliar words from the context • Critical reading skills: Investigating sources, recognizing author's purpose, distinguishing opinion from fact, inferring unstated assumptions and conclusions, forming judgments, evaluating arguments and evidence/s and deciphering unstated beliefs and assumptions	10

2.	Writing Skills	• Moving from description to analysis to argumentation • Argumentation: background, claim, evidence, and conclusion • Pre-writing strategies: Preparing a mind map of ideas, establishing links among the ideas • Avoiding plagiarism • Post-writing strategies: checking for conciseness and effectiveness • Summarising and paraphrasing • Preparing a CV, SOP (Statement of Purpose), composing emails	10
3	Listening-speaking	• Listening to and comprehending panel discussions, lectures, presentations and talks • Critical listening skills: Investigating sources, recognizing author's purpose, distinguishing opinion from fact, inferring unstated assumptions and conclusions, forming judgments, evaluating arguments and evidence/s and deciphering unstated beliefs and assumptions • Effective communication across digital platforms in formal contexts	6
4	Grammar and vocabulary	• Effective use of tenses in various personal and official contexts • Advanced article usage • Variation in sentences • Appropriate choice of vocabulary • Phrasal verbs • Scope of negation • Effective use of idioms and common figures of speech	(to be dealt with in context of reading and listening texts)

(Weekly two lectures; assuming there are 12-13 weeks in a semester, the course is designed for 26 lectures)

A)Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): -----NA-----

B) Short summary for including in the Courses of Study Booklet

ELC 113 is an advanced level course in English language proficiency and communication skills. It focuses on helping the learner comprehend complex reading and listening passages, write various kinds of texts typical of academic contexts, and communicate ideas effectively in various interpersonal contexts.

8. Recommended books:

Hamp-Lyons, L. & Heasley, B. (2006). *Study writing*. Cambridge University Press

Reinking, J. A. & Osten, R. (2017). *Strategies for successful writing*. Pearson

Greenlaw, R. (2012). *Technical Writing, Presentation Skills, and Online Communication: Professional Tools and Insights*. Information Science Reference.

Grower, R. (2008). *Grammar in practice 4*. Cambridge University Press

Grower, R. (2008). *Grammar in practice 5*. Cambridge University Press

Richards, J. C. (2015). *Interchange Level 3*. Cambridge University Press
Liz & John Soars (2012). New Headway 4th edn Upper Intermediate. Oxford University Press
Liz & John Soars (2012). New Headway 4th edn Advanced. Oxford University Press

8) Any other remarks: Students will be selected on the basis of their performance in the English Diagnostic Test.

Dated: April 23, 2022 Proposer: N.P. Sudhanshu

Dated:_____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____