STUDENT INFORMATION HANDBOOK

AND

SCHEME OF INSTRUCTIONS

UNDERGRADUATE PROGRAMMES

ACADEMIC YEAR: 2025-26

INDEX

CHAPTER 1

FOUR-YEAR BACHELOR OF SCIENCE (RESEARCH)

1.1 BASIC STRUCTURE

The Four-Year Bachelor of Science (Research) Program is organised into eight semesters. The following Major disciplines are available in the Bachelor of Science (Research) Program.

- Biology
- Chemistry
- Earth and Environmental Sciences
- Materials
- Mathematics
- Physics

A student is required to take a specified number of core courses in the 1st three semesters. At the end of the 3rd semester, each student will be assigned a Major discipline (from the list above) based on her/his preferences and CGPA. While students specialise in a Major discipline, they can also broaden their knowledge and skills by taking courses in other disciplines. Students who take a sufficient number of courses in a discipline other than the chosen Major will qualify for a Minor in that discipline.

1.2 FACULTY ADVISOR

In the first three semesters, the Dean and the Associate Deans will be advising the students. Each student will be assigned a Faculty Advisor (Major Discipline Coordinator) at the beginning of the 4th semester. The Faculty Advisor may be consulted about all matters (academic as well as non-academic) that may be of concern to the student. The Faculty Advisors will do their best to promote the development and growth of the students in their scientific career.

1.3 REGISTRATION OF COURSES AND COURSE LOAD

1.3.1 UNTIL BATCH 2021

Table 1.1: Details on course registration and credit limits till 2021 Batch

Semester	Criteria	Credits
I and II	Student needs to register fix number of credits	17 in each semester
III	Student needs to register fix number of credits	18
IV to VIII	CGPA < 8	Min.: 16 and Max.: 19
IV to VIII	CGPA ≥ 8	Min.: 16 and Max.: 23
IV to VIII	Preceding term TGPA ≥ 8	Min.: 16 and Max.: 23

1.3.2 BATCH 2022 ONWARDS

Table 1.2: Details on course registration and credit limits Batch 2022 onwards

Semester	Criteria	Credits
I	Student needs to register for a fixed number of credits	18
II	No CGPA and TGPA requirements	Min.: 17 and Max.: 21
III	No CGPA and TGPA requirements	Min.: 17 and Max.: 21

IV	CGPA < 8	Min.: 15 and Max.: 17
	CGPA ≥ 8	Min.: 15 and Max.: 21
V to VIII	CGPA < 8 or Preceding term TGPA < 8	Min.: 16 and Max.: 18
	CGPA ≥ 8 or Preceding term TGPA ≥ 8	Min.: 16 and Max.: 21

1.3.3 DETAILED BREAKUP OF COURSES FROM 1st TO 3rd SEMESTERS

Table 1.3: Detailed Breakup of Courses for Semester 1

SEMESTER I			
Course Type	**Course Code**	**Course**	**Credits**
Basic Courses (Mandatory)	UMA 101	Analysis and Linear Algebra I	4:0
	UBL 101	Introductory Biology I	3:1
	UCY 101	Introductory Chemistry I	3:1
	UPH 101	Introductory Physics I	3:1
Humanities (Mandatory)			2:0
Total Credits			**18**

Table 1.4: Detailed Breakup of Courses for Semester 2

SEMESTER II			
Course Type	**Course Code**	**Course**	**Credits**
Engineering (Mandatory)	UENG 103	Introduction to Earth and its Environment	3:0
Basic Courses *Choose any Three out of Four courses*	UBL 102	Introductory Biology II	3:1
	UCY 102	Introductory Chemistry II	3:1
	UMA 102	Analysis and Linear Algebra II	4:0
	UPH 102	Introductory Physics II	3:1
Humanities (Optional)			0-2
Optional Elective	UENG 102	Electrical and Electronics Engineering	3:1
Total Credits (Min. - Max.)			**15-21**

Table 1.5: Detailed Breakup of Courses for Semester 3

SEMESTER III			
Course Type	**Course Code**	**Course**	**Credits**
Engineering (Mandatory)	UENG 201	Introduction to Material Science	3:0
Basic Courses *Choose any three out of Four courses*	UBL 201	Introductory Biology III	3:1
	UCY 201	Introductory Chemistry III	3:1
	UMA 201	Probability and Statistics	4:0
	UPH 201	Introductory Physics III	3:1
Humanities (Optional)			0-2
Optional Elective	UENG 101	Algorithms and Programming	3:1
Total Credits (Min. - Max.)			**15-21**

Note: A. Humanities courses cannot be dropped in both semesters II and III.
B. Humanities courses cannot be dropped in both semesters IV and V.
C. Students must complete 9 credits in humanities pool by the end of six semester

1.4 CHOOSING MAJOR AND MINOR: BATCH 2022 ONWARDS

1.4.1 MAJOR DISCIPLINE

i) A student is required to select a Major discipline before the commencement of the 4th semester. The Major disciplines offered in the Four-Year Bachelor of Science (Research) Programme are listed below, along with the eligibility criteria.

Table 1.6: Majors and eligibility criteria

Sl. No.	Major	Criteria for being eligible to apply for Major Discipline
1	Biology	A student must have passed all three Biology Basic Core Courses by the end of the 3rd semester.
2	Chemistry	A student must have passed all three Chemistry Basic Core Courses by the end of the 3rd semester.
3	Earth and Environmental Sciences	All students are eligible to apply
4	Materials	All students are eligible to apply
5	Mathematics*	A student must have passed Mathematics Basic Core Courses by the end of the 3rd semester.
6	Physics	A student must have passed Physics Basic Core Courses by the end of the 3rd semester.

*Note: *A minimum of two 'B' and one 'C' grades are required in the mathematics core courses in the first three semesters.*

ii) A few examples explaining the eligibility criteria are given below.

Example 1: Student drops Physics in Semesters 2 & 3
In this case, the student is no longer eligible for a Physics Major but can choose from any other five Major disciplines (Biology, Chemistry, Mathematics, Earth & Environmental Science, Materials).

Example 2: Student drops Physics in Semester 2 and Chemistry in Semester 3
In this case, the student is ineligible for Physics and Chemistry Majors but can choose from any of the four other Major disciplines (Biology, Mathematics, Earth & Environmental Science, Materials)

iii) A student can choose up to three disciplines (provided the conditions laid down in table 1.6 are met) for a Major in the order of preference while applying for specialisation in the SLCM. The student will be assigned one of these disciplines as a Major on Dean UG's approval.

1.4.2 MINOR DISCIPLINE

i) Students are not required to choose a Minor discipline, as it is optional. If a student decides to opt for a Minor, they can do so before the commencement of the 4th semester and until the start of the 7th semester. The list of available Minor disciplines for the Four-Year Bachelor of Science (Research) Programme and eligibility criteria are provided below for reference.

Table 1.7: Minors and Eligibility criteria

Sl. No.	Minor	Criteria for being eligible to apply for Minor Discipline
1	Biology	A student must have completed the Biology Basic Core courses by the end of 6th Semester.
2	Chemistry	A student must have completed the Chemistry Basic Core courses by the end of 6th Semester.
3	Earth and Environmental Science	All students are eligible to apply.
4	Materials	All students are eligible to apply.
5	Mathematics	A student must have completed the Mathematics Basic Core courses by the end of 6th Semester.
6	Physics	A student must have completed the Physics Basic Core courses by the end of 6th Semester.
7	Bioengineering	All students are eligible to apply.
8	Quantum Technology	All students are eligible to apply.

ii) A student can choose up to three disciplines for a Minor in the order of preference while applying for specialisation in the SLCM. The student will be assigned one of these disciplines as a Minor on Dean UG's approval.

1.5 INTERNSHIP

ELIGIBILITY CRITERIA

1.5.1. Summer Term Internship:

- All students are permitted to undertake internships during the Summer Term.
- Students opting for internships outside the Institute are required to apply for **Internship Leave** through **SAP** prior to starting the internship.
- Students must report back to the Institute on or before 31st July.

1.5.2. Internship during Normal Semester or Extending to Normal Semester:

- Final year students enrolled in Bachelor's and Master's programme are eligible for internship for a period not exceeding one semester.
- For internships during the **7th or 9th semester**, the combined total of pending **course credits** and **project credits** must not exceed:
  - **21 credits** for students with a **CGPA of 8.0 or above**
  - **18 credits** for all other students
- For internships during the **8th or 10th semester**, all course requirements must be completed. Only **project credits** may remain, for which students must register during the **course registration period**.
- The internship request should be recommended by both the Project Guide and the Major Discipline Coordinator.
- For procedure related to applying for Internships, please refer section 5.12

1.6 PROJECTS

1.6.1 Project work could be initiated at the end of the 6th semester. **Each student must register for the Project at the beginning of the 8th semester.** The project is carried out under the supervision of a Project Advisor chosen based on the student's interests. The Project Advisor will also serve as the Faculty Advisor from this stage. The minimum pass grade is "D".

1.6.2 Major wise Project credit details are given below:

Table 1.8: Project credit details

DISCIPLINE	PROJECT DETAILS	
	Until Batch 2021	Batch 2022 onwards
Biology	16	16
Chemistry	14	12
Earth & Environmental Sciences	16	15
Materials	13	13
Mathematics	13	13
Physics	16	15

1.6.3 Extension of Projects: If there is a need for an extension of the project, prior approval from Dean UG must be obtained on or before April 15 of the Academic Year. In such cases, an application recommended by the project advisor and the subject coordinator is to be submitted. Then, the student must register for the summer term. The best grade that can be obtained in such cases will be a 'B' grade.

1.7 DEGREE AWARD REQUIREMENT

A. Normally, students have to complete the Bachelor of Science (Research) programme in 8 terms. However, in special circumstances, a student may be permitted an extension to complete all requirements for the degree within a maximum of 12 terms. Further, the core courses need to be cleared within a maximum of 6 terms. Summer terms are not counted for this purpose.

B. The computation of the final CGPA is done only if the student clears all courses successfully within the period specified.

C. A student must complete the specified course requirements of 131 credits of the relevant degree programme with a minimum CGPA of 5.0.

Table 1.9: Degree Award Requirement Until Batch 2021

<table>
<tr><th colspan="7">Degree Award Requirement Until Batch 2021</th></tr>
<tr><th>Basic Course</th><th>Engineering</th><th>Humanities</th><th>Major and Project</th><th>Minor (Optional)</th><th>Electives (Assortment Courses)</th><th>Total</th></tr>
<tr><td rowspan="2">36</td><td rowspan="2">19</td><td rowspan="2">9</td><td rowspan="2">52</td><td>15</td><td>0-15</td><td rowspan="2">131</td></tr>
<tr><td colspan="2">15*</td></tr>
</table>

NOTE:

1. **Students not opting for a minor should fulfil 15 credits of assortment courses.*
2. *To be eligible for a minor, a student should fulfil 15 credits from the minor pool.*
3. *Excess credit(s) from any pool will be counted towards assortment credits.*

Table 1.10: Degree Award Requirement Batch 2022 onwards

Degree Award Requirement Batch 2022 onwards						
Basic Course (Sem 1-3)	**Engineering (Sem 2-3)**	**Humanities (Sem 1-6)**	**Major and Project**	**Minor (Optional)**	**Electives (Assortment Courses)**	**Total**
40	6	9	51	15	10-25	131
				25*		

NOTE:

1. **Students not opting for a minor should fulfil 25 credits of assortment courses.*
2. *To be eligible for a minor, a student should fulfil 15 credits from the minor pool.*
3. *Excess credit(s) from any pool will be counted towards assortment credits.*

1.8 CLASSIFICATION OF AWARDS

Successful completion of the course can carry any one of the following awards: First Class with Distinction and First Class. The CGPA requirements for each award are given below:

Table 1.11: Classification of Awards

CGPA	Award
8.5 and above	First Class with Distinction
6.0 to 8.4	First Class

1.9 MEDALS

A list of medals awarded in the Four-Year Bachelor of Science (Research) program is given below.

Table 1.12: Medals

Discipline	Name of the Medal
Biology	Kothrapalli Satyanarayana and Vimaladevi Medal
Chemistry	Rajarshi Bhattacharya Memorial Medal
Earth and Environmental Sciences	Institute Medal
Materials	Sitaram Jindal Foundation Medal
Mathematics	Rohan Memorial Medal
Physics	Prof. R. Srinivasan Medal

Please refer to section 5.13 for the norms governing the recommendation of students for medals.

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CHAPTER 2

MASTER OF SCIENCE

2.1 BASIC STRUCTURE

Undergraduate students who fulfil the requirements towards the Bachelor of Science (Research) degree at the end of the 4th year have an option to continue for a 5th year to register for a Master of Science degree. The 5th year is organised into two semesters. Students are required to take a specified number of courses as outlined in table 2.1 and complete a research project in their Major discipline. A project report has to be submitted which will be evaluated and graded. All other guidelines as laid out for the Bachelor of Science (Research) programme will be applicable for the Master of Science programme as well.

2.2 MAJOR DISCIPLINE REQUIREMENTS

Table 2.1: Major Discipline Requirements for Master of Science Program

DISCIPLINE	COURSE CREDITS	PROJECT CREDITS
BIOLOGY	12	20
CHEMISTRY	12	20
EARTH & ENVIRONMENTAL SCIENCES	12	20
MATERIALS	12	20
MATHEMATICS	32	-
PHYSICS	12	20

Please refer to Section 2.5 for course/project details

2.3 CREDIT CARRYOVER

Credits fulfilled over and above 131 in the Bachelor's degree could be considered towards Master's degree provided the following conditions are met:

i) A maximum of 12 credits completed over and above 131 in the Bachelor's degree and belonging to the subject area of the student's Major discipline could be considered towards the Master's degree.

ii) If the 12 credits taken in excess of the required 131 in the Bachelor of Science (Research) programme are those of mandatory course credits required to be fulfilled in the Master's programme, then the student will only have to fulfil project credits in the 5th year.

iii) If the excess 12 credits (fulfilled in the Bachelor's programme) do not include any compulsory courses (as prescribed by the respective discipline for the Master' degree programme) then the student is required to fulfil the compulsory course credits in the 5th year.

iv) No exemptions will be given for compulsory courses.

2.4 REGISTRATION OF COURSES AND COURSE LOAD

Table 2.2

Semester	Credits
9th Semester	Min: 0 and Max: 18
10th Semester	Min: 20 and Max: 26

2.5 MANDATORY COURSE REQUIREMENTS: (BATCH 2020 ONWARDS)

i) **BIOLOGY**

Any 12 credits from the Biology division **[**(i.e. Biochemistry (BC), Centre for Ecological Sciences (CES), Centre for Neurological Sciences (CNS), Microbiology and Cell Biology (MCB), Molecular Biophysics Unit (MBU), Developmental Biology and Genetics (DBG), Courses offered by integrated Ph.D. by Biological Science Division (course codes starting with DB, LS)**]**, and from Department of Bioengineering (BE).

- UB 500 (0:20): Master's Project

ii) **CHEMISTRY**

Minimum of 6 credits (200 or 300 level) from within the Chemical Sciences Division **[**i.e. Inorganic and Physical Chemistry (IPC), Organic Chemistry (OC), Solid State and Structural Chemistry Unit (SSCU), Materials Research Centre (MRC), Chemical Division Courses offered for Integrated Ph.D. students (course codes starting with CD) & Courses offered for M.Sc. Chemical Sciences Programme (course codes starting with CY)**]** and 6 credits (200 or 300 level) from any division OR all 12 credits (200 or 300 level) from within the Chemical Sciences Division.

- UC 500 (0:20): Master's Project

iii) **EARTH AND ENVIRONMENTAL SCIENCES**

Any 4 courses (12 credits) from Departments/Centre participating i.e.; Civil engineering (CiE), Centre for Atmospheric and Oceanic Sciences (CAOS), Centre for Earth Sciences (CEaS), Centre for Sustainable Technologies (CST) in the E&ES programme or equivalent courses as per students' handbook after a discussion with the EES coordinators and 20 credits from the Project with the Masters' thesis advisor.

- UES 500 (0:20): Master's Project

iv) **MATERIALS**

The choice of 4 courses (12 credits) should be as follows:

i) Core courses*:

- MT 202 (3:0): Thermodynamics and Kinetics (Aug)
- MT 204 (3:0): Structure and Properties of Materials (Aug)

ii) Any one out of the following soft-core courses:

- MT 213 (3:0): Electronic Properties of Materials (Jan)
- MT 209 (3:0): Defects in Materials (Jan)
- MT 217 (3:0): Computational Mathematics for Materials Engineers (Aug)
- MT 307 (3:0): Materials in Extreme Environments (Aug)
- MT 253 (3:0): Mechanical Behaviour of Materials (Aug)
- MT 260 (3:0): Polymer Science and Engineering (Aug)
- MT 206 (3:0): Texture and Grain Boundary Engineering (Aug)
- MT 240 (3:0): Principles of electrochemistry and corrosion (Jan)

- MT 220 (3:0): Microstructural Engineering of Structural Materials (Jan)
- MT 205 (3:0): Structural Characterization of Materials (Aug)
- NE 316 (3:0): Advanced Electron Microscopy (Aug)

iii) Any one PG-level course offered in Materials Engineering or Materials Research Centre

**Those who have already taken MT 202 and/ or MT 204 in their Bachelor's programme, can fulfil the core credit requirements from the above list of soft core courses (refer point 2).*

- UMT 500 (0:20): Project: MATERIALS

v) **MATHEMATICS**

i) Following mandatory courses to be fulfilled:

- MA 389A (1:0): Seminar on topics in Mathematics I (AUG)
- MA 389B (1:0): Seminar on topics in Mathematics II (JAN)
- MA 213 (3:1): Algebra II (JAN)
- MA 222 (3:1): Analysis II (JAN)

ii) Soft core courses requirement: Any 3 courses from the list below

- MA 223 (3:0): Functional Analysis
- MA 232 (3:0): Introduction to Algebraic Topology
- MA 242 (3:0): Partial Differential Equations
- MA 361 (3:0): Probability Theory
- MA 235 (3:0): Introduction to Differentiable Manifolds
- MA 220 (3:0): Representation Theory of Finite Groups
- MA 312 (3:0): Commutative Algebra
- MA 313 (3:0): Algebraic Number Theory
- MA 262 (3:0): Introduction to Stochastic Processes
- MA 321 (3:0): Analysis III

iii) <u>Optional Reading Projects</u>:

UM 501 (0:6): Master's Project A (Aug term)
UM 502 (0:6): Master's Project B (Jan term)

Note :

1) The student must complete MA 213 (Algebra 2) and MA 222 (Analysis 2) either in the BS programme or in the fifth year in Master's programme.
2) 3 courses must be taken from the softcore pool of 10 courses. If 'n' number of courses out of these 3 softcore courses have been completed in the BS programme, then the remaining '3-n' courses must be credited in the fifth year.
3) Master's projects A and B are optional, but if credited in the fifth year, will count towards the 32 credits.
4) If the student has completed MA 213 - Algebra-II, MA 222 - Analysis-II, and 3 softcore courses in the BS programme, then the 30 credits in the fifth year can potentially be taken from any department (subject to the approval of the mathematics coordinator)

vi) **PHYSICS**

Following mandatory courses to be fulfilled:

- PH 206 (3:0): Electromagnetic Theory
- PH 208 (3:0): Condensed Matter Physics -1 **OR**
  IN 232 (3:0): Concepts in Solid State Physics
- PH/HE 215 (3:0): Nuclear and Particle Physics
- PH 217 (3:0): Fundamentals of Astrophysics

NOTES:

- The students have to complete 12-Credit blackboard courses during the 5th Year.
- In case none of the above-mentioned mandatory courses are completed by the student during the first four years (Bachelor of Science), they have to credit all of them in the 5th year.
- In case the student has already completed all of the above-mentioned mandatory courses during 1st Four-Years (Bachelor of Science), to fulfil the 12-credit requirement, they can take any other course(s) (200 or 300 level) from any department, with the consent of their respective advisor, Instructor and the UG coordinator.
- In case the student has completed part of the above-mentioned mandatory courses during the 1st Four-Years (Bachelor of Science), they have to complete the remaining mandatory courses and to fulfil the 12-credit requirement, any other course(s) (200 or 300 level) from any department, with the consent of their respective advisor, Instructor and UG coordinator.

- **UP 500 (0:20): Project: PHYSICS**

This is a 20-credit project course of six months duration and is compulsory for the completion of the MSc course. The student can choose any faculty of his or her choice from any of the three departments: Physics, Centre for High Energy Physics (CHEP), Instrumentation and Applied Physics (IAP) with mutual consent and take up an advanced topic of research either in the experimental or theoretical stream. At the end of the term, the student will submit a soft copy of the report to the coordinator. The viva-voce examination will be conducted with two examiners and evaluated accordingly.

2.6 CLASSIFICATION OF AWARD

Table 2.3: Classification of Award

CGPA	Award
8.5 and above	First Class with Distinction

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CHAPTER 3

BACHELOR OF TECHNOLOGY (MATHEMATICS AND COMPUTING)

3.1 BASIC STRUCTURE

The Bachelor of Technology (Mathematics and Computing) is a four-year programme, organised into 8 semesters. Students need to complete 128 credits as specified in the table and sections below.

Table 3.1: Summary of Credit requirements s Until Batch 2024

Course Category	Core	Breadth Soft Core	Humanities	Soft Core		ISP-I /ISP-II /Project /Electives	Total
				Math	Computing		
Minimum Credit Requirement	49	14	9	21		35*	128
				6	6		

Table 3.2: Summary of Credit requirements Batch 2025 onwards

Course Category	Core	Breadth Soft Core	Humanities	Soft Core		ISP-I /ISP-II /Project /Electives	Total
				Math	Computing		
Minimum Credit Requirement	50	14	9	21		34*	128
				6	6		

Note: *Any excess credits in the Breadth Soft Core, Humanities or Soft Core pool will be counted towards elective credits.

3.2 OVERVIEW OF COURSE REQUIREMENTS

i) **CORE:**

- **Mathematics:** Analysis and Linear Algebra I, II, Probability and Statistics, Basic Analysis, Introduction to Algebraic Structures.
- **Computing:** Algorithms and Programming, Introduction to Electronics and Electrical Engineering, Introduction to Computer Systems, Discrete Mathematics, Data Structures and Algorithms, Automata Theory and Computability, Introduction to Numerical Methods and, Introduction to Artificial Intelligence & Machine Learning.

ii) **BREADTH SOFT CORE**

14 credits from a selection of Physics, Chemistry, Biology, Material Science, Earth and Environmental Science subjects.

The list of core and breadth soft core courses and their semester wise break-up can be found in the scheme of instructions (SoI).

iii) **SOFT CORE**

The soft core consists of the Mathematics and Computing streams. Students have to take at least 6 credits in each stream. Students have to take at least 21 credits from the combined list of soft-core courses. The list of courses in each stream is specified in the Scheme of Instructions (SoI).

iv) **PROJECTS**

ISP stands for Independent Study Project. ISP-I (semester 7), ISP-II (semester 8) carries 6 credits each. Project refers to Research or Industry Project and carries 12 credits. Detailed rules governing projects are specified in Section 3.6.

v) **ELECTIVES**

Elective credits can be fulfilled by passing any course offered across the institute. Some useful elective courses are also provided under the category of suggested electives in the SoI.

vi) **STUDY TRACKS**

The programme structure encourages interested students to pursue a study track should they wish to do so. Here is an indicative list of study tracks (The corresponding courses in each study track can be found in the SoI); Mathematics, Artificial Intelligence & Machine Learning, Computational Science, Theoretical Computer Science, Quantum Computing, Computational Biology, Signal Processing, Mathematical Finance.

3.3 SEMESTER WISE COURSE STRUCTURE

Table 3.3: Course Structure for Semester I

SEMESTER I			
Course Type	**Course Code**	**Course**	**Credits**
Core Courses	UENG 101	Algorithms and Programming	3:1
	UMA 101	Analysis and Linear Algebra I	4:0
Breadth Soft Core *Choose any **TWO** out of the three courses*	UBL 101	Introductory Biology I	3:1
	UCY 101	Introductory Chemistry I	3:1
	UPH 101	Introductory Physics I	3:1
Humanities (Mandatory)			**2:0**
Normal Load			**18**

Note*:* UMA 101 is a prerequisite for UM 204

Table 3.4: Course Structure for Semester II

SEMESTER II			
Course Type	**Course Code**	**Course**	**Credits**
Core Courses	UENG 102	Electrical and Electronics Engineering	3:1
	UMA 102	Analysis and Linear Algebra II	4:0
	UMC 102	Computer Systems	3:0
	UMC 103*/ UMC 103A	Discrete Mathematics	2:0*/ 3:0
Breadth Soft Core *Choose any **ONE** out of the four courses*	UBL 102	Introductory Biology II	3:1
	UCY 102	Introductory Chemistry II	3:1
	UPH 102	Introductory Physics II (Elec-Mag-Optics)	3:1
	UENG 103	Introduction to Earth and its Environment	3:0
Humanities**			**0-2**
Normal Load			**17-20**
Reduced load (UMA 102, UMC 102, UMC 103A are mandatory. Must register for an additional 2 to 5 credits)			**12-15**

Note: * Applicable until batch 2024.

Table 3.5: Course Structure for Semester III

SEMESTER III			
Course Type	**Course Code**	**Course**	**Credits**
Core Courses	UMA 201	Probability and Statistics	4:0
	UMC 201	Data Structures & Algorithms	3:1
	UMC 202	Numerical Methods	3:1
Breadth Soft Core *Choose any ONE out of the Four*	UBL 201	Introductory Biology III	3:1
	UCY 201	Introductory Chemistry III	3:1
	UPH 201	Introductory Physics III	3:1
	UENG 201	Materials Science	3:0
Humanities**			**0-2**
Normal Load			**15-18**
Reduced Load *(UMA 201, UMC 201, UMC 202 are mandatory. Can register for a maximum of 4 additional credits)*			**12-16**

Note: **For students who are not under reduced load in both semesters II and III, Humanities course cannot be dropped in both semesters II and III.

Table 3.6: Course Structure for Semester IV

SEMESTER IV			
Course Type	**Course Code**	**Course**	**Credits**
Core Courses	UM 204	Analysis	3:1
	UM 205	Algebraic Structures	3:1
	UMC 203	Introduction to Artificial Intelligence and Machine Learning	3:1
	UMC 205	Automata and Computability	3:1
Humanities			**0-3**
Normal Load			**16-19**
Reduced Load *(drop one core course; can register for a maximum of 4 additional credits)*			**12-16**
Enhanced Load			**16-21**

Table 3.7: Course Structure for Semester V

SEMESTER V			
Course Type	**Course Code**	**Course**	**Credits**
Soft Core/Elective			16
Humanities***			0-3
Normal Load			**16-19**
Enhanced Load			**16-21**

Table 3.8: Course Structure for Semester VI

SEMESTER VI			
Course Type	**Course Code**	**Course**	**Credits**
Soft Core/Elective			16/15#
Humanities***			**0-3**
Normal Load			**16/15#-19**
Enhanced Load			**16/15#-21**

Note: ***Humanities course cannot be dropped in both semesters IV and V.
Applicable for 2025 batch onwards

Table 3.9: Course Structure for Semester VII

SEMESTER VII	
Course/Course Type	**Credits**
UMC 401 ISP I (0:6)/Soft Core/Electives	6
Soft Core/Electives	6
Normal Load	**12-16**
Enhanced Load	**12-21**

Table 3.10: Course Structure for Semester VIII

SEMESTER VIII			
Course Type	**Course Code**	**Course**	**Credits**
Any **ONE** of the Two	UMC 402 ISP II (0:6) /Soft Core/ Electives (6) + Soft Core/Electives (6)		12
	UMC 403 Project		0:12
Normal Load			**12-16**
Enhanced Load			**12-21**

Note:

1. For reduced, normal and enhanced load criteria, refer to section 3.5
2. Detailed rules governing projects are specified in section 3.6

3.4 FACULTY ADVISOR

Each student will be assigned a Faculty Advisor at the beginning of the first semester. The Faculty Advisor may be consulted about all matters (academic as well as non-academic) that may be of concern to the student. Faculty advisors will do their best to promote the development and growth of the students during the programme.

3.5 REGISTRATION FOR COURSES AND COURSE LOAD

i) Registration for courses will be done in consultation with the Faculty Advisor.

ii) All students must complete a total of at least 128 credits comprising courses and other components like projects, as specified in Tables 3.2 to 3.9. The course load for the 1st three semesters is fixed. Each subsequent semester has a “Normal”, “Reduced” and “Enhanced” course load, as specified in Table 3.2 to 3.9. Based on their CGPA and previous-term TGPA, students must register for an appropriate course load as specified in Table 3.10 below. Any deviation from the recommended load will be allowed only with the permission of the Dean.

Table 3.11: Recommended Course Load

Criteria	Course Load
CGPA ≤ 6.0 AND Prev-TGPA ≤ 5.5	Reduced in Semester II to IV, Normal in Semester V to VIII
6.0 < CGPA < 8.0 OR 5.5 < Prev-TGPA < 8.0	Normal in Semester II to VIII
CGPA ≥ 8.0 AND Prev-TGPA ≥ 8.0	Normal in Semester II and III, Enhanced in Semester IV to VIII

3.6 PROJECT

A. Students can choose to undertake an independent study/research experience/industry project (denoted 'ISP' in the course table) worth 6 credits in their 7th semester, followed by either an ISP for 6 credits or a research/industry project worth 12 credits in their 8th semester. Alternatively, students can choose to earn credits for one or more of these components from courses. The choice of ISP/project/electives must satisfy the following criteria:

i) The topics can be broadly in applications of Math or EECS, possibly advised by faculty in other departments.

ii) Each ISP/Project needs a faculty advisor from the institute, even if the ISP/Project is done outside. It is deemed to be done outside the Institute if it involves visiting an organization outside the Institute for more than 30 days in the semester.

iii) Students who have not opted for ISP-I are eligible for the 12 -credit Project in semester 8, provided they have a CGPA of 7.0 or above at the end of Sem 6.

iv) Students who have opted for ISP-I are eligible for ISP-II provided they do not have a C grade or lower in ISP-I.

v) Students who have opted for ISP-I are eligible for the 12-credit Project in semester 8 provided they do not have a B grade or lower in ISP-I.

vi) For ISP/Project outside the Institute:

- At most *one* of ISP-I, ISP-II, or Project can be done outside the institute (academia or industry).
- Students and outside organizations must be aware that the ISP/Project is **not** an internship, but an industry-relevant research-oriented project and will be evaluated as such.
- Students doing ISP-I in Sem 7 outside must satisfy the following conditions:
  - Must have a CGPA of at least 7.0 up to and including Sem 5.
  - Must have completed at least 3 of the 6 credits needed for Sem 7. The remaining can be completed in Sem 8. More precisely, the student should have completed 104+3=107 credits before Sem 7. Here 104 is the total minimum normal credit load in Sems 1-6.
  - Must have completed at least 18 soft-core credits before Sem 7.
- Students doing ISP-II / Project in Semester 8 outside, must have completed all other credit requirements earlier.

vii) Students who choose to do an ISP/Project component must obtain the consent of a faculty member who is willing to act as a Project Advisor. If the student chooses to do a project, the Project Advisor becomes the student's Faculty Advisor from that point.

viii) For applying internship/ project outside the Institute refer the procedure outlined in Chapter – 5, section -5.12.

B. Minimum Project Pass Grade: The minimum pass grade is D. Should there be a need for extension of the project, prior approval from the Dean needs to be obtained before the end of the 8th semester. In such cases, an application forwarded by the project advisor and the subject coordinator is to be submitted. The student must then register for the summer term and the maximum grade that can be obtained for project will be a B grade.

C. Internship to be undertaken in a laboratory/institute outside the institute in connection with the project, has to be proposed by the primary project advisor at IISc in the form of an application to the Dean with details of the work to be carried out by the student. A period not exceeding one semester may be permitted based on the application. A specific

recommendation by the primary project advisor at IISc has to be made. No exemptions will be given for compulsory courses during the period of absence. Project credits will have to be registered for that semester before leaving for internship.

D. Process Overview/ Logistics:

- The PCC will gather ISP/Project proposals from faculty and share them with the students.
- Students must approach a faculty member to fix an advisor and select a project topic. This can be done either from the list of proposals shared by the PCC or by choosing a topic independently.
- After selecting an advisor and project topic, students are required to fill in the ISP/Project Form and have it signed by the advisor. This completed form must be submitted to the UG Office for processing.
- Students must register for the ISP/Project on SAP at the beginning of the semester.

E. Evaluation:

- Students must submit a midterm report that outlines their progress on the project.
- Students must submit a final report and present their work to a committee, which will include their Advisor and the PCC coordinators.
- The final grade will be based on evaluations from the Advisor (70% weightage) and the Committee (30% weightage).

3.7 CLASSIFICATION OF AWARDS

Successful completion of the course can carry any one of the following awards: First Class with Distinction and First Class. The CGPA requirements for each award are given below:

Table 3.12: Classification of Awards

CGPA	Award
8.5 and above	First Class with Distinction
6.0 to 8.4	First Class

3.8 MEDALS

A list of medals awarded in the Four-Year Bachelor of Technology (Mathematics and Computing) programme is given below.

Table 3.13: Medals

Discipline	Name of the Medal
B.Tech (Mathematics & Computing)	Prof. M N Murty Medal

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CHAPTER 4

MASTER OF TECHNOLOGY (MATHEMATICS AND COMPUTING)

4.1 BASIC STRUCTURE

A. Students have the option to continue for their 5th year to obtain an M Tech degree in Mathematics and Computing. To be eligible to exercise this option, students must:

- have completed all the requirements of the B Tech Mathematics and Computing degree at the end of their 8th semester; and
- have a CGPA of 7.0 or more at the end of their 8th semester.

B. To obtain an M Tech degree, students need to complete 32 credits with the following breakup:

- 13 credits of courses in the 9th and 10th semesters.
- A project of 19 credits in the 9th and 10th semesters.

Project will be evaluated in both semesters. Registration for the project, however, will happen at the start of the 10th semester.

C. Students are required to complete a minimum of **10 credits** from the **Mathematics Soft Core Pool** and **10 credits** from the **Computing Soft Core Pool** over the entire **B.Tech / M.Tech** programme (10 semesters).

Table 4.1: Summary of Credit requirements

Course Category	Soft Core		Project	Elective	Total
	Math	Computing			
Minimum Credit Requirement	8		19	0-5*	32
	4	4			

Note: *Any excess credits from the Soft Core pool during masters will be counted towards elective credits.

4.2 SEMESTER WISE COURSE STRUCTURE

Table 4.2: Course Structure for Semester IX

SEMESTER IX	
Course/Course Type	**Credits**
Soft core / elective	**0-16**
Maximum Load	**16**

Table 4.3: Course Structure for Semester X

SEMESTER X	
Course/Course Type	**Credits**
Soft core / elective	**0-9**
UMC 501 Project	**19**
Maximum Load	**27**

4.3 PROJECT

MTech students must do a 19-credit project spanning their 9th and 10th semesters.

Projects can be broadly in the area of Mathematics and EECS (typically the areas covered by the CDS/CPS/CSA/ECE/EE/ESE/Math departments). Advisors can be in any department of the Institute, if the project topic is broadly in the Math/EECS areas.
Students must work on their projects with their advisors in the Institute. In cases where the project work requires the student to spend time in an outside academic/industry organisation with which the advisor collaborates, the student may spend up to a maximum of three months in the outside organisation. This must be based on a specific recommendation by the advisor and permission of the Dean.

i) Process Overview/ Logistics:

Students need to do the following:

- Identify a faculty member of the Institute who is willing to act as their Project Advisor.
- Fill out the MTech Project Form in consultation with their Project Advisor and get it signed by them.
- Submit the signed forms to the UG Office before the closing of registrations for the 9th semester.
- Register for the MTech Project on SAP in the beginning of their 10th semester.

ii) Evaluation:
Evaluation will be done by a committee which includes the Advisor and PCC representatives, on the basis of:

- Mid-Term report and/or presentation at the end of the 9th semester. This component will carry 30% weightage.
- Final report and presentation at the end of the 10th semester. This component will carry 70% weightage.

iii) Extension of Projects: If there is a need for an extension of the project, prior approval from Dean UG must be obtained on or before April 15 of the Academic Year. In such cases, an application forwarded by the project advisor and the subject coordinator is to be submitted. Then, the student must register for the summer term, and the best grade that can be obtained will be a 'B' grade.

4.4 CREDIT CARRYOVER

4.4.1 A maximum of 12 credits worth of courses fulfilled over and above the requirements of the B Tech program, can be considered towards fulfilment of the 13 course credits in Semesters 9 and 10.

Note:

1. Excess Credit in soft core pool (Math or Computing) can be carried forward to Master's for fulfilling soft core pool requirement. Remaining credits in the respective soft core pool needs to be completed during Master's programme.
2. Excess credit in elective or any other pool can be carried forward to Master's for fulfilling the elective requirement. Remaining credits in the elective pool needs to be completed during Master's programme.

4.4.2 Some Possible scenarios are explained below:

Credits completed in B.Tech						
Scenario	Math soft core pool	Computing soft core	Total Soft core	Elective	Total credits	Remarks
1	12	12	24	32	128	Soft core requirement completed. Student needs to complete 13 credits from any pool.
2	6	19	25	35	132	Student needs to complete 4 credits in math soft core pool and 5 credits from any pool.
3	19	6	25	35	132	Student needs to complete 4 credits in computing soft core pool and 5 credits from any pool.
4	15	15	30	34	136	Student needs to complete 5 credits from any pool.
5	15	15	30	39	141	Student needs to complete minimum 1 credit from any pool.
6	6	23	29	40	141	Student needs to complete 4 credits from Math soft core pool.

4.5 CLASSIFICATION OF AWARD

Table 4.4: Classification of Award

CGPA	**Award**
8.5 and above	First Class with Distinction

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CHAPTER 5

SLCM, COURSE REGISTRATION, GRADING SYSTEM, CONTINUATION, CANCELLATION, REINSTATEMENT OF REGISTRATION AND MEDAL NORMS

5.1 STUDENT LIFE CYCLE MANAGEMENT (SLCM) USER MANUAL – The user manual explaining SOP for various activities like Course registration, Course dropping, leave, internship etc. is available at DIGITS website

digits.iisc.ac.in

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SAP S/4 HANA

⇩

SAP User manuals, Training materials and FAQs

⇩

Login with IISc E-mail ID

⇩

SLCM for Academics

⇩

User manual – For UG Students

5.2 COURSE REGISTRATION

i) Course registration should be done on the SAP portal within the prescribed dates.

ii) Each student registers for a set of courses in the 1st three semesters under the guidance of the Dean and the Associate Deans. From the 4th semester onwards, the students register for courses under the guidance of the Faculty Advisor assigned to them.

5.3 LATE COURSE REGISTRATION

i) To ensure accountability while encouraging timely compliance, following late registration fee will be charged for registering courses after course registration deadline:

- First time: ₹2,500 per course
- Second time: ₹5,000 per course
- Third time: The student shall not be allowed to register for the course

ii) Additionally, late registration requests, if any, must be submitted to the UG Office within 15 days of the last date of course registration by raising AdSer request Requests (FORM - 2). The request raised beyond this period shall not be considered.

5.4 DROPPING OF COURSE

i) Students can drop the courses as per the timelines mentioned in the academic calendar in SAP. The options for dropping a course are as follows:
   - Course dropping without mention in the transcript.
   - Course dropping with mention in the transcript.

ii) Dropping the courses requires the approval of the course instructor and Faculty adviser/Dean UG. Dropping of a course is permitted only if the total number of credits does not fall below the minimum stipulated.

iii) It is advised that the student informs the course instructor if the course is being dropped.

iv) If a course is dropped during the 'course drop without mention' period (as mentioned in the Academic Calendar), the dropped course will not be listed in the final transcript. If a course is dropped during the 'course drop with mention' period, the dropped course will be included in the transcript with a 'W' (Withdrawn).

v) If a student fails to drop a course before the deadline for dropping with mention, an 'F' grade will be assigned for that course. Requests to drop the course after the stated deadline will not be accepted.

vi) A student may register again for the course that they dropped in an earlier term.

5.5 GRADING SYSTEM

i) The 10-point system of grading has been adopted in the Institute from the academic year 2016-2017.

ii) The instructor decides the grading pattern at the beginning of the semester. Only the grades are recorded in the transcripts. The letter grades and the corresponding grade points are provided in Table 5.1. All grades except the 'F' grade are passing grades.

iii) The Grade Point Average (GPA) is a measure of overall performance. The Term GPA (TGPA) is based on the grades of the current term, while the Cumulative GPA (CGPA) is based on the grades of all courses taken in the programme. The grade points accrued for each course is the product of the number of credits and the grade point value corresponding to the grade obtained in it.

iv) For instance, for a 3-credit course, if a student gets a B grade (which carries a grade point value of 7), then the accrual of the total grade points is equal to 3 x 7 = 21. The TGPA is obtained by adding the grade points accrued by all the courses taken in the current term divided by the total number of credits in the term. The CGPA is calculated similarly, the only difference being that one considers the grade points accrued for all the courses taken in the programme. The TGPA and CGPA are rounded off to the 1st decimal place.

Table 5.1: Grades and Grade Point Values

Grade	A+	A	B+	B	C	D	F
Grade Point Value	10	9	8	7	6	5	0

5.6 TERMINAL EXAMINATION

Terminal examinations are held during the last fortnight of each semester and during the last week of the Summer Term. The Timetable will be notified in advance. The graded answer scripts of the terminal examination will be made available to the students on a specified date within one week from the date of the terminal examination. Requests for changes in the grading of the terminal examination papers can be made only when the graded papers are shown to the students.

i) Attendance of the terminal examination is compulsory. If a student does not attend the examination, she/he shall be considered as having obtained zero marks in it and will get an F grade. Absence on medical grounds, certified by the Chief Medical Officer of the Institute, may be condoned, and the student may be permitted to take substitute examination(s) within a prescribed period (Refer Para. 5.5 (C)). **In such a case**, **students need to apply for medical leave on SLCM within seven days of recovery from an illness.** At the time of applying for medical leave on the SAP portal, supporting documents (medical certificate) issued by the Health Centre must be uploaded on the portal.

5.7 HANDLING OF 'F' AND 'X' GRADES

A. 'F' Grade

- 'F' is a failing grade. The student should clear the 'F' grade course either by repeating the same course or by taking a substitute course (in case of an elective), in consultation with the Major discipline coordinators.
- Only one chance is provided to the student to clear the 'F' grade. If, upon repeating the course (or in the substitute course), the student gets an 'F' grade again, the studentship will be terminated.
- If the 'F' grade is obtained in a core course, the same course must be repeated. For an elective/softcore course, the substitute course can be any other elective/softcore course.
- Such repetition of courses is permitted only to clear 'F' grades. Students are not permitted to retake courses in which they have obtained any other grades.
- Until an 'F' grade is cleared, it will be used for the computation of the TGPA and the CGPA. Subsequently, it will be omitted from the TGPA computation of the term in which the 'F' grade is cleared, and the grade from the repeated or the substitute course will be replaced in the CGPA computation.
- If a student has completed all the minimum course credit requirements for the award of a degree and obtains an 'F' grade in any additional courses, the student is not required to clear such 'F' Grades.
- While registering for the courses students should give priority for repeating or substituting the F grade courses.

B. Make-Up Examinations

- Make-up examinations are conducted in the summer term of the academic year for the courses (those with 'U' course code) that have been offered in the same academic year. Make-up examinations will only be conducted for the theory courses.
- If the 'F' grade is obtained in a core course, it may be cleared either by taking a make-up examination in the same course in the summer term of the same academic year or by repeating the same course in a subsequent semester.

- If a student secures an F grade due to shortage of attendance they are not eligible to register for a make-up exam in the summer term.
- Students can register for maximum of 14 credits in the summer term.
- If a student clears an F grade by taking a make-up examination, the highest grade she/ he can get in that course is 'C'. A student who fails the make-up examination should repeat or substitute the course as applicable.
- If the student wishes to take up a make-up examination, course registration in the SAP portal is mandatory.
- A student who has credited a non-UG/departmental course either as electives or as part of the mandatory requirements towards their degree programme in the 7th or 8th semesters (final year) and has got 'F' grades in such courses may also be allowed to take makeup exam subjected to following conditions.
    - If the DCC (of the department in which the course is offered) recommends, the student will be permitted to clear the 'F' grade in the 7th or 8th Semester through a make-up exam.
    - Consideration for make-up exams will be given to only students with a maximum of two 'F' active grades. A maximum grade of 'D' will be allowed in the make-up exam in such instances.
    - If the student has more than two 'F' grades, this (make-up exams) will not be applicable.

- The above provision of make-up exams for students who have taken non-UG/departmental courses as electives is also applicable to the Master of Science Students.

C. 'X' Grade

- 'X' grades may be awarded to students who are unable to attend the final examination due to medical reasons. Students must submit a valid medical certificate attested by the Institute's Chief Medical Officer (CMO). In the absence of such certification, an 'F' grade shall be awarded.
- To award an 'X' grade, the course instructor must upload the medical certificate or leave memo issued by the CMO or the Academics Section at the time of grading the course in SAP. The course instructor must also provide written justification based on the submitted document. The 'X' grade must be cleared within a specified period after completion of the final assessment.
- Under normal circumstances, the course instructor should conduct the retest and update the grades in SAP within 15 days from the declaration of results. However, in unavoidable circumstances where the examination cannot be conducted within this period, **the final assessment shall be completed no later than June 30 of the same academic year for courses offered in both the August and January terms.**
- **'X' grades shall not be awarded for courses registered during the summer term, as these are intended as make-up courses for UG students.**
- If the examination is conducted within the permitted timeframe, the 'X' grade will be replaced with the appropriate grade earned. If not, the 'X' grade shall lapse and be converted to an 'F' grade, unless additional certified medical justification is provided.

5.8 SCRUTINY OF ANSWER SCRIPTS

A student is entitled to go through their corrected answer scripts with respect to the courses offered during the August-December term before 14th January of the next calendar year, and similarly for the courses offered during the January-April term, the student may go through their corrected answer script before 25th May. If a change in the grade is warranted because of the scrutiny by the student, it should be done by the course instructor and approved by the SCC/UGSCC in the SLCM within two weeks of the above-mentioned dates.

5.9 CANCELLATION OF REGISTRATION

Not fulfilling any of the criteria below will lead to cancellation of registration.

i) The student should not have obtained more than four F grades at any given time during the period of studentship. If a 5th F grade is obtained without clearing the four existing F grades, she/he shall leave the Institute.

ii) In the 1st term, the TGPA should not be below 4.5 and in subsequent terms, the CGPA should not go below 5.0.

iii) Students should not get an F grade in the repeated course or in the specified substitute course.

iv) Normally, students must complete the Bachelor of Science (Research) programme in eight semesters (i.e., 4 Years). Summer terms are not counted for this purpose. However, in special circumstances, a student may be permitted an extension to complete all requirements for the degree within a maximum of twelve semesters (i.e., 6 Years). If a student fails to meet this condition, he/she must leave the institute.

5.10 TIME SPAN FOR DEGREE

The minimum and the maximum time span for completing the degree award requirement for a programme is given below:

Table 5.2

Programme	Minimum/Normal Duration	Maximum Duration
Four-Year Bachelor of Science (Research)	4 Years	6 Years
Master of Science (In continuation of Bachelor of Science (Research) degree)	5 Years (4+1)	6 Years
Bachelor of Technology (Mathematics & Computing)	4 Years	6 Years
Master of Technology (M Tech) (In continuation of B Tech degree)	5 Years (4+1)	6 Years

Note:

- B.S. (Research) /B.Tech. students belonging to SC/ST categories could be given the option to either complete the programme in four years or choose a slow track where they could complete the course within five years and still be eligible for continuation for the MS/M.Tech. in the 6th year.
- For other students, if they fulfil the requirements of the Bachelor of Science (Research) Degree/BTech by 31st July of the academic year in which they complete four years, they will be eligible to continue for the Master of Science/Master of Technology in the 5th year.
- Master of Science/MTech degree must be completed within a maximum period of two years from the time of enrolling for the Master's degree.
- In exceptional circumstances, the Director may grant a further extension of one more year based on the recommendation of UGSCC.

5.11 REINSTATEMENT OF REGISTRATION

i) If the students' registration is cancelled from the programme, they may appeal for reinstatement of registration within seven days from the receipt of intimation of registration cancellation.

ii) The competent authorities for reinstatement of student registration is placed below:

Table 5.3

Cancellation of Registration	**Competent Authority for Reinstatement of Registration**
1st time	Dean UG
2nd time	Director; based on recommendation of Dean, UG
*3rd time onwards until the maximum tenure permitted@ for the programme.	Director; based on the recommendation of the UGSCC

*Reinstatement may be done by the Director on a case-to-case basis depending on the merit and the UGSCC recommendation.

@ In case students taking a break in studies due to medical/extraordinary circumstances, reinstatement beyond the maximum tenure to be decided by the Director on the recommendation of the UGSCC

5.12 PROCEDURE FOR APPLYING INTERNSHIP/ PROJECT OUTSIDE THE INSTITUTE

Students intending to pursue an Internship/ Project outside the Institute during summer term or regular semester must follow the procedure outlined below:

i) Students should submit the Internship Application Form (Form – 1) along with all the supporting documents by raising a service request in the AdSer Portal.

ii) Once the Internship request is approved by the Competent Authority, the UG Office will issue the necessary documents, such as the Bonafide Certificate and the NOC, through AdSer.

iii) Once selected for the internship, the student must apply for internship leave on the SAP portal by attaching the approved documents issued by the UG Office. The student must ensure that the internship leave request is approved before proceeding for the internship.

iv) **Internship Leave Cancellation** - If a student decides not to proceed with the internship after the internship leave has been approved in SAP, the student must submit an internship leave cancellation request in SAP.

5.13 NORMS FOR RECOMMENDING A STUDENT FOR THE MEDALS

i) Only students who have fulfilled all degree requirements by the end of the **8th semester** are eligible for medal consideration.

ii) A minimum of **five eligible candidates** is required within a major discipline for the medal to be awarded. If fewer than five candidates meet the criteria, they may be considered **along with the next graduating batch** in the following year.

iii) In exceptional cases where fewer than five students are eligible, and a student has achieved a **CGPA of 9.5 or above**, the **Dean may recommend** the candidate for consideration by the Medal Committee, accompanied by a detailed justification.

iv) The recommended candidate must meet the following criteria:

a) a CGPA ≥ 8.5.

b) The **highest CGPA** among all eligible candidates

c) secured a minimum of an 'A' grade in the project work.

v) Only **one candidate** may be recommended for each medal. **Medals cannot be shared** between two students. In the event of a **tie in CGPA**, the following criteria may be used to determine the final nominee:

- Number of **'A+' grades**
- Number of **'A' grades**
- **Publications** or other academic achievements during the course of the programme.

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CHAPTER 6

FEE STRUCTURE AND OTHER CHARGES

6.1 BACHELOR OF SCIENCE (RESEARCH) & MASTER OF SCIENCE

Tuition and Other Annual Fees

Table 6.1

Particulars		**General/OBC/EWS (in ₹/INR)**	**SC/ST/PwD (in ₹/INR)**
Tuition Fee		10,000	Fully waived
Gymkhana Fee		1,800	1,800
Other Academic Fees		3,700	3,700
Students Emergency Fund		300	300
TOTAL		15,800	5,800
INSTALMENT PAYMENT	Instalment I	35%	
	Instalment II	35%	
	Instalment III	30%	

Note: For BSc (Research) students, instalment process is applicable from 2nd year onwards.

6.2 BACHELOR OF TECHNOLOGY (MATHEMATICS AND COMPUTING) & MASTER OF TECHNOLOGY

Tuition and Other Annual Fees

Table 6.2

Particulars		**Gen/OBC/EWS Category (in ₹/INR)**	**SC/ST/PwD Category (in ₹/INR)**
Tuition Fee		2,00,000	Fully Waived
Gymkhana Fee		1,800	1,800
Other Academic Fees		3,700	3,700
Students Emergency Fund		300	300
TOTAL		2,05,800	5,800
INSTALMENT PAYMENT	Instalment I	35%	
	Instalment II	35%	
	Instalment III	30%	

6.3 DUE DATES

Table 6.3

For students who joined in August	
Period	**Due Date**
I Instalment (August – October)	16th August
II Instalment (November – December)	15th November
III Instalment (January – July)	16th January

NOTE:

1. *Students who are in receipt of scholarship/fellowships the I, II, III instalment fees will be deducted from their scholarship/fellowship payable in the month of August, November and January, respectively.*

2. *Students who are not in receipt of scholarship/fellowship and those who are under Direct Beneficiary Transfer (DBT) scheme have to pay the fees as per the due dates given in the Table above. However, if the due date falls on a holiday, fees must be paid on the next working day (late fee will not be levied). Those students who do not pay the fees by the due dates, a fine of ₹ 20/- per week will be levied.*

6.4 REFUNDABLE DEPOSITS

Table 6.4

Deposits	Amount (in ₹/INR)
Hostel	20,000
Hostel (for Married apartment)	20,000
Statutory	7,500
Library	7,500

- The deposits are towards covering liabilities such as:
  - **i)** Damage of apparatus or other property
  - **ii)** Wastage of materials
  - **iii)** Fines
  - **iv)** Hostel and dining hall dues
  - **v)** Loss of books and other dues
- A request for a refund of Statutory and library deposits is to be submitted to the F & A at the time of leaving the Institute. Students should submit the request through the chair of the department.
- Concessions: Students belonging to SC and ST communities are exempted from the tuition fee only.

6.5 PENALTIES

- If a student fails to pay tuition and other fees by the due date, any one or more of the following penalties will be levied:
  a) Overdue charges of Rs. 20/- per week or part thereof
  b) Stoppage of scholarship and/or loss of attendance for the period of non-payment.
  c) Withdrawal of permission to take the examinations or to continue research and cancellation of registration.
- If the last date of payment is a holiday, the fees can be paid without penalty on the next working day.

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CHAPTER 7

SCHOLARSHIPS/FELLOWSHIPS AND FINANCIAL ASSISTANCE

The details of scholarships and fellowships available to the UG programme students are as follows.

7.1 DETAILS OF SCHOLARSHIPS/FELLOWSHIPS

For Four - Year Bachelor of Science (Research) programme:

Table 7.1

Scholarship/Fellowship Name	Details
KVPY (Up to Batch 2022)	**For 1st to 3rd year** Monthly Scholarship - Rs. 5,000 Summer project Grant per annum- Rs. 20,000 **For 4th and 5th year** Monthly Scholarship - Rs. 7,000 Summer project Grant per annum - Rs. 28,000 (For other details, refer to the official website: https://www.online-inspire.gov.in/)
INSPIRE (SHE)	Monthly Scholarship - Rs. 5000 Mentorship Grant per annum - Rs. 20,000 * Summer project must be carried out outside the parent institution (IISc) for availing the Mentorship grant. (For other details, refer to the official website: https://www.online-inspire.gov.in/)
IISc Promotional Scheme (IIScP) (Up to Batch 2025)	Monthly Scholarship - Rs. 5000 1st to 4th year 5th year for students continuing for Masters

In addition to the scholarships mentioned above, below are some private fellowships for UG Students.

Table 7.2

Private Scholarship/Fellowship Name	Programme
Dr. Priyadarshini Panda UG Fellowship	Four - Year Bachelor of Science (Research)
IISC- Class of 1998 ME(Int) Fellowship	
IISc-AANA Midwest Chapter Fellowship for Women in Science	
Mallika Fellowship for Women Students	
Pratibodh Foundation	
Prof. J. Nagaraju Memorial Fellowship for Women	
Smt. Jayalakshmi Late Sri K.T. Venkataramchar Women Fellowship	

Deep Asher Fellowship	Four – Year B. Tech (Mathematics & Computing)
Dibakar Das Memorial Fellowship	
Dr. Kolar and Mrs. Girija Kodandapani Scholarships	
IITIAM B.Tech Fellowship	
Jay Pullur Memorial B.Tech Fellowship	
Kotak UG B.Tech Fellowship	
Kunal Roy and Neelam Roy B.Tech. Fellowships	
Square Point Foundation Fellowships	
Subodh Arati Chakraborty Endowed Fellowship	
Synchronous Technologies Student Support Programme	
Late Hallimysore Hirannaiah & Late Subbalakshamma Fellowships	Four - Year Bachelor of Science (Research) and Four - Year B. Tech (Mathematics & Computing)
Ms Sumana Memorial Women UG Fellowship	
IISc 1975 BE EECS Batch Fellowships	Four - Year Bachelor of Science (Research) / Four - Year B. Tech (Mathematics & Computing)
Chamarahalli Nagappa Ramachandra and Kamala Iyer Fellowship	Master of Science

For more details regarding private fellowships, please refer to the Fellowships section in the ODAA website (https://odaa.iisc.ac.in/fellowships/)

7.2 ASSIGNMENT OF SCHOLARSHIP/ FELLOWSHIP

A. Initially, for 1st year students, a Scholarship/fellowship will be assigned by the UG Office based on eligibility.

B. The scholarship for the students admitted under 'provision' status will be processed only after admission is confirmed. Hence, the students must upload the required certificates/documents online in the Applicant's Interface and produce them at the UG Office to regularise admission on or before 31st October of the admission year.

7.3 PAYMENT OF SCHOLARSHIP/FELLOWSHIP

A. The students assigned with KVPY or INSPIRE (SHE) will get the scholarship payment directly credited to their bank account by the Department of Science and Technology (DST) in Direct Beneficiary Transfer (DBT) Mode, subjected to fulfilling renewal of scholarship criteria. To renew the scholarship, students should follow the instructions given by the scholarship agency.

B. The students who are assigned with the IIScP Scheme or other private fellowships/scholarships will have to raise scholarship payment requests for each month from the 6th to 15th. For more details refer to the SAP SLCM UG Student Manual.

C. If a student undertakes project work/Internship outside the Institute during these periods, payment will be made on production of a certificate of attendance and satisfactory progress in the training along with the declaration that they have not received any other emoluments during any part of this period. If the student has received any emolument during the project work/ Internship, no scholarship will be paid.

7.4 RENEWAL OF SCHOLARSHIP/FELLOWSHIP

A. The renewal of the scholarship/Fellowship is subject to the following eligibility criteria as on July 31st

Table 7.3

Scholarship/Fellowship Name	Eligibility criteria for renewal
KVPY	i) No Active 'F' or 'X' grade. ii) Previous year GPA >=6. iii) For SC/ST category students, Previous year GPA >=5. For more details, follow the instructions provided on the fellowship agency website.
INSPIRE (SHE)	i) No Active 'F' or 'X' grade. ii) Previous year GPA >=7. For more details, follow the instructions provided on the fellowship agency website.
IIScP Scheme or other private fellowships/scholarships	i) No Active 'F' or 'X' grade. ii) CGPA >=6.

B. If the student has an active 'X' grade(s), his/her scholarship renewal will be on hold until it becomes any other valid grade than 'F' within the stipulated time. If the grade is changed into 'F', then he/she is not eligible for scholarship renewal.

C. KVPY Scholarship: The students are directed to follow the renewal procedures as mentioned in the guidelines provided on the official website until the completion of the course.

D. INSPIRE (SHE): The students who are recommended through the Institute mode will be contacted by the UG Office for a renewal process and submission of summer project for availing the mentorship grant. To avail the mentorship grant, the scholars are expected to do project work under a Research Supervisor (Mentor) during summer vacation period, in any recognised Universities or Institutes or Research Laboratories/ Centres of their choice outside their parent institutions. The students are advised to visit the official website for more details/guidelines and to download prescribed format for the submission of the summer project.

E. IIScP Scheme or other private scholarship/fellowship: The students need to raise the renewal of scholarship/fellowship request via SAP for each academic year from the 2nd year onwards, preferably during the 1st week of August, subject to fulfilling the eligibility criteria mentioned above.

7.5 ATTENDING CONFERENCES

7.5.1 ELIGIBILITY

Students in the 4th year of the Bachelor's programme or the 5th year of the Master's programme are eligible to apply for partial financial support to attend and present papers at international conferences, subject to the following conditions:

- CGPA should be > =7.0
- The student must be the first author of the paper, and your research Mentor/Advisor/Guide must be from IISc.
- A specific recommendation letter from the Institute research advisor/mentor/guide must be provided.
- For Conferences for students in their final semester (8th or 10th) must take place **no later than April 30th**.

7.5.2 PROCEDURE TO APPLY FOR NO OBJECTION CERTIFICATE AND/OR FINANCIAL ASSISTANCE

- Students planning to attend a conference must submit an AdSer request at least 21 days in advance using **Form – 3** (Refer form section). Form 3 may be used for the request of No Objection Certificate (NOC), Financial Assistance (through GARP or/and ODAA), or both.
- The status of the permission request will be updated by the UG Office on the AdSer.
- Once your request is approved by the Competent Authority, the UG Office will issue the necessary documents, such as the Bonafide Certificate and the NOC, through AdSer.
- Then the student must apply for study leave on the SAP portal by attaching the approval documents issued by the UG Office. The student must ensure that the study leave request is approved before departing for the conference.

7.5.3 OVERVIEW OF FINANCIAL ASSISTANCE

A student can avail the travel grant from GARP and ODAA only once, respectively, within the program duration.

A. GARP Fund:

- Travel support through the GARP is subject to the availability of funds.
- Upon approval by the competent authority, GARP provides financial assistance of up to Rs. 25000. Students may avail up to **80% of the sanctioned amount** as an advance.
- GARP may be utilised for travel, hotel stay, conference registration fee and Visa fee.
- The students must book their travel ticket through the Government-authorised agencies, namely Ashoka Travels/ Balmer Lawrie/ IRCTC, only.
- For availing the Travelling Advance(TA), the student must apply 15 days before travel by submitting the TA Advance Request Form (link for the form **https://iisc.ac.in/wp-content/uploads/2024/07/TA_Approval-And-AdvanceForm_Bilingual.pdf**) provided.

B. ODAA TRAVEL GRANT

- Travel support through the ODAA grant is subject to the availability of funds.
- Upon approval by the competent authority, ODAA will provide information regarding the grant details and procedures to be followed via email.
- The ODAA travel grant can be used only for conference registration, visa fees, and round-trip economy travel (flight/train/bus), up to the approved maximum limit.
- Authorised agencies for booking travel are: IRCTC, Ashok Tours & Travels, and Balmer Lawrie.
- TA advance is not allowed through the ODAA Travel grant. Travel support will only be provided on a reimbursement basis.

C. Settlement of the TA Claim:

- After attending the conference, students must settle the TA bill by submitting all the supporting documents like the checklist for TA Claim, self-declaration, travel tickets, boarding passes, bills, etc. (link for TA Bill, checklist, self-declaration **https://iisc.ac.in/useful-forms/#ffs-tabbed-16)**

Note: The student must submit the TA Bill within the prescribed timeline (**30 days from the return journey**).

7.5.4 LEAVE CANCELLATION AND REFUND OF GRANT

If a student fails to attend the conference for any reason after the UG office has issued the NOC, they must apply for leave cancellation via the SAP Portal and return the TA advance availed if any within 10 days from the date of leave approved.

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CHAPTER 8

ATTENDANCE AND LEAVE RULES

8.1 ATTENDANCE

i) Students are required to attend lectures and other academic activities. Attendance in all classes (lectures, tutorials, laboratories, etc.) must be at least 80% of the total number of classes. Students with less than 80% attendance on a course at the time of the mid-term examination will not be allowed to take the examination. A student will be debarred from appearing in the terminal examination of a course if her/his attendance in the course for the semester falls below 80%. A shortage of attendance may be condoned by the Dean only in exceptional circumstances.

ii) Condonation of attendance: The 80% mandatory attendance may be condoned for medical issues, in which case, proper supporting documents (medical certificate issued by the CMO, Health Centre, IISc) need to be furnished at the time of applying for medical leave of absence on the SAP. In such instances, the attendance requirement will be condoned for the days of medical leave.

iii) **Application for medical leave of absence must be made on the SLCM portal within seven days of recovery from an illness.** At the time of applying for medical leave on the SAP portal, supporting documents (medical certificate) issued by the Health Centre must be uploaded on the portal

8.2 LEAVE RULES

Applications for leave of absence are to be made through the SAP Portal. A student is eligible for the following leaves:

i) **Leave on personal grounds**: 30 days a year. Leave of absence on personal grounds will not be condoned for attendance purposes.

ii) **Leave on medical grounds**: Up to 30 days a year with a scholarship for extended sickness normally requiring hospitalization. Medical Leave can be availed for any duration (maximum 30 days). A Medical Certificate and a subsequent Fitness Certificate from the CMO of the Institute are required for resumption of studies.

iii) Women students are permitted to avail maternity leave as per the prevailing GoI regulations - currently 26 weeks per child for a maximum of 2 children.

iv) A combination of different types of leave is normally not permitted.

v) Absence for a period not exceeding two weeks in a semester due to unavoidable reasons for which prior application could not be made may be condoned by the Dean of Undergraduate Studies provided she/he is satisfied with the explanation.

vi) No carryover of leave is permitted.

vii) With regard to leave, the year is reckoned from the date of commencement of the 1st term, irrespective of the date of joining.

viii) Leaves availed more than the permissible limit will be treated as leave without scholarship.

ix) All students are entitled to take leave for the full summer term. Students are not required to apply for leave during term break (Summer Term). However, permission needs to be sought in case of attending an internship during this period.

x) **Students taking up an Internship outside the Institute should apply for Internship leave for the entire duration on SAP.**

xi) Students permitted to attend approved conferences may be considered on duty. However, students are required to apply for "Study leave / Travel" on SAP. Prior permission on SAP should be sought before any travel.

xii) Cancellation of the approved leaves (in case of a change of plan) may be sought through SAP mentioning reason for cancellation.

8.3 BREAK IN STUDIES

i) Students may be permitted a break in studies only on medical grounds for a maximum period of one year. Students should apply on SAP as soon as the problem is presented for consideration by the UGSCC. Break in studies in other pressing cases may also be granted under exceptional circumstances with the approval of the Director following a favourable recommendation of UGSCC.

ii) The request must be accompanied by a certificate from the Chief Medical Officer (CMO) of the Institute. It should be forwarded through the Subject Coordinator/PCC chair and Dean UG.

iii) Resumption of studies requires a fitness certificate from the CMO of the Institute.

iv) For Break in studies on medical grounds, scholarship will be paid for a maximum period of one month and the rest of the leave period will be without any scholarship.

v) To maintain the studentship status, the student should pay tuition and all other fees even during the break period.

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CHAPTER 9

DISCONTINUATION OF STUDIES

9.1 Students who wish to discontinue their studies due to personal reasons, or who secure a job opportunity must initiate a request on SAP attaching a request letter justifying the reason for discontinuation recommended by subject coordinator/PCC Chair and Dean, UG before leaving the Institute.

9.2 Students must apply for No Dues through the SAP portal and initiate discontinuation request on SAP once the No Dues process is completed from all the respective departments/units/sections.

9.3 A request for a refund of statutory deposits should be made with the Finance and Accounts section.

9.4 After 15 days from leaving the Institute, the Finance and Accounts may be contacted for the refund status on telephone no: 080-22932570.

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CHAPTER 10

STUDENTS' ASSISTANCE PROGRAMME

10.1 STUDENTS' AID FUND

i) Each student shall contribute at least Rs. 50 per annum towards the Students' Aid Fund. Donations are also received from other sources.

ii) The Fund is administered by a committee constituted by the Director. This Committee prescribes operational rules for sanctioning assistance from time to time.

iii) Assistance in the form of loans from the fund is available to poor students to meet:
   - tuition fees
   - purchase of books, instruments and stationery necessary for the course or research programme
   - other expenses connected with their work and for their maintenance at the Institute as may be approved by the Committee.
   - hostel, dining hall, medical expenses, etc.

iv) No payment shall be made as scholarships or prizes to students from this fund.

v) This assistance in the form of loans will be reimbursed for expenditure incurred. The amount will be recovered in equal instalments. The number of instalments will be decided at the time of sanctioning the loan.

vi) Requests for assistance should be made to the Academic Section in the prescribed form.

vii) Financial Assistance for medical care: Students can get limited assistance to meet the cost of expenditure incurred in the case of hospitalisation from the Students' Medical Care Fund, formed out of contributions made by the students and a matching grant made by the Institute.

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CHAPTER 11

SAP, AdSER and SOLMAN

11.1 SAP (SYSTEMS APPLICATIONS AND PRODUCTS IN DATA PROCESSING)

i) Since 2021, IISc has implemented the digital platform SAP for almost all its academic and financial activities. Currently most of the academic and financial activities related to students are being (or already) migrated to SAP. What follows is a brief overview of SAP. Complete details of SAP, related to student activities, are available at **(https://digits.iisc.ac.in)**

ii) At the time of Registration, a student will be assigned an SAP number, and the students should familiarise themselves with the essential features of SAP. On being assigned an SAP number, the student should:

- Provide contact details – address, telephone number, email etc. – of a person to be contacted in case of emergency.
- Provide bank account details for scholarship related transactions.

iii) Application of leave, scholarship etc. are to be done on SAP.

iv) The student is responsible for paying tuition and other fees on time. In case the tuition fee is remitted from external funding agencies, it is the responsibility of the student to ensure that tuition and other fees are deposited on time. A fine may be imposed if the tuition fees are not paid on time.

v) The courses credited by a student and the grades obtained are maintained in SAP. It is advisable to check the accuracy of the data and contact the Academic section (through AdSeR portal) in case of any issues to avoid errors in the transcripts generated though SAP.

vi) SOP for various student-related activities in SLCM is available on the DIGITS website **(https://digits.iisc.ac.in)** under SAP S/4 HANA section.

11.2 ADSER (ADMINISTRATIVE SERVICE REQUEST)

i) AdSeR is a portal developed in-house primarily for students, faculty, and administrative employees to raise service requests pertaining to administrative functions.

ii) AdSeR is an online system that facilitates employees and students to raise service requests/queries to various administrative units. (Academic Section, Finance and Accounts, etc.) The service requests are automatically forwarded to the respective admin officer for review and resolution. The service request can also be delegated by the admin officer to any other employees dealing with the subject matter. The system tracks various stages of service requests and notifies the initiator and the admin officers about the progress.

iii) The URL to access AdSeR portal is**: https://adser.iisc.ac.in/**

iv) Users can login to the AdSeR portal using their IISc e-mail id and password. The portal access is restricted within the IISc network and VPN.

v) **Students should raise all queries and service requests on the AdSeR portal** and avoid making personal visits, e-mail communication and telephone calls to administrative units unless absolutely necessary.

vi) Requests for documents like NOC, course completion certificates, Bonafide certificates, scholarship certificates, thesis submission certificates, provisional degree certificates etc. should be made on AdSer portal.

11.3 SOLMAN (SAP Solution Manager)

i) Student can raise their complaints related to SAP processes using the URL: **solman.iisc.ac.in**

ii) Please refer to the user guide with the following link: **SAP Complaint and Service Request Management (Solution Manager) for IISc Users**

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CHAPTER 12

CONDUCT RULES AND CODE OF ETHICS

Discipline and code of ethics summarise the behavioural expectations from students at the Institute campus. The following document outlines the general norms, rules, and responsibilities of a student and failure to comply with the code of ethics may result in disciplinary action by the competent authority

12.1 PRIVILEGES AND RESPONSIBILITIES

i) All students are bound by the rules and regulations of the Institute.

ii) Full Time Students (including foreign nationals): During the tenure of their studentship, full-time students are eligible for the following:

- Residence in the Hostel, subject to availability.
- Membership of the Gymkhana.
- Participation in the activities of the Students' Council
- Participation in the Students' Assistance Programme
- Assistance from the Students' Aid Fund (SAF)
- Leave privileges
- Limited assistance from the Special Medical Care Scheme

iii) Foreign Nationals need prior permission from the Dean to go out of India on vacation/ leave.

iv) Sponsored and ERP Candidates are eligible for Gymkhana membership.

v) At the time of admission, each student must sign a statement accepting the code of ethics and conduct, and giving an undertaking that:

- The student will complete their studies in the Institute.
- If the student is forced to discontinue studies for any legitimate reasons, it will be done only with permission of the Deans of the Faculty.

12.2 WHAT CONSTITUTES MISCONDUCT?

The Institute believes in promoting an environment that ensures safety to all and promotes academic efficiency by enforcing behavioural standards. These standards include upholding of academic integrity and respecting all people, their rights and property etc., Prohibited conduct includes, but is not limited to the following:

12.2.1 Alcohol and Substance Abuse

i) Consumption, manufacture, sale, possession, and distribution of alcohol is prohibited on campus. Any student found guilty of behaving irresponsibly under the influence of alcohol will be penalized. A first-time offender will be charged a fine of Rs 10,000/- and asked to submit a written commitment that they will not repeat the offence. A second- time offender will be fined Rs 25,000/- and the offence will also be reflected in the student records. A third-time offence will attract a more severe penalty, including rustication from the Institute.

ii) Students found guilty of engaging in any unlawful possession, use, distribution or manufacture of controlled substances or illegal drugs, or their raw materials will be referred to the state police. Once found guilty the student will be suspended and could also be dismissed.

12.2.2 Ragging

All forms of ragging are prohibited. The Institute has a coherent and effective anti-ragging policy in place which is based on the UGC Regulation on Curbing the Menace of Ragging in Higher Educational Institutions, 2009 [hereinafter referred to as the 'UGC Regulations']. The UGC Regulations have been framed as per the directions issued by the Honourable Supreme Court of India to prevent and prohibit ragging in all Indian Educational Institutions and Colleges.

A. **Ragging constitutes one or more of the following acts:**

i) Any conduct by a student or students hurting, teasing, or being rude to others.

ii) Rowdy or undisciplined activities which causes or are likely to cause annoyance, hardship, physical or psychological harm or raise fear or apprehension thereof in any other student.

iii) Asking a student to do an act which makes them uncomfortable, and which has the effect of causing or generating a sense of shame, torment or embarrassment, affecting the physique or psyche of such a student,

iv) Any act that prevents, disrupts or disturbs the regular academic activity of any student.

v) Exploiting other students to complete academic tasks assigned to them,

vi) Any act of financial extortion or forceful expenditure burden put on a student by other students,

vii) Any act of physical abuse including sexual abuse, stripping, indulging in obscene, lewd acts including but not limited to gestures, causing bodily harm or any other danger to the health of a student,

viii) Any act or abuse either orally or in writing including by spoken words, emails, post, public insults which would also include deriving perverted pleasure, the vicarious or sadistic thrill from actively or passively participating in the discomfiture to any other student.

ix) Any act that affects the mental health and self-confidence of any other student with or without an intent to derive sadistic pleasure.

12.2.3 Anti-Ragging Committee

The Anti-Ragging Committee, as constituted by the Director and headed by students' affairs advisors, shall examine all complaints of anti-ragging and come up with recommendations based on the nature of the incident. The committee can have the Deans, Student Counsellors, Faculty Advisors, and the Chairperson of the concerned Department as its members as decided by the Competent Authority from time to time. The Committee, however, should have a diverse mix of membership in terms of levels and gender.

12.2.4 Anti-Ragging Squad

To assist students, the Institute has also constituted a body called the Anti-Ragging Squad, which consists of various members of the campus community. The Squad shall keep a tab on ragging incidents taking place in the community and undertake patrolling functions. Students may note that the Squad is active and alert at all times. It also makes surprise raids in hostels and other hotspots in the Institute. The Squad can also investigate incidents of ragging and make recommendations to the Anti-Ragging Committee.

12.2.5 Penalties in case of ragging

On receipt of any recommendation from the Anti-Ragging Squad or on receipt of any information concerning any reported incident of ragging, the Head of the Institution shall also immediately determine if a case under the criminal laws have been made out and if so, then either on his own or through a member of the anti-ragging committee authorised by him on his behalf proceed to file a First Information Report (FIR) within twenty four hours of receipt of such recommendation with the police or local authorities including those of abetment to ragging, criminal conspiracy to rag, unlawful assembly and other offences as enumerated in Para 12.9 and Para 12.11 of the Regulation.

The Institute shall also continue with its own enquiry initiated and any remedial action shall be initiated and completed immediately and no later than 7 days of reported occurrence of the incident of ragging. A student found guilty by the committee will attract one or more of the following penalties, as imposed by the Anti- Ragging Committee:

i) Suspension from attending classes and academic privileges;
ii) Withholding/withdrawing scholarship/fellowship and other benefits;
iii) Debarring from appearing in any test/examination or other evaluation processes;
iv) Withholding results;
v) Debarring from undertaking any collaborative work or attending national or international conferences/symposia/meeting to present their research work;
vi) Suspension/expulsion from the hostels and mess;
vii) Cancellation of admission;
viii) Expulsion from the institution and consequent debarring from admission to any other institution for a specified period;
ix) When the persons committing or abetting the act of ragging are not identified, the institute shall resort to collective punishment;
x) If need be, in view of the intensity of the act of ragging committed, a First Information Report (FIR) shall be filed by the Institute with the local police authorities.

The Anti-Ragging Committee of the Institute shall take an appropriate decision, including the imposition of punishment, depending on the facts and the nature and gravity of the incident. An Appeal against any of the orders of punishment enumerated above can be submitted to the Director of the Institute.

12.3 SEXUAL HARASSMENT

Students are expected to conduct themselves in a manner that provides a safe working environment for fellow students. Sexual harassment of any kind is unacceptable and will attract disciplinary action.

Students should note that sexual misconduct or harassment encompasses a range of behaviour, including but not limited to, sexual assault, unwanted physical contact, persistent unwelcome comments, sending e-mails, messages on social media or pictures that are insulting or degrading.

Sexual harassment amounts to a serious misconduct and will be dealt with as per the Indian Institute of Science Policy on Prevention and Prohibition of Sexual Harassment at Workplace, 2017 and the Indian Institute of Science Rules for Internal Committee, 2017. All cases will be referred to the 'Internal Committee Against Sexual Harassment' (ICASH) of IISc. ICASH will determine, based on the circumstances of each case, whether the action brought to its notice constitutes a violation of the sexual autonomy and dignity of the recipient of the action.

Further details can be obtained from the website **http://iisc.ac.in/icash/**

12.4 OTHER MISCONDUCTS

i) Students are expected to dress and to conduct themselves in a professional manner.

ii) Storing, possessing or using real or replica firearms or other weapons, explosives (including fireworks), ammunition, drugs, or toxic or otherwise dangerous materials on Institute premises.

iii) Stealing, misusing, destroying, defacing or damaging Institute property or property belonging to someone else.

iv) Any act of discrimination (physical or verbal conduct) based on an individual's gender, caste, race, religion or religious beliefs, skin colour, region, language, sexual orientation, marital or family status, physical or mental disability etc.

v) Unauthorised use of any Institute facilities, equipment, services or computers. Theft or abuse of the Institute computers and other electronic resources such as computer and electronic communications facilities, systems, and services which includes unauthorised entry, use, tampering of Institute property or facilities, the private residence of staff/professors, offices, classrooms, computers networks, and other restricted facilities.

vi) Making false accusations against any member of the Institute.

vii) Not producing the identity card issued by the Institute or refusing to produce it on demand by campus security.

viii) Physical assault, threats of violence, which includes any disruptive activity in a classroom or in an event sponsored by the Institute. Any conduct which has a negative impact or constitutes a nuisance on and off campus.

ix) Organising meetings and processions without permission from the Institute.

x) Accepting membership of religious or terrorist groups banned by the Institute/Government of India.

xi) Smoking on the campus of the Institute.

xii) Parking a vehicle in a no parking zone or an area earmarked for parking other types of vehicles.

xiii) Rash driving on campus may cause inconvenience to others.

xiv) Not disclosing a pre-existing health condition, either physical or psychological, to the Chief Medical Officer, which may cause hindrance to academic progress.

xv) Misbehaviour at the time of student body elections or during any activity of the Institute.

xvi) Engaging in disorderly, lewd, or indecent conduct, including, but not limited to, creating unreasonable noise; pushing and shoving; inciting or participating in a riot or group disruption at the Institute.

xvii) Altercations of any kind between students or student groups will be taken seriously as a violation of the code and will be dealt with accordingly.

xviii) Students encouraging, aiding, or conspiring in any prohibited conduct. And failing to comply with a disciplinary measure or disciplinary measures imposed under the procedures of this Code.

xix) If these acts are committed off-campus, the Institute will determine whether the Code will apply after considering the seriousness of the alleged offence, the risk of harm involved, whether the victim(s) are members of the campus community and/or whether the off-campus conduct is part of a series of actions, which occurred both on, and off- campus.

12.5 PRINT AND VISUAL MEDIA AND SOCIAL MEDIA CLAUSES

i) Students are expected not to interact, on behalf of the Institute, with media representatives or invite media people to the campus without the permission of the Institute authorities.

ii) Students are not permitted to either audio or video record lectures in classrooms, actions of other students, faculty, or staff without prior permission.

iii) Students are not permitted to provide audio and video clippings of any activity on campus to the media without prior permission.

iv) Students are expected to use social media carefully and responsibly. They cannot post derogatory comments about other individuals from the Institute on social media or indulge in any such related activities that could have negative ramifications on the reputation of the Institute.

12.6 STUDENT PARTICIPATION IN GOVERNANCE

Students are members of the Institute campus, and they have a substantial interest in the governance of the Institute. The Code, policies and the varied procedures laid down herein seek to encourage students to be involved in governance in both administrative and academic areas. Students must, at all junctures, be encouraged to put forth their views and advice, for informed decision making. Therefore, all students who are a part of the Institute and who are going to be enrolled in the Institute, are advised to uphold the policy, inform the Institute of any violations, and assist individually and collectively to improve the quality and effectiveness of this Code and policies.

12.7 THE DISCIPLINARY PROCESS

A complaint of misconduct can be made by any student, staff or faculty member of the Institute at the Department concerned, Security office, the Hostel office or the Dean's office.

An enquiry will be made by the concerned authority. All efforts will be made to address the issue. If the problem persists, the case may be referred to by the Students Affairs Committee.

The subsequent process will be as follows: A case sheet will be opened. The student(s) will be called for a hearing, and the alleged charges and circumstances will be documented. If the committee feels there is indeed an offence, the committee will make recommendations to the Dean of Science or Engineering, who are the disciplinary authorities. The recommendation will be reviewed by the Dean, who will recommend subsequent action.

The officer in charge of the academic section will issue the penalty.

12.8 PENALTIES

The recommendation can be, but will not be restricted to, one or more of the following actions, depending on the nature of the offence:

i) Warning- indicating that the action of the said student was in violation of the Code and any further acts of misconduct shall result in severe disciplinary action. The student may be required to tender a written apology.

ii) Community Service - for a specified period to be extended if needed. However, any future misconduct along with failure to comply with any conditions imposed may lead to severe disciplinary action, including suspension or expulsion.

iii) Restrictions - reprimanding and restricting access to various facilities on the campus for a specified period.

iv) Monetary Penalty - may also include suspension or forfeiting scholarship/fellowship for a specific period.

v) Withholding Grades – withholding the grade card or certificate for the courses studied or work carried out.

vi) Suspension - a student may be suspended for a specified period, which will entail prohibition from participating in student-related activities, classes, programmes etc. Additionally, the student will be forbidden to use various Institute facilities unless permission is obtained from the Competent Authority. Students may be suspended and dismissed, along with the following additional penalties.

vii) Expulsion - students may be expelled from the Institute permanently. The student is prohibited from entering the Institute premises or participating in any student-related activities and staying in campus residences etc.

viii) Ineligibility - to reapply for admission to the Institute for a period of three years.

ix) Repeat offenders will be given a higher penalty.

12.9 DISCIPLINARY AUTHORITIES

i) For imposing the penalties of 12.18 A and 12.18 B, the Students' Affairs Committee will be the Disciplinary Authority.

ii) For all other penalties, the Dean Science, Dean Engineering or Dean Undergraduate will be the Disciplinary authority for students from Science, Engineering or Undergraduate Programmes, respectively.

iii) The hostel office with the approval of the Chair, CoW may impose penalties related to certain cases of misconduct in the hostels and messes.

12.10 APPEAL

If the delinquent student is aggrieved by the imposition of any of the aforementioned penalties, they may appeal to the Director. The Director may decide on one of the following:

i) Accept the recommendation of the committee and impose the punishment as suggested by the Committee or modify and impose any of the punishments as stipulated in the Code corresponding to the gravity of the proved misconduct, or

ii) Refer the case back to the committee for reconsideration.

In any case, the Director's decision is final and binding in all cases where there is possible misconduct by a student.

12.11 IISC POLICY FOR ACADEMIC INTEGRITY

As a premier institution for advanced scientific and technological research and education, the Institute values academic integrity and is committed to fostering an intellectual and ethical environment. Academic Integrity encompasses honesty, responsibility and awareness of the ethical standards for the conduct of research and scholarship. The Institute believes that in all academic work, the ideas and contributions of others must be appropriately acknowledged. Academic integrity is essential for the success of the Institute and its research missions, and hence, violations of academic integrity constitute a serious offence.

Scope and Purpose

Academic Integrity, which forms an integral part of the Code, applies to all students at the Institute. Students are required to adhere to the said policy. The purpose of the Policy is two-fold:

i) To clarify the principles of academic integrity

ii) To provide examples of dishonest conduct and violations of academic integrity

Failure to uphold these principles of academic integrity threatens both the reputation of the Institute and the value of the degrees awarded to its students. Every member of the Institute community, therefore, bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

The principles of academic integrity require that a student:

i) Properly acknowledges and cites the use of the ideas, results, material or words of others, where 'others' includes both web sources and AI tools;

ii) Properly acknowledges all contributors to a given piece of work;

iii) Make sure that all work submitted is his or her own in a course;

iv) Produces academic work without the aid of impermissible materials or impermissible collaboration.

v) Obtains all data or results by ethical means and reports them accurately without suppressing any results inconsistent with his or her interpretation or conclusions;

vi) Respects the integrity of other students and their right to pursue educational goals without interference. This requires that a student neither facilitates academic dishonesty by others nor obstructs their academic progress.

Violations of this policy include, but are not limited to:

1. **Plagiarism**: It includes the use of material, ideas, figures, code or data as one's own, without appropriately acknowledging the original source. This may involve the submission of material, verbatim or paraphrased, that is authored by another person or entity or published earlier by oneself. Examples of plagiarism include:

   i) Reproducing, in whole or part, text/sentences from a report, book, thesis, publication or the internet, or AI tools.

   ii) Self-plagiarism which constitutes copying verbatim from one's own earlier published work (data, illustrations, figures, images) in a journal or conference proceedings without appropriate citations.

   iii) Taking material from class notes or incorporating material from the internet graphs, drawings, photographs, diagrams, tables, spreadsheets, computer programs, or other

non-textual material from other sources into one's class reports, presentations, manuscripts, research papers or thesis without proper attribution.

iv) Submitting a purchased or downloaded term paper or other materials to satisfy a course requirement.

v) Using AI tools to assist in course work in violation of policies specified by the Course, Department, Division, or Institute (in order of priority).

2. **Cheating:** It includes, but is not limited to:
   i) Copying during examinations, and copying homework, assignments, term papers, thesis, or manuscripts.
   ii) Allowing or facilitating copying or writing a report or taking an examination for someone else.
   iii) Using unauthorised material, copying, collaborating when not authorised and purchasing or borrowing papers or material from various sources.
   iv) Fabricating or falsifying (manipulating) data and reporting them in thesis and publications.
   v) Creating sources or citations that do not exist.
   vi) Altering previously evaluated data and resubmitting the work for re-evaluation.
   vii) Signing another student's name on an assignment, report, research paper, thesis, or attendance sheet.

3. **Guidelines for academic conduct are provided below to guard against negligence as well as deliberate dishonesty:**
   i) Use proper methodology for experiments and computational work. Any use of AI tools for tasks other than word processing (see below) must be disclosed in the Methods or Acknowledgements section, including details of precisely which tools, their usage, and the extent to which these tools were used. Accurately describe and compile data. *AI tools can be used in a responsible manner for research purposes with the approval of RS, with discretion and caution, and with due acknowledgement.*
   ii) Carefully record and save primary and secondary data such as original pictures, instrument data readouts, laboratory notebooks, and computer folders. There should be minimal digital manipulation of images/photos; the original version should be saved for later scrutiny if required, and the changes made should be clearly described.
   iii) Ensure robust reproducibility and statistical analysis of experiments and simulations. It is important to be truthful about the data and not to cherry pick data: omitting some data points to make an impressive figure.
   iv) Laboratory notes must be well maintained in bound notebooks with printed page numbers, which can be checked during publications or patents. The date should be indicated on each page.
   v) Write clearly in your own words. It is necessary to resist the temptation to "copy and paste" from the Internet or other sources for class assignments, manuscripts and thesis. AI tools may be used freely, without acknowledgement, for word-processing tasks such as improving grammar, punctuation, clarity, etc. However, see item (G) below.
   vi) Give due credit to previous reports, methods, computer programs, etc., with appropriate citations. Material taken from your own published work should also be cited.
   vii) Do not input sensitive, confidential, or restricted information into open generative AI tools.

12.12 CONFLICT OF INTEREST

A clash of personal or private interests with professional activities can lead to a potential conflict of interest, in diverse activities such as teaching, research and publication, and working in committees, funding and consultancy. It is necessary to protect actual professional independence, objectivity and commitment, and also to avoid any impropriety arising from conflicts of interest.

Conflict of interest is not restricted to personal financial gain; it extends to a large gamut of professional academic activities, including peer reviewing, serving on various committees, which may, for example, oversee funding or give recognition, as well as influence public policy.

To promote transparency and enhance credibility, potential conflicts of interest must be disclosed in writing to appropriate authorities, so that a considered decision can be made on a case-by-case basis.

12.13 INDIVIDUAL AND COLLECTIVE RESPONSIBILITY

The responsibility varies with the role one plays.

i. **Student roles:** Before submitting a thesis (BSc (Research) /MS, M. Tech (Res), or PhD) to the department, the student is responsible for checking the thesis for plagiarism using software that is available on the web. In addition, the student should undertake that the student is aware of the academic guidelines of the Institute, has checked the document for plagiarism, and that the thesis is an original work. A web-check does not necessarily rule out plagiarism. If a student observes or becomes aware of any violations of the academic integrity policy, such student is strongly encouraged to report the misconduct in a timely manner. Any student who uses AI tools must do so within the permitted framework. Further, the student is wholly responsible for the correctness of the content generated by such tools.

ii. **Faculty roles**: Faculty members should ensure that the students follow proper methods for experiments, computations, and theoretical developments, use of AI tools, record proper data and save them for future reference. In addition, they should review manuscripts and theses carefully. Faculty members are also responsible for ensuring personal compliance with the above broad issues related to academic integrity. Faculty members are expected to inform students at the Institute’s academic integrity policy within their specific courses to ensure minimal academic dishonesty, and to respond appropriately to violations of academic integrity. Course Instructors should clearly specify, at the beginning of the course, specific policies governing the use of AI tools for the course's sessional works and final works that will be assessed.

12.14 REPORTING AUTHORITY AND PENALTIES

i) It is recommended that the faculty bring any academic violations to the notice of the Department Chair or concerned Dean. All complaints lodged against students regarding breach of academic integrity and research misconduct against students shall be governed by the Indian Institute of Science (IISc) policy for handling Misconduct in Research.

ii) All cases of student-faculty conflict will be handled by the concerned Dean with assistance from the committee. Students may approach the committee or the Dean if they have a genuine problem.

iii) Upon receipt of reports of scientific misconduct, the Director may appoint a committee to investigate the matter and suggest appropriate measures on a case-by-case basis.

iv) A breach of academic integrity is a serious offence with long-lasting consequences for both the individual and the institute, and this can lead to various penalties. In the case of a student, the first violation of academic breach will lead to a warning and/or an 'F' grade in the course. A repeat offence, if deemed sufficiently serious, could lead to expulsion.

12.15 INTELLECTUAL PROPERTY

Intellectual Property or IP" refers to creation of mind and primarily encompasses inventions; literary and artistic works; designs; symbols and names used in commerce, method or process of manufacture; biological material; drawings, prototypes, integrated circuit, circuit layout or semiconductor chip layout or design; or scientific, technical or engineering information; computer software (in source and object format); improvement, modification or development of any of the foregoing; trade secret and Know-how

Indian Institute of Science (the "Institute"), through the Intellectual Property (IP) Policy and Guidelines has put in place a system that brings order to the process of protection of IP including inventions, and the utilisation of IP through processes of technology transfer and entrepreneurship. The complete details of the IP policy of the Institute are available at **https://iptel.iisc.ac.in/ip-policy/**

The IP Policy of the Institute is applicable to all Institute Personnel (including students), active, retired or alumni, associated or engaged with IISc and/or making Substantial Use of Institute Resources. "Institute resources" means any form of funds, facilities or resources, including equipment, consumables and human resources.

Students are not authorised to negotiate, discuss, or enter into any legal agreements, contracts, or binding commitments on behalf of IISc or in connection with their academic or extracurricular activities conducted under the institute's auspices.

Any violation of the IP policy by students is considered as misconduct and will be handled by the competent authority.

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CHAPTER 13
STUDENTS' GRIEVANCE REDRESSAL

Grievance means a formal complaint that includes any kind of dissatisfaction arising out of any guideline associated with the Institute that a student believes is unfair/discriminatory.

GUIDELINES FOR STUDENT'S GRIEVANCE REDRESSAL

The Students' Grievance Redressal system at the Indian Institute of Science (IISc), Bangalore, is established to address and resolve student complaints in a fair, transparent, and efficient manner. It ensures that students can raise concerns related to both academic and non- academic matters without fear of discrimination or unfair treatment.

The Indian Institute of Science (IISc) has different mechanisms to address student grievances, both academic and non-academic matters to ensure quick and accountable response to all student related concerns, thereby ensuring and creating an environment in which students can freely express their grievances without fear of discrimination or victimisation.

13.1 EXTENT AND APPLICABILITY

Students at the Institute during their tenure/registration period.

13.2 OBJECTIVES

i) To ensure that the views of aggrieved students are valued, and they are neither discriminated against nor victimised.
ii) To ensure a fair, impartial redressal of different issues faced by the students.
iii) To develop a responsive and accountable approach for maintaining a harmonious atmosphere in the IISc campus.
iv) To ensure that grievances are resolved promptly, objectively and with complete understanding and confidentiality.

13.3 TYPES OF GRIEVANCES

13.3.1 Academic

- Admissions
- Courses registration and other related matters
- Examination/Assessments/Evaluation
- Research related matter/issues.
- Issuance of various certificates which within the domain of Academic Section
- Placement & Internships
- Discontinuation/Termination.
- Revocation of registration

Process of handling

- An aggrieved student shall first submit his/her complaint to his/her Advisor/Research Supervisor. In case the matter is unresolved, she/he shall forward it to the DCC/Chair of the Department for appropriate action.

- In case the grievance is not resolved/satisfied by the resolution, he/she shall request the Deans of Faculty giving the reasons for his/her dissatisfaction.
- Deans of Faculty shall verify the facts and shall take necessary action to redress the grievance of the student.
- In case the aggrieved student is not satisfied with the decision of the Deans of Faculty, he/she can submit an appeal to the Director, within a period of 15 days from the date of receipt of decision of Deans of Faculty.

13.3.2 Non-Academic

- **Hostel Facilities – Complaints regarding amenities/provisions/ food services, safety and security inside the hostels, harassment (excluding complaints of sexual harassment) of any form inside the Hostel**

  First Point of Contact – Respective hostel wardens- Chair, Council of Wardens Escalation Point- SAC

- **DIGIT - Wi-Fi/Internet Connectivity, Computer facilities**.
  First Point of Contact - Office of Digits Escalation Point- SAC

- **Amenities - Utility stores, Drinking Water, Sanitation & Hygiene, Maintenance**
  First Point of Contact - Samadhan/CCMD Escalation Point- SAC

- **Dept wellness committee, Wellness centre, CMO, Wellness related**
  First Point of Contact - Assistant Registrar handling wellness centre Escalation Point- SAC

- **Finance & Accounts - Collection of fees, Scholarships Disbursement**
  First Point of Contact - Financial Controller,
  F&A Escalation Point- SAC

- **Other issues like ID cards, Safety and Security, Discipline, Misbehaviours**
  First Point of Contact - Assistant Registrar, Security Escalation Point- SAC

- **Physical health issues, Medical Facilities, emergency services, Mental health issues**
  First Point of Contact - CMO, Health Centre Escalation Point- SAC

- Complaints of sexual harassment may be made to the Internal Committee Against Sexual Harassment (ICASH). Details of the ICASH are available on the IISc website.

Process of handling:

- The Institute shall provide on its website all relevant information in respect of the SAC and the Ombudsperson for the purpose of appeals.
- The students can approach appropriate authority mentioned in para 5(ii) above. In case the aggrieved student is not satisfied with the resolution, the student can send the grievance through email to the SAC Chair.
- SAC may be approached if the students are not sure of approaching any authorities.
- The law of natural justice shall be observed and fair hearing to the grievant shall be given.
- SAC shall give their recommendations based on the examination of the grievance of the student to the concerned Dean.

13.3.3 Exclusions

The following complaints/grievances shall not be within the purview of SAC/Ombudsperson for consideration:

i) Decisions of the Court/Council/Senate and other related Academic Committees constituted by the Institute.
ii) Complaints involving policy matters in which the student has not been affected directly/ indirectly.
iii) Decisions regarding the award of fellowships, scholarships, fee concessions, medals and other related matters.
iv) Decisions regarding disciplinary matters/misconduct. All such matters relating to students/Institute members are dealt with as per the relevant conduct rules and hence outside the purview of student grievances.
v) Decisions regarding recruitment/selection in the Institute.
vi) Anonymous complaints.

13.3.4 Appellate Authority/Ombudsperson

13.3.4.1 Functions Of Ombudsperson

i) The Ombudsperson shall hear appeals from an aggrieved student, only after the student has availed of all other remedies provided under these Guidelines.
ii) All such appeals shall be routed through the Chair/Secretary, SAC.
iii) While issues of Academic matters may be referred to the Ombudsperson, such application shall only be entertained by the Ombudsperson in case of specific irregularity leading to student discrimination.
iv) The Ombudsperson may avail assistance of any person for hearing complaints/grievances.

13.3.4.2 Procedure For Redressal Of Grievances By Ombudsperson

i) Grievances not resolved by the SAC within the time period of thirty days may be referred to the Ombudsperson.

ii) The Ombudsperson shall, after giving reasonable opportunities of being heard to the parties concerned, on the conclusion of proceedings, pass such order, with reasons thereof, as may be deemed fit to redress the grievance and provide such relief as may be appropriate to the aggrieved student

iii) The Institute, as well as the aggrieved student, shall be provided with copies of the order under the signature of the Ombudsperson.

iv) The institution may comply with the recommendations of the Ombudsperson.

v) The Ombudsperson may recommend appropriate action against the complainant, where a complaint is found to be false or frivolous.

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CHAPTER 14

IMPORTANT COMMITTEES

14.1 UNDERGRADUATE SENATE CURRICULUM COMMITTEE (UGSCC)

A. The Undergraduate Senate Curriculum Committee (UGSCC) is one of the important standing committees of the institute which deals with the curriculum, examination, and course-related activities at IISc for UG Programme.

B. The UGSCC/SCC holds the authority to make decisions on the following matters:

- Academic Calendar
- Course Registration
- Course Dropping
- Examination Timetable
- Course-Instructor feedback
- Finalisation of Marks and Publishing of Results
- Termination of Deficient academic performers
- Granting an extension to complete the course work.
- To ensure that all programmes and courses meet acceptable standards.
- Academic Structure of different programmes.

14.2 UNDERGRADUATE PROGRAMMES BOARD OF STUDIES COMMITTEE (UG BoS)

The UG BoS Committee is to advise the UG programme about various academic aspects providing recommendations of new courses, revising the syllabus of any existing course(s), inclusion of new elective(s)/deletions of any elective(s), and addition or modification or deletion of any core course(s) on the merit of the case in addition to any other academic matter relevant to the UG programmes. The UG BoS will be for both the UG programmes Four-Year Bachelor of Science (Research) & B.Tech (Mathematics and Computing).

14.3 STUDENT AFFAIRS COMMITTEE (SAC)

The Student Affairs Committee (SAC) is the standing disciplinary committee of the institute. SAC is mandated to:

- Handle all students' complaints and grievances related to academic matters, availability of academic and research facilities, student-faculty relationships and other students' affairs.
- Enquire into the alleged case and recommend suitable disciplinary action.
- Act as 'mentoring cell' on curbing the menace of ragging.
- To review of students' code of ethics and conduct and make recommendations.

Members SAC

- Prof. M S Bobji (Chair & Advisor)
- Prof. P Thilagar (Member & Counselor)
- Prof. Annapoorni Rangarajan (Member & Counselor)
- Prof. Arpita Patra (Member & Counselor)
- Prof. Manish Jain (Member & Counselor)

- Prof. Vishwesha Guttal (Member & Counselor)
- Prof. Harish Seshadri (Member & Counselor)
- Prof. Digbijoy Nath (Member & Counselor)
- Mr. T Jayasurya (Cultural Secretary, GSAC)
- Mr. M. Senthil Kumar (Assistant Registrar, Academic Member Secretary)

14.4 THE SEXUAL HARASSMENT COMPLAINT COMMITTEE (SHCC)

i) Sexual harassment includes such unwelcome sexually determined behaviour (whether directly or by implication) as physical contact and advances, demand or request for sexual favours, sexually coloured remarks, any other unwelcome physical, verbal or non-verbal conduct of a sexual nature. It is discriminatory when the aggrieved woman has reasonable ground to believe that her objection would disadvantage her in connection with her employment, or when it creates a hostile working environment. In accordance with the Hon'ble Supreme Court's decision, a Sexual Harassment Complaint Committee (SHCC) was constituted in April 2003.

ii) The SHCC will provide equal opportunity for all women in IISc, without regard to age, to lodge complaints of any sexual harassment in the workplace. The affront to personal dignity that occurs as a result of sexual and other types of harassment constitutes an action unbecoming of a student/ staff member of the Institute and will attract appropriate disciplinary action. Complaints may be made verbally or in writing at any time.

iii) The Government of India (GoI) has enacted the Protection of Women from Sexual Harassment at Workplace (Prevention, Prohibition and Redressal) Act (the SH Act), 2013. For details, refer: http://shebox.wcd.gov.in (SHe-Box–Ministry of Women & Child Development) and https://www.rightsofemployees.com/2018/01/26/sexual-harassment-at-workplace/

14.5 INTERNAL COMMITTEE AGAINST SEXUAL HARASSMENT (ICASH)

i) The Internal Committee against Sexual Harassment (ICASH) will provide equal opportunity for all IISc personnel, without regard to gender or age, to lodge complaints of any sexual harassment in the workplace.

ii) Any ICASH members may be contacted verbally or in writing at any time, for lodging complaints. The details about ICASH committee members are available at https://iisc.ac.in/icash/

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CHAPTER 15

FACILITIES AT INSTITUTE

15.1 JRD TATA MEMORIAL LIBRARY

The J.R.D. TATA Memorial Library, at the Indian Institute of Science, is one of the oldest yet modern Science and Technology libraries in India. Starting in 1911 as one of the first set of departments in the Institute, it has become a precious national resource centre in the fields of Science and Technology. The library is centrally located with four floors with lift facility and has a total area measuring about 5,000 sq. mts. The collection of the library which includes books, journals, reports, theses, Indian Patents and standards is regarded as one of the richest collections in the country. This rich and valuable collection built over ten decades has some rare reference materials and back volumes of several important journals. Apart from its print resources, the library has access to a large collection of e-journals, eBooks and databases. Functioning as an effective support system for information services across the campus continues to be the primary goal of the library.

The library has a total collection of about 5 lakh documents which includes books and monographs, bound volumes and periodicals, theses, standards, technical reports etc. It subscribes to over 750 current e-journals. In addition to Library subscriptions, the **e-Shodh Sindhu Consortium (INFLIBNET)** provides access to over 8000+ e- journals. The library continues to maintain pre-eminence in providing access to a large number of eresources.

A. **EPrints & ETD Digital Repositories**

ePrints@IISc (ePrints@IISc) is one of the earliest and largest Institutional Repositories in the country. The ePrints@IISc was started by the erstwhile National Centre for Science Information. It is currently being managed by the J.R.D. Library. The repository collects, preserves, and disseminates the research output created by the IISc research community in digital format. The repository content can be accessed through the search and browse functionalities. As on date, the total number of publications in the repository is about 46,000+.

etd@IISc (etd@IISc) is the digital repository of Theses and Dissertations of IISc, Bangalore, India. This repository has been developed to capture, disseminate, and preserve the research theses of IISc. The repository content can be accessed through the search and browse functionalities. To date, the total number of records in the repository is about 3800+.

A.1. Library Automation

The library has been using LIBSYS, a Library Management Software for its functions such as Acquisition, Cataloguing, Serials Control, and Circulation. Online access to Library holdings data is through WEB-OPAC. Users have the facility to browse and search the library to catalogue and view the status of a document or their own transactions and make on-line reservations for a document issued.

A.2. Working hours

Monday – Saturday	08:00 to 2:00 AM (Next day)
Sunday	09:00 to 17:00 hrs.
General Holiday's	10:00 to 16:00 hrs.

A.3. Circulation rules and procedures

- Items that can be borrowed:
  a) Books
  b) Series Publications
  c) Reference Books (except Handbooks, Dictionaries, Encyclopaedias, etc.)
- Loan Period:
  a) Books (General): 14 days
  b) Periodicals (bound/series/references): 48 hours.

A.4. Library Website

The Library maintains its own web portal (Library iisc.ac.in) and the portal acts as a one-stop-shop to access all the information related to the library including services & facilities available, Web OPAC, links to all e-resources subscribed, Staff etc.

Contact No: 080 2293 2407
E-mail: library@iisc.ac.in
Website: Library.iisc.ac.in

15.2 SUPERCOMPUTING EDUCATION AND RESEARCH CENTRE AND COMPUTATIONAL FACILITIES

The Supercomputing Education and Research Centre (SERC) is a state-of-the-art supercomputing facility in Indian Institute of Science (IISc). It primarily caters to computational and specifically, high performance computing needs for scientific and engineering research in IISc. The Centre hosts 24/7 supercomputing facilities and services including supercomputers of Petaflop capacities for traditional HPC (High performance computing), deep learning and AI based applications, HPC software and about 2 Petabytes of storage.

SERC currently boasts of a supercomputing system called Param Pravega installed under the National Supercomputing Mission (NSM), a prestigious project in the country. Param Pravega is a 2.6 PFlop system with 28000 CPU cores, 80 GPUs and 4 Petabytes storage. It is the largest supercomputing system in an academic Institution in India. Besides this, SERC also has a medium-scale cluster with about 2000 CPU cores and the latest GPU resources. In addition to the hardware, SERC has a wide array of attractive computational and visualization softwares including MPI, OpenMP, MATLAB, Mathematica, ScaLAPACK, Ansys, and other domain-specific software for various fields of research.

The supercomputer systems in SERC have served about 44 departments, 134 research groups and 450 users of the Institute in various fields including Aerospace, Brain Research, Chemistry, Climate Modelling, Computational and Data Sciences, Computer Science, Earth Sciences, Electronics System Engineering, Inorganic and Physical Chemistry, Materials Research, Mechanical Engineering, Microbiology and Cell Biology, Molecular Biophysics, Physics etc.

About 150 million CPU core hours per year are being provided and used for research by both faculty and students in these areas. Supercomputing usage results in a total of about 50 publications every year across the Institute. SERC resources are also being used by researchers from other academic organisations, government-funded R&D laboratories and industries.

Students can easily access these attractive state-of-the-art resources by filling in a simple form mentioning their programme and other details and submitting them to SERC, which then facilitates the access within a day. Students can then remotely log in to these resources from the convenience

of their labs, hostel rooms, or even their homes and submit jobs for executions 24/7. The centre also provides periodic HPC training courses to both the Institute community and personnel from outside the Institute and offers HPC consulting services. Students can avail themselves of these training programmes to get acclimatised with the usage of the latest resources in SERC.
Contact No: 080 2360 0492
E-mail: office.serc@iisc.ac.in
Website: https://www.serc.iisc.ac.in/

15.3 HEALTH CENTRE

15.3.1 Medical services for students are provided at the Health Centre. It has out-patient and in- patient facilities served by Medical Officers and nursing staff. Specialists in the areas of eye, dental and psychiatry visit the Health Centre regularly. There is a doctor on duty to look after emergency cases at night.

15.3.2 Diagnostic facilities like a clinical laboratory, an X-ray facility, ECG and ultrasonography are available. Cases requiring other specialist services refer to appropriate centres/ hospitals.

15.3.3 All regular students are covered by the "Students Health Care Scheme" which permits reimbursement of medical expenses incurred as per norms. Students must undergo a medical examination at the time of joining only and medically fit candidates are admitted to the Institute. Health insurance is mandatory for all Institute students.

15.3.4 Appointments can be made through the website: Health Centre Login (iisc.ac.in)

15.3.5 Important Contacts:

15.3.5.1 Medical Officers

1. Dr. Satish Rao. C, Sr. Medical Officer, Officer-in-charge, Ph:2293 2226(off), 2293 2031(res)
2. Dr. Nirmala. R, Sr. Medical Officer, Ph: 2293 2411 (off), 2293 2073 (res)
3. Dr. Aditya Malladi, Medical Officer, Ph: 2293 2936 (off)
4. Dr. Neethi Ravindran, Medical Officer 2293 2552 (off)
5. Dr. Rohan Khot, Authorised Medical Officer, Ph No. 2293 2346
6. Dr. Chelsy Anna, Authorised Medical Officer, Ph No. 2293 2346
7. Dr. K. T. Bharath, Authorised Medical Officer, Contact No. 080 2293 3468
8. Dr. Ravi Kiran, Authorised Medical Officer, Ph No. 2293 2346
9. Authorised Medical Officer (Night-Duty): Ph: 2293 2006 / 2390

15.3.5.2 Consultants

1. Dr. Shyam Prasad, Skin/Dermatology, Ph: 2293 2552 (off), 2331 8936 (res)
2. Dr. Sanjay B Patil, ENT, Ph: 2293 2226 (off), 2349 3487 (res)
3. Dr. M. N. Srinivasan, Consultant Radiologist, Ph: 2293 2412 (off), 98451 66705 (mob)
4. Dr. Nandyala Sundari, Consultant Gynecologist, Ph. No. 080 2293 2412
5. Dr. Kailash Chhabria, Consultant Ophthalmologist, Ph. No. 080 2293 2412
6. Dr. Suryanarayana, Endocrinologist, Ph: 2293 2226 (off)
7. Dr. Basavaraj Kuntoji, Physician, Ph. 2293 2411
8. Dr. Shalini Sharma, Pediatrician, Ph. 2293 2990
9. Ms. Savitha M. S, M.Sc. (Clinical Psychology), PDCP Ph: 080 2294 3628
10. Mr. Shridhar B. G, M.Sc. (Clinical Psychology), Ph: 080 2293 3629

15.3.5.3 Allied Specialty

1. Mr. K. Vishnu Kumar Reddy, Physiotherapy, Ph: 080 2293 3468
2. Mrs. Ruth Boyle, Physiotherapy, Ph: 080 2293 3468

15.3.5.4 Other Contacts

1. Office	:	080 2293 2234/3617
2. Reception	:	080 2293 2227
3. Laboratory	:	080 2293 2007
4. Nursing	:	080 2293 2390/2006
5. X-ray	:	080 2293 2348
6. Pharmacy	:	080 2293 2412

15.4 HOSTELS AND DINING HALLS

15.4.1 The registered students at the Institute are eligible to apply for the available on campus hostel accommodation.

15.4.2 **The first-year students are required to vacate their hostel before 31st May.**

15.4.3 There are four dining halls: Vegetarian 'A' 'D' & 'E'; and Composite 'B' and 'C' (both vegetarian and non-vegetarian).

15.4.4 Contact No: 080 2293 2593 / 080 2293 2822

15.4.5 For information on Married Student Apartments, please contact the Housing Allotment Committee (HAC) office.

15.4.6 Charges towards Hostel facilities per month are given below:

A. Single Room charges per student per month

Table 15.1

Students admitted to	General (in ₹/INR)	SC/STs (in ₹/INR)
Bachelor of Science (Research)	400	200

B. Double Room charges per student per month

Table 15.2

Students admitted to	General (in ₹/INR)	SC/STs (in ₹/INR)
Bachelor of Science (Research)	200	100

C. Married Apartment charges per month

Table 15.3

Type of Apartment		General/ SC/STs (in ₹/INR)
Bhaskara		1,800
Kapila		1,800
Kaveri		2,250
Ramanujam		2,250
Aryabhata	Double Room	2,250
	Single Room	1,350

D. Other charges

Table 15.4

Particulars	For single room, double room (in ₹/INR)	For married apartment (in ₹/INR)
Establishment charges	200	200
Amenities charges	200	200
Electricity & water charges	200	200
Mess Amenities charges	1000	1000

15.5 STUDENTS' COUNCIL

15.5.1 Students' Council (SC) is the representative body of the entire student community of the Indian Institute of Science. It is an interface between the students and the administration and works together with the students to identify and address concerns that affect them, directly or indirectly. The Students' Council also represents the interests of the students and plays an active role in discussions and decisions affecting the student community.

15.5.2 The Students' Council is also vested in the all-round development of the students and organizes several extracurricular activities throughout the year. These activities include sporting and cultural events organized in association with the Gymkhana and the different activity clubs on campus. The Students' Council also coordinates the student volunteer effort for the various Institute events like Sangam - Freshers' welcome party and the Open Day, thus actively encouraging student participation and contribution. The motivation is to instil a sense of social responsibility and a drive to give back to society.

15.5.3 The Students' Council takes a stand on issues of social importance and organises the student body in their protests and acts as united voice of the students at the institute. This is aimed at making the students aware of the outside world and encouraging them to take a stand for what is right.

15.5.4 The office bearers of the Students' Council are elected for a term of one year. Nominated members constitute the Steering and Executive Committee of the Students' Council. Additionally, two representatives from each of the departments are members of the Council. The Students' Council is also responsible for the constitution of the following committees:

- **Academic:** All issues relating to courses, academic resources
- **Amenities:** Looking after on-campus amenities and monitoring quality of the existing ones
- **Communication:** Media interface and dissemination of information to student's Hostel – Looking after students' Hostel
- **Student Support Network:** Coordinate with Counselling Centre to provide counselling platform for students.
- **Placements:** Looking after the campus placements and other career opportunities
- **Health:** Coordination between health centre and students
- **Women's Welfare:** Work with Women Cell for the welfare of the women students
- **Cultural:** Organising and promoting intra and inter-institute cultural events.
- **Environment:** Reducing the institute's environmental footprint, expanding the green cover

15.5.5 There are also other committees like social, UG Welfare, and Foreign Student Welfare. Contact No: 080 2293 2653
Email: office.sc@iisc.ac.in

15.6 STUDENTS' BODY FOR INNOVATION AND ENTREPRENEURSHIP (ENTIISC)

15.6.1 **EntIISc** is the abbreviation for 'Entrepreneurship and Innovation at IISc'. It is a student-run forum to encourage, promote and support entrepreneurship and innovation activities at IISc. It aims to become a welcoming forum to promote and sustain entrepreneurial spirit and facilitate ideas and networking by means of events, workshops, and training. The beneficiaries include students, faculty, research staff and associates.

- **Vision:** The vision of this club is to leverage the unique ecosystem of IISc to create an international hub for entrepreneurship and innovation.
- **Mission:** The mission of EntIISc is to be a welcoming forum to promote and sustain entrepreneurial spirit and facilitate ideas and networking by means of events, workshops, and training.
- **Stakeholders:** IISc students primary, IISc community (Faculty, supporting staff and others), external entities (IISC alumni, Industry, Partners (VCs, Industry bodies, Govt., other academic institutes and interested individuals)
- **Objectives:** Be a world class showcase for entrepreneurship and innovation by executing professionally through:
  - Innovative and comprehensive IT-driven operations
  - Creative, engaging, and useful events that benefit the stakeholders.
  - Metrics-driven achievements, demonstrating transparency and integrity in actions and thoughts via constant communication to all stakeholders on a regular basis.

15.6.2 **Events at EntIISc:**

Since its formal inception, the office bearers of EntIISc have established this forum as the go-to place for all IISc students and entities external to IISc on matters related to student entrepreneurship and innovation. EntIISc has been able to engage about 500 students from the campus through more than 10 events conducted during the first six months of its operation. Students and other scholars of IISc, professionals, entrepreneurs, and innovators benefited from the various sessions of these events.

Website**:** entiisc.iisc.ac.in

15.7 RECREATIONAL FACILITIES

15.7.1 **Gymkhana** is a centre of cultural activity at the Institute. It has a cricket ground, tennis, volleyball, and basketball courts and a cinder track. An indoor badminton court, table tennis, billiards, karate, shaolin-chu-kung-fu, taekwondo, chess and carrom are a few among the many facilities in the gymkhana. Athletic and recreational facilities at the gymkhana provide a conducive atmosphere for interaction between students and staff, as also a break from the regular work schedules at the Institute.

The gymkhana also has a good gymnasium with facilities like Home Gym, a Hercules multi trainer and wall bar equipment.

Attached to the gymkhana is a small well-kept swimming pool where coaching classes are also conducted during summers. The gymkhana subscribes to about 14 magazines in English at its Ranade Library, apart from making available about 10,000 books to readers. The music room in the gymkhana houses a stereo system and record player, with a good collection of records. There is a separate TV lounge. An indoor Students' Auditorium where cultural activities can be organized is available as a facility. There is also an open-air auditorium.

15.7.2 General Facilities

- The Film Club regularly screens popular and classic films in its main hall.
- The gymkhana organizes inter-departmental, inter-collegiate and inter-university tournaments in sports, games and cultural events. 'VIBRATIONS', a weeklong annual cultural festival, which attracts students from institutions all over the country and helps to bring out their inherent cultural talent, is celebrated at the gymkhana.
- A dark room facility for the photographic club situated at the gymkhana caters to the needs of camera-loving members.
- A snack parlour, which serves coffee, snacks and soft drinks to the members, is also situated in the gymkhana premises.
- Other general facilities at the Institute include banks, Xerox centres (photocopying facility), travel agencies, bookstores, and a cafe and tea kiosk.
  Contact No: 080 2293 2257
  Email: office.gym@iisc.ac.in
  Website: iiscgym.iisc.ac.in

15.8 OFFICE OF DEVELOPMENT AND ALUMNI AFFAIRS (ODAA)

15.8.1 INTRODUCTION

The Office of Development and Alumni Affairs spearheads IISc's efforts to raise funds from alumni, corporates and philanthropists. These contributions have been used for several initiatives at the Institute including construction of new buildings, establishment of new research/academic centres, establishment of student fellowships, travel fellowships, chair professorships and setting up of new labs.

15.8.2 FELLOWSHIPS

Multiple fellowships have been established for students of the Institute through ODAA. There are more than 20 fellowships available to students at present with more being added periodically. The available fellowships include Jay Pullur Memorial BTech Fellowship for undergraduate students. ODAA has also spearheaded IISc's efforts to encourage more women students to pursue careers in science and engineering, to address the gender inequality in science and technology. These efforts have resulted in the establishment of a number of fellowships for women students. These include the IISc-AANA Midwest Chapter UG Women Fellowship and the Mallika Women in Science for undergraduate students.
For a complete list of fellowships, please visit: Fellowships | ODAA (iisc.ac.in)

15.8.3 TRAVEL GRANTS

A number of travel grants have been instituted by various corporations/alumni endowments through ODAA. These include the Tata Trusts Travel Grant, the IDR Division Travel Awards and the Apra Labs travel grants for women students. Students are encouraged to write to: alumniaffairs.odaa@iisc.ac.in for more details.

15.8.4 ALUMNI ENGAGEMENT

ODAA is IISc's main point of contact with its alumni from all over the world. The office updates alumni of all programmes ongoing at the Institute and works with them on initiatives aimed at benefiting existing students. An example of this is the Institute Gold Medals for the best outgoing students, established with endowments from various alumni. The details of these endowments/contributions are available here: https://odaa.iisc.ac.in/alumni-2/

15.8.5 LABS

ODAA's fundraising efforts have resulted in the development of several new facilities available to students from different departments.

This includes the four new labs established for the two-year M Tech (AI) joint degree programme offered by the Division of Electrical, Electronics and Computer Sciences. These labs have been established with CSR funding from SBI Cards, Tata Elxsi, GroupM and Timken. An Instructional Laboratory for Secure and Intelligent Computer Systems was also established in the department of Computer Science and Automation using the CSR funding given by Wells Fargo International Solutions. The complete list of benefactors is available here: https://odaa.iisc.ac.in/corporates/

Contact No: 080 2293 3590
Email: office.odaa@iisc.ac.in
Website: odaa.iisc.ac.in

15.9 OFFICE OF INTERNATIONAL RELATIONS (OIR)

The Office of International Relations (OIR) was constituted in 1998. Since its inception, OIR has been overseeing all the international programmes and bilateral activities of the Institute as well as admission of international students to various programmes offered by the Institute, including Bachelor of Science (Research), B Tech (Mathematics & Computing), MS, M Tech (Course and Research), and PhD in Science & Engineering. Currently, the Institute has a small proportion of international students enrolled in the full-time UG/PG/PhD programmes in various disciplines of Science and Engineering. All these students are provided with the campus accommodation and fellowships on par with the Indian students. OIR has formulated several mechanisms for engaging with foreign universities and research institutions. This includes joint supervision of research students, joint degree programmes (including PhD), visiting programmes for international faculty, researchers and students, nurturing joint research ventures through bilateral exploratory workshops, webinars and seed funds, supporting study abroad programmes and internship opportunities with selected partners. Furthermore, OIR provides the required documents and support for Visa processing and registration with FRRO/e-FRRO. OIR facilitates the networking of our international students by organising orientation programmes for newly admitted students and connect them to the Institute's international student body and student council.

Contact No: 080 2293 2560
Email: oir.admin@iisc.ac.in
Website: oir.iisc.ac.in

15.10 OFFICE OF COMMUNICATIONS (OoC)

The Office of Communications (OoC) at the Indian Institute of Science (IISc) is the single point of contact for all external communications related to the Institute. OoC's activities include publishing periodic magazines and newsletters related to research and campus life, as well as books by faculty members, maintaining and archiving historical documents, disseminating science news and organizing talks on diverse science-related topics. The office also coordinates the publication of the Institute's Annual Reports, brochures, and other publicity materials.

Contact No: 080 2293 2750/2066
Email: office.ooc@iisc.ac.in
Website: ooc.iisc.ac.in

15.11 DIGITAL CAMPUS AND IT SERVICES (DIGITS)

DIGITS (Digital Campus and IT Services) Office is IISc's hub for digitalisation. It is a unit set up by the Institute to plan and create a best-in-class information technology (IT) and networking system for the campus, and to implement agile IT and networking services for operational excellence in the Institute.

Some of the main activities of DIGITS are:

- maintenance of emails, SAP and Scholar One,
- making available legal copies of widely used softwares,
- Broadcast Service for IISc wide announcements,
- maintenance of the campus wide network and various portals, and IISc website.

For more information, see https://digits.iisc.ac.in

Contact No: 080 2293 3006

Email: office.digits@iisc.ac.in

Website: digits.iisc.ac.in

15.12 OFFICE OF CAREER COUNSELLING AND PLACEMENT (OCCaP)

15.12.1 About the Office of Career Counselling and Placement (OCCaP)

The Office of Career Counselling and Placement (OCCaP) (previously known as 'Placement Cell') provides centralised support for the internship and full-time placements for the M Tech, M Tech (Res), MDes, MMgmt, Master of Science, Bachelor of Science (Research), Bachelor of Technology (Mathematics & Computing), PhD, Post Doc scholars at IISc.

15.12.2 Internship placements

The Institute allows students to take up internship positions in the industry for up to three months without affecting their academic activities. Undergraduate and Master's students may take up these internships during the summer months (May to July). Research students can avail internships if their coursework is completed, subject to approvals from the advisor and department. Longer internships are allowed with special arrangements. OCCaP organises special events to facilitate interactions between students and companies interested in hiring them as interns. For further information on internships, please refer to respective programme rules.

15.12.3 Full-time placements

The placement season begins in October and goes on until May. Interested and eligible students (as per the criteria specified by the recruiter) show their willingness to appear for the recruitment process of a company by entering their details online. Details of all such students become available to the organisation for downloading or viewing through the OCCaP account. OCCaP will schedule recruiters' visits for pre-placement talks, tests, and personal interviews.

For more details visit: https://occap.iisc.ac.in/

Contact No: 080 2293 2005

Email: occap@iisc.ac.in

Website: occap.iisc.ac.in

15.13 WELLNESS CENTRE

IISc has an active Wellness Centre for students and all members of the Campus community. The mandates of the Wellness Centre are:

- Promotion of psychological well-being of the llSc community
- Identification of resources required for early communication, including emergency hotline and other modes of communication, or advice from consulting psychiatrists and psychologists (outside campus), as well as psychological social workers.
- Organisation of events such as workshops, seminars etc. to create awareness.

The Wellness Centre is a part of the overall health support system at the Institute. It is chaired by Prof. P. S. Anil Kumar (Dean Administration & Finance) and, in addition to medical doctors, psychologists and psychiatrists, has representatives from students, faculty and staff at IISc. There are various options for seeking and receiving help – 24 x 7 helpline, Online counselling (DOST), and one-on-one meetings. Students are encouraged to help themselves and one-another at the first appearance or signs of emotional and physical distress.

Contact No: 080 2293 3627

Email: office.wellness@iisc.ac.in

Website: https://wellness.iisc.ac.in/

15.14 SECURITY AT IISC

15.14.1 IISc has a vibrant and diverse campus set in 440 acres of greenery in the city of Bengaluru (formerly Bangalore), which includes administrative buildings, departmental buildings, gymkhana, students' hostels & messes, auditoriums, amenities shops, food outlets, faculty, and staff residential quarters and other in-house facilities spread in seven blocks / clusters. IISc is maintaining a safe and secure campus for all students, faculty, staff, visitors and institute's property and physical assets.

15.14.2 The mission of the Security Department at the Institute is to create an environment that is conducive, secure, safe and practical where faculty, students and staff work in comfort, move freely within the Institute campus to complete their time targeted task/s without many barriers or restrictions. The institute is under professional security cover 24x7. All security personnel are sufficiently trained & qualified, and all supervisory staff are retired from Paramilitary Forces/ Armed Forces.

Emergency contact (24x7) – 080-2293 5555
Security Control Room (24x7) – 080-2293 2400 / 2225 / 2841
Assistant Registrar (Security) – 080-2293 2617
Email: security.officer@iisc.ac.in

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CHAPTER 16

AUXILIARY RULES AND PROCEDURES

16.1 IMPORTANT PROCEDURES

A. ID Cards

A.1 Types of Requests:

1. New ID Card,
2. Renewal, Address Change, or Corrections
3. Lost or damaged ID card,
4. Payment for lost or new ID Card

A.2 Procedure

1. Visit: https://studentidcard.iisc.ac.in
2. Fill in the required details
3. Submit the application

NOTE: 1. Lost or duplicate ID Card

Students will have to pay Rs. 250/- at Finance Section and share the receipt via mail to the UG office along with the copy of **Lost Article Report** registered through e-Lost Reports (kspapp.in).

2. Payment link

For lost ID Cards, a payment link will be sent by the office once the student submits their request through the portal.

3. Confiscated ID Cards

If your ID card has been confiscated by security personnel, report to the UG Office immediately.

16.2 CERTIFICATES ISSUED BY UG OFFICE

16.2.1 PROVISIONAL DEGREE CERTIFICATE (PDC)

Provisional Degree Certificate (PDC) mentioning the date of degree award, can be requested by students on the AdSeR portal. The Provisional Degree Certificate will be issued only after the recommendation in the Governing Council meeting.

16.2.2 BONAFIDE CERTIFICATE

The request for Bonafide certificate for various purposes should be made on the AdSeR portal and must mention the reason for applying for the certificate. The request for issuance of Bonafide certificate for undertaking internship/summer project etc. should be made with the recommendation from the faculty advisor/coordinator and invitation, if any, received. The certificate is issued only to the students whose registration has not been cancelled.

16.3 IMPORTANT INFORMATION

16.3.1 Conversion of CGPA from 8-point scale to 10-point scale

The CGPA obtained in 8-point scale should be multiplied by 1.25 to get equivalent CGPA in 10-point scale

16.3.2 Conversion of CGPA to percentage

The Grade points awarded are not convertible into percentage. However, notionally, to obtain percentage of marks, the CGPA may be multiplied by 10 (for CGPA on the 10-point scale) or 12.5 (for CGPA on an 8-point scale).

Note: Use the following links for conversion of CGPA certificate, medium of instruction of course certificate and Migration Certificate:

IISc-CGPA-Percentage-Conversion-notification-signed.pdf

IISc-medium-of-instruction-certificate.pdf

IISc_Migration_TC_generic_certificate_signed.pdf

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CHAPTER 17

SCHEME OF INSTRUCTIONS (SOI)

FOUR-YEAR BACHELOR OF SCIENCE (RESEARCH) PROGRAMME

BIOLOGY

Curriculum applicable From Batch 2022 onwards

Basic Core Courses (for Biology Major and Minor)

Sl. No.	Code	Title	Credits	Semester
1	UBL 101T	Introductory Biology I	3:0	I
2	UBL 101L	Introductory Biology I (Lab)	0:1	I
3	UBL 102T	Introductory Biology II	3:0	II
4	UBL 102L	Introductory Biology II (Lab)	0:1	II
5	UBL 201T	Introductory Biology III	3:0	III
6	UBL 201L	Introductory Biology III (Lab)	0:1	III

Curriculum applicable until Batch 2021

Basic core courses

Sl. No.	Code	Title	Credits	Semester
1	UB 101T	Introductory Biology	2:0	I
2	UB 101L	Introductory Biology (Lab)	0:1	I
3	UB 102T	Introductory Biology II	2:0	II
4	UB 102L	Introductory Biology II (Lab)	0:1	II
5	UB 201T	Introductory Biology III	2:0	III
6	UB 201L	Introductory Biology III (Lab)	0:1	III

Courses offered from the 4th semester onwards (All batches)

[Core, elective courses for Biology Major/Minor]

Sl. No.	Code	Title	Credits	Semester	Course type
1	UB 205	Introductory Physiology	2:0	IV	Major- Core, Minor- Elective
2	UB 206	Experiments In Biochemistry and Physiology	0:2	IV	Major- Core, Minor- Elective
3	UB 207	General Biochemistry	2:0	IV	Major- Core, Minor- Core
4	UB 301L	Experiments In Microbiology	0:1	V	Major- Core Minor- Elective
5	UB 307L	Experiments In Ecology and Evolution	0:2	V	Major- Core Minor- Elective
6	UB 309	Genetics	2:0	V	Major- Elective Minor- Elective
7	UB 302	Developmental Biology	2:0	VI	Major- Core Minor- Elective
8	UB 303	Experiments In Molecular Biophysics	0:1	VI	Major- Core Minor- Elective
9	UB 304	Experiments In Neurobiology	0:1	VI	Major- Elective Minor- Elective
10	CH 248	Molecular Systems Biology	3:0	VI/ VIII	Major- Elective Minor- Elective
11	CH 242	Special Topics in Theoretical Biology	3:0	V/ VII	Major- Elective Minor- Elective
12	DS 301	Bioinformatics	2:0	V/ VII	Major- Elective Minor- Elective
13	UB 400	Project: Biology	0:16	VIII	Bachelor's Project
14	UB 500	Project: Biology	0:20	X	Master's Project

Note: **Electives for Biology Major and Minor**

In addition to the above courses, courses offered by the Biological Sciences departments i.e; Biochemistry (BC) / Microbiology and Cell Biology (MCB) / Centre for Neuroscience (CNS) / Centre for Ecological Sciences (CES) / Molecular Biophysics Unit (MBU) / Developmental Biology and Genetics (DBG), Course offered for Integrated PhD by Biological Science Division -DB & LS Course codes & Department of Bioengineering (formally BSSE) will be considered towards Biology Major and Minor electives.

Credit Requirements for Biology Major

Course Type	Basic Courses (Sem 1-3)	Engg (Sem 1-3)	Humanities (Sem 1-3)	Core (Sem 4-8)	Major Electives	Project	Assortment/ Institute Elective	Total
Till Batch 2021	36	19	9	12	24	16	15	131
From Batch 2022 onwards	40	6	9	12	23	16	25	131

Course Details

Coordinators: Jayanta Chatterjee, Sumanta Bagchi
Instructors UG: Vikrant Kumar Sinha, Eswara Rao Tatta, Sadhana Mutalik, Shruti Shree D P and Safeena Majeed
Teaching Assistants: Padma S, Raga S S, Smitha B B, Monica S, Asiya Rehman and Uma N

SEMESTER 1 (AUGUST)

UB 101T (2:0)/ UBL 101T (3:0): Introductory Biology I

Instructors: Sumanta Bagchi and Jayanta Chatterjee

Organismal Biology and the Molecular Basis of Life

Introduction to the World of Living Organisms; Levels of Biological Organisation; the Scientific Method and Causation in Biology; Diversity of life on Earth; Evolution: History and Evolution of Life on Earth; Mechanisms of Evolution; the Evidence for Evolution and Natural Selection; Adaptation, Speciation and Diversification; Phylogenetics; Sex and Sexual selection; Animal Behavior: Classical Experiments in Ethology; Communities and Ecosystem: Species Interactions, Trophic Cascades, Ecology and Global Change; Why Biodiversity Matters?

Introduction to Chemical Evolution; Thermodynamic Principles and Biological Macromolecules (water, lipids, carbohydrates, nucleic acids, proteins, enzymes); Placing Biomolecules in the Cellular Context: Cell as a Unit of Life and the Site for Life Processes. Elementary Enzymology.

UB 101L (0:1)/ UBL 101L (0:1): Introductory Biology I (Lab)

Instructors: Sumanta Bagchi and Jayanta Chatterjee

Understanding methods and concepts in evolution, ecology, and behaviour by observing, describing and quantifying; experimental manipulations; representing and interpreting data; titration of amino acids, estimation of reducing and nonreducing sugars, estimation of proteins, DNA, RNA, lipids. Techniques like thin layer chromatography for lipids, melting curves for DNA and SDS-PAGE for proteins.

SUGGESTED BOOKS:

1. Campbell Biology (10th/11th editions) By JB Reese, LA Urrey, ML Cain, SA Wasserman. Pearson Global Editions. ISBN 10: 0321739752; ISBN 13: 9780321739759, 2010/ 2013
2. Ernst Mayr, This is Biology: The Science of the Living World, Harvard University Press, 1997
3. Jerry A. Coyne, Why Evolution is True, Viking Penguin, New York, USA, 2009
4. Jonathan Weiner, The Beak of the Finch, Vintage Books, New York, USA, 1995
5. Sean B. Carroll, The Serengeti Rules: The Quest to Discover How Life Works and Why it Matters, Princeton University Press, New Jersey, 2016
6. Wilson, E. O., Life on Earth. Freely available at: http://eowilsonfoundation. org/e-o- wilson-s-life- on-earth
7. Wilson, E. O. The Future of Life, Alfred A. Knopr, 2002
8. Lodish, H., Berk, A., Kreiger, C. A., Scott, M. P., Bretscher, A., Ploegh, H. and Matsudaira, P., Molecular Cell Biology, W. H. Freeman Publishers, 6th Edition, 2008
9. Krebs, J. E., Goldstein E. S., and Kilpatrick, S. T., Lewin's Genes X, Jones and Bartlett Publishers, 10th Edition, 2011
10. Nelson, D. L. and Cox, M. M., Lehninger Principles of Biochemistry, W. H. Freeman Publishers, 5th Edition, 2009
11. Berg, J. M., Tymoczko, J. L. and Styrer, L., Biochemistry, W. H. Freeman & Co., 6th Edition, 2006
12. Voet, D. and Voet, J. G., Biochemistry, Wiley, 4th Edition, 2010

SEMESTER 2 (JANUARY)

UB 102T (2:0)/ UBL 102T (3:0): Introductory Biology II

Instructors: Dipshikha Chakravortty, Sachin Kotak and Arun Kumar

Introduction to the microbial world and its diversity; the importance of microbes in the exploration of basic principles of biology; bacterial growth and its modulation by nutrient availability in the medium; structure and function of a bacterial cell; structure of cell wall; isolation of auxotrophs; introduction to viruses – life cycles of temperate and lytic bacteriophages, structure and function of extra-chromosomal elements and their applications in molecular microbiology.

Introduction to cell biology, eukaryotic cells and their intracellular organization; introduction to the light microscopes and other methods of studying intracellular organelles; further studies on endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, nucleus (organization and function), plasma membrane structure and its function, the cytoskeleton, the cell cycle.

Mendelian genetics (segregation and independent assortment); sex determination and sex linkage in diploids; cytoplasmic inheritance; pedigrees, markers, mapping and genetic disorders; gene frequencies and Hardy-Weinberg principle.

UB 102L (0:1)/ UBL 102L (0:1): Introductory Biology II (Lab)

Instructors: Dipshikha Chakravortty, Sachin Kotak and Arun Kumar

Light microscopy, identification of microorganisms, staining techniques (Gram's, acid fast), bacterial plating, tests for antibiotic resistance, cell media and tissue culture; cell counting, immunostaining for actin, microtubules, DNA and identifying interphase and various mitotic phases; Drosophila crosses using red eye and white eye mutants, observation of Barr body in buccal mucosa cells, preparation of mitotic/ polytene chromosomes from Drosophila larvae; and karyotyping using human metaphase plate photos.

SUGGESTED BOOKS:

1. Berg, J. M., Tymoczko, J. L. and Styrer, L., Biochemistry, W. H. Freeman & Co., 6th Edition, 2006
2. Stanier, R. Y., Adelberg, E. A. and Ingraham, J. L., General Microbiology, MacMillan Press, 5th Edition, 2007
3. Alberts, B., Molecular Biology of the Cell, Garland Science, 5th Edition, 2008
4. Strick berger, M. W., Genetics, Prentice-Hall, India, 3rd Edition, 2008
5. Daniel, H., Essential Genetics: A genomics perspective, Jones & Bartlett, 3rd Edition, 2002
6. Strachan, T. and Read, A. P., Human Molecular Genetics, Garland Science, 3rd Edition, 2004

SEMESTER 3 (AUGUST)

UB 201T (2:0)/ UBL 201T (3:0): Introductory Biology III

Instructors: Tanweer Hussain, Dipankar Nandi, Arnab Barik and Ashesh Dhawale

Molecular biology (central dogma, DNA repair, replication, transcription, genetic code and translation); examples of post-transcriptional and post-translational modifications; genetic methods of gene transfer in bacteria.

Introduction to the immune system – the players and mechanisms, innate immunity, adaptive responses, B cell receptor and immunoglobulins, T cell activation and differentiation and Major Histocompatibility Complex encoded molecules.

Overview of the nervous system, ionic basis of resting membrane potential and action potentials, neuro-development, neurotransmitters, sensory systems, motor systems, learning and memory, attention and decision making.

UB 201L (0:1)/ UBL 201L (0:1): Introductory Biology III (Lab)

Instructors: Tanweer Hussain, Dipankar Nandi, Arnab Barik and Ashesh Dhawale

M13 infection, plaque assay, preparation of bacterial competent cells, transformation, transduction, conjugation, β -galactosidase assay. Immune organs and isolation of cells from lymph node, spleen and thymus; lymphocyte and macrophage activation studies, nitrite detection, ELISA and cell cycle analysis; gross anatomy of the human brain; staining of mouse brain sections; generation of action- potential; psychophysical and cognitive neurobiology experiments.

SUGGESTED BOOKS:

1. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A., Ploegh, H. and Matsudaira, P., Molecular Cell Biology, W. H. Freeman Publishers, 6th Edition, 2007
2. Kindt, T., Goldsby, R. and Osborne, B. A., Kuby Immunology, W. H. Freeman Publishers, 6th Edition, 2006
3. Bear, M., Connors, B. and Paradiso, M., Neuroscience: Exploring the Brain, Lippincott Williams & Wilkins, 3rd Edition, 2006

SEMESTER 4 (JANUARY)

UB 205 (2:0): Introductory Physiology

Instructors: Nikhil Gandasi and Naresh Loudya

Mammalian Physiology: Introduction to physiology, internal environment, control of internal environment by feedback systems, renal physiology, body fluids and kidneys, urine formation by the kidneys, principles of membrane transport, transporters, pumps and ion channels, cell signalling and endocrine regulation, hormonal regulation of energy metabolism, hormonal regulation of calcium metabolism, hormonal control of reproduction in males and females, pregnancy and lactation; structure of heart, cardiac muscle contraction, cardiac cycle, electric conductivity of heart, regulation of cardiac homeostasis, structure and function of arteries and vein, blood pressure, blood flow, capillary exchange, physiology of lymphatic system.

Plant Physiology: Plant organs and their functions, Plant cell structure and cell wall, phytochrome and light signaling, plant hormones and signaling, photosynthesis and photorespiration, transport in plant life (water, minerals, and solutes), secondary metabolites, control of flowering, plant senescence, and stress physiology.

SUGGESTED BOOKS:

1. Hall, J. E., Guyton and Hall Textbook of Medical Physiology, Elsevier, 12th Edition, 2011
2. Jameson, J. L. and De Groot, L. J., Endocrinology, Elsevier, 6th Edition, 2010
3. Taiz, L. and Zeiger, E., Plant Physiology, Sinauer Associates, 5th Edition, 2010

UB 206 (0:2): Experiments in Biochemistry and Physiology

Instructors: Shantanu Shukla, Mahipal Ganji

Expression of recombinant proteins, purification and characterisation. Quantitation of proteins using biochemical assays and physicochemical characterisation of proteins by immunoassays (solid phase and Western blotting). Enzyme assays and determining the specific activity of enzymes. Assessing metabolic activity of cells and their susceptibility to drugs.

UB 207 (2:0): General Biochemistry

Instructors: Somnath Dutta and Mahavir Singh

Biochemical properties of proteins, nucleic acids, lipids, and carbohydrates, basics of protein structures, protein sequencing, protein purification and characterization strategies, methods of DNA sequencing, biological membranes and membrane proteins, structure of nucleic acids, protein–nucleic acid (DNA/RNA) interaction.

Basic concepts of enzymes and enzyme kinetics, mechanisms of enzyme actions, basic concepts of metabolism and its design, catabolism and anabolism, energy generation and storage, glycolysis, citric acid cycle, oxidative phosphorylation, gluconeogenesis, fatty acid metabolism, integration of metabolism etc.

SUGGESTED BOOKS:

1. Voet, D. and Voet, J. G., Biochemistry, Wiley, 4th Edition, 2010
2. Berg, J. M., Tymoczko, J. L. and Styrer, L., Biochemistry, W. H. Freeman & Co., 7th Edition, 2011

SEMESTER 5 (AUGUST)

UB 301L (0:1): Experiments in Microbiology

Instructor: Dipshikha Chakravortty

Students will get hands-on experience in understanding the basic concepts of microbiology. The topics include the microbial growth curve, microbial nutritional requirements, genetic engineering techniques, plasmid isolation, creation of genetic knockout in bacteria, bacterial infection in cell culture system, estimation of infection by colony forming unit (CFU) analysis and fluorescence technique.

UB 307L (0:2): Experiments in Ecology and Evolution

Instructor: Kartik Shanker

Students will explore key concepts in Ecology, Evolution and Behaviour using field methods, laboratory manipulations and computer simulations. Students will design many of their own experiments and will utilize different modes of scientific communication, including oral presentations and documentaries. Topics include niche and population dynamics, competition and predation, trophic interactions, evolution and adaptation, natural and sexual selection, and conservation. This module also includes a mandatory field trip where students develop an independent research project.

UB 309 (2:0): Genetics

Instructor: Kavita Babu

Genes to genomics with an emphasis on model systems, Mendel's Principals, Extension of Mendel's laws, Inheritance with respect to chromosomes, Gene mapping, DNA structure and replication, Gene mutation analysis, Gene expression, Gene and genome analysis, Gene regulation in prokaryotes, Epigenetics, Gene regulation in Eukaryotes, Genetics of Development, Genetics of Cancer, Population Genetics

SUGGESTED BOOKS:

1. Genetics: From Genes to Genomes
2. Leland Hartwell, Michael Goldberg, Janice Fisher and Leroy Hood 6th Edition, Copyright@2018

SEMESTER 6 (JANUARY)

UB 302 (2:0): Developmental Biology

Instructors: Usha Vijayraghavan, Ramray Bhat and Utpal Nath

Introduction, history, and concepts of developmental biology; the current understanding on the mechanisms of development using model organisms, including invertebrates, vertebrates and plants; general principles for the making of a complex, multicellular organism from a single cell; the creation of multi-cellularity (cellularization, cleavage), reorganisation into germ layers (gastrulation), cell type determination; creation of specific organs, (organogenesis); molecular mechanisms underlying morphogenetic movements, differentiation, and interactions during development; fundamental differences between animal and plant development; embryogenesis in plant – classical and modern views; axis specification and pattern formation in angiosperm embryos; organization and homeostasis in the shoot and root meristems; patterning in vegetative and flower meristems; growth and tissue differentiation in plants; stem cells and regeneration; evolution of developmental mechanisms

SUGGESTED BOOKS:

1. Wolpert, L. and Tickle, C., Principles of Development, Oxford University Press, 4th Edition, 2010
2. Gilbert, S. F., Developmental Biology, 9th edition, Sinauer Associates, 2010
3. Slack, J. M. W., Essential Developmental Biology, John Wiley & Sons, 3rd Edition, 2012
4. Leyser, O. and Day, S., Mechanisms in Plant Development, Willey-Blackwell, 2003
5. Taiz, L. and Zeiger, E., Plant Physiology, 5th edition, Sinauer Associates, 2010
6. Alberts, B., Molecular Biology of the Cell, Garland Science, 5th Edition, 2008

UB 303 (0:1): Experiments in Molecular Biophysics

Instructor: Vidya Mangala Prasad

UV spectroscopy of proteins (quantitation and determination of extinction coefficient), Estimation of free sulfhydryl groups in proteins by Ellman's assay, Fluorescence spectroscopy of proteins, determination of tryptophan accessibility by acrylamide quenching, CD spectroscopy of proteins and calculation of helical contents, CD spectroscopy of DNA (monitoring the role of salt and oligonucleotide sequence in the formation of G-quadruplexes), UV spectroscopy of DNA (determination of melting temperature and influence of buffer composition), computational biophysics: molecular visualization and graphics.

UB 304 (0:1): Experiments in Neurobiology

Instructors: Arnab Barik and Ashesh Dhawale

The vertebrate nervous system and its organization; demonstration of tissue sectioning techniques; preparation of primary neuronal cultures and imaging neurons; recording and manipulating activity live neurons; rate coding; macrostimulation; effect of temperature and stretch on conduction velocity; neuropharmacology – effects of nicotine MSG; measuring the somatosensory homunculus; measuring alpha rhythm and surprise potentials with EEG; building a blink interface by recording eye potentials.

PREREQUISITE: NS 201 or NS 202 (AUG) (2:0)

SEMESTER 8 (JANUARY)

UB 400 (0:16): Project: Biology

Instructors (UG): Sumanta Bagchi and Jayanta Chatterjee

An independent research project will be carried out by all the UG-Biology Major students under the supervision of the faculty members. It is recommended that students initiate laboratory work during the summer break after completing their sixth semester. The progress of the project will initially be monitored at the end of the seventh semester. Finally, the submitted project report will be graded before the end of the eighth semester as follows: faculty assessment (40% marks), independent referee (40% marks) and presentation by the students (20%). Based on the student's performance, the final grades will be determined. Criteria for finding a faculty member for the UG project guide:

i. Faculty members in the Division of Biological Sciences, IISc.
ii. Faculty members outside the Division of Biological Sciences can also act as Project Guides. In that case, the student and the Project Guide are required to briefly describe the project in a one-page write-up and get it approved by the Biology Coordinators before starting the project. The proposal will be approved by the coordinators if they find it sufficiently biological in nature and content.
iii. Scientists outside of IISc CANNOT act as Project Guides for the UG students.
iv. Students must inform the UG Biology Coordinators about their chosen project guide before the start of the 7^{th} semester, students are encouraged to work in their chosen lab during both 7^{th} and 8^{th} semesters to work on longer-term projects.

ADDITIONAL COURSES IN SEMESTERS 5, 6, 7 AND 8:

Please see courses listed in the Scheme of Instruction for postgraduate students and select appropriate courses in consultation with the faculty advisor and UG Biology Coordinators.

Please note that the following courses that are not offered by the Division of Biological Sciences will be considered a part of UG-Biology Major (Electives):

CH 248 (JAN) 3:0 Molecular Systems Biology

INSTRUCTOR: Rahul Roy

DS 301 (AUG) 2:0 Bioinformatics

INSTRUCTORS: K. Sekar & Debnath Pal

CH 242 (AUG) 3:0 Special Topics in Theoretical Biology

INSTRUCTOR: Narendra M Dixit

Master of Science

Fulfilment of 12 credits from the courses offered by the following departments and 20 credits from the project.

Biochemistry (BC)
Centre for Ecological Sciences (CES)
Centre for Neuroscience (CNS)
Microbiology and Cell Biology (MCB)
Molecular Biophysics Unit (MBU)
Developmental Biology and Genetics (DBG)
Department of Bioengineering (BE) formally BSSE
Course offered for Integrated PhD by Biological Science Division -DB & LS Course codes.

Project:

UB 500 (0:20): Project: Biology

Note: For credit carry over from BS (Research) to MS please refer to Chapter – II, section - 2.3

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CHEMISTRY

Curriculum applicable From Batch 2022 onwards

Basic Core Courses (for Chemistry Major and Minor)

Sl. No.	Code	Title	Credits	Semester
1	UCY 101T	Introductory Chemistry I	3:0	I
2	UCY 101L	Introductory Chemistry I (Lab)	0:1	I
3	UCY 102T	Introductory Chemistry II	3:0	II
4	UCY 102L	Introductory Chemistry II (Lab)	0:1	II
5	UCY 201T	Introductory Chemistry III	3:0	III
6	UCY 201L	Introductory Chemistry III (Lab)	0:1	III

Curriculum applicable until Batch 2021

Basic core courses

Sl. No.	Code	Title	Credits	Semester
1	UC 101T	Introductory Chemistry I	2:0	I
2	UC 101L	Introductory Chemistry I (Lab)	0:1	I
3	UC 103T	Introductory Chemistry II	2:0	II
4	UC 103L	Introductory Chemistry II (Lab)	0:1	II
5	UC 206T	Basic Organic Chemistry	2:0	III
6	UC 206L	Basic Organic Chemistry (Lab)	0:1	III

Courses offered from the 4th semester onwards (All batches)

[Core, elective courses for Chemistry Major/Minor]

Sl. No.	Code	Title	Credits	Semester	Course Type
1	UC 202 UCY 204 *	Thermodynamics And Electrochemistry	2:0 3:0	IV	Major- Core Minor- Elective
2	UC 204 UCY 205 *	Inorganic Chemistry: Chemistry Of Elements	2:0 3:0	IV	Major- Core Minor- Elective
3	UC 205 UCY 206 *	Basic Organic Reactions	2:0 3:0	IV	Major- Core Minor- Elective
4	UC 207T	Instrumental Methods of Chemical Analysis	2:0	IV	Major- Core Minor- Core
5	UC 207L	Instrumental Methods of Chemical Analysis (Lab)	0:1	IV	
6	UC 301 UCY 301 *	Organic And Inorganic Chemistry (Lab)	0:1 0:3	V	Major- Core Minor- Elective
7	CD 211	Physical Chemistry I - Quantum Chemistry and Group Theory	3:0	V	Major- Core Minor- Elective
8	CD 212	Inorganic Chemistry-Main Group and Coordination Chemistry	3:0	V	Major- Core Minor- Elective
9	CD 213	Organic Chemistry – Structure & Reactivity	3:0	V	Major- Core Minor- Elective
10	UC 302 UCY 302 *	Physical And Analytical Chemistry (Lab)	0:1 0:3	VI	Major- Core Minor- Elective
11	UC 303 CY 303 *	Basic Organometallic Chemistry	3:0 3:0	VI	Major- Core Minor- Elective
12	CD 221	Physical Chemistry II- Statistical Mechanics	3:0	VI	Major- Core Minor- Elective
13	CD 222**	Materials Chemistry	3:0	VI	Major- Core/ Elective Minor- Elective
14	CD 223	Organic Synthesis	3:0	VI	Major- Core Minor- Elective
15	UC 402	Molecular Spectroscopy, Dynamics and Photochemistry	3:0	VII	Major- Core Minor- Elective
16	UC 400 UCY 400 *	Project: Chemistry	0:14 0:12	VIII	Bachelor's Project
17	UC 500	Project: Chemistry	0:20	X	Master's Project

Note: i) * Effective from the Batch of 2022

ii) * *CD 222: Major core course until Batch 2021 and Major elective for Batch 2022 onwards.

iii) **Electives for Chemistry Major and Minor -** In addition to the above courses, courses offered by the Chemical Sciences Division i.e; Inorganic and Physical Chemistry (IPC), Organic Chemistry (OC), Solid State and Structural Chemistry Unit (SSCU), Materials Research Centre (MRC) and Chemical Division Courses offered for Integrated PhD students -

CD & Courses offered for MSc Chemical Sciences Program-CY) will also be considered towards Chemistry Major and Minor electives.

Credit Requirements for Chemistry Major

Course Type	Basic Courses (Sem 1-3)	Engg (Sem 1-3)	Humanities (Sem 1-3)	Core (Sem 4-8)	Major Electives	Project	Assortment/ Institute Elective	Total
Till Batch 2021	36	19	9	35	3	14	15	131
From Batch 2022 onwards	40	6	9	39	0	12	25	131

Course Details

Coordinators: Dr. Anoop Thomas and Garima Jindal
Instructors UG: Tanaya Kundu, Mamata Mahato, Sachind Prabha and Siddhartha De
Teaching Assistants: Guruprasad B B, Mahitha M K and Akshata Hegde

SEMESTER 1 (AUGUST)

UC 101T (2:0) / UCY 101T (3:0): Introductory Chemistry-I

Instructor: Anshu Pandey

Overview of atoms, molecules and chemical bonding, intermolecular forces and interaction potentials. Introduction to quantum mechanics, postulates, exemplary exact solutions. Chemical thermodynamics, state functions, spontaneity, reaction thermodynamics. Chemical equilibrium and chemical kinetics, reaction coordinate diagrams. Properties of solutions, colligative properties.

SUGGESTED BOOKS:

1. D. A. McQuarrie, and J. D. Simon, Physical Chemistry – A Molecular Approach
2. R. J. Silbey, R. A. Alberty and M. G. Bawendi, Physical Chemistry
3. R. S. Berry, S. A. Rice and J. Ross, Physical Chemistry

UC 101L (0:1)/UCY 101L (0:1): Introductory Chemistry-I

Instructors: Veerabhadrarao Kaliginedi and Susanta Hazra

SEMESTER 2 (JANUARY)

UC 103T (2:0)/ UCY 102T (3:0): Introductory Chemistry-II

Instructor: Sreedhara M B

Multi-electron atoms – periodic trends, Chemical bonding: ionic solids, CFT: d-orbital splitting, tetrahedral, square planar, cubic and octahedral crystal fields, covalent bonding, Lewis model (2 Dim), VSEPR (3 Dim) hybridization, Molecular orbital theory: heteronuclear diatomics, triatomics, Shapes of main group compounds, Acid-base chemistry: concepts, measures of acid-base strength, HSAB, Main group chemistry: carbon group compounds and noble gases.

SUGGESTED BOOKS:

1. Lee, J. D. Concise Inorganic Chemistry, 5/E, Oxford University Press, Indian Edition
2. Miessler, G. L. and Tarr, D.A. Pearson Inorganic Chemistry, Third Edition
3. Shriver, D. F., Atkins, P. W. and Langford, C. H. Inorganic Chemistry, Oxford University Press
4. Huheey, J. E., Keiter, E.A. and Keiter, R. L. Inorganic Chemistry, 4/E, Pearson Education Asia

UC 103L (0:1)/ UCY 102L (0:1): Introductory Chemistry-II (Lab)

Instructors: Subinoy Rana and Sandya Sukumaran

SEMESTER 3 (AUGUST)

UC 206T (2:0)/ UCY 201T (3:0): Introductory Chemistry-III

Instructors: Akkattu T Biju, Durga Prasad Rao Hari

Part 1: Nomenclature of Organic Compounds, Orbital Picture of Molecular Structure, Aromaticity, Acids and Bases, Organic Reactions and Mechanism: Substitution, Aromatic Substitution, Elimination, Addition And Rearrangements, Oxidation-Reduction etc.

Part 2: Introduction to Chirality and Stereochemistry; Elements of Symmetry; Configurational Nomenclatures; Optical Activity; Chiral Resolution and Kinetic Resolution; Stereospecific and Stereoselective Reactions and Mechanisms; Conformation of Acyclic and Cyclic Systems.

SUGGESTED BOOKS:

1. Solomons, T. W. G. and Fryhle, C. 2009 Organic Chemistry, John Wiley & Sons
2. McMurry, J. E. 2007 Organic Chemistry 7th edition, Thomson
3. Bruice, P. Y. Organic Chemistry, 6th edition, Pearson
4. Nasipuri, D. Stereochemistry of Organic Compounds, Principles and Applications
5. Eliel, E. L. Stereochemistry of Carbon Compounds

UC 206L (0:1)/ UCY 201L (0:1): Introductory Chemistry-III (Lab)

Instructors: Akkattu T Biju and Vignesh Palani

SEMESTER 4 (JANUARY)

UC 202 (2:0)/ UCY 204 (3:0): Thermodynamics and Electrochemistry

Instructor: Naga Phani Aetukuri

Equations of state, Laws of thermodynamics, State and path functions, Intensive and extensive quantities, Energy, Enthalpy, Specific heat, Entropy; Application to engines; Free energy; Chemical potential, Activity and activity coefficient; Mixtures, and chemical equilibrium, Solution thermodynamics; Phase transitions; Unary and binary phase diagrams; Introductory Electrochemistry, Electrode thermodynamics, Nernst equation and electrochemical cells; Electrode kinetics, Transition state theory and Butler-Volmer equation; Mass transfer and cyclic voltammograms; Interfacial phenomena and Electrical double layers; Electrolyte theory, Debye-Hückel theory and conductivity of electrolytes.

SUGGESTED BOOKS:

1. D.A Mc Quarrie, and J.D Simon, Physical Chemistry – A Molecular approach
2. R.J Silbey, R.A. Alberty, and M.G. Bawendi, Physical Chemistry
3. R.S. Berry, S.A. Rice, and J. Ross, Physical Chemistry
4. E. Fermi, Thermodynamics
5. D.R. Crow, Principles and Applications of Electrochemistry
6. A.J. Bard and L.R. Faulkner, Electrochemical Methods: Fundamentals and Applications
7. J. Newman and K.E. Thomas-Alyea, Electrochemical Systems
8. P.T. Kissinger and W.R. Heineman, Laboratory Methods in Electroanalytical Chemistry

UC 204 (2:0)/ UCY 205 (3:0): Inorganic Chemistry: Chemistry of Elements

Instructor: Susanta Hazra

Main Group: Hydrogen and its compounds – ionic, covalent, and metallic hydrides, hydrogen bonding; chemistry of lithium, beryllium, boron, nitrogen, oxygen and halogen groups. MOT - polyatomic molecules (distortion), bioinorganic chemistry: s and p-block elements in biology (Na, Ca, Mg, P, Cl). Chemistry of lanthanides and actinides. Chemistry of d-block elements: MOT, descriptive chemistry of metals: periodic trends, chemistry of various oxidation states of transition metals, oxidation states and EMFs of groups.

SUGGESTED BOOKS:

1. D. F. Shriver and P. W. Atkins, Inorganic Chemistry (4th edition)
2. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry: Principles of Structure and Reactivity
3. N. N. Greenwood and A. Earnshaw, Chemistry of the Elements
4. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry

Pre-requisite: Successful completion of UC 103/UCY 102

UC 205 (2:0)/ UCY 206 (3:0): Basic Organic Reactions

Instructor: Santanu Mukherjee

Acids and Bases: Effect of Structure, Kinetic and Thermodynamic Acidity, General and Specific Acid/ Base Catalysis; Reactions of Carbon-Carbon Multiple Bonds: Addition of Halogens, Hydrogen Halides and Inter- Halogen Compounds, Hydration, Epoxidation, Dihydroxylation, Ozonolysis, Cyclopropanation, Hydrogenation; Reactions of Carbonyl Compounds: Addition to Carbonyls, Oxidation, Reduction, Rearrangements and their Applications, C–C Bond Forming Reactions involving Carbonyls; Introduction to Pericyclic Reactions: Cycloadditions, Electrocyclic Reactions, Sigmatropic Rearrangement and Group Transfer Reactions. Introduction to Organometallic Reagents: Grignard Reagents, Organolithium, Organocopper and Organozinc Compounds.

SUGGESTED BOOKS:

1. R. O. C. Norman, and J. M. Coxon, 1993 Principles of Organic Synthesis, 3rd edition
2. W. Carruthers and I. Coldham, Modern Methods of Organic Synthesis, 4th edition, Cambridge University Press
3. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, Oxford University Press
4. F.A. Carey and J.R. Sundberg, Advanced Organic Chemistry, Part A & Part B, 5th edition, Springer

Pre-requisite: Successful completion of UC 206/UCY 201

UC 207T (2:0): Instrumental Methods of Chemical Analysis

Instructor: Veerabhadrarao Kaliginedi and Anoop Thomas

Propagation of errors in measurement, statistical analysis of data, etc., Separation Techniques: extraction and separation, principles of chromatography, Electroanalytical Techniques: voltammetry and its variants, ion selective electrodes and electrochemical techniques for analysis, Spectroscopic Techniques: atomic absorption/emission, electronic, fluorescence, and vibrational (IR and Raman), Spectroscopy: basic principles, operation and application to chemical problems, NMR Spectroscopy, Basic principles and operation, Application of one dimensional NMR for identification of chemicals, Mass Spectrometry: Principles and Applications.

SUGGESTED BOOK:

1. Skoog, Fundamentals of Analytical Chemistry, 8th edition, West, Holler and Crouch

UC 207L (0:1): Instrumental Methods of Chemical Analysis (Lab)

Instructor: Veerabhadrarao Kaliginedi and Anoop Thomas

SEMESTER 5 (AUGUST)

CD 211 (3:0): Physical Chemistry I - Quantum Chemistry and Group Theory

Instructor: Sujit Das and Upendra Harbola

Postulates of Quantum Mechanics and introduction to operators; Exactly solvable problems Perturbational and Variational Methods, Hückel model, Many electron Atoms, Slater determinants, Hartree-Fock Variational method for atoms; Molecular Quantum Mechanics, Symmetry and Group theory, Point Groups, Reducible and Irreducible Representations (IR), Great Orthogonality theorem, Projection operators, applications to molecular orbitals and normal modes of vibration and selection rules in spectroscopy.

SUGGESTED BOOKS:

1. I. N. Levine, Quantum Chemistry
2. D. Griffiths, Introduction to Quantum Mechanics
3. F. A. Cotton, Chemical Applications of Group Theory

CD 212 (3:0): Inorganic Chemistry-Main Group and Coordination Chemistry

Instructor: Abhishake Mondal and Geetharani Kalimuthu

Unusual bonding in hyper- and low valent compounds. Multiple bonding in main group compounds. Chains, rings, and cage. Main group organometallics. Chemistry of Group 8 elements. Coordination chemistry: Spectral properties; Orgel diagrams; Tanabe- Sugano diagrams; Magnetic properties; inorganic reactions and mechanisms: hydrolysis reactions, substitution reactions trans-effect; isomerization reactions, redox reactions; metal-metal bonding and clusters; mixed valence systems.

SUGGESTED BOOKS:

1. Shriver and Atkins, Inorganic Chemistry by: Atkins, Overton, Rourke, Weller and Armstrong, Fifth Edition. South Asia Edition (paperback), Oxford University Press, 2010
2. Bochmann, M., Cotton, F. A., Wilkinson, G. and Murilla, C. A. 2007 Advanced Inorganic Chemistry, 6th edition, Wiley Student Edition, NY
3. Huheey, J. E., Keiter, E. A., Keiter, R. L. and Medhi, O. K. 2006 Inorganic Chemistry, Principles of Structure and Reactivity, 4th edition, Pearson

CD 213 (3:0): Organic Chemistry – Structure & Reactivity

Instructor: Vignesh Palani and Mrinmoy De

Stereochemistry and chirality; Conformation of acyclic and cyclic compounds including medium rings, effect of conformation on reactivity. Methods of deducing organic reaction mechanisms: Kinetic analysis, Hammond postulate, Curtin-Hammett principle. Linear free energy relationships – Hammett equation. Kinetic isotope effects. Solvent effects on reaction rates.
Reactive intermediates, classical and nonclassical carbocations, carbanions, free radicals, carbenes, nitrenes, arynes, radical ions, diradicals. Photochemistry. Concerted reactions. FMO theory, Wood- ward-Hoffman rules.

SUGGESTED BOOKS:

1. Anslyn, E. V. and Dougherty, D. A. 2006 Modern Physical Organic Chemistry, University Science Books
2. Smith, M. B. and March J. 2007 March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 6th edition, Wiley
3. Carey, F. A. and Sundberg, R. J. 2008 Advanced Organic Chemistry, Part A, 5th edition, Plenum
4. Lowry, T. M. and Richardson, K. S. 1998 Mechanism and Theory in Organic Chemistry, Third Edition, Addison - Wesley – Longman

UC 301 (0:1)/ UCY 301 (0:3): Organic & Inorganic Chemistry (Lab)

Instructor: P Rajamalli and Sharvan Kumar

1. Synthesis of Fe-acac complex using two different methods.
2. Acetylferrocene: synthesis and purification.
3. Tris-(8-hydroxyquinoline) aluminium: synthesis and characterisation.
4. VO(acac)2: Synthesis, characterization and catalytic applications; oxidation of anthracene.
5. Suzuki-Miyaura cross-coupling Reaction in aqueous media and purification of product using column chromatography.
6. Synthesis of Pd2(dba)3 and catalytic applications.
7. Synthesis and characterization of Mn (III) salen complex - Catalyst for the epoxidation of alkenes.
8. Synthesis and characterization of polyoxometallate complexes and grafting the amino group.
9. Structural analysis of diamagnetic and paramagnetic Ni (II) Schiff base complexes by NMR spectroscopy.
10. Synthesis and characterization of Europium (III) and Terbium (III) complexes.
11. Cu(I) catalyzed fast and organic solvent-free tandem click chemistry in aqueous micellar medium.
12. Synthesis and characterization Cr-coordination complexes and use of Tanabe-Sugano diagram to assign the bands in UV-Vis spectra.
13. Wittig reaction, including synthesis of ylide.
14. Grignard Reaction: Preparation of Triphenylmethanol.
15. Estimation of concentration of a n-BuLi solution and lithiation reaction.
16. Diels Alder reaction between anthracene and maleic anhydride.
17. Oxidation of Isoborneol to Camphor.
18. Reduction of (R)-(+)-3-Methylcyclohexanone.
19. NHC preparation and complexation.
20. Pinacol - pinacolone rearrangement.
21. Beckmann rearrangement – nylon synthesis via caprolactam.
22. Coumarin synthesis.
23. Synthesis of azo dyes.
24. Favorskii rearrangement.

SEMESTER 6 (JANUARY)

CD 221 (3:0): Physical Chemistry II: Statistical Mechanics

Instructor: Sai G Ramesh

Thermodynamics: Basic Ideas and postulates (2), equilibrium conditions (2), thermodynamic potentials and extremum conditions (2), maximum work theorem (1), stability conditions (2), phase transitions (2); Postulates of statistical mechanics (1): Phase space, ensembles, ergodic hypothesis; Ensembles (3): Canonical ensemble, grand canonical ensemble, Isothermal-Isobaric ensemble and Fluctuations; Fermi-Dirac and Bose-Einstein Statistics (2): Derivations in the grand-canonical ensemble and behaviour in the classical limit; Ideal Monatomic and Diatomic Gases (5): Translational, vibrational and rotational partition functions, rigid rotor-harmonic oscillator approximation, thermodynamic functions; Black Body Radiation (2): Stefan-Boltzmann law and Wien's-

displacement law; Crystals (2): Einstein and Debye models; Electron Conduction in Metals (2): Contribution to heat capacity at low temperatures; Non-Ideal Gases (3): Virial equation of state, and Virial coefficients in the classical limit; Classical Liquids (6): Distribution functions, radial distribution function and relation to thermodynamic quantities, Ornstein-Zernike equation, PY and HNC closure; Debye-Hueckel Theory (3): Theory for ionic solutions; Ising Model (3): Solutions in one-dimension for different boundary conditions and mean field theory.

SUGGESTED BOOKS:

1. E. Fermi, Thermodynamics
2. H .B. Callen, Thermodynamics and Introduction to Thermostatistics
3. D. A. McQuarrie, Statistical Mechanics
4. D. Chandler, Introduction to Modern Statistical Mechanics
5. B. Bagchi, Statistical Mechanics for Chemistry and Material Science

CD 223 (3:0): Organic Synthesis

Instructors: Vignesh Palani and Durga Prasad Rao Hari

Synthetic methods, methodologies and mechanisms in reductions, oxidations of carbon-carbon and carbon-heteroatom bonds; Carbon-carbon bond-forming methodologies through ionic, radical, concerted and organometallic reaction mechanisms; Approaches to multi-step synthesis with examples of chosen natural and un-natural product synthesis, through anti-thetic analysis and logical synthesis.

SUGGESTED BOOKS:

1. House, H. O. 1972 Modern Synthetic Methods, W. A. Benjamin, Inc
2. Smith, M. B. 2002 Organic Synthesis, McGraw-Hill
3. Corey, E. J. and Chung, 1989 Logic in Chemical Synthesis, John-Wiley & Sons
4. Chosen primary literature and review articles

PREREQUISITES: UG students having completed UC 205/UCY206, CD 213;

UC 302 (0:1)/ UCY 302 (0:3): Physical and Analytical Chemistry (Lab)

Instructor: Soumen Ghosh

Chemical kinetics. Langmuir adsorption, chemical analysis by potentiometric and conductometric methods, cyclic voltammetry, flame photometry, electronic states by UV-Visible spectroscopy, IR spectroscopy, solid state chemistry synthesis of solids and chemical analysis. Thermogravimetry. X-ray diffraction, electrical and magnetic properties of solids. Vacuum techniques in preparative chemistry.

SUGGESTED BOOK:

1. Vogel, A. I. 1989 Vogel's text book of quantitative chemical analysis Longman

UC 303 (3:0)/ CY 303 (3:0): Basic Organometallic Chemistry

Instructor: P Thilagar

Structure and bonding in organometallic compounds – isolobal analogies, metal carbonyls, carbenes and NHC complexes, olefin and acetylene complexes, alkyls and allyl complexes, metallocenes. Major reaction types – oxidative addition, reductive elimination, insertion, isomerization and rearrangement reactions. Catalytic reactions: metathesis, hydrogenation, allylic activation, C-C coupling reactions, C-X coupling.

SUGGESTED BOOKS:

1. Elschenbroich, Ch. 2005 Organometallics, 3rd edition, Wiley-VCH, Weinheim
2. Gupta, B. D. and Elias, A. J. 2013 Basic Organometallic Chemistry: Concepts, Syntheses and Applications (Second edition)

SEMESTER 7 (AUGUST)

UC 402 (3:0): Molecular Spectroscopy, Dynamics and Photochemistry

Instructor: Soumen Ghosh

Energy levels of molecules and their symmetry, Polyatomic rotations and normal mode vibrations. Electronic energy states and conical intersections (6); time-dependent perturbation theory and selection rules (6); microwave, infrared and Raman, electronic spectroscopy (12); energy transfer by collisions, both inter and intramolecular. Unimolecular and bimolecular reactions and relations between molecularity and order of reactions, rate laws (6); temperature and energy dependence of rate constants, collision theory and transition state theory, RRKM and other statistical theories (6); photochemistry, quantum yield, photochemical reactions, chemiluminescence, bioluminescence, kinetics and photo- physics (6)

SUGGESTED BOOKS:

1. L5evine, I. N., Molecular Spectroscopy
2. McHale, J. L., Molecular Spectroscopy
3. Steinfeld, J. I., Fransisco, J. S. and Hase, W. L., Chemical Kinetics and Dynamics
4. Laidler, K. J., Chemical Kinetics

SEMESTER 8 (JANUARY)

UC 400 (0:14)/ UCY 400 (0:12): Project: Chemistry

Instructor: Dr. Anoop Thomas and Garima Jindal

The final year research project aims to introduce undergraduate students to actual research. Students perform research under the supervision of a faculty member of the chemical sciences division. The project supervisor is decided by the mutual consent of the student and the concerned faculty member. The project is evaluated at the end of the eighth semester by a committee of faculty from the division of chemical sciences. Students are required to submit a project report towards the end of the semester as well as make a short presentation emphasizing their novel findings.

Master of Science

Instructors: Dr. Anoop Thomas and Garima Jindal

Minimum of 6 credits (200 or 300 level) from within the Chemical Sciences Division i.e; Inorganic and Physical Chemistry (IPC), Organic Chemistry (OC), Solid State and Structural Chemistry Unit (SSCU), Materials Research Centre (MRC), Chemical Division Courses offered for Integrated PhD students -CD & Courses offered for MSc Chemical Sciences Programme-CY) and 6 credits (200 or 300 level) from any division OR all 12 credits (200 or 300 level) from within the Chemical Sciences Division and 20 credits from the project.

UC 500 (0:20): Project: Chemistry

Note: For credit carry over from BS (Research) to MS please refer to Chapter – II, section - 2.3

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EARTH AND ENVIRONMENTAL SCIENCES

Courses offered from the 4th semester onwards (All batches)

[Core, elective courses for Earth and Environmental Sciences Major/Minor]

Sl. No.	Code	Title	Credits	Semester	Course Type
1	UES 206T UEES 206T*	Experimental Methods in Environmental Chemistry	1:0 2:0	IV	Major- Core Minor- Elective
2	UES 206L UEES 206L*	Experimental Methods in Environmental Chemistry (Lab)	0:2 0:1	IV	Major- Core Minor- Elective
3	UEES 207	Geophysical Processes	3:0	IV	Major- Core Minor- Elective
4	UEES 208T	Introduction To Mineralogy and Petrology	2:0	IV	Major- Core Minor- Elective
5	UEES 208L	Introduction To Mineralogy and Petrology (Lab)	0:1	IV	
6	UEES 301T*	Introduction To Earth Systems	2:0	V	Major- Core Minor- Elective
7	UEES 301L*	Introduction To Earth Systems Lab	0:1	V	Major- Core Minor- Elective
8	UES 302 UES 314*	Design Principles in Environmental Engineering	2:0 3:0	V	Major- Core Minor- Elective
9	UEES 313T*	Experimental Methods in Environmental Engineering	2:0	V	Major- Core Minor- Elective
10	UEES 313L*	Experimental Methods in Environmental Engineering (Lab)	0:1	V	
11	UES 400 UEES 400*	Project: Earth and Environmental Science	0:16 0:15	VIII	Bachelor's Project
12	UES 500	Project: Earth and Environmental Science	0:20	X	Master's Project

Note:

i) *** Effective from the Batch of 2022**

ii) **Electives for EES Majors**

Students majoring in EES must take 6 courses (18 credits) from the departments participating in the EES programme i.e; Centre for Earth Sciences (CEaS), Centre for Sustainable Technologies (CST), Civil Engineering (CiE), Centre for Atmospheric and Oceanic Sciences (CAOS) and selected courses from ICWaR after a discussion with the EES coordinators.

iii) **Requirements for Minor in EES (15 credits)**

Students taking a minor in EES must take a minimum 3 out of the 6 core courses listed for EES Majors. Remaining 2 courses can be taken for courses offered in departments participating in the EES programme i.e; Centre for Earth Sciences (CEaS), Centre for Sustainable Technologies (CST), Civil Engineering (CiE), Centre for Atmospheric and Oceanic Sciences (CAOS)

Credit Requirements for ENVS Major

Course Type	Basic Courses (Sem 1-3)	Engg (Sem 1-3)	Humanities (Sem 1-3)	Core (Sem 4-8)	Major Electives	Project	Assortment/ Institute Elective	Total
Till Batch 2021	36	19	9	15	21	16	15	131
From Batch 2022 onwards	40	6	9	18	18	15	25	131

Course Details

Coordinators: Dr. Sreenivasan Ramaswami and Ramananda Chakrabarti
Instructor UG: Saranya K and Sharath Raj
Teaching Assistants: Soorya P S and Veeresh S

SEMESTER 4 (JANUARY)

UES 206T (1:0)/ UEES 206T (2:0): Experimental Methods in Environmental Chemistry

Instructor: Sreenivasan Ramaswami

Introduction to enviro/water laboratory: fundamental instruments, lab water types and grades of chemicals. Solutions: concentration, dilution factor, preparing solutions. Water quality parameters: pH, electrical conductivity, turbidity & dissolved oxygen. Solids in water: total, suspended, dissolved. Hardness and alkalinity. Spectrophotometric determination: principle, limits, determination of ammonium-nitrogen, phosphate-phosphorous. Nitrogen in water – determination of nitrogen compounds ($N\text{-}NH_4^+$, $N\text{-}NO_2^-$, $N\text{-}NO_3^-$ and TN) and material balance. Organic parameters: COD, BOD, TOC. Chromatographic techniques, determination of anions by ion chromatography. Different wastewater sources, water & environmental pollution.

SUGGESTED BOOKS:

1. APHA, Standard methods for the examination of water and wastewater. American Public Health Association, 23rd edition, Washington DC, (2017)
2. ISO standards

UES 206L (0:2)/ UEES 206L (0:1): Experimental Methods in Environmental Chemistry (Lab)

Instructor: Sreenivasan Ramaswami

Safety instructions. Introduction to enviro/water laboratory: grades of chemicals, glassware classes, checking pipettes; pH meter calibration and pH measurement in different water samples. pH of solutions of acids and bases of different strengths. Electrical conductivity of different water samples. Conductivity of solutions with varying NaCl content; Turbidity standards and calibration; Determination of turbidity in water samples. Dissolved oxygen measurement by iodometric method and optical probe; Determination of total, suspended, and dissolved solids concentrations in water samples; Determination of hardness and alkalinity of water samples; Determination of ammonium-N: calibration curve and measurement; Calibration curves for nitrite-N and nitrate-N; Determination of ammonium-N, nitrite-N, nitrate-N and total nitrogen in water samples. Material balance; Determination of COD, BOD and TOC in water samples; Determination of anions in water samples by ion chromatography.

UEES 207 (3:0): Geophysical Processes

Instructors: Attreyee Ghosh, Pawan Bharadwaj and Binod Sreenivasan

Description of Processes: Subduction zone processes (earthquakes, volcanism, India-Eurasia collision, Pacific northwest subduction); Processes in divergent zones (mid-oceanic ridge system, types of spreading ridges, continental rifting; Transform faults (continental and oceanic transforms); Hotspots and mantle plumes; Large igneous provinces; LIPs and mass extinctions. Applications of Physics and Computation to the Earth Sciences: The second half of this course will focus on the applications of the basic principles of classical physics, computation, and mathematics to the earth sciences. Topics will be selected from: mechanics of rotating bodies, Geo dynamo, thermal convection, maxwell's equations, oscillations and normal modes, seismic wave propagation, mechanics of faulting, diffusion, and heat transfer.

SUGGESTED BOOK:

1. William Lowrie, Fundamentals of Geophysics, Cambridge University Press

UEES 208T (2:0): Introduction to Mineralogy and Petrology

Instructors: K. Sajeev

Introduction to crystallography and mineralogy, Classification and nomenclature of sedimentary, igneous, and metamorphic rocks and their textures, igneous structures and field relationships, introduction to thermodynamics and phase rule, chemical petrology, Mantle melting, Magma diversity, tectonics and magmatism, metamorphic textures and mineral assemblages, Metamorphic facies and reactions, Geochronological methods
Lab: Study of minerals and rocks in hand specimens, optical mineralogy, and study of thin sections.

SUGGESTED BOOKS:

1. John D. Winter, Principles of Igneous and Metamorphic Petrology, 2nd Edition, 2010
2. S. M. Sengupta, Introduction to Sedimentology, 1994

UEES 208L (0:1): Introduction to Mineralogy and Petrology (Lab)

Instructors: K. Sajeev

SEMESTER 5 (AUGUST)

UEES 301T (2:0): Introduction to Earth Systems

Instructors: Sambuddha Misra

Geological time scale and Evolution of Vertebrates, invertebrate and Plants, Origin Of Atmosphere and compositional-structural-energy evolution, Greenhouse effect, oxygenation and genesis of ozone layer, Evidence of early Life, residence time of trace gases in the atmosphere, radiation laws and budget, glacial interglacial cycles, Carbon cycle, rock cycle, energy balance model, Hydrosphere, hydrological cycle, Ocean circulation, aqueous contamination and effect on biosystem, weathering and erosion, evolution of ocean, Life diversification.

SUGGESTED BOOKS:

1. Roland Martin, Earth's evolving systems; The history of Planet Earth 2nd edition
2. Steven M. Stanley and John A. Luczaj Earth System History, W. H. Freeman and Company

UEES 301L (0:1): Introduction to Earth Systems (Lab)

Instructors: Sambuddha Misra

UES 302 (2:0)/ UES 314 (3:0): Design Principles in Environmental Engineering

Instructor: Lakshminarayana Rao

Laws of Conservation: Mass, Energy and Momentum Balances. Fundamentals of Chemical Reaction Engineering: Thermodynamics, Stoichiometry, and Kinetics of Chemical Reactions, Chemical Reactors – Stirred Tank and Plug Flow Reactors. Design for wastewater treatment processes: Physical Unit Operations such as Sedimentation and Filtration, Chemical and Biological Treatment Processes. Design for Air Pollution Control: Gas-Liquid Interactions, Absorption and Adsorption Processes, Particulate Emission Control.

SUGGESTED BOOKS:

1. Davis, M. and Masten, S. 2004. Principles of Environmental Engineering, McGraw Hill
2. Davis, M. and Cornwell, D. 2006. Introduction to Environmental Engineering, McGraw Hill
   Mihelcic, J. and Zimmerman, J. B. 2010. Environmental Engineering: Fundamentals
3. Sustainability and Design, John Wiley
4. Spellman F. R. and Whiting, N. E. 2005. Environmental Engineer's Mathematics Handbook, CRC Press

UEES 313T (2:0): Experimental Methods in Environmental Engineering

Instructor: Yagnaseni Roy

Selection strategy of environmental remediation method for practical applications, Adsorption for pollutants in liquid and gaseous effluents - mechanisms of adsorption, isotherm & kinetic studies, desorption overview of packed and fluidized beds for practical scale. Absorption for CO2 sequestration - stripping, practical implementation in tray and packed columns, system design and sizing. Zero liquid discharge by evaporative techniques - energy requirement calculation, determination of salt composition. Coagulation, flocculation, and sedimentation - fundamental principles, design and sizing of settling tanks. Membrane filtration - osmotic pressure, fouling, practical-scale system design parameters. Environmental impact of discussed remediation techniques - fuel requirement, global warming potential.

SUGGESTED BOOKS:

1. "Industrial Separation Processes: Fundamentals", André B. de Haan, Hans Bosch, Year: 2013, Publisher: De Gruyter
2. "Separation Process Principles, 3rd Edition" Seader, Henley, and Roper, Year: 2011, Publisher: Wiley

UEES 313L (0:1): Experimental Methods in Environmental Engineering (Lab)

Instructor: Yagnaseni Roy

Batch adsorption of dye molecules using activated carbon, desorption using sodium hydroxide solution. Implementation of the same in a lab-scale adsorption column; CO_2 absorption in a packed column; Evaporation experiment of water from artificial seawater and measurement of boiling point elevation. Evaporation of water can be done to obtain distilled water as well as to obtain salt crystals, thereby illustrating the concept of zero liquid discharge; Calculation of solubility limit of salts in artificial sweater using software (PHREEQC) and demonstration of the same in the lab; Coagulation and flocculation of humic acid using alum; Filtration of solution with dye molecules using a stirred vacuum filtration setup, investigation of different membrane samples (microfiltration, ultrafiltration, nanofiltration, reverse osmosis).

SEMESTER 8 (JANUARY)

UES 400 (0:16)/ UEES 400 (0:15): Project: Earth and Environmental Sciences

Instructors: Faculty members involved in Earth and Environmental Sciences Programme

An independent research project will be performed by all UG-Earth and Environmental Science Major students under the supervision of faculty. It is recommended that students initiate laboratory/ computational work during the summer break post completion of the sixth semester. The progress of the project will be monitored at the end of the seventh semester by a committee comprising of project supervisor, common examiner and external examiner. The student shall submit project report at end of 8th semester and make a presentation to the committee. Based on the overall student's performance, final grade will be awarded to the research project by the committee.

Master of Science

Any 4 courses (12 credits) from Departments/Centres participating i.e; Civil Engineering (CiE)/ Centre for Atmospheric and Oceanic Sciences (CAOS)/ Centre for Earth Sciences (CEaS)/ Centre for Sustainable Technologies (CST) in the E & ES programme or equivalent courses as per students' handbook after a discussion with the EES coordinators and 20 credits from the project with the Masters' thesis advisor.

UES 500 (0:20): Project: Earth and Environmental Science

An independent research project will be performed by all UG-Earth and Environmental Science Major students for their master's under the supervision of faculty from the four participating Departments/Centers. Faculty from other departments working on Earth and Environmental Science related research areas can act as thesis supervisors only after approval of the EES coordinators. It is recommended that students initiate laboratory/ computational work during the summer break post completion of the eighth semester. The student shall submit a project report at the end of the 10th semester and make a presentation to the committee. Based on the overall student's performance, final grade will be awarded to the research project by the committee.

Note: For credit carry over from BS (Research) to MS please refer to Chapter – II, section - 2.3

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ENGINEERING

Curriculum applicable From Batch 2022 onwards

Core courses for completion of Engineering Credits

Sl. No.	Code	Title	Credits	Semester
1	UENG 103	Introduction to Earth and Its Environment	3:0	II
2	UENG 201	Introduction to Materials Science	3:0	III

Engineering courses offered in 2nd and 3rd semester (Optional)

Sl. No.	Code	Title	Credits	Semester
1	UENG 102T	Introduction to Electrical and Electronics Engineering	3:0	II
2	UENG 102L	Introduction to Electrical and Electronics Engineering (Lab)	0:1	II
3	UENG 101T	Algorithms And Programming	3:0	III
4	UENG 101L	Algorithms And Programming (Lab)	0:1	III

Note: Courses registered from the above table will be considered towards Assortment/ Institute Elective pool

UG -Level Engineering courses offered in other semesters

Sl. No.	Code	Title	Credits	Semester
1	UE 201	Introduction To Scientific Computing	2:1	Aug
2	UE 204	Elements Of Solid Mechanics	3:0	Jan
3	UE 203T	Sensor Technologies For Biomedical Applications	2:0	Jan
4	UE 203L	Sensor Technologies For Biomedical Applications	0:1	Jan
5	UMC 102	Computer Systems	3:0	Jan
6	UMC 201	Data Structures and Algorithms	3:1	Aug
7	UMC 301	Applied Data Science and AI	3:1	Aug
8	UMC 205	Automata And Computability	3:1	Jan
9	UMC 203	Introduction To AI & ML	3:1	Jan

10	UMT 202T	Structure Of Materials	2:0	Jan
11	UMT 202L	Structure Of Materials (Lab)	0:1	Jan
12	UMT 203	Thermodynamics Of Materials	3:0	Jan
13	UMT 205	Mechanical Behaviour of Materials	3:0	Jan
14	UMT 301	Materials Kinetics	3:0	Aug
15	UMT 302T	Introduction To Materials Manufacturing	2:0	Aug
16	UMT 302L	Introduction To Materials Manufacturing Lab	0:1	Aug
17	UEES 313T	Experimental Methods in Environmental Engineering	2:0	Aug
18	UEES 313L	Experimental Methods in Environmental Engineering Lab	0:1	Aug

Note: Courses registered from the above table will be considered towards Assortment/ Institute Elective pool

Curriculum applicable until Batch 2021

Core Engineering courses

Sl. No.	Code	Title	Credits	Semester
1	UE 101T	Algorithms and Programming	2:0	I
2	UE 101L	Algorithms and Programming (Lab)	0:1	I
3	UE 102T	Introduction To Electrical and Electronics Engineering	2:0	II
4	UE 102L	Introduction To Electrical and Electronics Engineering (Lab)	0:1	II
5	UE 200	Introduction To Earth and Its Environment	2:0	II
6	UE 202	Introduction To Materials Science	2:0	III

List of Engineering Elective Courses – The update list of engineering electives can be accessed by clicking on the below link. For more details refer to the instructions given below, under the list of approved engineering elective courses section.

UG-Engineering-Courses-2025-26.docx.

Coordinators: Deepak D'Souza and Kaushik Basu
Teaching Assistant: V Madhuri

SEMESTER 2 (JANUARY)

UE 102T (2:0)/ UENG 102T (3:0): Introduction to Electrical and Electronics Engineering
UE 102L (0:1)/ UENG 102L (0:1): Introduction to Electrical and Electronics Engineering (Lab)

Instructor: Kaushik Basu

Refer Chapter -17 for the syllabus

UE 200 (2:0)/ UENG 103 (3:0): Introduction to Earth and Its Environment

Instructors: Ramananda Chakrabarti, Attreyee Ghosh and Sambuddha Misra

Nucleosynthesis, formation of planets, minerals, rocks and bulk earth composition; radioactivity and age of the earth; mantle convection and plate tectonics; introduction to stable isotope geochemistry; general application of stable isotopes; the carbon cycle; The S cycle; The nitrogen cycle; chemical weathering and global thermostat; short-term climate variation; wind and oceanic circulation; Thermohaline circulation and its role in climate change; surficial water cycle aqueous chemistry; redox chemistry in aquatic environment – implication and application; carbonate chemistry and its application; instrumentation in environmental and low-temperature geochemistry

SUGGESTED BOOKS:

1. Environmental and Low-temperature Geochemistry - Peter Ryan
2. How to Build a Habitable Planet - Langmuir and Broecker

SEMESTER 3 (AUGUST)

UE 101T (2:0)/ UENG 101T (3:0): Algorithms and Programming
UE 101L (0:1)/ UENG 101L (0:1): Algorithms and Programming (Lab)

Instructors: L Sunil Chandran and Viraj Kumar

Refer Chapter -17 for the syllabus

UE 202 (2:0)/ UENG 201 (3:0): Introduction to Materials Science

Instructor: Suchandrima Das

Bonding, types of materials, basics of crystal structures and crystallography. Thermodynamics, thermochemistry, unary systems, methods of structural characterization. Thermodynamics of solid solutions, phase diagrams, defects, diffusion. Solidification. Solid-solid phase transformations. Mechanical behaviour: elasticity, plasticity, fracture. Electrochemistry and corrosion. Band structure, electrical, magnetic and optical materials.

Classes of practical materials systems: metallic alloys, ceramics, semiconductors, composites.

SUGGESTED BOOK:

1. W.D. Callister: Materials Science and Engineering, Wiley India (2007)

SEMESTERS 4, 5 AND 6

UE 203T (2:0): Introduction to Sensor Technologies for Biomedical Applications

Instructor: Hardik J Pandya

Introduction and Overview to Sensors, Microelectromechanical Systems and Electronic Systems. Introduction to Microfabrication Facility: Cleanrooms, Standard Operating Procedures, Gowning Procedure, Operating Conditions, Clean Room Protocols, Safety and Contamination, and Overview of Cleanroom Hazards. Fundamentals of Material Deposition Techniques: Physical Vapor Deposition and Chemical Vapor Deposition. Fundamentals of Lithography: Hard and Soft Lithography, Bright Field and Dark Field Masks, and Photoresists. Tools in Photolithography: Fume Hood, Spin Coater, Hotplates, Ovens, Mask Aligner Systems, and Wet Benches. Fundamentals of Etching: Wet and Dry Etching, Understanding Terminology in Etching, Etching of Metals, Semiconductors and Insulators, Lift-Off Process. Dry Etching Process: Plasma Assisted Etch Process, Reactive Ion Etching (RIE) and Deep Reactive Ion Etching (DRIE). Design of Process Flow for Device Fabrication: Microheater, Interdigitated Electrodes, Gas Sensors, Microcantilever and Force Sensors. Fundamentals of Diffusion and Ion Implantation. Introduction to MEMS packaging. Understanding electrocardiogram (ECG or EKG), electroencephalogram (EEG), Electrocorticography (ECoG). Understanding drug efficacy using microchips, Technologies (Micro/Nano and circuits) for measuring EC0G, EEG and ECG. Fabrication of devices for neural recordings and stimulations. System Engineering with Microfabricated Sensors (Case Studies). Microtechnology and Processes for Medical Devices: Sensors/Biosensors for Cancer Screening/Diagnosis, Microfluidic Chips for Communicable Disease, Understanding tissue properties from onset to disease progression.

UE 203L (0:1): Introduction to Sensor Technologies for Biomedical Applications (Lab)

Familiarization with Gowning Procedure and Safety Protocols. Introductory Clean Room Visit and Overview of Equipment. Hands-On-Training on Wafer Cleaning Processes. Familiarization with E-beam Evaporation of Metals and Insulators. Familiarization with Photolithography: Photoresist Coating, Soft Bake, UV Exposure using Mask Aligner System, Development, Hard Baking, and Litho-Inspection. Familiarization with Wet Etching of Metals, Semiconductors, and Insulators. Device Design Considerations, FEM Simulations and Mask Design using Clewin. Device Fabrication: From Wafer to Microchips: Fabrication, characterization, and testing of the devices that students designed. Soft Lithography: Microfluidic Device Fabrication by Poly Dimethyl Siloxane (PDMS) Molding and Bonding with Plasma Bonder, Microfluidic Device: Demonstration. System Engineering with Microfabricated Sensors: Case studies of System-Level Integration of Microfabricated Sensors with Data Acquisition and Testing (using NI-DAQ Card, Impedance Analyzer, and Micromanipulator), Calibration of Force Sensors.

Prerequisites (Preferred for better understanding **not mandatory**)**:**

- Fundamentals of undergraduate level physics, chemistry, and mathematics
- Fundamentals of undergraduate level material science
- Fundamentals of electrical and electronics engineering

Main Textbooks:

1. Fundamentals of Microfabrication by Madou Marc J.
2. Silicon VLSI Technology: Fundamentals, Practice, and Modeling by James D. Plummer, Michael Deal, and Peter D. Griffin

Reference Textbooks:

3. Fundamentals of Semiconductor Fabrication by S M Sze
4. VLSI Technology by S M Sze
5. Fundamentals of Microelectronics by B Razavi
6. Franco, S., 2002. Design with operational amplifiers and analog integrated circuits. New York: McGraw-Hill.
7. Pallas-Areny, R. and Webster, J.G., 2012. Sensors and signal conditioning. John Wiley & Sons.

UE 204 (3:0): Elements of Solid Mechanics

Instructor: Ananth Ramaswamy

Elastic Bodies. Axial and Shear Stresses, Hooke's Law, Stress Resultants, Axially Loaded Members, Torsion of Circular Bars, Shear Force, Bending Moment, and Axial Thrust, Theory of Simple Bending, Bending and Shear Stress Distribution in Beams, Two Dimensional State of Stress, Principal Stresses and Strains, Mohr's Diagram, Pressure Vessels, Combined States of Stress and Failure Theories, Detection of Beams, Statically Indeterminate Beams, Unsymmetrical Bending, Shear Centre, Buckling of Columns, Energy Methods, Principle of Virtual Work, Castigliano's Theorems and Applications.

SUGGESTED BOOKS:

1. Gere, J. M. and Timoshenko, S. P., Mechanics of Materials, CBS Publishers, New Delhi, 2nd edition, 1984
2. Popov, E. P., Engineering Mechanics of Solids, Prentice Hall, New Jersey, 1990
3. Utku, S., Norris, C. H. and Wilbur, J. B., Elementary Structural Analysis, McGraw-Hill, New York, 1991
4. Crandall, S. H. and Dahl, N. C., An Introduction to Mechanics of Solids, McGraw-Hill, New York,1959
5. Burden, R. L. and Faires, J. D., Numerical Analysis: Theory and Applications, Indian Edition, Cengage Brooks, Cole Publishers, 2010

UE 201 (2:1): Introduction to Scientific Computing

Instructor: Ratikanta Behera

Number Representation, Stability and Convergence and Error Analysis; Interpolation: Lagrange, New-Ton's Divided Difference, Neville; Root Finding: Bisection, Newton- Raphson, Secant, Regula Falsi, RidDers, Steffensen; Data Analysis and Fitting: Goodness of Fit, Chi-Square Test; Numerical Integration and Differentiation: Newton-Cotes, Gaussian Quadrature, Romberg Integration, Importance Sampling; Numerical Solution of Odes: Euler and Runge-Kutta Methods; Fourier Series and Fourier Transforms, Basics of Sampling Theory, DFT And FFT; Simple Computer Implementation Exercises.

SUGGESTED BOOKS:

1. Kreyszig, E. Advanced Engineering Mathematics, John Wiley & Sons, 10th edition, 2011
2. Press, W. H., Teukolsky, S. A., Vetterling, W. T. and Flannery, B. P. Numerical Recipes: The Art of Scientific Computing, Cambridge University Press, 3rd edition, 2007
3. Hildebrand, F. B., Introduction to Numerical Analysis, 2nd edition, Dover Publications, 1987

Students can choose to take courses from within the pool of elective courses listed, towards their Engineering credits for this academic year.

List of Approved UG Engineering Courses

- Courses listed below will be counted towards Engineering Credits for the BS students until Batch 2021, subject to the following caveats. From Batch 2022 onwards below, courses will be counted towards Assortment/ Institute Elective. Students are requested to get the approval from their faculty advisor and major coordinator for the courses they choose.
- A course being listed here **does not** mean that it will be offered in this academic year: for that please check the (PG) SoI or the department/instructors' webpage.

Caveats

- Among UE 204, PD 202, and AE 221 only one can be chosen.
- Among PD 202 and ME 201, only one can be chosen.
- Among CH 204 and ME 271 only one can be chosen.
- Among CH 202, DS 288, DS 289, UE 203 only one can be chosen.
- Among PD 205 and ME 228, only one can be chosen.
- UE 201 and DS 288 are equivalent courses. If UE 201 is offered students must register for UE 201 if they wish to take one of these courses.

DIVISION OF MECHANICAL SCIENCES

Department of Materials Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
NE 240	Materials Design Principles	3:0	Aug		
MT 271	Introduction to Biomaterials Science and Engineering	3:0	Jan		
MT260 / CH 237	Polymer Science and Engineering	3:0	Aug		

Department of Mechanical Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
ME 201	Fluid Mechanics	3:0	Aug	UP 101, UP 202	Max 20 students
ME 271	Thermodynamics	3:0	Jan	UC 202	

Department of Aerospace Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
AE 221	Flight Vehicle Structures	3:0	Aug		Max 10 students
AE 266	Introduction to Neural Network and Engineering Applications	3:0	Aug/ Jan		Max 10 students
AE 264	Vibrations	3:0	Jan		
AE 201	Flight and Space Mechanics	3:0	Aug		

Centre for Atmospheric and Oceanic Sciences

Course No	Title	Credit	Sem	Prerequisites	Remarks
UES 204	Fundamentals of Climate Science	3:0	Jan		

Department of Chemical Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
CH 202	Numerical Methods	3:0	Aug		
CH 203	Transport Processes	3:0	Aug		
CH 204	Thermodynamics	3:0	Aug		
CH 205	Chemical Reaction Engineering	3:0	Jan		
CH 251	Machine Learning for Materials and Molecules	3:0	Jan	Basics of Linear Algebra, Probability and Statistics	

Centre for Product Design and Manufacturing

Course No	Title	Credit	Sem	Prerequisites	Remarks
PD 201	Elements of Design	2:1	Aug		
PD 202	Elements of Solid and Fluid Mechanics	2:1	Aug		
PD 203	Creative Engineering Design	2:1	Jan		
PD 212	Computer Aided Design	2:1	Jan		Max 15 students
PD 216	Design of Automotive Systems	2:1			
PD 214	Advanced Materials & Manufacturing	3:0	Jan	Materials Science	Max 15 students

Centre for Sustainable Technologies

Course No	Title	Credit	Sem	Prerequisites	Remarks
UES 302	Design Principles in Environmental Engineering	2:0	Aug		
ST 202	Energy Systems and Sustainability	3:0	Aug		Max 20 Students
ST 213	Turbo Machines in Renewable Energy	3:0	Jan		
ST 216	Physics in Experiments with Classical	3:0	Aug		
ST 217	Field Hydrology, River Engineering, Basin Studies	3:1	Aug		

Civil Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
CE 207	Geoenvironmental Engineering	3:0	Jan		
CE 214	Ground Water Hydrology	3:0	Jan		
CE 235	Optimisation Methods	3:0	Jan		
CE 262	Public Transportation Systems Planning	3:0	Jan		

DIVISION of ELECTRICAL, ELECTRONICS and COMPUTER SCIENCES

Department of Computer Science and Automation

Course No	Title	Credits	Sem	Prerequisites	Remarks
E0 206	Theorist's Toolkit	3:1	Aug		
E0 214	Linear Algebra and Optimization	3:1	Aug		
E0 220	Graph Theory	3:1	Jan		
E0 222	Automata Theory and Computability	3:1	Aug		
E0 224	Computational Complexity Theory	3:1	Aug		
E0 225	Design and Analysis of Algorithms	3:1	Aug	A or S in UE101 and UG Math courses.	Only 5th Sem or later; max 10 students
E0 227	Program Analysis and Verification	3:1	Aug		
E0 229	Foundations of Data Science	3:1	Aug	Basic probability	
E0 230	Computational Methods of Optimization	3:1	Aug		
E0 235	Cryptography	3:1	Aug		
E0 254	Network and Distributed Systems Security	3:1	Aug		
E0 256	Theory and Practice of Computer Systems Security	3:1	Aug		
E0 259	Data Analytics	3:1	Aug	UM201 Probability and Statistics	
E0 267	Soft Computing	3:1	Aug		Only 5th Sem or later
E0 271	Graphics and Visualization	3:1	Aug		
E1 201	Foundations of Robotics	3:1	Aug		
E0 205	Mathematical Logic and Theorem Proving	3:1	Jan		

E0 207	Computational Topology: Theory and Applications	3:1	Jan		
E0 208	Computational Geometry	3:1	Jan		

E0 209	Principles of Distributed Computing	3:1	Jan		
E0 210	Dynamic Program Analysis: Algorithms and Tools	3:1	Jan		
E0 212	Graph Algorithms	3:1	Jan	E0 225 Design and Analysis of Algorithms	
E0 234	Introduction to Randomized Algorithms	3:1	Jan		
E0 238	Intelligent Agents	3:1	Jan		Only 5th Sem or later
E0 248	Theoretical Foundations of Cryptography	3:1	Jan		
E0 249	Approximation Algorithms	3:1	Jan	E0 225	
E0 251	Data Structures and Algorithms	3:1	Jan		
E0 255	Compiler Design	3:1	Jan		
E0 261	Database Management Systems	3:1	Jan		
E0 264	Distributed Computing Systems	3:1	Jan		
E0 270	Machine Learning	3:1	Jan	Basic courses in Linear Algebra and Probability	
E0 272	Formal Methods in Software Engineering	3:1	Jan		
E1 254	Game Theory	3:1	Jan	A or S in UE 101 and all Mathematics courses.	Only sixth semester or later; Max 10 students;
E1 277	Reinforcement Learning	3:1	Jan		

Department of Electrical Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
E1 213	Pattern Recognition & Neural Networks	3:1	Jan		

E1 241	Dynamics of Linear Systems	3:0	Aug		Max 10 students
E1 251	Linear and Nonlinear Optimization	3:0	Aug	Linear Algebra, Multivariate Calculus	
E5 253	Dielectrics and Electrical Insulation Engineering	3:0	Aug		
E3 252	Embedded Systems Design for Power Applications	3:1	Jan		

E9 201	Digital Signal Processing	3:0	Aug		
E9 241	Digital Image Processing	2:1	Aug		
E9 253	Neural Networks and Learning Systems	3:1	Aug		
E9 291	DSP System Design	2:1	Aug		
E1 216	Computer Vision	3:1	Jan		Only 6th semester or later;
E1 242	Nonlinear Systems and Control	3:0	Jan		Max 50 students
E3 252	Embedded Systems Design for Power Applications	3:1	Jan		
E9 205	Machine Learning for Signal Processing	3:1	Jan		
E9 213	Time-Frequency Analysis	3:0	Jan		

Department of Electrical Communication Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
E2 201	Information Theory	3:0	Aug		
E2 205	Error-Control Coding	3:0	Aug	Basic Linear Algebra	Max 10 students
E2 206	Quantum Information Theory	3:0	Aug	Matrices and Linear Algebra	
E2 237	Statistical Learning Theory	3:0	Aug		
E3 220	Foundations of Nanoelectronic Devices	3:0	Aug		

E3 238	Analog VLSI Circuits	2:1	Aug	UE 102	Max 10 students
E7 213 / NE 213	Introduction to Photonics	3:0	Aug		3rd or 4th yr students
E3 222 T	Micromachining for MEMS Technology	2:1			
E1 244	Detection and Estimation Theory	3:0	Jan		
E1 260	Optimization for Machine Learning and Data Science	3:1	Jan		
E2 204	Stochastic Processes and Queueing Theory	3:0	Jan		
E2 210	Quantum Error-Correcting Codes	3:0	Jan		

E2 236	Foundations of Machine Learning	3:1	Jan		
E7 214	Optoelectronic Devices	3:0	Jan		
E7 221	Fiber Optic Communications	2:1	Jan		
BE 218	Computational Epidemiology	3:1	Jan		

Department of Electronic Systems Engineering

Course No	Title	Credit	Sem	Prerequisites	Remarks
E3 235	Design for Analog Circuits	2:1	Aug		Max 10 students
E2 270	Quantum Information Theory	3:0	Aug		
E3 282	Basics of Semiconductor Devices and Technology	3:0	Aug		
E9 253	Neural Networks and Learning Systems	3:1	Jan		
UENG 203	Sensor Technologies for Biomedical Applications	2:1	Jan		
E3 253 **(defunct)**	Industrial Instrumentation	2:1	Jan		
E3 267 / IN 222 **(defunct)**	Microcontroller Applications	2:1	Jan		

DIVISION OF INTERDISCIPLINARY RESEARCH

Department of Computational and Data Sciences

Course No	Title	Credits	Sem	Prerequisites	Remarks
DS 201	Bioinformatics	2:0	Aug		

DS 215	Introduction to Data Science	3:0	Aug		
DS 221	Introduction to Scalable Systems	3:1	Aug		
DS 226	Introduction to Computing for AI and ML	2:1	Aug		
DS 284	Numerical Linear Algebra	2:1	Aug		
DS 288	Numerical Methods	3:0	Aug		
DS 290	Modeling and Simulation	3:0	Aug		
DS 216	Machine Learning for Data Science	3:1	Jan		
DS 202	Algorithmic Foundations of Big Data Biology	2:1	Jan		
DS 260	Medical Imaging	3:0	Jan	Knowledge of systems theory	
DS 294	Data Analysis and Visualization	3:0	Jan	Basic Numerical Methods	

Center for Biosystems Science and Engineering

Course No	Title	Credits	Sem	Prerequisites	Remarks
BE 201	Fundamentals of Biomaterials & Living Matter	3:0	Aug		

Center for Nanoscience

Course No	Title	Credits	Sem	Prerequisites	Remarks
NE 201	Micro and Nano Characterization Methods	2:1	Aug		Splited into two courses NE 201A and NE 201B
NE 231	Microfluidics	3:0	Aug		
NE 327	Nanoelectronics Device Technology	3:1	Aug		
NE 241	Material Synthesis	3:1	Jan		

MISCELLANEOUS

Centre for Neuroscience

Course No	Title	Credits	Sem	Prerequisites	Remarks
NS 212	Neural signal processing	3:0	Jan		

Instrumentation and Applied Physics

Course No	Title	Credits	Sem	Prerequisites	Remarks
QT 202	Introduction to Quantum Measurement and Control	3:0	Jan		
QT 204	Introduction to Materials for Quantum Technologies	3:0	Jan		
QT 207	Introduction to Quantum Computation	3:0	Aug		
QT 209	Introduction to Quantum Communication and Cryptography	3:0	Aug		
QT 211	Basic Quantum Technology Lab	1:2	Aug		

Mathematics

Course No	Title	Credits	Sem	Prerequisites	Remarks
MA 208	Proofs and Programs	3:1	Jan		

Cyber Physical Systems

Course No	Title	Credits	Sem	Prerequisites	Remarks
CP 214	Foundations of Robotics	3:1	Aug		
CP 280	Experimental Techniques for Robotics and Automation	1:2	Jan		

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HUMANITIES

The Humanities course as part of the Undergraduate Programme offered at the Indian Institute of Science is an opportunity to bring about synergy between the Humanities and Social Sciences (or 'Human Sciences') with the Natural Sciences. With this aim in mind, IISc offers a wide variety of courses in Humanities for students to choose from. These courses are not designed to teach Humanities as a series of distinct disciplines but are designed to create an intellectual milieu in which the students learn science.

The following are the rules that govern the Humanities part of the curriculum.

- Nine credits from the Humanities pool must be completed within the first six semesters. Any additional Humanities credits accrued will be counted towards elective credits.
- Students can choose from the wide variety of courses listed in the Humanities pool for each semester
- Students have an option not to take a Humanities course in either semester 2 or 3 (but not both). Likewise, students can choose not to take a Humanities course in either semesters 4 or 5 (but not both). All courses in the Humanities pool are two or three credits, so the requirements can be completed in fewer than six semesters.
- Students are allowed to credit at most one course from the Humanities pool each semester.

Courses offered in August-December Term

Sl. No.	Code	Title	Credits	Semester
1	UHS 102	Introduction to Music Appreciation	2:0	I/III/V
2	UHS 111	Designing Sustainably	2:0	I/III/V
3	UHS 112	Practical English Communication	2:0	I/III/V
4	UHS 121	Legal System Fundamentals	2:0	I/III/V
5	UHS 130	Principles of Anthropology	2:0	I/III/V
6	UHS 132	Basic Economics	2:0	I/III/V
7	UHS 134	Methods of History	2:0	I/III/V
8	UHS 136	Foundations of Political Science	2:0	I/III/V
9	UHS 137	Introduction to Psychology	2:0	I/III/V
10	CO 201	Art of Communication for Leaders	2:0	III/V
11	CO 204	Science Communication	2:0	III/V
12	CO 301	Introduction to History and Philosophy of Science	2:0	III/V
13	MG 201	Managerial Economics	3:0	V
14	MG 212	Behavioural Science	2:1	V
15	MG 251	Finance and Accounts	3:0	V

Courses offered in January-April Term

Sl. No.	Code	Title	Credits	Semester
1	UHS 100	Understanding India	2:0	II/IV/VI
2	UHS 101	Literary Theories & Appreciation	2:0	II/IV/VI
3	UHS 103	Explorations into Theatre & Visual Art	2:0	II/IV/VI
4	UHS 110	Concepts of Archaeology	2:0	II/IV/VI
5	UHS 133	Economic Life in Contemporary India	2:0	II/IV/VI
6	UHS 135	Perspectives from Philosophy	2:0	II/IV/VI
7	UHS 220	India: Dialogues that Matter	2:0	IV/VI
8	UHS 231	Essentials of Critical Thinking	2:0	IV/VI
9	CO 201	Art of Communication for Leaders	2:0	IV/VI
10	CO 203	Stars, Optics and Fun	3:0	III/V
11	MG 281	Management of Technology for Sustainability	3:0	IV/VI
12	MG 298	Entrepreneurship for Tech Startups	2:1	IV/VI
13	PS 301	Science and Technology Policy Discussions	3:0	IV/VI
14	PS 303	Communicating Science to Non-experts	3:0	IV/VI
15	ST 206	Environmental and Natural Resource Management	2:1	IV/VI

Course Details

SEMESTERS 1,3 and 5

UHS 102 (2:0): Introduction to Music Appreciation

Instructor: Ritwik Kaikini

Music is a universal language distilled by cultural, societal and personal experiences, having gone through a series of changes over time. Listening to music is a highly active process involving a variety of thought-provoking moments that explore memory, emotion and intuitive conjectures. Some of us use music to relax, some of us use it during physical fitness sessions, some of us use it to meditate and some of us also use it as an occasion to make new friendships. As music forms a significant portion of our daily lives in society, we owe it the critical attention and study its needs for it to evolve further. Research also shows that music helps with human cognitive functioning and overall well-being. This course will cover preliminary concepts of music theory and move towards appreciating music of different styles. The course will have the following aspects:

1) Basics of Music Theory

Introduction to Musical Notation

Concept of Rhythms, Beats, Time Signatures

Key signatures and Scales

2) Music Appreciation: Western Music

Exploring the music of Bach, Mozart and Beethoven.

3) Music Appreciation: Music of India and South Asia

Exploring the musical traditions of Sufi, Hindustani, Folk and Carnatic Music

4) Music Appreciation: Popular Music

Exploring Indian Cinema, English Pop and English Rock.

Readings:

- Music: Appreciation by Roger Kamien
- Listening and Voice: Phenomenologies of Sound by Don Ihde
- The Third Ear: On Listening to the World by Joachim-Ernst Berendt

UHS 111 (2:0): Designing Sustainably

Instructor: Kruthika Ganesh, Narmada Khare

Humans have historically taken inspiration from nature to design their tools and develop their technologies. The Japanese bullet train (based on a kingfisher's beak) and complex urban transportation network (based on growing slime mould) are two of the more popular examples. But humans aren't the only organisms to build things – there are several other skilled architects and builders in the animal world. Human or animal – what drives the design of the structures they build? In this transdisciplinary course, we will focus on natural and

nature-inspired designs of shelters and habitats built by organisms. Our specific stress will be on the role climate has played in the evolution of these designs. Keeping this in mind, we aim to induce discussions about the specific behaviours of builders, impact of the materials used and how shapes and sizes affect the essence of a structure. More specifically, we would like to discuss experiments in building sustainable structures to battle the drastic climate change that is already upon us.

Readings:

Essays and research papers, thesis chapters etc:

- Size and Shape, Stephen Jay Gould
- Animal architecture Mark E. Laidre, Current Biology 31, R1449–R1466, November 22, 2021 © 2021 Elsevier Inc.
- Bonachela, J.A., Pringle, R.M., Sheffer, E., Coverdale, T.C., Guyton, J.A., Caylor, K.K., Levin, S.A., and Tarnita, C.E. (2015). Termite mounds can increase the robustness of dryland ecosystems to climatic change. Science 347, 651–655
- The Concepts of Animal Architecture, Dr-Parag Govardhan Narkhede, Ar. Gautami Bura, August 2021, Compliance Engineering 12(8):38

Books:

- Hansell, M. (2007). Built by Animals: The Natural History of Animal Architecture (Oxford University Press).
- Hölldobler, B., and Wilson, E.O. (2016). Auf den Spuren der Ameisen (In the Footsteps of the Ants) (Heidelberg: Springer Verlag).
- Martin, A.J. (2017). The Evolution Underground: Burrows, Bunkers, and the Marvelous Subterranean World Beneath Our Feet (New York: Pegasus Books).
- Tschinkel, W.R. (2021). Ant Architecture: The Wonder, Beauty, and Science of Underground Nests (Princeton University Press).
- William, Myers. (2012). Bio Design: nature, science and creativity (Thames and Hudson)
- Beatriz, Colomina., Wigley, Mark. (2016). Are we human? Notes on archaeology of design (Lars Müller Publishers: Zurich)
- Rob, Thompson. (2013). Sustainable Materials, Processes and Production (Thames and Hudson)
- Anuradha, Mathur., Da Cunha, Dilip (2014). Design in the terrain of water.
- Maibritt Pedersen Zari (2018). Regenerative Urban Design and Ecosystem Biomimicry (Taylore and Francis)

UHS 112 (2:0): Practical English Communication

Instructor: Sarah Talat

In a globalised world, proficiency in English is not only essential for effective communication but also for academic and professional success. It is also a major part of interpersonal communication in and

outside the academic arena. In the context of higher education, undergraduate studies often require students to engage with complex ideas, conduct research, communicate, and present their findings effectively.

The course is designed for learners of ESL (English as a Second Language), as they must navigate academic discourse, engage in critical thinking, and profess communicative abilities in a second language. Each session covers a fundamental approach to the English language based on the discussions in class, small writing tasks, as well as group activities.

Session-wise topic:

1. Listening skills - Introducing the self, course expectations
2. Introduction to reading strategies, and genres- Reading an academic text
3. Approaches to critical reading and thinking in English
4. Writing- editing, paraphrasing, and summarization, and Cornell notes
5. Writing an analytical essay and reading an argumentative paper
6. Persuasive writing techniques, rhetoric, syntax, and elements of style
7. Fundamentals of communication skills-phatic communication - interpersonal communication
8. Communicative and cultural competence- contextual speaking skills, public speaking, presenting yourself
9. Language immersion and speaking skills

Readings:

1. A Psalm of Life by H.W. Longfellow
2. Excerpt from- Why I want a wife by Judy Brady
3. Growing up male by Krishna Kumar
4. Win Every Argument by Mehdi Hasan
5. The ones who walk away from Omelas by Ursula Le Guin
6. Listening Audio: British Council Vocabulary exercises
7. Dream Children by Charles Lamb
8. On Study by Francis Bacon
9. An Introduction by Kamla Das
10. Healing the Earth by Aravind Gupta

Assessment:

1. In-class written assignment - Reflective Essay
2. Graded Presentations

UHS 121 (2:0): Legal System Fundamentals

Instructor: Shobana V

The course will cover the following topics: Indian Constitution & Legal Framework, Criminal Law, Procedures, Civil Procedure, Law of Evidence, Law of Contracts, Family Law, Law of Torts (Including Consumer Protection), Environmental Law, Cyber Law, Intellectual Property Rights (IPR), and Introduction to International Law.

Readings:

Textbooks:

- Basu, D.D., Introduction to the Constitution of India, LexisNexis, Latest Edit
- Singh, Avtar, Law of Contract and Specific Relief, Eastern Book Company, Latest Edition.
- Pillai, P.S.A., Law of Tort, Eastern Book Company, Latest Edition., Ratanlal & Dhirajlal The Law of Torts (26th Edition)
- Narayanan, P. – Intellectual Property Law (Eastern Law House)

Bare Acts:

- The Constitution of India
- Bharatiya Nyaya Sanhita (BNS)
- Indian Contract Act, 1872
- Consumer Protection Act, 2019
- Information Technology Act, 2000
- Transfer of Property Act 1882
- The Environment (Protection) Act, 1986
- The Patents Act, 1970 (as amended)
- The Trade Marks Act, 1999
- The Copyright Act, 1957 (as amended)
- The Information Technology Act, 2000 (for Cyber IPR provisions)

UHS 130 (2:0): Principles of Anthropology

Instructor: Bitasta Das

This is an activity-based introductory course on Anthropology. It facilitates students' exploration of cultural diversity through hands-on learning and real-world applications. Blending the four fields of anthropology—cultural, biological, linguistic, and archaeological—it emphasizes the practical utility of anthropological premises in everyday life. Through interactive activities and observation exercises, students will engage with key concepts like culture, identity, communication, belief systems, and social structures. The course fosters critical thinking, cross-cultural understanding, and respect for difference.

Readings:

- Asad, Talal (ed.) (1973), Anthropology and the Colonial Encounter, Ithaca Press.
- Fanon, Frantz (1961), The Wretched of the Earth by Frantz Fanon, Penguin UK.
- Geertz Clifford (1973), The Interpretation of Cultures, Basic Books, Inc., Publishers.
- Guest, Kenneth J (2015), Cultural Anthropology: A Toolkit for a Global Age, W. W. Norton & Company.
- Lavenda, Robert H and Schultz Emily A (2017), Anthropology: What Does It Mean to Be Human? Oxford University Press.

UHS 132 (2:0): Basic Economics

Instructor: Anant Kamath

This course introduces students to the basics of economics. Students opting for this course will understand the basics issues that define the discipline and become familiarised with themes in microeconomics (such as supply/demand, consumer, and producer behaviour, competition and monopoly), macroeconomics (national economy, trade, and development), as well as market failure, technology, and global economy. The course departs from a mainstream economics course in both textbook material and pedagogy, by drawing from modern, interdisciplinary, context-specific, and more 'realistic' thematic engagement. Any student opting for this course will have the basic tools in hand to understand their own economic decision-making, the functioning of the world around them, and broad trends in the national and global economy.

Readings:

- Goodwin, N., Harris., J.M., Rajkarnikar, P.J., Roach, B., and Thornton, T.B. Essentials of Economics in Context, Routledge, London and New York, 2021
- Core, The Economy: Economics for a Changing World, Oxford University Press, 2017
- Adam Szirmai, Socio-Economic Development, Second Edition, Oxford Univ. Press, 2015

UHS 134 (2:0): Methods of History

Instructor: Nithin M

An introductory course in methods of historical inquiry, the course will start from the colonial project of history and then move back and forward in time to look at some key debates in history and historiography. Primarily, the course hopes to speak to some dominant contemporary debates and anxieties that students find themselves in conversation with — to challenge common sense discourse on the same and build capacities for a more complex engagement. We will especially look at the history of science, religion, sexuality, gender and mental health and the potentialities and problems with historicism therein.

Readings:

- E.H. Carr, "The Historian and His Facts," in Carr, *What is History?* (New York: Vintage, 1967), 7-30.
- Ashis Nandy, "History's Forgotten Doubles" in *History and Theory* (34 (2), 1995), 44-66.

- Elizabeth Lambourn, *Abraham's Luggage: A Social Life of Things in the Medieval Indian Ocean World*, Cambridge University Press, 2018.
- Gayatri Chakravorty Spivak, & Sarah Harasym, *The Post-Colonial Critic: Interviews, Strategies*, Dialogues (1st ed., Routledge, 1990)
- Hayden White, "The Value of Narrativity in the Representation of Reality" *in The Content of the Form*, pp. 1-25.
- Indira Chowdhury, "Speaking of the Past: Perspectives on Oral History" in *Economic and Political Weekly*, Vol. 49, No. 30 (JULY 26, 2014), pp. 39-42.
- Michel Foucault, *History of Sexuality*, Volume I to IV, (Penguin, NY, 2021)
- Michel-Rolph Trouillot, *Silencing the Past: Power and the Production of History* (Beacon Press, 1995)
- Popper, K, *The Poverty of Historicism*, (Ark Paperbacks, London, 1957).
- Ranajit Guha, *Elementary Aspects of Peasant Insurgency in Colonial India*, (Duke University Press, 1999)
- Romila Thapar, *Time as a Metaphor of History: Early India* (OUP, Delhi, 1996).
- S N Balagangadhara, *What Do Indians Need, a History or the Past? A challenge or two to Indian historians, Parts I and II*. (Text written for the 7th Maulana Abul Kalam Azad Memorial Lecture organised by the Indian Council for Historical Research and delivered on 11 November 2014 in Delhi)
- Thomas S Kuhn, *The Structure of Scientific Revolutions*, 50th ed. (University of Chicago Press, 2012)

UHS 136 (2:0): Foundations of Political Science

Instructor: Geetisha Dasgupta

Essential concepts and ideas: defining the scope and methods of the discipline; nation, state, and government—key components like the territory, population, and constitution; political theory including key thinkers such as Plato, Aristotle, Locke, Hobbes and Rousseau and their ideas; prominent political ideologies like liberalism, conservatism, socialism and communism, political systems like democracy, dictatorship and federalism; political behaviour in different social contexts with specific reference to voting behaviour and political participation; public policy as process and its social impact; political movements including movement for decolonisation of India; modern Indian political thought including Gandhi, Ambedkar, Phule, Nehru, and MN Roy; Constitution of India; international relations.

Readings:

- Gauba, O.P. Introduction to Political Theory. 9th Edition. National Paperback
- Bhargava, Rajeev & Ashok Acharya. Political Theory: An Introduction. Pearson Longman
- DD Basu. Introduction to the Constitution of India. 22nd Edition. Lexis Nexis
- Goodin, Robert E. The Oxford Handbook of Political Science. September 2011
- Chakraborty, B. Modern Indian Political Thought: Text and Context, Taylor & Francis 2024

UHS 137 (2:0): Introduction to Psychology

Instructor: Sudhir Udayakanth

This course introduces students to the foundational principles of Psychology. The students will explore major psychological concepts, theories, and methods. Topics include the biological basis of behavior, learning and memory, personality, psychiatric disorders, and social dynamics. The course emphasizes critical thinking, real-life applications, and appreciation for human diversity and development.

Readings:

Core Textbooks:

- "Psychology" by David G. Myers – A classic, engaging text that covers all foundational concepts clearly.
- "Introduction to Psychology" by James W. Kalat – Very student-friendly, with real-life examples and focus on biological and behavioural aspects.
- "Discovering Psychology" by Don Hockenbury and Sandra E. Hockenbury – Great for visual learners, with a strong emphasis on diversity and real-world application.

Supplementary Readings:

- "The Man Who Mistook His Wife for a Hat" by Oliver Sacks – Fascinating case studies in neurological disorders, perfect for biological basis of behaviour and psychiatric disorders topics.
- "Thinking, Fast and Slow" by Daniel Kahneman – Brilliant insight into decision-making, cognition, and critical thinking.
- "The Psychology of Everyday Things" by Donald Norman – Explores how psychology applies to everyday design and behaviour – real-life application of psychological principles.

SEMESTERS 2, 4 and 6

UHS 100 (2:0) Understanding India

Instructor: Bitasta Das

This course introduces students to contemporary India through folk and vernacular art; oral literature, song, dance, theatre, paintings etc. It aims to broaden their understanding by exploring the deep, often overlooked connections between social life and scientific and technological development. By treating the arts as windows into the worldviews of diverse communities, the course emphasises how traditional knowledge can offer valuable insights that complement scientific understanding, without conflating the two. In doing so, it reorients the study of the nation from top-down narratives to lived experiences, encouraging future leaders to engage more thoughtfully with India's plural realities.

Readings:

- Dundes, Alan (1989), *Folklore Matters*, University of Tennessee.
- Bhabha, Homi K (2004), *The Location of Culture*, Routledge Classics
- Basham, A L (ed.) (1994), *A Cultural History of India*, Oxford University Press
- Snow, CP (1959), *The Two Cultures*, Cambridge University Press

UHS 101 (2:0): Literary Theories & Appreciation

Instructor: Anchitha Krishna

This introductory course explores the basic concepts in literature through a survey of the major developments in literary theory and criticism and aims to hone critical reading skills through practical reading sessions.

Literary Genres

Early developments of poetry, drama and novels.

Literary Theory: An Introduction

Formalism; Structuralism; Poststructuralism; Postcolonialism; Posthumanism; Literature and Science - Leavis and Snow

Reading and the Reader

Reading and Writing in the contemporary era; Frankenstein; "The Minority Report;" Malgudi Days

Readings:

- Dick, Philip K. "The Minority Report", *The Minority Report*, Citadel Twilight, 1991.
- Eagleton, Terry. *Literary Theory: An Introduction.* John Wiley & Sons, 2011.
- Leavis, Frank Raymond. *The Two Cultures?* Cambridge University Press, 2013.
- Narayan, R.K. *Malgudi Days*. Penguin Books, 2006.
- Shelley, Mary. *Frankenstein*. David S. Lake Publishers, 1986.
- Snow, Charles Percy. *The Two Cultures*. Cambridge University Press, 2012.

UHS 103 (2:0): Explorations into Theatre & Visual Art

Instructor: Sharath Parvathavani and Mahesh Pattar

Theatre

Introduction to Theatre Theory: The idea of theatre, definition, purpose, function, uniqueness, relevance, the uninterrupted gaze, differences between theatre and cinema

Drama: Story, foundations, representation of the world and human experience, mechanics and structure, characters, psychology and emotions

Classical Drama: Elements of Aristotle's Poetics, Bharatha's Natya Shastra basics, Navarasa, comparison of both genres

Units of a Play: Acting, scenery & setting, properties, music & sound, lighting, costumes, makeup, direction

Playwriting: Process & techniques basics

In Class: Watching and analysis of a short play, theatre activities

Visual Art

This module offers an introductory exploration into the world of visual art, focusing on how we see, interpret, and create images. Through a combination of visual studies, studio practice, discussions, and observations, students will engage with core concepts of visual language such as line, form, color, space, and composition. The course encourages students to explore their creative voice while understanding the cultural, social, and historical contexts of visual art. The module will involve:

Introduction to basic principles and elements of visual art.

Engage the students in hands-on art-making and observational practices.

Develop an appreciation of visual aesthetics, creativity, and personal expression.

Connect visual art to broader cultural, environmental, and interdisciplinary contexts.

Readings:

- *Ways of Seeing* by John Berger
- *The Elements of Graphic Design* by Alex W. White
- *Drawing on the Right Side of the Brain* by Betty Edwards (selected chapters)
- Selected articles on Indian and contemporary art (provided in class)

UHS 110 (2:0): Concepts of Archaeology

Instructor: Srikumar Menon

This course is a primer into archaeological techniques – especially archaeoastronomy. Conventional archaeology offers information about the material culture of societies in the past. However, it is possible to glean insights into the knowledge systems possessed by bygone cultures from examining the monuments and artefacts they left behind. For instance, an understanding of the knowledge of geometry, engineering, astronomy etc. of a given culture is embedded in the design and layout of the monuments they created. The emphasis in this course will be on knowledge of astronomy prevalent in ancient cultures. The main aspects covered in this course will be: basics of archaeology, an introduction to the archaeology of the Indian subcontinent, prehistoric and later monuments in the Indian subcontinent – megaliths, stupas, temples of different periods and regions, case studies of selected monuments, introduction to astronomy, astronomy and ritual in history, megalithic astronomy, Stonehenge, Newgrange and other examples of deliberate astronomical alignments, Indian examples – Nilaskal, Byse, Sun-facing monuments like temples, field-observation techniques and surveys, summing up.

Reading:

- Atkinson, R. J. C. (1956) Stonehenge, Penguin Books, New York.

- Cornell, J. (1981) The First Stargazers: An Introduction to the Origins of Astronomy, The Athlone Press, London.
- Hawkins, G. S. (1965) Stonehenge Decoded, Dorset Press, New York.
- Hawkins, G. S. (1973) Beyond Stonehenge: From Ancient Egypt to the Peruvian Desert Lines, Hubert Allen and Associates, USA.
- Hoskin, M. (2001) Tombs, Temples and their Orientations: A New Perspective on Mediterranean Prehistory, Ocarina Books, United Kingdom.
- Hoyle, F. (1977) On Stonehenge, W. H. Freeman and Company, San Francisco.
- Koestler, A. (1959) The Sleepwalkers: A History of Man's Changing Vision of the Universe, Penguin Books, New York.
- Krupp, E. C. (Ed.) (1979) In Search of Ancient Astronomies, McGraw Hill, USA.
- Krupp, E. C. (1983) Echoes of the Ancient Skies – the Astronomy of Lost Civilizations, Courier Corporation Publishing, Massachusetts.
- Krupp, E. C. (1999) Skywatchers, Shamans and Kings – Astronomy and the Archaeology of Power, Wiley, New York.
- Lockyer, N. (2006: originally published 1894) The Dawn of Astronomy: A Study of Temple Worship and Mythology of the Ancient Egyptians, Dover Publications, New York.
- Magli, G. (2009) Mysteries and Discoveries of Archaeoastronomy: From Giza to Easter Island, Springer, New York.
- Magli, G. (2013) Architecture, Astronomy and Sacred Landscape in Ancient Egypt, Cambridge University Press, Cambridge.
- Magli, G. (2015) Archaeoastronomy: Introduction to the Science of Stars and Stones, Springer, New York.
- Ridpath, I. (2003) Norton's Star Atlas and Reference Handbook, Addison Wesley, Boston.
- Ruggles, C. (1999) Astronomy in Prehistoric Britain and Ireland, Yale University Press, Bellevue.
- Ruggles, C. (2005) Ancient Astronomy, ABC-Clio Publishing, Santa Barbara.
- Sewell, R. and Dikshit, S. B. (1995) The Indian Calendar – with Tables for the Conversion of Hindu and Muhammadan into AD dates and Vice Versa, Motilal Banarsidass Publishers Private Limited, Delhi.
- Sharma, V. N. (1995) Sawai Jai Singh and his Astronomy, Motilal Banarsidass Publishers Private Limited, Delhi.
- Subbarayappa, B. V. and Sarma, K. V. (1985) Indian Astronomy: A Source-Book, Nehru Centre, Bombay.

UHS 133 (2:0): Economic Life in Contemporary India

Instructor: Anant Kamath

This course introduces students to the essentials of economics in the context of life and livelihood in contemporary India. The course begins with introducing some concerns in everyday economic life and in human well-being and development. We then move on to analysing and interpreting critical issues of contemporary

relevance via the application of a few interesting concepts. We dive into understanding the nature of the state, market, development, caste and gender, urbanity, and inequality. Any student opting for this course will become better informed and intellectually more equipped to understand the trends in economic life our era; they will discover how economics can help them understand subtle and inescapable realities about their individual selves and of the world around them.

Readings:

- Sukhadeo Thorat and Katherine Newman *Blocked by Caste*, Oxford University Press, 2012
- Jean Dreze and Amartya Sen *An Uncertain Glory*, Princeton University Press, 2013
- Nitin Kumar Bharti, Lucas Chancel, Thomas Piketty, Anmol Somanchi. *Income and Wealth Inequality in India, 1922-2023: The Rise of the Billionaire Raj*, 2024.
- Carol Upadhya *Caste and Capital*, in Jodhka and Naudet (eds.) *The Oxford Handbook of Caste*, Oxford University Press, 2023

UHS 135 (2:0): Perspectives from Philosophy

Instructor: Dunkin Jalki

Understood broadly, 'philosophy' is an inquiry into issues like existence, knowledge, values, reason, mind, language, etc. However, if you take this route, you will soon realise that we can only question and criticise Indians and their culture. Consider the way the West has characterised India for centuries: irrational, corrupt, lazy, oppressive, and so on. But can a culture survive for millennia if it is plagued by so many problems? When our ISRO scientists perform pooja, are they being unscientific and superstitious? When your mother insists that you wear a bindi, is she being communal? We will learn to address such questions in this course. This course explores Indian culture and our daily lives, aiming to provide a perspective that is both scientific and relatable to our experiences.

Readings:

- Articles available on the website: https://www.hipkapi.com/
- Balagangadhara, S. N., and Sarika Rao. 2021. What Does It Mean to Be 'Indian'? Chennai: Notion Press.

SEMESTERS 4 and 6

UHS 220 (2:0): India: Dialogues that Matter

Instructor: Uday Balakrishnan

Integration: The creation of the Indian State

From Unitary to Federal: The evolution of the Indian Republic

Electoral democracy in India

Public policy making in India: The changing relationships between the executive, legislative and judicial branches of the Government.

Let us talk demography: The demographic dividend, it's there but we have to work to make it transformative.

The role of science and technology in policy making in India

Challenges and Response: India in the world - a close look at the evolution of India's foreign policy -1947 -2025

Is climate change the greatest challenge the Indian state has ever faced? An inquiry

Social Justice in India: A deep look

India's North- East: An examination

Is there a North-South, East-West divide?: We'll check the number!

How is India defended? An inquiry.

UHS 231 (2:0): Essentials of Critical Thinking

Instructor: Vandana Goswami

This introductory course is designed to help students practice some key critical thinking skills and capabilities --- ability to analyse and find connections between topics and ideas, look at data and information from multiple perspectives, synthesize ideas and communicate them to others effectively. A key objective of this course is to give students some of the tools that will help them think independently, evaluate situations from all perspectives, come up with informed opinions on issues and ideas, sharpen questioning skills and make balanced decisions. All these are twenty-first century life skills that students will use in different contexts, both personal and professional. These abilities will be honed in through critical examination of content material selected from things we see around us --- media reports, social media forwards, songs, poetry and various other sources. Classes will be predominantly activity and discussion-oriented, where students will be encouraged to critique their own thinking, identify biases, and express their thoughts in a reasoned manner.

Readings:

The course will not have a textbook. Readings will be assigned as handouts or web pages as and when necessary.

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IN-SEMESTER PROJECT

Sl. No.	Code	Title	Credits	Semester	Course Type
1	UI 202	In-semester project	0:1	IV	Elective
2	UI 301	In-semester project	0:1	V	Elective
3	UI 302	In-semester project	0:1	VI	Elective

SEMESTER 4 (JANUARY)

UI 202 (0:1): In-semester project

Instructor: Major discipline coordinators

SEMESTER 5 (AUGUST)

UI 301 (0:1): In-semester project

Instructor: Major discipline coordinators

SEMESTER 6 (JANUARY)

UI 302 (0:1): In-semester project

Instructor: Major discipline coordinators

Course modalities: Student should reach out to any faculty member willing to host a UG student for an in-semester project. The student should discuss the project details with the faculty member and carry out the project. At the end of the semester, the student needs to write a report and submit it to the project advisor which will be evaluated by a committee (written or written and oral both) and a grade will be given. Once the student finds a faculty member, this information must be passed on to the major discipline coordinator and the UG office for record keeping.

Note:

1. **Students are allowed to take ONLY one of these three courses. For example, if a student of 4th semester takes UI202, that student is not allowed to take UI301 or UI302. Likewise, if a student of 5th semester takes UI301, then the student is not allowed to take UI302.**

2. The course credit for the above courses will be counted towards Assortment course (AC) pool.

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MATERIALS

Courses offered from the 4th semester onwards from Batch -2022 onwards

[Core, elective courses for Materials Major/Minor]

Sl. No.	Code	Title	Credits	Semester	Course Type
1	UMT 202T	Structure of Materials	2:0	IV	Major- Core Minor- Core
2	UMT 202L	Structure of Materials (Lab)	0:1	IV	Major- Core Minor- Core
3	UMT 203	Thermodynamic of Materials	3:0	IV	Major- Core Minor- Soft core
4	UMT 205	Mechanical Behavior of Materials	3:0	IV	Major- Core Minor- Soft core
5	UMT 301	Materials Kinetics	3:0	V	Major- Core Minor- Soft core
6	UMT 302T	Introduction To Materials Processing	2:0	V	Major- Core Minor- Soft core
7	UMT 302L	Materials Processing (Lab)	0:1	V	Major- Core Minor- Soft core
8	UMT 309*	Functional Properties of Materials I	3:0	V	Major- Core Minor- Soft core
9	UMT 312T	Mechanical Testing and Failure of Materials	2:0	V	Major- Core
10	UMT 312L	Mechanical Testing (Lab)	0:1	V	Major- Core
11	UMT 310T	Introduction To Materials Manufacturing	2:0	VI	Major- Core
12	UMT 310L	Materials Manufacturing (Lab)	0:1	VI	Major- Core
13	UMT 311	Functional Property Characterization (Lab)	0:1	VI	Major- Core
14	UMT 401**	Functional Properties of Materials II	3:0	VI	Major- Core
15	UMT 400	Project: Materials	0:13	VIII	Project
16	UMT 500	Project: Materials	0:20	X	Project

The courses listed in the above table other than the Minor Core courses would be treated as electives for Materials Minor.

Note:

i) *** Course was offered during VI semester until Batch- 2021**

ii) **** Course was offered during VII semester until Batch- 2021**

The following PG Courses listed below will be considered towards both Major / Minor electives

Sl. No.	Code	Title	Credits	Semester
1	MT 209	Defects in Materials	3:0	VI or VIII
2	MT 260	Polymer Science and Technology	3:0	V or VII
3	MR 303	Nanomaterial Synthesis and Devices	3:0	V or VII
4	MR 306	Electron Microscopy in Materials Characterization	3:0	V or VII
5*	MT 271 OR MR 203	Introduction to Biomaterials Science and Engineering OR Introduction to Biomaterials	3:0 3:0	V or VII
6	MT 201	Phase Transformations	3:0	VII
7	MT 307	Materials in Extreme Environments	3:0	VII
8	MT 255	Solidification Processing	3:0	VII
9	MT 248	Modeling and Simulations in Materials Engineering	3:0	VI or VII
10	MR 308	Computational Modeling of Materials	2:1	V or VII

Note: Sl. No.5* - Only one of two (or four) courses will count towards materials elective credits. For instance, if you credit both MT 271 and MR 203, only one of them will count towards materials elective, the other will count as a non-materials elective.

The following non-MTE/non-MRC PG Courses will be considered towards Major electives

Sl. No.	Code	Title	Credits	Semester
1	MT 211	Magnetism, magnetic materials and devices	3:0	V or VII
2	IN 232	Concepts in solid state physics	3:0	VII
3	NE 201	Micro and Nano Characterization Methods	2:1	VI
4	IN 201	Analytical Instrumentation	3:0	V or VII
5	NE 241	Materials Synthesis: Quantum Dots to Bulk Crystals	3:0	VI
6	SS 205	Symmetry and Structure in the Solid State	3:0	V or VII
7	ME 251	Biomechanics	3:0	VII
8	ER 206	Transport Phenomena in Energy systems	3:0	VII
9	IP 323	Topics in Basic and Applied Electrochemistry	3:0	VII
10	PH 351	Crystal Growth, Thin Films and Characterization	2:0	VII
11	NE 205	Semiconductor Devices and Integrated Circuit Technology	3:0	VII
12	IN 214	Semiconductor Devices and Circuits	3:0	VII
13	E3 282	Basics of Semiconductor Devices and Technology	3:0	VII
14	IN 224	Nanoscience and Device fabrication	3:0	VII
15	NE 310	Photonics technology: Materials and Devices	3:0	VII
16	PD 202	Elements of Solid and Fluid Mechanics	3:0	VII
17	ME 273	Solid and Fluid Phenomena at Small Scales	3:0	VII
18	MT 207	Introduction to Electronic Properties of Materials	2:0	VII

19	MT 217	Computational Mathematics for Materials Engineers	3:0	VII
20	MT 261	Polymers Science and Engineering II: Organic Electronics	3:0	VII
21	NE 316	Advanced Electron Microscopy in Materials Characterization	3:0	V or VII
22	MR 222	Chemistry of Materials	3:0	
23	NE 240	Materials design principles for electronic, electromechanical and optical functions	3:0	

Credit Requirements for Materials Major/ Elective courses plus Project

Course Type	Basic Courses (Sem 1-3)	Engg (Sem 1-3)	Humanities (Sem 1-6)	Core (Sem 4-8)	Major Electives	Project	Assortment/ Institute Elective	Total
Till Batch 2021	36	19	9	28	11	13	15	131
From Batch 2022 onwards	40	6	9	28	10	13	25	131

Course Details

Coordinator: Sai Gautam Gopalakrishnan
Instructors UG: Elumalai and Arathi Ramachandran
Teaching Assistants: Shukla Harshit Kirtbhai and Jeevan S

SEMESTER 4 (JANUARY)

UMT 202T (2:0): Structure of Materials

Instructor: N. Ravishankar

Elements of bonding, structures of simple metallic, ionic and covalent solids; Coordination polyhedra, projections of structures, stacking; Lattices, symmetry operations, stereographic projection; Structure and thermodynamics of point defects and solid solutions, non-stoichiometry, ordered structures; Dislocations and slip, twinning and interfaces.

SUGGESTED BOOKS:

1. Kelly, A. and Groves, G. W., Crystallography & Crystal Defects, Addison Wesley
2. Barrett, C.S. and Massalski, T. B., Structure of Metals, Pergamon
3. West, A. R., Introduction to Solid State Chemistry, John Wiley

UMT 202L (0:1): Structure of Materials (Lab)

Instructor: S. Karthikeyan

UMT 203 (3:0): Thermodynamics of Materials

Instructor: T. A. Abinandanan

First law, enthalpy, thermochemistry; Second law, entropy, statistical interpretation; Helmholtz and Gibbs free energies, chemical potential; Solution thermodynamics; Conditions for equilibrium, phase rule, phase diagrams; Chemical reactions and equilibria; Surfaces and interfaces

SUGGESTED BOOKS:

1. DeHoff, R.T. 2006. Thermodynamics in Materials Science, Taylor & Francis
2. Gaskell, D. R. 2003. Introduction to the Thermodynamics of Materials (4th Ed), Taylor & Francis

UMT 205 (3:0): Mechanical Behavior of Materials

Instructor: S. Karthikeyan

Structures, vector mechanics (statics) and types of loads; Introductory concepts in stress and strain and their transformation; Linear elasticity in single and poly-crystals and in amorphous solids; Stresses in constrained systems – thermal and misfit stresses; Viscoelasticity and hyper elasticity in polymers; Stress concentration; Fracture mechanics and toughening mechanisms; Introduction to plastic deformation; Uniaxial stress-strain curve and flow instabilities; Effect of strain, strain-rate and temperature of flow stress; Continuum-based yield criteria; Plastic deformation mechanisms – slip, twinning and diffusion; Introduction to dislocation theory – slip systems, critical resolved shear stress, strengthening mechanisms.

SUGGESTED BOOKS:

1. Beer, F. P., Johnston, E. R., DeWolf, J. T., and Mazurek, D.F. 2014. Mechanics of Materials, 7th edition, McGraw Hill
2. Hosford, W. 2010. Mechanical Behavior of Materials, 2nd edition, Cambridge University Press
3. Courtney, T. H. 2001. Mechanical Behavior of Materials, 2nd edition, Tata McGraw Hill
4. Ward, I. M. and Sweeney, J. 2012. Mechanical Properties of Solid Polymers, 3rd edition, Wiley

SEMESTER 5 (AUGUST)

UMT 301 (3:0): Materials Kinetics

Instructor: Abhik Choudhury

Point defects, Fick's laws of diffusion, concept of jump frequency, activation energy, Kirkendall effect, solidification, nucleation, constitutional supercooling, sintering, interfaces, grain growth, solid state transformations, JMA theory, GP zone, Spinodal decomposition, ordering and martensitic transformations, effect of stress and electric current.

SUGGESTED BOOKS:

1. Reed-Hill, R. E. and Abbaschian, R. 2009. Physical Metallurgy Principles, Cengage
2. Porter, D. A. and Easterling, K. E. 2009. Phase Transformations in Metals and Alloys, Taylor and Francis

UMT 302T (2:0): Introduction to Materials Processing

Instructor: Surendra Kumar Makineni

Metals: Principles of extraction of metals, mineral beneficiation, hydrometallurgy, electrometallurgy, pyrometallurgy.
Ceramics: Synthesis of ceramic powders, consolidation, sintering.
Polymers: Introduction to polymer science and engineering, polymer synthesis, introduction to polymer processing.

SUGGESTED BOOKS:

1. Alcock, C. B. 1976. Principles of Pyrometallurgy, Academic Press, London
2. Venkatachalam, S. 1998. Hydrometallurgy, Narosa, New Delhi
3. Kingery, W. D., Bowen, H. K. and Uhlmann, D. R. 1976. Introduction to Ceramics, Wiley
4. Billmeyer, F. W. Textbook of Polymer Science
5. Gowarikar, V. R., Vishwanathan, N. V. and Sreedhar, J., Polymer Science

UMT 302L (0:1): Materials Processing (Lab)

Instructor: Surendra Kumar Makineni

UMT 309 (3:0): Functional Properties of Materials I

Instructor: Subho Dasgupta

Brief review of the fundamentals of quantum mechanics, statistical mechanics, electrostatics and electrodynamics; Energy bands in crystals, density of states, electric conduction in metals and alloys, thermoelectric phenomenon and applications, semiconductors and devices, electrical properties of polymers, ceramics, dielectric and amorphous materials, classical and quantum mechanical description of optical properties, lasers, LEDs, photonics, magnetic phenomenon and applications, thermal properties of materials.

SUGGESTED BOOKS:

1. Kittel, C., Introduction to Solid State Physics, McGraw-Hill
2. Solymar, L. and Walsh, D., Lectures on Electrical Properties of Materials
3. Omar, M. A., Elementary Solid State Physics
4. Hummel, R. E., Electronic Properties of Materials
5. Hench, L.L, West, J.K. 1990. Principles of Electronic Ceramics, Wiley
6. West, A.F., Solid State Chemistry and its Applications, Wiley (2nd ed.)

UMT 312T (2:0): Mechanical Testing and Failure of Materials

Instructor: S. Karthikeyan

Overview of solid mechanics, Overview of deformation and failure mechanisms in metals, ceramics and polymers, Mechanical testing techniques: Tensile and compression, hardness, fatigue, impact, creep, fracture, Introduction to instrumentation, controls and data acquisition.

SUGGESTED BOOKS:

1. Hosford, W. 2010. Mechanical Behavior of Materials, 2nd edition, Cambridge University Press
2. Courtney, T. H. 2001. Mechanical Behavior of Materials, 2nd edition, Tata McGraw Hill
3. Ward, I. M. and Sweeney, J. 2012. Mechanical Properties of Solid Polymers, 3rd edition, Wiley

UMT 312L (0:1): Mechanical Testing (Lab)

Instructors: S. Karthikeyan

SEMESTER 6 (JANUARY)

UMT 310T (2:0): Introduction to Materials Manufacturing

Instructors: Prosenjit Das

Processing of metallic materials: Principles of hot, warm and cold working of metallic materials; Fundamentals of metal forming processes – rolling, forging, extrusion, wire drawing and sheet metal forming, defects in forming; Introduction to metal casting and joining; Powder processing of metallic and ceramic materials: Powder production, compaction and sintering.

Polymer processing: Basic concepts of compounding and processing; concept of master batches; classification and type of additive for plastics: antioxidants, light stabilisers, UV stabilisers; Processing techniques: Basics of various processing techniques, Extruders: single screw and twin screw extruders, film blowing, fiber spinning, thermoforming; Molding: Injection molding, blow molding, compression molding, injection stretch blow molding, gas and water assisted injection molding.

SUGGESTED BOOKS:

1. Grover, M. P. 2011. Introduction to Manufacturing Processes, Wiley
2. Dieter, G. E. 1988. Mechanical Metallurgy, McGraw-Hill
3. Billmeyer, F. W. Textbook of Polymer Science, 3rd Edition
4. Gowarikar, V. R., Vishwanathan, N. V. and Sreedhar, J., Polymer Science

UMT 310L (0:1): Materials Manufacturing (Lab)

Instructors: Prosenjit Das, Avadhani G S

UMT 311 (0:1): Functional Property Characterization (Lab)

Instructor: Subho Dasgupta

Resistivity measurement by different methods, four probe method, determination of B-H curve, Curie point measurement Hall effect experiment, magnetostriction measurement, measurement of dielectric constant as function of temperature, Seebeck effect, efficiency of solar Cell

UMT 401 (3:0): Functional Properties of Materials II

Instructor: V. Jayaram

Crystal chemistry, point defects and associated thermodynamic equilibria, microstructural control (texture, porosity and grain size), energy levels (band structure in metals and semiconductors, junctions, electrical double layers), thermodynamic relationships, symmetry dependence and tensorial representation of properties; Introduction to properties: dielectric (piezoelectric, ferroelectric, pyroelectric), magnetic (ferro-, ferri-, magnetostriction), electrical conductivity (ionic and electrical), thermoelectricity; Specific examples of systems: piezoelectric, ferro-electric and -magnetic materials (domain structure, poling, influence on endurance, soft and hard materials), Actuator materials, Energy conversion devices (common batteries, fuel cells, supercapacitors)

SUGGESTED BOOKS:

1. Kingery, D.W., Bowen, H.K., Uhlmann, D.R, Introduction to Ceramics, Wiley (2nd Ed)
2. Solymar, L. and Walsh, D. Electrical Properties of Materials, Oxford University Press (8th ed)
3. Newnham, R.E. 2004. Properties of Materials, Oxford University Press
4. Hench, L.L, West, J.K. 1990. Principles of Electronic Ceramics, Wiley
5. West, A.F., Solid State Chemistry and its Applications, Wiley (2nd ed)

SEMESTERS 8 (JANUARY)

UMT 400 (0:13): Project: Materials

Instructors: Faculty from Department of Materials Engineering OR Materials Research Centre

Master of Science

Students are required to complete 32 additional credits in their fifth year to qualify for a Master's degree. These credits are divided into 12 classroom credits and 20 credits for UMT 500, the Master's Project. The classroom credits include four courses - two mandatory PG-level core courses, one PG-level soft-core course from a prescribed list of courses and one PG-level elective as indicated below:

The choice of 4 classroom courses (12 credits) should be as follows:

1. **Two core courses**

Sl. No.	Code	Title	Credits	Semester
1	MT 202	Thermodynamics and Kinetics	3:0	Aug
2	MT 204	Structure and Properties of Materials	3:0	Aug

2. **Any one out of the following soft-core courses:**

Sl. No.	Code	Title	Credits	Semester
1	MT 213	Electronics Properties of Materials	3:0	Jan
2	MT 209	Defects in Materials	3:0	Jan
3	MT 217	Computational Mathematics for Materials Engineers	3:0	Aug
4	MT 307	Materials in extreme environments	3:0	Aug
5	MT 253	Mechanical Behavior of Materials	3:0	Aug
6	MT 260	Polymer Science and Engineering	3:0	Aug
7	MT 206	Texture and Grain Boundary Engineering	3:0	Aug
8	MT 240	Principles of Electrochemistry and Corrosion	3:0	Jan
9	MT 220	Microstructural Engineering of Structural Materials	3:0	Jan
10	MT 205	Structure and Characterization of Materials	3:0	Aug
11	NE 316	Advanced Electron Microscopy	3:0	Aug

3. **Any one PG-level course offered in Materials Engineering or Materials Research Centre**

* Those who have already taken MT 202 and/ or MT 204 in their Bachelor's program, must substitute the same from the above list of soft-core courses.

Additionally, Masters students need to complete **UMT 500** (**0:20**): **Project: Materials**

Note: For credit carry over from BS (Research) to MS please refer to Chapter – II, section - 2.3

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MATHEMATICS

Curriculum applicable From Batch 2022 onwards

Basic Core Courses (for Mathematics Major and Minor)

Sl. No.	Code	Title	Credits	Semester
1	UMA 101	Analysis and Linear Algebra – I	4:0	I
2	UMA 102	Analysis and Linear Algebra - II	4:0	II
3	UMA 201	Probability And Statistics	4:0	III

Curriculum applicable until Batch 2021

Basic core courses

Sl. No.	Code	Title	Credits	Semester
1	UM 101	Analysis and Linear Algebra – I	3:0	I
2	UM 102	Analysis and Linear Algebra - II	3:0	II
3	UM 201	Probability And Statistics	3:0	III

Courses offered from the 4th semester onwards

[Core, elective courses for Mathematics Major/Minor]

Sl. No.	Code	Title	Credits	Semester	Course Type
1	UM 204	Introduction to Basic Analysis	3:1	IV	Major- Core Minor- Core
2	UM 205	Introduction to Algebraic Structures	3:1	IV	Major- Core Minor- Core
3	MA 200	Multivariable Calculus	3:1	V	Major- Core Minor- Core
4	MA 212	Algebra I	3:0	V	Major- Core Minor- Core
5	MA 219	Linear Algebra	3:1	V	Major- Core Minor- Core
6	MA 231	Topology	3:1	V / VII	Major- Core
7	MA 213#**	Algebra II	3:1	VI	Major- Core/ Soft core
8	MA 222#**	Measure & Integration	3:1	VI	Major- Core/ Soft core
9	MA 224	Complex Analysis	3:1	VI	Major- Core
10	MA 241	Ordinary Differential Equations	3:1	VI	Major- Core
11	UM 400	Project: MATHEMATICS	0:13	VIII	Bachelor's Project
12	Electives Offered in August-December Semester				Electives
13	Electives Offered in January-April Semester				Electives
14	UM 501	Master's Project A	0:6	IX	Project
15	UM 502	Master's Project B	0:6	X	Project

Note:

i) **# Core until Batch 2021**

ii) **** From Batch 2022 onwards, students have to complete either MA 213 or MA 222**

iii) **Requirements for Minor in Mathematics**

The courses listed in the above table as minor core courses would be treated as Mathematics Minor. Either MA 200 or MA 219 can be taken

Credit Requirements for Mathematics Major

Course Type	Basic Courses (Sem 1-3)	Engg (Sem 1-3)	Humanities (Sem 1-3)	Core (Sem 4-8)	Soft core	Major Electives	Project	Assortment/ Institute Elective	Total
Till Batch 2021	36	19	9	39	0	0	13	15	131
From Batch 2022 onwards	40	6	9	31	4	3	13	25	131

ELECTIVES OFFERED IN AUGUST – DECEMBER SEMESTER

Course Code	Title	Credits	Instructors
MA 261	Probability Models	3:0	Manjunath Krishnapur
MA 223	Functional Analysis	3:0	Swarnendu Sil
MA 232	Introduction to Algebraic Topology	3:0	Harish Seshadri
MA 242	Partial Differential Equations	3:0	Arka Mallick
MA 312	Commutative Algebra	3:0	Bharathwaj Palvannan
MA 313	Algebraic Number Theory	3:0	Radhika Ganapathy
MA 315	Lie Algebras and their Representations	3:0	R. Venkatesh / Shushma Rani
MA 319A	Schubert Calculus	3:0	Arvind Ayyer
MA 333	Riemannian geometry	3:0	Ved Datar
MA 339	Geometric Analysis	3:0	Vamsi Pritham Pingali
MA 341	Matrix Analysis and Positivity	3:0	Apoorva Khare
MA 361	Probability Theory	3:0	Srikanth K. Iyer
MA 380	Introduction to Complex Dynamics	3:0	Gautam Bharali

ELECTIVES OFFERED IN JANUARY-APRIL SEMESTER

Course Code	Title	Credits	Instructors
MA 235	Introduction to differentiable manifolds	3:0	Subhojoy Gupta
MA 218	Number theory	3:0	Shaunak Deo
MA 220	Representation theory of finite groups	3:0	R Venkatesh
MA 222A	Topics in Measure Theory	3:0	Arka Mallick
MA 237	Introduction to Tilings	3:0	Subhojoy Gupta
MA 262	Introduction to Stochastic Processes	3:0	Arvind Ayyer
MA 305	Lie Groups and Lie Algebras	3:0	Muna Naik
MA 319	Algebraic Combinatorics	3:0	Digjoy Paul / Arvind Ayyer
MA 321	Analysis III	3:0	A K Nandakumaran
MA 326	Fourier Analysis	3:0	Kalachand Shuin / E. K. Narayanan
MA 336A	Introduction to Stochastic Finance	3:0	Srikanth K. Iyer
MA 340	Advanced Functional Analysis	3:0	E. K. Narayanan
MA 376	Extremal Combinatorics	3:0	Hiranya Kishore Dey / Arvind Ayyer
MA 379	Linear Algebraic Groups	3:0	Radhika Ganapathy
MA 347A	Topics in Finite Element Methods	3:1	Thirupathi Gudi

Course Details

Coordinators: Vamsi Pritham Pingali and Purvi Gupta
Instructors: Manpreet Singh and Sathish Kumar

SEMESTER 1 (AUGUST)

UM 101 (3:0)/ UMA 101 (4:0): Analysis and Linear Algebra – I

Instructor: Soumya Das

One-variable Calculus: Real and Complex numbers; Convergence of sequences and series; Continuity, intermediate value theorem, existence of maxima and minima; Differentiation, mean value theorem, Taylor series; Integration, fundamental theorem of Calculus, improper integrals. Linear Algebra: Vector spaces (over real and complex numbers), basis and dimension; Linear transformations and matrices.

SUGGESTED BOOKS AND REFERENCES:

1. Apostol, T. M., *Calculus, Volume I, 2nd edition*, Wiley, India, 2007
2. Strang, G., *Linear Algebra and its Applications, 4th Edition*, Brooks/Cole, 2006

SEMESTER 2 (JANUARY)

UM 102 (3:0)/ UMA 102 (4:0): Analysis and Linear Algebra - II

Instructor: Purvi Gupta

Linear Algebra continued: Inner products and Orthogonality; Determinants; Eigenvalues and Eigenvectors; Diagonalisation of symmetric matrices. Multivariable calculus: Functions on R^n partial and total derivatives; Chain rule; Maxima, minima and saddles; Lagrange multipliers; Integration in R^n, change of variables, Fubini's theorem; Gradient, Divergence and Curl; Line and Surface integrals in R^2 and R^3; Stokes, Green's and Divergence theorems. Introduction to Ordinary Differential Equations; Linear ODEs and Canonical forms for linear transformations.

SUGGESTED BOOKS AND REFERENCES:

1. Apostol, T. M., *Calculus, Volume II, 2nd edition*, Wiley, India, 2007
2. Strang, G., *Linear Algebra and its Applications, 4th Edition*, Brooks/Cole, 2006
3. Artin, M., *Algebra*, Prentice Hall of India
4. Hirsch, M., Smale, S. and Devaney, R. L., *Differential Equations, Dynamical Systems, and an Introduction to Chaos, 2nd edition*, Academic Press, 2004

SEMESTER 3 (AUGUST)

UM 201 (3:0)/ UMA 201 (4:0): Probability and Statistics

Instructor: Sanchayan Sen

Basic notions of probability, conditional probability and independence, Bayes' theorem, random variables and distributions, expectation and variance, conditional expectation, moment generating functions, limit theorems. Samples and sampling distributions, estimation of parameters, testing of hypotheses, regression, correlation and analysis of variance.

SUGGESTED BOOKS AND REFERENCES:

1. Ross, S., Introduction to Probability and Statistics for Engineers and Scientists, Academic Press; 4th ed. (2009)
2. Freedman, Pisani and Purves, *Statistics*, Viva Books; 4th ed. (2011)
3. Feller, W., *An Introduction to Probability Theory and its Applications - Vol. 1*, Wiley; 3rd ed. (2008)
4. Ross, S., *A First Course in Probability*, Pearson Education; 9th ed. (2013)
5. Athreya, S., Sarkar, D. and Tanner, S., *Probability and Statistics (with Examples using R)*, Unfinished book

SEMESTER 4 (JANUARY)

UM 204 (3:1): Introduction to Basic Analysis

Instructor: Muna Naik

Basic notions from set theory, countable and uncountable sets. Metric spaces: definition and examples, basic topological notions. The topology of R^n: topology induced by norms, the Heine-Borel theorem, connected sets. Sequences and series: essential definitions, absolute versus conditional convergence of series, some tests of convergence of series. Continuous functions: properties, the sequential and the open- set characterizations of continuity, uniform continuity. Differentiation in one variable. The Riemann integral: formal definitions and properties, continuous functions and integration, the Fundamental Theorem of Calculus. Uniform convergence: definition, motivations and examples, uniform convergence and integration, the Weierstrass Approximation Theorem.

SUGGESTED BOOKS AND REFERENCES:

1. Tao, T. 2014., *Analysis I, 3rd edition*, Texts and Readings in Mathematics, vol. 37, Hindustan Book Agency
2. Tao, T. 2014., *Analysis II, 3rd edition*, Texts and Readings in Mathematics, vol. 38, Hindustan Book Agency
3. Apostol, T. M., *Mathematical Analysis, 2nd edition*, Narosa

UM 205 (3:1): Introduction to Algebraic Structures

Instructor: Abhishek Banerjee

1. Set theory: equivalence classes, partitions, posets, axiom of choice/Zorn's lemma, countable and uncountable sets.
2. Combinatorics: induction, pigeonhole principle, inclusion-exclusion, Möbius inversion formula, recurrence relations.
3. Number theory: Divisibility and Euclids algorithm, Pythagorean triples, solving cubics, Infinitude of primes, arithmetic functions, Fundamental theorem of arithmetic, Congruences, Fermat's little theorem and Euler's theorem, ring of integers modulo n, factorisation of polynomials, algebraic and transcendental numbers.
4. Graph theory: Basic definitions, trees, Eulerian tours, matchings, matrices associated to graphs.
5. Algebra: groups, permutations, group actions, Cayley's theorem, dihedral groups, introduction to rings and fields.

SUGGESTED BOOKS AND REFERENCES:

1. L. Childs, *A Concrete Introduction to Higher Algebra, 3rd edition*, Springer-Verlag
2. M. A. Armstrong, *Groups and Symmetry*, Springer-Verlag
3. Miklos Bona, *A Walk Through Combinatorics: An Introduction to Enumeration and Graph Theory*, World Scientific

4. D. M. Burton., *Elementary Number Theory*, McGraw HillNiven, Zuckerman, H. S. and Montgomery, H. L., *An Introduction to the Theory of Numbers, 5th edition*, Wiley Student Editions
5. Fraleigh, G., *A First Course in Abstract Algebra, 7th edition*, Pearson

SEMESTER 5 (AUGUST)

MA 200 (3:1): Multivariable Calculus

Prerequisite courses for Undergraduates: UM 204

Instructor: E K Narayanan

Functions on R^n, directional derivatives, total derivative, higher order derivatives and Taylor series. The inverse and implicit function theorem, Integration on R^n, differential forms on R^n, closed and exact forms. Green's theorem, Stokes' theorem and the Divergence theorem.

SUGGESTED BOOKS AND REFERENCES:

1. Munkres, Analysis on manifolds (Primary text)
2. Spivak, Calculus on manifolds
3. Rudin, Principle of Mathematical Analysis
4. J. H. Hubbard and B.B. Hubbard, Vector Calculus, Linear algebra and differential forms

MA 212 (3:0): Algebra I

Prerequisite course: UM 205

Instructor: Shaunak Deo

Part A: Group theory

1. Basic definitions, examples
2. Cyclic groups and its subgroups
3. Homomorphisms, quotient groups, isomorphism theorems
4. Group actions, Sylow's theorems, simplicity of A_n for $n \geq 5$
5. Direct and semi-direct products
6. Solvable and nilpotent groups
7. Free groups Part B: Ring theory

1. Basic definitions, examples
2. Ring homomorphisms, quotient rings, properties of ideals
3. Localization, ring of fractions
4. The Chinese remainder theorem
5. Euclidean domains, principal ideal domains, unique factorization domains
6. Polynomial rings over fields, irreducibility criteria Part C: Module theory

1. Basic definitions and examples
2. Homomorphisms and quotient modules
3. Direct sums and free modules
4. Tensor product of modules
5. Structure theorem of modules over PID's and consequences
6. Noetherian rings and modules, Hilbert basis theorem

SUGGESTED BOOKS AND REFERENCES:

1. Artin, *Algebra*, M. Prentice-Hall of India, 1994
2. Dummit, D. S. and Foote, R. M., *Abstract Algebra*, McGraw-Hill, 1986

3. Lang, S., *Algebra (3rd Ed.)*, Springer, 2002
4. Hungerford, *Algebra*, Graduate Texts in Mathematics 73, Springer Verlag, 1974
5. Nathan Jacobson, *Basic Algebra I & II*, Dover, 2009
6. Nathan Jacobson, *Lectures in Abstract Algebra I, II & III*, Graduate Text in Mathematics, Springer Verlag, 1951

MA 219 (3:1): Linear Algebra

Prerequisite course: UM 102/UMA 102

Instructor: Apoorva Khare

Vector spaces: Definition, Basis and dimension, Direct sums. Linear transformations: Definition, Rank-nullity theorem, Algebra of linear transformations, Dual spaces, Matrices.

Systems of linear equations: Elementary theory of determinants, Cramer's rule. Eigenvalues and eigenvectors, the characteristic polynomial, the Cayley- Hamilton Theorem, the minimal polynomial, algebraic and geometric multiplicities, Diagonalization, The Jordan canonical form. Symmetry: Group of motions of the plane, Discrete groups of motion, Finite groups of SO(3). Bilinear forms: Symmetric, skew symmetric and Hermitian forms, Sylvester's law of inertia, Spectral theorem for the Hermitian and normal operators on finite dimensional vector spaces.

SUGGESTED BOOKS AND REFERENCES:

1. Artin, M., *Algebra*, Prentice Hall of India, 1994
2. Halmos, P., *Finite dimensional vector spaces*, Springer-Verlag (UTM), 1987
3. Hoffman, K. and Kunze, R., *Linear* Algebra *(2nd Ed.)*, Prentice-Hall of India, 1992

MA 231 (3:1): Topology

Instructor: Siddhartha Gadgil

Open and closed sets, continuous functions, Metric topology, Product topology, Connectedness and path-connectedness, Compactness, Countability axioms, Separation axioms, Complete metric spaces, Quotient topology, Topological groups, Orbit spaces, Urysohn's lemma, Metrizability, Baire Category theorem.

SUGGESTED BOOKS:

1. Armstrong, M. A., Basic Topology, Springer (India), 2004
2. Munkres, J. R., Topology, Pearson Education, 2005
3. Viro, O.Ya., Ivanov, O.A., Netsvetaev, N., and Kharlamov, V.M., Elementary Topology: Problem Textbook, AMS, 2008

Note: The course MA 231 can be deferred to VII semester, with the approval of the subject coordinator.

SEMESTER 6 (JANUARY)

MA 213 (3:1): Algebra II

Prerequisite course: MA 212

INSTRUCTOR: R Venkatesh

Part A: Field theory

1. Theory of symmetric polynomials – Newton's theorem
2. Basic theory of field extensions
3. Algebraic and transcendental extensions (and transcendence degree)
4. Construction with straight edge and compass; Gauss-Wantzel theorem
5. Algebraic closure – Steinitz's theorem
6. Splitting fields, normal extensions
7. Separable extensions
8. Finite fields: construction, subfields, Frobenius
9. Primitive element theorem
10. Dedekind-Artin linear independence of (semi)group characters

Part B: Galois theory

1. Fundamental theorem of Galois theory (including Normal Basis Theorem)
2. Composite extensions and Galois group
3. Galois group of cyclotomic extensions, finite fields
4. Galois groups of polynomials, Fundamental theorem of Algebra
5. Solvable and radical extensions, insolvability of a quintic

SUGGESTED BOOKS AND REFERENCES:

1. Artin, M., Algebra, Prentice Hall of India, 1994
2. Dummit, D. S. and Foote, R. M., Abstract Algebra, McGraw-Hill, 1986
3. Lang, S., Algebra (3rd Ed.), Springer, 2002
4. Jonathan Alperin and Rowen Bell, Groups and Representations, Graduate Texts in Mathematics 162, Springer Verlag, 1995
5. Hungerford, Algebra, Graduate Texts in Mathematics 73, Springer Verlag, 1974
6. Galois Theory, Artin, E., University of Notre Dame Press, 1944
7. Nathan Jacobson, Basic Algebra I & II, Dover, 2009
8. Nathan Jacobson, Lectures in Abstract Algebra I, II & III, Graduate Text in Mathematics, Springer Verlag, 1951

MA 222 (3:1): Measure & Integration

Prerequisite course: UM 204

INSTRUCTOR: Harish Seshadri

Construction of Lebesgue measure, Measurable functions, Lebesgue integration, Abstract measure and abstract integration, Monotone convergence theorem, Dominated convergence theorem, Fatou's lemma, Comparison of Riemann integration and Lebesgue integration, Product sigma algebras, Product measures, Sections of measurable functions, Fubini's theorem, Signed measures and Radon-Nikodym theorem, Lp-spaces, Characterization of continuous linear functionals on Lp - spaces, Change of variables, Complex measures, Riesz representation theorem.

SUGGESTED BOOKS AND REFERENCES:

1. Royden, H. L., Real Analysis, Macmillan, 1988
2. Folland, G.B., Real Analysis: Modern Techniques and their Applications (2nd Ed.), Wiley
3. Hewitt, E. and Stromberg, K., Real and Abstract Analysis, Springer, 1969

MA 224 (3:1): Complex Analysis

Prerequisite course: UM 204

Instructor: Gautam Bharali

Complex numbers, holomorphic and analytic functions, Cauchy-Riemann equations, Cauchy's integral formula, Liouville's theorem and proof of fundamental theorem of algebra, the maximum-modulus principle. Isolated singularities, residue theorem, Argument Principle. Mobius transformations, conformal mappings, Schwarz lemma, automorphisms of the disc and complex plane. Normal families and Montel's theorem. The Riemann mapping theorem. If time permits - analytic continuation and/or Picard's theorem.

SUGGESTED BOOKS AND REFERENCES:

1. Ahlfors, L. V., *Complex Analysis*, McGraw-Hill, 1979
2. Conway, J. B., *Functions of One Complex Variable*, Springer-Verlag, 1978
3. Stein, E.M, and Shakarchi, R., *Complex Analysis*, Princeton University Press, 2003

MA 241(3:1): Ordinary Differential Equations

Prerequisite course: UM 204

Instructor: Vamsi Pritham Pingali

Basics concepts: Introduction and examples through physical models, First and second order equations, general and particular solutions, linear and nonlinear systems, linear independence, solution techniques. Existence and Uniqueness Theorems: Peano's and Picard's theorems, Grownwall's inequality, Dependence on initial conditions and associated flows. Linear system: The fundamental matrix, stability of equilibrium points, Phase- plane analysis, Sturm-Liouvile theory. Nonlinear system and their stability: Lyapunov's method, Non-linear Perturbation of linear systems, Periodic solutions and Poincare- Bendixson theorem.

SUGGESTED BOOKS AND REFERENCES:

1. Hartman, *Ordinary Differential Equations*, P. Birkhaeuser, 1982
2. Coddington, E. A. and Levinson, N., *Theory of Ordinary Differential Equations*, Tata McGraw-Hill, 1972
3. Perko, L., *Differential Equations and Dynamical Systems*, Springer-Verlag, 1991

SEMESTER 7 (AUGUST)

The coursework for this semester comprises electives. Refer the table above for the list of electives offered by the Department of Mathematics.

SEMESTER 8 (JANUARY)

UM 400 (0:13): Project: Mathematics

Mandatory project for undergraduate Mathematics Majors in their fourth year, second semester.

Master of Science

Following mandatory courses to be fulfilled:

MA 389A (1:0): Seminar on topics in mathematics I (AUG)
MA 389B (1:0): Seminar on topics in mathematics II (JAN)
MA 213 (3:1): Algebra II (JAN)
MA 222 (3:1): Analysis II (JAN)

Soft core courses requirement: Any 3 courses from the list below

MA 223 (3:0): Functional Analysis
MA 232 (3:0): Introduction to Algebraic Topology
MA 242 (3:0): Partial Differential Equations
MA 361 (3:0): Probability Theory
MA 235 (3:0): Introduction to Differentiable Manifolds
MA 220 (3:0): Representation Theory of Finite Groups
MA 312 (3:0): Commutative Algebra
MA 313 (3:0): Algebraic Number Theory
MA 262 (3:0): Introduction to Stochastic Processes
MA 321 (3:0): Analysis III

The remaining 13 credits could be comprised of the following Master's projects A & B and courses offered by any department or a combination thereof.

Courses offered in August Semester

UM 501 (0:6): Masters Project A
Optional reading project.

Courses offered in January Semester

UM 502 (0:6): Masters Project B
Optional reading project.

Note: 1) The student must complete MA 213 (Algebra 2) and MA 222 (Analysis 2) either in the BS programme or in the fifth year in Master's programme.

2) Three courses must be taken from the softcore pool of 10 courses. If 'n' number of courses out of these 3 softcore courses have been completed in the BS programme, then the remaining '3-n' courses must be credited in the fifth year.

3) Master's projects A and B are optional, but if credited in the fifth year, will count towards the 32 credits.

4) If the student has completed MA 213 - Algebra-II, MA 222 - Analysis-II, and 3 softcore courses in the BS programme, then the 30 credits in the fifth year can potentially be taken from any department (subject to the approval of the mathematics coordinator)

Note: For credit carry over from BS (Research) to MS please refer to Chapter – II, section - 2.3

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PHYSICS

Curriculum applicable From Batch 2022 onwards

Basic Core Courses (for Physics Major and Minor)

Sl. No.	Code	Title	Credits	Semester
1	UPH 101T	Introductory Physics I Mechanics, Oscillations and Waves	3:0	I
2	UPH 101L	Introductory Physics I Mechanics, Oscillations and Waves (Lab)	0:1	I
3	UPH 102T	Introductory Physics II (Electricity, Magnetism and Optics)	3:0	II
4	UPH 102L	Introductory Physics II (Electricity, Magnetism and Optics) (Lab)	0:1	II
5	UPH 201T	Introductory Physics III (Thermal and Modern Physics)	3:0	III
6	UPH 201L	Introductory Physics III (Thermal and Modern Physics) (Lab)	0:1	III

Curriculum applicable until Batch 2021

Basic core courses for Physics Major

Sl. No.	Code	Title	Credits	Semester
1	UP 101T	Introductory Physics I Mechanics, Oscillations and Waves	2:0	I
2	UP 101L	Introductory Physics I Mechanics, Oscillations and Waves (Lab)	0:1	I
3	UP 102T	Introductory Physics II (Electricity, Magnetism and Optics)	2:0	II
4	UP 102L	Introductory Physics II (Electricity, Magnetism and Optics) (Lab)	0:1	II
5	UP 201T	Introductory Physics III (Thermal and Modern Physics)	2:0	III
6	UP 201L	Introductory Physics III (Thermal and Modern Physics) (Lab)	0:1	III

Courses offered from the 4th semester onwards (All batches)

[Core, elective courses for Physics Major/Minor]

Sl. No.	Code	Title	Credits	Semester	Course Type
1	UP 202T	Intermediate Mechanics, Oscillations and Waves	2:0	IV	Major- Core Minor- Elective
2	UP 202L	Intermediate Mechanics, Oscillations and Waves (Lab)	0:1	IV	Major- Core Minor- Elective
3	UP 203T	Intermediate Electromagnetism and the Quantum Physics of Radiation	2:0	IV	Major- Core Minor- Elective
4	UP 203L	Intermediate Electromagnetism and the Quantum Physics of Radiation (Lab)	0:1	IV	Major- Core Minor- Elective
5	UP 204T	Intermediate Thermal Physics and the Physics of Materials	2:0	IV	Major- Core Minor- Core
6	UP 204L	Intermediate Thermal Physics and the Physics of Materials (Lab)	0:1	IV	Major- Core Minor- Core
7	PH 201	Classical Mechanics	3:0	V	Major- Core Minor- Elective
8	PH 203	Quantum Mechanics I	3:0	V	Major- Core Minor- Elective
9	PH 205	Mathematical methods of Physics	3:0	V	Major- Core Minor- Elective
10	PH 211	General Physics Laboratory	0:3	V	Major- Core Minor- Elective
11	PH 202	Statistical Mechanics	3:0	VI	Major- Core Minor- Elective
12	PH 204	Quantum Mechanics II	3:0	VI	Major- Core Minor- Elective
13	UP 400 UPH 400*	Project: Physics	0:16 0:15	VIII	Bachelor's Project
14	UP 500	Project: Physics	0:20	X	Master's Project

Note: i) Effective from the Batch of 2022

ii) **Electives for Physics Major and Minor**

Any courses offered by Centre for High Energy Physics (CHEP) / Instrumentation and Applied Physics (IAP) / Physics departments will be considered towards Major and Minor electives with the consent of the course instructor.

Credit Requirements for Physics Major

Course Type	Basic Courses (Sem 1-3)	Engg (Sem 1-3)	Humanities (Sem 1-3)	Core (Sem 4-6)	Major Electives	Project	Assortment/ Institute Elective	Total
Until Batch 2021	36	19	9	27	9	16	15	131
Batch 2022 onwards	40	6	9	27	9	15	25	131

Course Details

Coordinator: Victor Suvisesha Muthu and Prasad Hegde
Instructors UG: Haritha Pamuluri, Nandha Gopal P and Jesla P K
Teaching Assistants: Rashmi R K, Tyby Monachan, Pavithra P N, Haneena P K and Aria Kutty

SEMESTER 1 (AUGUST)

UP 101T (2:0)/ UPH 101T (3:0): Introductory Physics I – Mechanics, Oscillations and Waves

Instructor: Sebabrata Mukherjee

Kinetics, laws of motion. Circular motion, work. Kinetic and potential energy. Line integrals. Conservative forces. Friction, terminal velocity in air. Systems of particles. Conservation of linear momentum. Scattering in one and two dimensions. Angular momentum. Moment of inertia. Rotation about one axis. Precession of gyroscope. Central force. Reduction of two- body problem to one-body problem and effective one-body potential. Planetary motion and Kepler's laws. Simple pendulum damped and forced, resonance. Coupled oscillators, normal modes. Small oscillations. Transverse waves on a string. Linear superposition, interference, beats. Fourier series. Sound waves in air. Doppler effect.

SUGGESTED BOOKS:

1. Kittel,C., Knight, W.D., Ruderman, M.A., Helmholz, A.C. and Moyer,B.J.2011 Mechanics, Berkeley Physics Course: Volume 1, 2nd edition
2. Kleppner,D. and Kolenkow,R.J.2007 An Introduction To Mechanics (Special Indian Edition)
3. David Halliday, Robert Resnick, Jearl Walker: Fundamentals of Physics
4. Raymond A. Serway and John W. Jewett: Physics for Scientists and Engineers with Modern Physics
5. Hugh D. Young and Roger A. Freedman: University Physics with Modern Physics
6. Vector Analysis (Schaum's Series) by M. R. Spiegel
7. Classical Mechanics By N. C. Rana & P. S. Joag

UP 101L (0:1)/ UPH 101L (0:1): Introductory Physics I – Mechanics, Oscillations and Waves (Lab)

Instructors: K. Ramesh, Animesh Kuley and Binita Tongbram

SEMESTER 2 (JANUARY)

UP 102T (2:0) / UPH 102T (3:0): Introductory Physics II – Electricity, Magnetism and Optics

Instructor: Gaurav Narain

Introduction, review of vector algebra, vector calculus: gradient, divergence, curl, Gauss' theorem and Stokes' theorem, Laplacian etc. Coulomb's law, electric field, electrostatic potential, Uniqueness theorem, conductors, capacitance, method of images, bound charges and dipole moment density, energy stored in electric fields. Magnetostatics: electric currents, Biot-savart law, Ampere's law, magnetic fields of straight wires, circular loops and infinite solenoids, vector potential, magnetic dipole moment and bound currents. Lorentz force and Faraday's law, inductance, energy stored in a magnetic field. Linear dielectric and magnetic materials, bound current, magnetism, charge conservation, displacement current, Maxwell's equations.

SUGGESTED BOOKS:

1. Purcell, E.M.2011 Electricity and Magnetism, Berkeley Physics Course-Volume2, 2nd edition, Tata Mc Graw Hill
2. Griffiths, D.J.2003 Introduction to Electrodynamics, 3rd edition, Prentice- Hall of India. SICS

UP 102L (0:1)/ UPH 102L (0:1): Introductory Physics II – Electricity, Magnetism and Optics (Lab)

Instructors: Ramesh Mallik and Sai Siva

SEMESTER 3 (AUGUST)

UP 201T (2:0) / UPH 201T (3:0): Introductory Physics III- Thermal and Modern Physics

Instructors: Prerna Sharma

Temperature, The First Law of Thermodynamics, Kinetic Theory of Gases and Maxwell-Boltzmann Statistics, Heat Engines, Entropy and the Second Law of Thermodynamics, Relativity, Introduction to Quantum Physics, Basics of Quantum Mechanics, Atomic, Molecular and Solid-state physics, Nuclear Physics, Particle Physics and Cosmology.

SUGGESTED BOOKS:

1. Serway and Jewett, Physics for Scientists and Engineers (7th Edition)
2. Young and Freedman, University Physics (12thEdition)
3. Halliday, Resnick and Walker, Fundamentals of Physics, Extended (8thEdition)
4. Harris Benson, University Physics, Revised Edition
5. KennethKrane, Modern Physics, Second Edition
6. Resnick -- introduction to special theory of relativity
7. Beiser -- Modern Physics

UP 201L (0:1) / UPH 201L (0:1): Introductory Physics III- Thermal and Modern Physics (Lab)

Instructors: Subroto Mukerjee, Manish Jain and Banibrata Mukhopadhyay

SEMESTER 4 (JANUARY)

UP 202T (2:0): Intermediate Mechanics, Oscillations and Waves

Instructor: Nirmal Raj

Special theory of relativity. Lorentz transformations. Energy-momentum relation. Lorentz four-vectors. Motion in non-inertial frames. Fictitious forces. Coriolis force. Foucault pendulum. Basic scattering theory. Vibrations of particles on a circle and a line. Orthonormal basis. Wave equation. Fourier transform Phase space. Hamiltonian equations, fixed points and stability. Nonlinear equations. Chaos. Logistics map and period doubling. Fluid mechanics. Euler equation. Bernoulli's equation. Waves in fluids. Gravity waves. Viscosity. Navier-Stokes equation. Basic ideas about turbulence. Elasticity. Strain and stress tensors. Elastic moduli. Bending of rods. Waves in solids.

SUGGESTED BOOKS:

For Fluid Mechanics:

1. https://www.damtp.cam.ac.uk/user/tong/fluids.html
2. http://www.fluiddynamics.it
3. Elementary Fluid Dynamics by D. J. Acheson
4. Griffiths Electrodynamics for some parts of Special Relativity
5. For Classical Mechanics I: `Classical Mechanics' by Tom W.B. Kibble and Frank H. Birkshire.
6. For non-linear dynamics and Chaos: `Non-Linear Dynamics and Chaos' by Steven H. Strogatz
7. Kleppner, D. and Kolenkow, R.J.2007 An Introduction to Mechanics (Special Indian Edition)
8. https://www.amazon.com/Classical-Mechanics-John-R-Taylor/dp/189138922X
9. The Feynman Lectures on Physics: https://www.feynmanlectures.caltech.edu/
10. Spacetime Physics by Taylor and Wheeler: https://www.amazon.in/Spacetime- Physics- Introduction-Special-Relativity/dp/0716723271

UP 202L (0:1): Intermediate Mechanics, Oscillations and Waves (Lab)

Instructors: R. Ganesan and D. S. Nadig

UP 203T (2:0): Intermediate Electromagnetism and the Quantum Physics of Radiation

Instructor: Ranjan Laha

Electromagnetic Waves: Wave equation from Maxwell's equations, polarization, energy and momentum in EM waves, propagation in linear media, reflection and refraction, Snell's law and Fresnel's equations, Brewster angle and total internal reflection. EM waves in conductors, skin depth, simple theories for dispersion of EM waves. Wave guides and coaxial cables, optical fibers Geometrical optics: Fermat's principle, Snell's law, reflection and refraction at spherical surfaces, convex and concave mirrors and lenses, real and virtual images.

Physical Optics: Coherence, Young's two slit experiment, multiple slits, diffraction grating, wavelength resolution and fringe visibility, Newton's rings, Michelson and Fabry-Perot interferometer, diffraction from rectangular and circular apertures, Airy disc and resolving power of microscopes.

Quantum optics: Photons, spontaneous and stimulated emission, Einstein A and B coefficients and relation to the Planck distribution, rate equations for absorption and emission, two level and three level systems, population inversion and light amplification, optical resonators and the basic working principle of a laser, examples of lasers: Ruby, He-Ne, semiconductor etc.

SUGGESTED BOOKS:

1. Griffiths, D.J.2003 Introduction to Electrodynamics, 3rdedition, Prentice-Hall of India
2. Hecht, E. and Ganesan, A.R.2008 Optics,4 the edition, Pearson
3. Ghatak, A. and Thyagarajan K 1991Optical Electronics, Cambridge University Press

UP 203L (0:1): Intermediate Electromagnetism and the Quantum Physics of Radiation (Lab)

Instructors: Victor S Muthu and Abha Misra

UP 204T (2:0): Intermediate Thermal Physics and the Physics of Materials

Instructor: Prabal Maiti

Review of kinetic theory and thermodynamics, Free energies, Phases and phase transitions, Vander Waals gas and the liquid gas transition, Thermodynamics of magnetic systems, Ensembles and rules of Statistical Mechanics, The Ideal Maxwell-Boltzmann Gas, The Ideal Fermi Gas, The Ideal Bose Gas, Crystal Structure, Lattice Vibrations, Band theory of electrons in crystalline solids, Thermal properties of crystalline solids.

SUGGESTED BOOKS:

1. Callen, H.B. Thermodynamics and Introduction to Thermostatics (2nd edition), Wiley Student Edition
2. Ken Dill and Sarina Bromberg, Molecular Driving forces, CRC Press
3. Kittel, C. Introduction to Solid State Physics, 5th/6th/7 the edition, Wiley International
4. S. J. Blundell and K. M. Blundell, Concepts in thermal physics, Oxford University Press

UP 204L (0:1): Intermediate Thermal Physics and the Physics of Materials (Lab)

Instructors: Upendra Behera and Minakshi Nayak

SEMESTER 5 (AUGUST)

PH 201 (3:0): Classical Mechanics

Instructor: Baladitya Suri

Newton's laws generalized co-ordinates. Lagrange's principle of least action and equations. Conservation laws and symmetry. Integrable problems, elastic collisions and scattering. Small oscillations including systems with many degrees of freedom, free and forced oscillations, damped and undamped oscillations, normal modes, counting and density of states, parametric oscillations and Floquet's theorem, numerical computations in parametric oscillations. Hamilton's equations. Poisson brackets. Hamilton Jacobi theory. Canonical perturbation theory, chaos, elements of special relativity. Lorentz transformations, relativistic mechanics. Nonlinear dynamics – nonlinear oscillator, critical points, flow, linearization, Lyapunov exponents, general Lyapunov stability. Introduction to Classical Field Theory -
- Massive and massless scalar fields, Noether's theorem.

SUGGESTED BOOKS:

1. Landau, L.D and Lifshitz, E.M.Mechanics, Third Edition, Butterworth- Heinemann
2. Goldstein H., Poole C., and Safko J Classical Mechanics, Third Edition (Pearson Education)
3. Rana, N.C. and Jog,P.S. Classical Mechanics, Mc Graw-Hill Education, New Delhi
4. Strogatz Steven H., Nonlinear dynamics and Chaos: CRC press, 2nd edition, Special Indian Edition
5. R Shankar, Principles of Quantum Mechanics, Second Edition, Springer (India), 2010
6. Kleppner D and Kolenkow R J, An Introduction to Mechanics (Special Indian Edition) (2021)

PH 203 (3:0): Quantum Mechanics I

Instructor: Banibrata Mukhopadhyay

Wave function for a single particle. Hamiltonian. Schrodinger equation. Probability current. Wave packets. One-dimensional problems: particle in a box and on a circle, step, barrier and delta-function potentials. Tunneling, scattering and bound states. Energy bands in periodic potentials. Simple harmonic oscillator, operator approach.

Ehrenfest's theorem. Particle in an electromagnetic field. Aharonov-Bohm effect. Uncertainty relations. Hermitian and unitary operators. Orthonormal basis. Postulates of quantum mechanics. Matrix formulation of quantum mechanics Three-dimensional problems. Rotations, angular momentum operators, commutation relations.

Spherical harmonics. Hydrogen atom, its spectrum and wave functions. Spin angular momentum. Spin-1/2 and two- level systems. Addition of angular momentum. Spin-orbit and hyperfine interactions. Time-independent perturbation theory. Stark and Zeeman effects.

SUGGESTED BOOKS:

1. C. Cohen-Tannoudji, B. Diu and F. Laloe, Quantum Mechanics, Vol.1 and 2,John Wiley & Sons, 2005
2. D. J. Griffiths, Introduction to Quantum Mechanics, Pearson, 2005
3. L.D .Landau and Lifshitz, Quantum Mechanics, (Vol. 3 of Course of Theoretical Physics), 1999
4. F. Schwabl, Quantum Mechanics, Springer, 1995
5. R. Shankar, Principles of Quantum Mechanics, Springer, 2010

PH 205 (3:0): Mathematical Methods of Physics

Instructor: Justin David

Linear vector spaces, linear operators and matrices, systems of linear equations. Eigen values and Eigenvectors,

classical orthogonal polynomials. Linear ordinary differential equations, exact and series methods of solution, special functions. Linear partial differential equations of physics, separation of variables method of solution. Complex variable theory; analytic functions. Taylor and Laurent expansions, classification of singularities, analytic continuation, contour integration, dispersion relations. Fourier and Laplace transforms.

SUGGESTED BOOKS:

1. Arfken, G, Weber H. and Harris F., Mathematical methods for Physicists, 7th edition, Academic Press
2. Dennery, P. and Krzywicki, A. 1967 Mathematics for Physicists, Harper and Row
3. Riley, K. Hobson M.,Bence, S. Mathematical Methods for Physics and Engineering, CUP, 1997

PH 211L (0:3): General Physics (Lab)

Instructors: T Das Gupta and Srimanta Middey

Identification of NaCl monocrystals (with X-ray unit). Gamma ray absorption with Multi Channel Analyzer (calibration & attenuation coefficient). NMR: Nuclear Magnetic Resonance (find the magnetogyric ratio of Hydrogen and Fluorine). Velocity of sound in liquids (Raman-Nath experiment). Normal modes in (3D) acoustic chamber. Solar cell (IV Characteristics). UV-VIS spectroscopy (Band gap of semiconductor, thickness measurement). X-ray fluorescence with Multi Channel Analyzer. Rutherford Scattering. Elastic Plastic Deformation.

SEMESTER 6 (JANUARY)

PH 202 (3:0): Statistical Mechanics

Instructor: Shibananda Das

Phenomena and experiments; thermodynamic entropy and the 0th, 1st and 2nd Laws; Free energies, Legendre transformations, Maxwell relations; Stability, equilibrium, van der Waals eqn of state & phase transitions; Elements of probability theory and the central limit theorem; The postulates of equilibrium classical statistical mechanics and their mechanical basis; the postulates of quantum statistical mechanics; the density matrix; the 3rd Law; Partition functions; ensembles and their equivalence; numerical methods; Noninteracting systems: ideal classical and quantum gases with examples; interacting systems: virial expansion, lattice gas, Ising model (1D and Bragg- Williams/Curie-Weiss); Random walks, Brownian motion, and the Langevin equation.

SUGGESTED BOOKS:

1. Kardar, M. 2007: Statistical Physics of Particles. Cambridge University Press
2. Mazenko G.F. 2000: Equilibrium statistical mechanics, Wiley, New York
3. Reif, F. 2010: Fundamentals of Statistical and Thermal Physics, Sarat Book Distributors
4. Bhattacharjee, J.K. 1996: Statistical Physics: Equilibrium and Nonequilibrium Aspects, Allied, New Delhi
5. Landau, L.D. and Lifshitz, E.M. 1980 Statistical Physics, Pergamon
6. Statistical Mechanics, R K Pathria
7. Reif, F. 2010: Fundamentals of Statistical and Thermal Physics, Sarat Book Distributors
8. Concepts in Thermal Physics, Blundell and Blundell

PH 204 (3:0): Quantum Mechanics II

Instructor: Biplob Bhattacharjee

Recap of quantum mechanics I, WKB approximation and variational methods, Density Matrices, Time dependent perturbation theory, Fermi golden rule, Transitions caused by a periodic external field, Dipole transitions and selection rules, Decay of an unstable state, Born cross section for weak potential scattering, Adiabatic and sudden approximations, Berry phase and the Aharonov-Bohm effect, Scattering theory: partial wave analysis, low energy scattering, scattering length, Born approximation, optical theorem, Wigner-Eckart theorem, Quantization of the radiation field. One out of the following topics: Entanglement, the Dirac equation and Hartree-Fock theory.

SUGGESTED BOOKS:

1. Landau, L.D. and Lifshitz, E.M.1974 Quantum Mechanics, Pergamon, NY
2. Cohen-Tannoudji, C.,Diu,B.andLaloe,F.1977 Quantum Mechanics(2Vols.),John Wiley
3. Modern Quantum Mechanics, by Sakurai and Napolitano
4. Quantum Mechanics by Schwabl
5. Quantum Mechanics by Schiff
6. The Principles of Quantum Mechanics by Dirac

UP 400 (0:16) / UPH 400 (0:15): Project: Physics

Coordinator: Victor S Muthu and Prasad Hegde

This is a 15/16 credit project course of six months duration and is compulsory for the completion of the BSc Research course. The student can choose any faculty of his or her choice from any of the three departments: Physics, Centre for High Energy Physics (CHEP), Instrumentation and Applied Physics (IAP) with mutual consent and take up an advanced topic of research either in the experimental or theoretical stream. At the end of the term, the student will submit a soft copy and hard copy of the report with proper binding. The viva-voce examination will be conducted with two examiners and evaluated accordingly.

Master of Science

The following courses are mandatory for the 5th year UG (MS) students and 20 credits from the project:

PH 206 (3:0): Electromagnetic Theory
PH 208 (3:0): Condensed Matter Physics 1 or IN 232 (3:0): Concepts in Solid State Physics
PH 217 (3:0): Fundamentals of Astrophysics
PH/HE 215 (3:0): Nuclear and Particle Physics

The students have to complete 12-credit blackboard courses during the 5th year.

In case none of the above-mentioned mandatory courses are completed by the students during the first 4 years (Bachelor of Science), they have to credit all of them in the 5th year.

In case the students already completed all of the above-mentioned mandatory courses during the first 4 years (Bachelor of Science), to fulfill the 12-credit requirement, they can take any other course(s) (200 or 300 level) from any department, with the consent of their respective advisor, Instructor, and UG coordinator.

In case the students completed part of the above-mentioned mandatory courses during the 1st Four-Years (BS), they have to complete the remaining mandatory courses and, to fulfill the 12-credit requirement, any other course(s) (200 or 300 level) from any department, with the consent of their respective advisor, Instructor and UG coordinator.

UP 500 (0:20) : Project: Physics

Coordinator: Victor S Muthu and Prasad Hegde

This is a 20-credit project course of six months duration and is compulsory for the completion of the MSc course. The student can choose any faculty of his or her choice from any of the three departments: Physics, Centre for High Energy Physics (CHEP), Instrumentation and Applied Physics (IAP) with mutual consent and take up an advanced topic of research either in the experimental or theoretical stream. At the end of the term, the student will submit a soft copy of the report to the coordinator. The viva-voce examination will be conducted with two examiners and evaluated accordingly.

Note: For credit carry over from BS (Research) to MS please refer to Chapter – II, section - 2.3

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BIOENGINEERING

Minor in Bioengineering for IISc Undergraduates

Bioengineering is a thriving interdisciplinary field in academic research and industrial practice today. On the one hand, Bioengineering is the engineering counterpart to life sciences, just as aerospace, chemical, civil, electrical, material, and mechanical engineering disciplines are engineering extensions of physics and chemistry. On the other hand, bioengineering is much more expansive. At one end of its broad spectrum, it deals with quantitative aspects and design principles of biomolecules, cells, tissues, organs and systems. The development of novel diagnostic and therapeutic devices, orthotics, human-assistive devices, etc., lies at the other end of the spectrum of bioengineering. In a nutshell, bioengineering is the engineering of biology, for biology, and with biology.

Using engineering principles and techniques to understand biology at the fundamental level is a hallmark of bioengineering. Biomaterials, cell and tissue engineering, immunoengineering, and regenerative medicine are pursued within bioengineering towards developing novel drug-delivery techniques, implants, prosthetics, and artificial organs. Neuroengineering interfaces neuroscience to not only understand how the brain works but also to study neurological diseases and their treatment. Emerging areas of systems and synthetic biology, which use computational methods and even the new trends in artificial intelligence, are also within the ambit of bioengineering.

Biosensors and implantable prostheses that involve various micro and nano technologies, image processing, signal processing, bioelectronics, medical imaging, etc., also come within the purview of bioengineering. The spectrum of bioengineering ranges from developing novel biochemical assays and apparatus such as microscopes to designing new biomedical instruments that are crucial for medical diagnosis and treatment.

Working with clinicians and clinical researchers is another important aspect of bioengineering, or its extension called biomedical engineering. Familiarity with physiology and anatomy empowers engineers to work on the unmet needs of clinical practice and explore careers in the biomedical industry. Bioengineering also has organic links to the thriving biopharma industry.

IISc undergraduates who opt for a minor in bioengineering will become familiar with the basics of bioengineering and touch upon its multiple facets. This minor program is administered by the Department of Bioengineering (BE) (earlier known as BioSystems Science and Engineering (BSSE)), a full-fledged academic department in IISc. BSSE was founded in 2015 based on the rapidly growing activities in this domain that became evident due to the Interdisciplinary PhD program in Bioengineering, which started in 2012. BSSE changed its name to BE in 2023. It is an inclusive department that works with several other departments as well as its numerous clinical partners. BE is a place of confluence of biologists, clinicians, designers, and engineers. It has a primary faculty of its own, associate faculty, adjunct faculty, research staff, and Ph.D. and M.Tech. students. Its thematic common laboratories support research and teaching.

BE has a well-thought-out and growing curriculum to train and nurture students with different backgrounds to become bioengineers with expertise and appreciation for biology and engineering. It also prepares them for pursuing careers in academia, research organizations, and the industry.

A few courses are selected from BE's curriculum to serve as core and elective courses, as shown in two tables, to fulfil 15 credits required for the minor in the undergraduate program of IISc. The core courses provide basics of traditional and emerging areas of biomaterials, biosensors, biomechanics, and systems biology. The electives

provide an opportunity to study these topics in depth, depending on the interests of the students after taking the core courses. It may be noted that the core courses are offered by BE, while the electives are taught by BE and other departments in IISc. While most courses are lecture-oriented, some have hands-on laboratories.

Coordinator: Mohit Kumar Jolly

Total credits required for the Minor subject option: 15

Core courses (4 credits):

BE 213 (2:0) Fundamentals of Bioengineering 1 (AUG)
BE 214 (2:0) Fundamentals of Bioengineering 2 (JAN)

Elective (11 credits): To be selected from the following:

BE 210 (3:0) Drug Delivery: Principles and Applications (AUG)
BE 211 (3:0) Cell Mechanics (JAN)
BE 216 (3:0) Dynamical Systems Biology (JAN)
BE 222 (3:0) Stem Cell Technology (JAN)
BE 224 (3:0) Diagnostics and Devices (JAN)
MT 271 (3:0) Introduction to Biomaterials (AUG)
ME 251 (3:0) Biomechanics (JAN)
NE 231 (3:0) Microfluidics (AUG)
CH 248 (3:0) Molecular Systems Biology (JAN)
EC 303 (2:1) Stochastic and spatial dynamics in Biology (AUG)
NS 201 (2:0) Systems Neuroscience (AUG)
DS 201 (2:0) Bioinformatics (AUG)
BC 302 (3:0) Current Trends in Drug Discovery (JAN)

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QUANTUM TECHNOLOGY

Inclusion of Quantum Technology as a Minor in the UG Program

Coordinator: Arindam Ghosh and Baladitya Suri

Total credits required for the Minor subject option: 15

Core courses (12 credits):

QT 207 (3:0) Introduction to Quantum Computation (AUG)
QT 209 (3:0) Introduction to Quantum Communications and Cryptography (AUG)
QT 202 (3:0) Introduction to Quantum Measurement and Sensing (JAN)
QT 204 (3:0) Introduction to Materials for Quantum Technologies (JAN)

Elective (3 credits): To be selected from the following:

QT 306 (3:0) Advanced Quantum Computation and Information (JAN)
E0 213 (3:0) Quantum-safe Cryptography (JAN)
E2 210 (3:0) Quantum Error-correcting Codes (JAN)
E2 270 (3:0) Quantum Information Theory (AUG)
E7 211 (2:1) Photonics Integrated Circuits (AUG)
NE 203 (3:0) Advanced Micro and Nanofabrication Technology and Process (AUG)
NE 222 (3:0) MEMS Modelling, Design and Implementation (AUG)
NE 310 (3:0) Photonics Technology: Materials and Devices (AUG)
NE 320 (3:0) Quantum Optics (JAN)
PH 359 (3:0) Physics at the Nanoscale (JAN)
NE 312 (3:0) Nonlinear and Ultrafast Photonics (AUG)
IN 332 (3:0) 2D Materials (JAN)

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CHAPTER 18

SCHEME OF INSTRUCTIONS (SOI)

BACHELOR OF TECHNOLOGY (MATHEMATICS AND COMPUTING) PROGRAM

Core Courses: Mathematics and Computing

Sl. No.	Code	Title	Credits	Semester
1	UENG 101T	Algorithms and Programming	3:0	I
2	UENG 101L	Algorithms and Programming (Lab)	0:1	I
3	UMA 101	Analysis and Linear Algebra - I	4:0	I
4	UENG 102T	Electrical and Electronics Engineering	3:0	II
5	UENG 102L	Electrical and Electronics Engineering (Lab)	0:1	II
6	UMA 102	Analysis and Linear Algebra - II	4:0	II
7	UMC 102	Computer Systems	3:0	II
8	UMC 103	Discrete Mathematics	2:0	II
	UMC 103A*		3:0	
9	UMA 201	Probability and Statistics	4:0	III
10	UMC 201	Data Structures & Algorithms	3:1	III
11	UMC 202	Numerical Methods	3:1	III
12	UM 204	Introduction to Basic Analysis	3:1	IV
13	UM 205	Introduction To Algebraic Structures	3:1	IV
14	UMC 203	Introduction to Artificial Intelligence and Machine Learning	3:1	IV
15	UMC 205	Automata and Computability	3:1	IV

Note: * Effective from the Batch of 2025

Humanities

Refer to Humanities section of Chapter 17 for details

Breadth Soft Core Courses

Sl. No.	Code	Title	Credits	Semester
1	UBL 101T	Introductory Biology I	3:0	I
2	UBL 101L	Introductory Biology I (Lab)	0:1	I
3	UCY 101T	Introductory Chemistry I	3:0	I
4	UCY 101L	Introductory Chemistry I (Lab)	0:1	I
5	UPH 101T	Introductory Physics I	3:0	I
6	UPH 101L	Introductory Physics I (Lab)	0:1	I
7	UBL 102T	Introductory Biology II	3:0	II

8	UBL 102L	Introductory Biology II (Lab)	0:1	II
9	UCY 102T	Introductory Chemistry II	3:0	II
10	UCY 102L	Introductory Chemistry II (Lab)	0:1	II
11	UENG 103	Introduction to Earth and its Environment	3:0	II
12	UPH 102T	Introductory Physics II	3:0	II
13	UPH 102L	Introductory Physics II (Lab)	0:1	II
14	UBL 201T	Introductory Biology III	3:0	III
15	UBL 201L	Introductory Biology III (Lab)	0:1	III
16	UCY 201T	Introductory Chemistry III	3:0	III
17	UCY 201L	Introductory Chemistry III (Lab)	0:1	III
18	UENG 201	Introduction to Materials Science	3:0	III
19	UPH 201T	Introductory Physics III	3:0	III
20	UPH 201L	Introductory Physics III (Lab)	0:1	III

Project

Sl. No.	Code	Title	Credits	Semester
1	UMC 401	Independent Study Project I (ISP I)	6	VII
2	UMC 402	Independent Study Project II (ISP II)	6	VIII
3	UMC 403	Project	12	VIII

Note: Refer to Section 3.6 for detailed rules regarding projects.

Soft Core: Mathematics

Sl. No.	Code	Title	Credits
1	E0 220	Graph Theory	3:1
2	E0 228	Combinatorics	3:1
3	E0 265	Convex Optimization and Applications	3:1
4	E0 298	Linear Algebra and its Applications	3:1
5	E0 350	Advanced Convex Optimization	3:1
6	E1 222	Stochastic Models and Applications	3:0
7	E1 251	Linear and Nonlinear Optimization	3:0
8	E2 202	Random Processes	3:0
9	E2 212	Matrix Theory	3:0
10	MA 200	Multivariable Calculus	3:1
11	MA 212	Algebra I	3:0
12	MA 216	Introduction to Graph Theory	3:0
13	MA 218	Number Theory	3:0
14	MA 219	Linear Algebra	3:1
15	MA 222	Analysis – II	3:1
16	MA 223	Functional Analysis	3:0
17	MA 224	Complex Analysis	3:1
18	MA 231	Topology	3:1
19	MA 232	Introduction to Algebraic Topology	3:0
20	MA 235	Introduction to Differentiable Manifolds	3:0
21	MA 241	Ordinary Differential Equations	3:1
22	MA 242	Partial Differential Equations	3:0
23	MA 262	Introduction to Stochastic Processes	3:0
24	MA 278	Introduction to Dynamical Systems Theory	3:0
25	MA 347A	Topics in Finite Element Methods	3:1
26	MA 361	Probability Theory	3:0
27	PH 205	Mathematical Methods of Physics	3:0

Note:

1. Among E1 222, E2 202 and MA 262, only one can be chosen
2. Between E2 212, E0 298 and MA 219, only one can be chosen
3. Between E0 220 and MA 216, only one can be chosen

Soft Core: Computing

Sl. No.	Code	Title	Credits
1	UMC 301	Applied Data Science and Artificial Intelligence	3:1
2	DS 207	Introduction to Natural Language Processing	3:1
3	DS 211	Numerical Optimization	3:0
4	DS 221	Introduction to Scalable Systems	3:1
5	DS 250	Multigrid Methods	3:1
6	DS 252	Introduction to Cloud Computing	3:1
7	DS 256	Scalable Systems for Data Science	3:1
8	DS 284	Numerical Linear Algebra	2:1
9	DS 289	Numerical Solution of Differential Equations	3:1
10	DS 291	Finite Elements: Theory and Algorithms	3:1
11	DS 294	Data Analysis and Visualization	3:0
12	DS 295	Parallel Programming	3:1
13	DS 301	Bioinformatics	2:0
14	E0 205	Mathematical Logic and Theorem Proving	3:1
15	E0 206	Theorist's Toolkit	3:1
16	E0 208	Computational Geometry	3:1
17	E0 209	Principles of Distributed Software	3:1
18	E0 224	Computational Complexity Theory	3:1
19	E0 225	Design and Analysis of Algorithms	3:1
20	E0 227	Program Analysis and Verification	3:1
21	E0 230	Computational Methods of Optimization	3:1
22	E0 234	Introduction to Randomized Algorithms	3:1
23	E0 235	Cryptography	3:1
24	E0 240	Modelling and Simulation	3:1
25	E0 244	Computational Geometry and Topology	3:1
26	E0 248	Theoretical Foundations of Cryptography	3:1
27	E0 249	Approximation Algorithms	3:1
28	E0 255	Compiler Design	3:1
29	E0 259	Data Analytics	3:1
30	E0 267	Soft Computing	3:1
31	E0 270	Machine Learning	3:1
32	E0 272	Formal Methods in Software Engineering	3:1
33	E1 213	Pattern Recognition and Neural Networks	3:1
34	E1 244	Detection and Estimation Theory	3:0
35	E1 254	Game Theory	3:1
36	E1 277	Reinforcement Learning	3:1

37	E2 201	Information Theory	3:0
38	E2 230	Network Science and Modelling	3:0
39	E2 232	TCP/IP Networking	2:1
40	QT 207	Introduction to Quantum Computation	3:0
41	BE 218	Computational Epidemiology	3:1
42	MA 208	Proofs and Programs	3:1

Suggested Institute Electives

Sl. No.	Code	Title	Credits
1	MG 201	Managerial Economics	3:0
2	MG 265	Data Mining	3:0
3	MG 221	Applied Probability and Statistics	2:1
4	MG 226	Time Series Analysis and Forecasting	3:0
5	MG 258	Financial Instruments and Risk Management Strategies	3:0
6	PH 202	Statistical Mechanics	3:0
7	PH 204	Quantum Mechanics II	3:0
8	PH 206	Electromagnetic Theory	3:0
9	BC 302	Current Trends in Drug Discovery	3:0
10	MA 253	Numerical Methods for Partial Differential Equations	3:0
11	EC 201	Theoretical and Mathematical Ecology	2:1
12	EC 303	Spatial dynamic in Biology	2:1
13	NE 101	Entrepreneurship, Ethics and Societal Impact	1:0
14	E1 396	Stochastic Approximation Algorithms	3:1
15	MA 331	Topology and Geometry	3:0
16	E0 259	Data Analytics	3:1
17	BE 218	Computational Epidemiology	3:1
18	CP 214	Foundations of Robotics	3:1
19	PH 354	Computational Physics	3:0
20	E2 270	Quantum Information Theory	3:0
21	DS 301	Bioinformatics	2:0
22	E0 207	Computational Topology	3:1

STUDY TRACKS

The program structure encourages interested students to pursue a study track should they wish to do so. Here is an indicative list of study tracks.

A. MATHEMATICS
- Linear Algebra, Multivariable calculus
- Algebra: Algebra-I, Algebra-II, Number theory, Graph theory, Cryptography
- Analysis: Measure and Integration, Functional Analysis, ODE, PDE, Convex Optimization, Numerical solutions to Differential Equations
- Geometry/Topology: Topology, Differentiable Manifolds, Algebraic Topology, Graph theory, Computational Geometry and Topology
- Probability: Measure and Integration, Probability Theory, Random Processes, Stochastic Processes, Percolation and Random Graphs, Random Matrix Theory

B. INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
- Random Processes
- Applied Data Science and Artificial Intelligence
- Computational Methods of Optimization
- Machine Learning, Game Theory
- Data Mining
- Soft Computing
- Reinforcement Learning
- Scalable Systems for Data Science
- Foundations of Robotics
- Data Analysis and Visualization

C. COMPUTATIONAL SCIENCE
- Numerical Optimization
- Multigrid Methods
- Numerical Solution of Differential Equations
- Finite Element Methods, Bioinformatics

D. THEORETICAL COMPUTER SCIENCE
- Algorithms and Complexity: Design and Analysis of Algorithms, Theorist's Toolkit, Computational Complexity Theory, Introduction to Randomized Algorithms, Approximation Algorithms
- Combinatorics and Geometry: Computational Geometry, Computational Topology, Combinatorics, Graph Theory
- Cryptography and Security: Theoretical Foundations of Cryptography, Cryptography, Network and Distributed Systems Security, Foundations of Secure Computation
- Logic and Verification: Mathematical Logic and Theorem Proving, Formal Methods in Software Engineering, Program Analysis and Verification, Proofs and Programs

E. QUANTUM COMPUTING
- Mechanics
- Electricity, Magnetism and Optics
- Quantum Mechanics I
- Physics/Engineering foundations of Quantum Technologies
- Introduction to Quantum Computation
- Introduction to Quantum Communication & Cryptography
- Advanced Quantum Computing & Information

F. COMPUTATIONAL BIOLOGY
- Biology for Engineers
- Fundamentals of Bio Engineering I, II
- Theoretical and Mathematical Ecology
- Dynamical Systems in Biology
- Introduction to Molecular Simulation
- Current Trends in Drug Discovery
- Digital Epidemiology
- Neural Signal Processing
- Theoretical and Computational Neuroscience
- Algorithmic foundations of Big Data Biology

G. SIGNAL PROCESSING
- Detection and estimation theory
- Random processes
- Linear and non-linear optimization
- Matrix theory or Computational linear algebra
- Pattern recognition and neural networks
- Signal processing in practice
- Digital Signal Processing
- Digital Image Processing
- Neural Signal Processing

H. MATHEMATICAL FINANCE
- Probability Theory
- Stochastic Finance
- Random Processes
- Detection and Estimation
- Data Analysis
- Financial Instruments and Risk Management
- Statistics
- Time Series Analysis
- Numerical Solutions to Differential Equations

SEMESTER 1 (AUGUST)

Core Courses:

UENG 101T (3:0): Algorithms and Programming
UENG 101L (0:1): Algorithms and Programming (Lab)

Instructors: L. Sunil Chandran and Viraj Kumar

The emphasis of this course is on translating algorithms (either implicitly known or taught during the course as pseudocode) into both a high-level programming language (Python) and a systems-level high- performance programming language (C). This course is broadly divided into three parts.

Part 1: Introduction to Python
Implementation, testing and debugging of elementary algorithms in Python involving operators and expressions, basic data types (integers, floats, Booleans, strings, lists), variables (references vs. objects), assignments, conditionals, iteration, functions, recursion, and modules.

Part 2: Basic Algorithms and Data Structures
Implementation of iterative algorithms (linear and binary search, string matching, iterative sorting algorithms, etc.) and recursive algorithms (exponentiation, recursive sorting, etc.). Introduction to asymptotic analysis. Big O notation. Recursive relations. Arrays versus Linked lists. Improving running times of algorithms using appropriate data structures such as hash tables, binary search trees, heaps, etc. Simple graph algorithms (shortest path, minimal spanning tree).

Part 3: Introduction to C
Differences between C and Python with respect to syntax and semantics (basic data types: integers, C arrays vs. Python lists, and strings; passing arguments to functions). Pointers and managing dynamic memory in C. Comparing the runtime performance of Python and C implementations of algorithms.

SUGGESTED BOOKS:

1. How to Think Like a Computer Scientist: Interactive Edition, based on the book by Allan Downy and Jeff Elkner (https://runestone.academy/ns/books/published/thinkcspy/index.html)
2. How to Solve it by Computer by R. G. Dromey, Pearson Education, 2007
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language. Prentice Hall of India, 2009
4. Introduction to Programming in Python by Robert Sedgewick, Kevin Wayne, and Robert Dondero, 1st edition, 2015 (https://introcs.cs.princeton.edu/python/home/)
5. A Byte of Python by Swaroop C H (https://python.swaroopch.com/)
6. CPython implementation of binary heaps (https://github.com/python/cpython/blob/3.10/Lib/heapq.py)
7. Graphs and Graph Algorithms (https://runestone.academy/ns/books/published/pythonds3/Graphs/toctree.html)
8. An Introduction to Programming through C++ by Abhiram Ranade. McGraw Hill, 1st edition, 2017
9. C for Python Programmers (https://realpython.com/c-for-python-programmers/)

Humanities (Mandatory)

Refer to Chapter 17 for details

UMA 101 (4:0): Analysis and Linear Algebra – I

Refer to Chapter 17 for the syllabus

Breadth Soft Core Courses:

UBL 101T (3:0): Introductory Biology I
UBL 101L (0:1): Introductory Biology I (Lab)

Refer to Chapter 17 for the syllabus

UCY 101T (3:0): Introductory Chemistry - I

UCY 101L (0:1): Introductory Chemistry - I

Refer to Chapter 17 for the syllabus

UPH 101T (3:0): Introductory Physics I
UPH 101L (0:1): Introductory Physics I (Lab)

Refer Chapter -17 for the syllabus

SEMESTER 2 (JANUARY)

Core Courses:

UENG 102T (3:0): Introduction to Electrical and Electronics Engineering
UENG 102L (0:1): Introduction to Electrical and Electronics Engineering (Lab)

Instructor: Kaushik Basu

Circuit analysis: KVL, KCL, dependent voltage/current sources, series and parallel equivalent, mesh and nodal analysis, Norton and Thevenin's equivalent, network theorems (superposition, maximum power transfer, Tellegen, Millman etc.), Laplace transform, first and second order RLC circuit transient analysis, RLC circuit analysis in sinusoidal steady state using phasors, idea of complex impedance, active and reactive power, Fourier series, Bode plots and passive filters. P-N junction theory. Ideal diode, Zener diodes, rectifier, clipper and clamper circuits, Zener- based power supply. MOSFET device theory and derivation of circuit model. MOSFET DC biasing and large signal analysis, small signal analysis CE, CG, CC amplifiers, differential amplifier and source coupled pair, a three-stage differential amplifier. Biasing with MOSFETs, current mirror, cascode, source degeneration. Amplifiers at high frequency. Two stage CMOS Operational Amplifier. Ideal Op-Amp. Op-Amp nonidealities, gain bandwidth product. Op-Amp with negative feedback and applications such as instrumentation amplifier, active filters, and analog computers. Operational Amplifier with positive feedback and applications such as Schmidt trigger, multivibrator, Wein-Bridge oscillator. Sample and Hold, ADC, DAC circuits. Combinational logic functions and its implementation using Boolean algebra (AND/OR/NOT), sum of products-product of sums, reduction with Karnaugh maps. Binary arithmetic, ripple carry adder and multiplier circuits. Multiplexer, de-multiplexer, decoder, encoders, and tri-state buffer. Logical sufficiency of NAND/NOR gates and their implementation with CMOS. Digital circuit design considerations-noise margin, propagation delay, fan- out, power loss. Sequential circuits with RS latch, D-T-JK flipflops and metastability. Asynchronous and synchronous counters. Finite state machines and its implementation. Introduction to computer organization: microprocessors and microcontrollers.
Software: SPICE and Verilog/VHDL.

SUGGESTED BOOKS:

1. Electrical Engineering: Principles and Applications, Allan R Hambley
2. Microelectronic Circuits: Theory And Applications, Sedra, Smith and Chandorkar
3. Fundamentals of digital logic with Verilog design, Stephen Brown and Jovonko Vranesic

Humanities

Refer to Chapter 17 for details

UMA 102 (4:0): Analysis and Linear Algebra – II

Refer to Chapter 17 for the syllabus

UMC 102 (3:0): Introduction to Computer Systems

Instructor: Vinod Ganapathy and Sanchari Sen

Computer Programs as Instructions and Data; Instruction Execution; Representation of Data: Signed Integers, Reals; Program Execution: Function Call and Return, Memory Layout, Exceptions; Overview of System Software; Memory Hierarchy and Locality; Operating System Concepts: Process, Virtual Memory, File; Concurrency and Parallelism.

SUGGESTED BOOKS:

1. Computer Systems: A Programmer's Perspective, by Randal E. Bryant and David R. O'Hallaron, Pearson, 2015

UMC 103 (2:0)/ UMC 103A (3:0): Discrete Mathematics

Instructor: C. Pandu Rangan

Mathematical Logic: Propositional logic: connectives, tautologies, and contradictions, logical equivalences, normal forms and applications. Predicates and quantifiers, interpretation and validity, proving validity, rules of inference.

Sets, Functions and Relations: Sets and cardinality, relations, functions, partial orders, total orders, linear orders, equivalence relations, partitions, n-ary relations.

Induction and Recursion: Induction, strong induction, well-ordering principle, recursive definitions and structural induction.

Basic Counting Principles: Pigeon-hole principle, permutations and combinations, Binomial coefficients and identities, elementary applications to discrete probability, recurrence relations and equations, generating function techniques, principles of inclusion and exclusion and its applications.

Graph Theory: Graphs and graph models, basic notions and operations, matchings, Hall's marriage theorem, vertex and edge connectivity, Euler and Hamiltonian circuits, vertex coloring. Trees.

SUGGESTED BOOKS:

1. Kenneth H Rosen: Discrete Mathematics and its Applications, McGraw Hill (2012)
2. Winfield K Grassmann and Jean-Paul Tremblay: Logic and Discrete Mathematics: A Computer Science Perspective, Prentice-Hall (1996)
3. M. Ben Ari: Mathematical Logic for Computer Science, 3rd edition, Springer (2012)
4. Eric Lehman, F Thomson Leighton, Albert R Meyer: Mathematics for Computer Science, (Open Edition 2013)

Breadth Soft Core Courses:

UBL 102T (3:0): Introductory Biology - II
UBL 102L (0:1): Introductory Biology - II (Lab)

Refer to Chapter 17 for the syllabus

UCY 102T (3:0): Introductory Chemistry - II
UCY 102L (0:1): Introductory Chemistry - II (Lab)

Refer to Chapter 17 for the syllabus

UENG 103 (3:0): Introduction to Earth and its Environment

Refer to Chapter 17 for the syllabus

UPH 102T (3:0): Introductory Physics II
UPH 102L (0:1): Introductory Physics II (Lab)

Refer to Chapter 17 for the syllabus

SEMESTER 3 (AUGUST)

Core Courses:

Humanities
Refer to Chapter 17 for details

UMA 201 (4:0): Probability and Statistics
Refer to Chapter 17 for the syllabus

UMC 201 (3:1): Data Structures and Algorithms

Instructor: C. Pandu Rangan

Review of Basic Data Structures - Arrays, Linked Lists, Stacks, Queues. Asymptotic complexity functions. Standard Data Structures - Heaps, Balanced Search Trees. Algorithmic Paradigms - Divide and Conquer, Greedy, Dynamic Programming. Graph Algorithms - Traversals, Shortest Paths, Minimum Spanning Trees. Advanced Data Structures - Union Find, Hashing. Amortized analysis, Splay trees, Fibonacci trees.

SUGGESTED BOOKS:

1. Data Structures and Algorithm Analysis in C by Mark Allen Weiss, Second edition, 1997 (Pearson)
2. Algorithm Design by Kleinberg and Tardos, 2006 (Pearson)
3. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Fourth edition, 2022 (MIT Press)

UMC 202 (3:1): Introduction to Numerical Methods

Instructor: Ratikanta Behera

Numerical Solution of Algebraic and Transcendental Equations, Iterative Algorithms, Convergence, Newton Raphson Procedure, Solutions of Polynomial and Simultaneous Linear Equations, Gauss Method, Relaxation Procedure, Error Estimates, Numerical Integration, Euler-Maclaurin Formula. Newton-Cotes Formulae, Error Estimates, Gaussian Quadratures, Extensions to Multiple Integrals.

Numerical Integration of Ordinary Differential Equations: Methods of Euler, Adams, Runge-Kutta and Predictor – Corrector Procedures, Stability of Solution. Solution of Stiff Equations.
Solution of Boundary Value Problems: Shooting Method with Least Square Convergence Criterion, Galerkin Method (Finite Element) Solution of Partial Differential Equations: Finite-Difference Techniques, Stability and Convergence of the Solution, Finite Element Methods.

SUGGESTED BOOKS:

1. Richard L. Burden and J. Douglas Faires, Numerical Analysis: Theory and Applications, India Edition, Cengage Brooks-Cole Publishers, 2010
2. Press, W. H., Teukolsky, S.A., Vetterling, W. T., and Flannery, B. P., Numerical Recipes in C/FORTRAN, Prentice Hall of India, New Delhi, 1994
3. Borse, G. J., Numerical Methods with MATLAB: A Resource for Scientists and Engineers, PWS Publishing Co., Boston, 1997
4. Conte, S. D. and Carl de Boor., Elementary Numerical Analysis, McGraw-Hill, 1980
5. Hildebrand, F. B., Introduction to Numerical Analysis, Tata McGraw-Hill, 1988
6. Froberg, C. E., Introduction to Numerical Analysis, Wiley, 1965

Breadth Soft Core Courses:

UBL 201T (3:0): Introductory Biology - III
UBL 201L (0:1): Introductory Biology - III (Lab)

Refer to Chapter 17 for the syllabus

UCY 201T (3:0): Introductory Chemistry - III
UCY 201L (0:1): Introductory Chemistry - III (Lab)

Refer to Chapter 17 for the syllabus

UENG 201 (3:0): Introduction to Materials Science

Refer to Chapter 17 for the syllabus

UPH 201T (3:0): Introductory Physics - III
UPH 201L (0:1): Introductory Physics - III (Lab)

Refer to Chapter 17 for the syllabus

SEMESTER 4 (JANUARY)

Core Courses:

Humanities

Refer to Chapter 17 for details

UM 204 (3:1): Introduction to Basic Analysis

Refer to Chapter 17 for the syllabus

UM 205 (3:1): Introduction to Algebraic Structures

Refer to Chapter 17 for the syllabus

UMC 203 (3:1): Introduction to Artificial Intelligence and Machine Learning

Instructors: Aditya Gopalan and Shishir N Kolathaya

Overview: Machine Learning Paradigms; Supervised, Unsupervised, and Reinforcement Learning. Supervised Learning: Bayes Classifier, Optimality; Risk Minimization; Generalisation Error Estimation. Perceptron, Logistic Regression, Least Squares, Regularization, Kernel Methods; SVMs, Multilayer Perceptrons, CNNs and Other Neural Network Models. Classifier Ensembles, Adaboost Algorithm. Unsupervised Learning: Generative Models, Parameter Estimation – Maximum Likelihood, Bayesian Methods; Latent Variables and EM Algorithm; Graphical Models, Deep Generative Models, Principal Component Analysis, Independent Component Analysis. Reinforcement Learning and Markov Decision Processes.

SUGGESTED BOOKS:

1. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006
2. S. Shalev-Shwartz and S. Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014
3. Kevin Murphy, Machine learning: A probabilistic perspective, 2012
4. T. Hastie, R. Tibshirani and J. Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction', Springer, 2009
5. A. Zhang, Z. C. Lipton, M. Li, A. J. Smola, Dive into Deep Learning, 2019 (free PDF available)
6. I. Goodfellow, Y. Bengio and A. Courville, Deep Learning, MIT Press, 2016

UMC 205 (3:1): Automata Theory and Computability

Instructor: Deepak D'Souza

Finite-state automata: deterministic finite-state automata, pumping lemma, non-determinstc automata, regular expressions, Myhill-Nerode theorem, and ultimate periodicity.

Pushdown automata and context-free languages: Context-free grammars, Chomsky normal form, pumping lemma for CFLs, Parikh's semilinearity theorem, non-deterministic pushdown automata, equivalence of context-free grammars and pushdown automata, pushdown systems and reachability, and complementing deterministic PDAs. Turing machines and undecidability: deterministic Turing machines, notion of computable functions using Turing machines, recursive and recursively enumerable languages, halting problem, reductions, Rice's theorems, undecidable problems related to context-free languages, and Godel's Incompleteness theorem.

Finite-State Automata, including the Myhill-Nerode Theorem, Ultimate Periodicity, and Buchi's Logical Characterization. Pushdown Automata and Context-Free Languages, Including Deterministic PDA's, Parikh's Theorem, and The Chomsky-Shutzenberger Theorem. Turing Machines and Undecidability, Including Rice's Theorem and Godel's Incompleteness Theorem.

SUGGESTED BOOKS:

1. Dexter Kozen: Automata and Computability. Springer 1997.
2. Hopcroft J.E. and Ullman J.D.: Introduction to Automata, Languages and Computation. Addison Wesley, 1979.

SEMESTER 5 (AUGUST)

Core Courses:

Humanities

Refer to Chapter 17 for details

Soft Core/Electives Courses – 16 Credits (Please refer to the table of Soft Core courses)

UG Soft Core Courses:

UMC 301 (3:1): Applied Data Science and Artificial Intelligence

Instructor: Deepak Subramani

Data Science Fundamentals: Identifying and framing a data science problem in different fields; Different types of Analytics; Introduction to Machine Learning, Artificial Intelligence; Is MUAI the right tool for your problem?; Stakeholder Discussion Guidelines; End-to-end Problem Solving through a 6-Step Data Science Process. Model selection for different data types. Assess the effectiveness of AI/ML models using A/B testing.

Exploratory Data Analysis: Visualizing data. Framing questions from data. Analyzing statistical relationships via Hypothesis Testing. How much data is sufficient data? Pre- processing of data: Data Distributions, Imputation, Outlier handling.

Data Science for Tabular Data: CART Algorithm, Random Forest Models, Gradient Boosted Models (XGBoost, CatBoost, LightGBM), Feature Importance and Selection, Development-Testing Paradigm. Cross Validation

Deep Learning for AI: A unified view of data-driven neural models for AI - From Linear Regression to Neural Networks, Basics of Stochastic Gradient Descent and Backpropagation, Hyperparameter Tuning, Different types of Layers, Neural models as data-processing pipelines.

Computer Vision: Practical computer vision with Transfer Learning. Identifying key AI tasks in Computer Vision. Choosing the right model, applying it, and taking the models to production.

Natural Language Processing: Natural Language Processing with Bag of Words and sequence Transformer Models. BERT-class models for Natural Language Understanding tasks; GPT-class models for Natural Language Generation Tasks. LLMOps – Taking an NLP problem from scratch to production.

SUGGESTED BOOKS:

1. Aurelien Geron. Hands-On Machine Learning with Scikit-Leam. Keras, and TensorFlow, 3rd Edition. O'Reilly Media. Inc.• 2022
2. F. Chollet. Deep Learning with Python. 2nd Edition. Manning 2021
3. Raschka, Sebastian, Yuxi Hayden Liu, Vahid Mirjalili, and Dmytro Dzhulgakov. Machine Learning with PyTorch and Scikit·Leam: Develop machine learning and deep learning models with Python. Packt Publishing Ltd. 2022
4. Lakshmanan. Valliappa. Martin Gomer. and Ryan Gillard. Practical machine learning for computer vision. O'Reilly Media, Inc.• 2021
5. Tunstall, Lewis, Leandro Von Werra. and Thomas Wolf. Natural language processing with transformers. O'Reilly Media, Inc.• 2022

Note: For details of the other soft core and elective courses please refer to respective department websites.

SEMESTER 6 (JANUARY)

Core Courses:

Humanities

Refer to Chapter 17 for details

Soft Core/Electives Courses – 16 Credits
(Please refer to the table of Soft Core/Electives courses)

SEMESTER 7 (AUGUST)

UMC 401 ISP I (0:6)/ Soft Core/ Electives (6) + Soft Core/ Electives (6)

SEMESTER 8 (JANUARY)

- **UMC 402 ISP II (0:6)/ Soft Core/Electives Courses (6) + Electives (6) OR**
- **UMC 403 Project (12)**

Note: For Semesters 7 and 8 please refer to Section 3.6 for eligibility criteria for taking ISP I / ISP II / Project.

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Abbreviations/Acronyms

Sl No.	Abbreviation	Full form
1	ADSER	Administrative Service Request
2	AI	Artificial Intelligence
3	B.Tech (M& C)	Bachelor of Technology (Mathematics and Computing)
4	BSc (Research)	Bachelor of Science (Research)
5	CGPA	Cumulative Grade Point Average
6	CMO	Chief Medical Officer
7	CoW	Council of Wardens
8	DBT	Direct Beneficiary Transfer
9	DCC	Departmental Curriculum Committee
10	DIGITS	Digital Campus and IT Services
11	DST	Department of Science and Technology
12	EntIISc	Entrepreneurship and Innovation at IISc’
13	EWS	Economically Weaker Section
14	ICASH	Internal Committee Against Sexual Harassment
15	ID Cards	Identification Document Cards
16	IIScP	Indian Institute of Science - Promotional Scheme
17	INR	Indian Rupee
18	INSPIRE (SHE)	Innovation in Science Pursuit for Inspired Research - Scholarship for Higher Education
19	M.Tech	Master of Technology
20	MSc	Master of Science
21	OBC	Other Backward Community
22	OCCaP	Office of Career Counselling and Placement
23	ODAA	Office of Development and Alumni Affairs
24	OIR	Office of International Relations
25	OoC	Office of Communications
26	PCC	Program Curriculum Committee
27	PDC	Provisional Degree Certificate
28	PwD	Persons with Disabilities
29	SAC	Student Affairs Committee
30	SAF	Students’ Aid Fund
31	SAP	Systems Applications and Products in Data Processing
32	SC	Schedule Caste
33	SC	Students’ Council
34	SCC	Senate Curriculum Committee
35	SERC	Supercomputing Education and Research Centre
36	SHCC	Sexual Harassment Complaint Committee
37	SLCM	Student Life Cycle Management
38	SOLMAN	SAP Solution Manager
39	ST	Schedule Tribe
40	TGPA	Term Grade Point Average
41	UG BoS	Undergraduate Programs Board of Studies Committee
42	UGSCC	Undergraduate Senate Curriculum Committee

INTERNSHIP/COLLABORATIVE RESEARCH (CR) WORK / ISP/ PROJECT FORM OUTSIDE IISc FOR UNDERGRADUATE PROGRAMS

Name of the Student: S. R. No: Batch:	Mr/Ms.
Program: Discipline/Major:	☐B.Sc (Research) ☐Master of Science ☐B.Tech ☐M.Tech
Semester: Completed Credits :	CGPA : Pending credits for degree requirement :
Request for (Choose the appropriate option)	☐Internship ☐CR Work ☐ISP ☐Project
Name and **Department** of the Faculty Advisor/Project Guide(s) from IISc	
Details about the Internship / CR Work / ISP / Project Name of the University / Company: Name of the Laboratory : Place : Name of the guide/ collaborator from the visiting University : Period of Internship/Project (DD/MM/YYYY):	From: ____ /____ /_____To: ____ / ____ / _____
Are you paid during the Internship period?	☐Yes ☐No (If yes, Amount_____)

Mandatory documents to be attached to the form as a single PDF file in the same order: -

- ☐ The acceptance/Invitation from the sponsoring University.
- ☐ Recommendation letter from the Research Mentor/ Advisor/ Guide(s).
- ☐ Recommendation letter from the discipline coordinator/ PCC Chair.

Undertaking

I understand that if I am selected for the internship/project, I will apply for internship leave on SAP and will commence the internship/project work only after the leave has been formally approved.

Declaration

I hereby declare that all entries in this form, as well as the information provided in the attached documents, are true to the best of my knowledge and belief.

Date: **Signature of the Student**

FOR OFFICE USE ONLY		
Remarks by UG Office		
Name:	**Date:**	**Signature of the caseworker**
Remarks by the Associate Dean		
Date:		**Signature of the Associate Dean**
Approval of the Dean		
Date:		**Signature of the Dean UG**

Note : For Procedure refer Section 5.12 of Student Information Handbook.

(Refer Section 5.3)

LATE COURSE REGISTRATION FORM
FOR UNDERGRADUATE PROGRAMS

Date:

Name of the student:

SR No: **Batch:**

Program:

Major: **Minor (If Applicable) :**

Sl No	Course Code	Course title	Course Credits	Course Type	Name of the Course instructor	Instructor Signature

Signature of the student

Signature of the Project Advisor (if applicable)
Name of the project Advisor:

Department:

Signature of the Coordinator/PCC
Name of the Co Ordinator:

Department:

REQUEST FOR APPROVAL FOR NO OBJECTION CERTIFICATE/ FINANCIAL ASSISTANCE TO ATTEND CONFERENCE FOR UNDERGRADUATE PROGRAMS

1	Name of the Student: S. R. No: Batch:	Mr./Ms.
2	Program: Discipline/Major:	☐B.Sc (Research) ☐Master of Science ☐B.Tech ☐M.Tech
3	Semester: Total credits completed: CGPA:	☐7th ☐8th ☐9th ☐10th
4	Name of the Conference: Period of the Conference (DD/MM/YYYY): Place of the Conference:	From: ___ /___ /_____ To: ___ /___ /_____
5	**Paper Presentation Details** Title of Paper: Presentation: ☐Poster ☐Oral Are you the first author of the paper? ☐Yes ☐ No Name of the Authors (as mentioned in the paper):	
6	**Name** and **Department** of the Research Mentor/ Advisor/ Guide(s) from IISc	
7	Approval requested for (Choose the appropriate option or both)	☐No Objection Certificate (NOC): Leave from ___/___/_____ to ___/___/_____ ☐Financial Assistance
8	If you have previously availed financial assistance from any of the following sources, select the appropriate option(s)	☐ GARP ☐ ODAA ☐None of the above
9	If financial assistance is requested for this conference, please specify the source (Choose the appropriate option or both)	☐ GARP ☐ ODAA Total estimated amount: Rs.
10	Are you availing financial assistance for this conference from any other source? If yes, please provide source and amount details.	☐Yes ☐No
11	**Check list of mandatory documents to be attached to the form as a single PDF file, in the following order:** ☐ Final Conference Program/Brochure. ☐ The acceptance/Invitation from the conference organisers. ☐ The full paper with all authors' names and affiliations. ☐ Recommendation letter from the Research Mentor/ Advisor/ Guide(s). ☐ Recommendation letter from the discipline coordinator/ PCC Chair.	

Undertaking: I hereby undertake that I shall apply for study/travel leave on SAP and shall commence the journey only upon receipt of formal approval.

Declaration: I hereby declare that all entries in this form, as well as the information provided in the attached documents, are true to the best of my knowledge and belief. I undertake to abide by the rules and regulations set forth by the Institute.

Date: **Signature of the Student**

FOR OFFICE USE ONLY

Remarks by UG Office

Name: **Date:** **Signature of the caseworker**

Remarks by the Associate Dean

Date: **Signature of the Associate Dean**

Recommendation of the Dean

NOC : Approved Not Approved Not Applicable

Financial Assistance through

GARP: Recommended (up to Rs. 25,000) Not Recommended Not Applicable

ODAA Grant: Recommended (up to Rs.) Not Recommended Not Applicable

Recommended ODAA Fund:

Remarks:

Date: **Signature of the Dean UG**
Approval of the Dean (A & F) for Financial Assistance through GARP
Date: **Signature of the Dean (A & F)**

Note: For eligibility requirements, procedures, and regulations, please refer to Section 7.5 of the Student Information Handbook.