Bachelor of Science and Master of Science (BS-MS) in Interdisciplinary Sciences

Indian Institute of Technology Dharwad is starting a five-year Bachelor of Science-Master of Science (BS-MS) dual degree program in *Interdisciplinary Sciences*. The proposed program is available to senior secondary students who have passed the JEE Advanced examination. The major emphasis of this program is to provide students a unique multidisciplinary learning with an exit option under the ambit of National Education Policy – 2020. The main goal of the program is to educate and train students in many aspects of sciences along with an exposure to different aspects of Arts, Humanities, Social Sciences, and Engineering.

The five year BS-MS program is divided into ten semesters. The first semester of the course will be common along with the other undergraduate students at the Institute (such as BTech). All the undergraduate students, after successful completion of the first semester, are eligible for change of branch/program (*i.e.*, change of branch within the BTech program; change of program from BTech to BS-MS and *vice versa* from BS-MS to BTech). The students under the BS-MS program will also therefore be eligible for branch/program change as per the Institute rules and regulations (refer to branch change rules).

The second and the third semesters of the program will emphasize on common foundation courses in sciences, after which the students are encouraged to choose a Major stream (from Biology, Chemistry, Mathematics and Physics) to gain an expertise in that subject and possibly another stream as Minor. The Minor stream can be chosen from Biology, Chemistry, Mathematics and Physics or any of the Minors being offered in the Institute (including Engineering). The allotment to the Major stream will be based on the academic performance and the preference given by the students. The total number of seats in a specific Major stream will be capped at 25% of the actual intake in to the BS-MS program that year.

Courses in the first three semesters will cover the fundamentals of biology, chemistry, physics, mathematics, computer programming, and social studies. The major stream courses chosen by the students will offer an in-depth understanding of important core topics as well as a chance to pursue multidisciplinary courses through minor and electives. Many of the courses have a substantial laboratory component that will enable students to find answers

for basic or translational problems.

Through a wide-ranging choice of courses in the 4-8 semesters, the students may customize their breadth and depth by choosing courses from their Major stream and also engineering courses, liberal arts, social sciences, as their electives or to perform few minor projects which will help them to find their real interest to pursue in the future. After intense study of the major subjects of their choice, the students are allowed to undertake a two semester long (semester 9-10) independent research project at IIT Dharwad or in any of the frontier research labs across the country. In addition to this, students of BS-MS program are also encouraged to explore their interest with industries by undertaking internships/co-op programs. Importantly, they can also team up with the budding engineers at the early stages towards setting up start-ups and become entrepreneurs of tomorrow's new world, where interdisciplinary knowledge is a necessity.

Structure of Foundation Courses (Semester 1-3)

	Semester I	Semester II	Semester III
Biology	Introduction To Modern Biology(2-1-0-6)	Biomolecules (2-1-0-6)	Basics of Cell Biology & Genetics (2-1-0-6)
Chemistry	Fundamental Concepts &Applications Of Chemistry (3- 0-0-6)	Organic Chemistry (3-0-0-3),States Of Matter (3-0-0-3)	Physical Organic and Bioorganic Chemistry(3-0-0-3) InorganicChemistry (3-0-0-3)
Math	Calculus I (3-1-0-4) Calculus II (3-1-0-4)	Linear Algebra (3-1-0-4) Differential Equations (3-1-0-4)	Introduction to Probability Theory(3-1-0-8)
Physics	Quantum Physics & Applications(2-1-0-6)	Electricity & Magnetism (2-1- 0-6)	Waves, Oscillation, & Optics (2-1-0-6)
Engineering	Introduction to Programming - 1 (Using C) (3-0-2-4) Introduction to Programming - 2 (Using Python)	Data Structures And Algorithm (3-0-0-6) Lab (0-0-3-3)	

	(3-0-2-4)		
HSS	Introduction To Fine Arts (P/NP) Design Thinking And Creativity (P/NP) National Sports organization (NSO) (P/NP)		Economics (3-0-0-6)
Labs	Hands On Science Laboratory (0-0-3-3)	Hands On Science Laboratory –II (3-0-3-3)	Mathematics Laboratory (0-0-3-3)
		ALO (2)	ALO (2)
Total Credits	37	38	35

Course Structure BSBE Major

Semester IV	Semester V	Semester VI	Semester VII	Semester VIII	Semester IX -X
Metabolism and Bioenergetics (2-1-0-6)	**Molecular Biology (2-1-0-6)**	**Bioinformatics (0-0-3-3)**	**Immunology (2-1-0-6)**		**Independent Project (60)**
Biophysics (3-0-0-3)	**Genomics & Proteomics (2-0-1-3)**	**Environmental studies (CH301) (3-0-0-6)**			
	Biostatistics (3-0-0-3)				
Bio Lab I (0-0-6-6)	**Bio Lab II (0-0-6-6)**	**Bio Lab III (0-0-6-6)**	**Bio Lab IV (0-0-6-6)**		
HSS-E1 (6)			**HSS -E2 (6)**	**Minor project (12)**	
PE (6)	**PE (9)**	**PE (6)**	**PE (6)**	**PE (6)**	
IE (6)	**IE (6)**	**IE (6)**	**IE (6)**	**IE (6)**	
33	33	27	30	**24**	
Total credits – 147+60 = 207 (PE=Program Elective; IE: Institute Elective)					
ALO (2)	**ALO (2)**	**ALO (2)**	**ALO (2)**		

BSBE						
SEMESTER	IC	PC	PE	IE		
I	37	0	0	0		
II	23	15	0	0		
III	6	29	0	0		
IV	0	15	6	12		
V	0	18	9	6		
VI	6	9	6	6		
VII	0	12	6	12		
VIII	0	0	6	18		
IX-X			60			
	72	**98**	**93**	**54**	**317**	

Course Structure Chemistry Major

Semester IV	Semester V	Semester VI	Semester VII	Semester VIII	Semester IX -X
Non-transition and transition metal chemistry (2-1-0-6)	Coordination and Organometallic chemistry (2-1-0-6)	PE-5 (2-1-0-3)	IE-2 (2-1-0-6)	IE-4 (2-1-0-6)	Independe nt Project* (60)
Organic reactions and reagents (2-1-0-6)	Concepts in organic synthesis (2-1-0-6)	Environmental studies (CH301) (3-0-0-6)	IE-3 (2-1-0-6)	IE-5 (2-1-0-6)	
Chemical Bonding and symmetry (2-1-0-6)	PE-2 (2-1-0-6)	Instrumental methods for structure determination (2-1-0-6)	HSS-1 (3-0-0-6)	HSS-2 (3-0-0-6)	
Molecular energetics and Dynamics (2-1-0-6)	Molecular spectroscopy (2-1-0-6)	IE-1 (2-1-0-6)	PE-7 (2-1-0-6) or Minor project (6c)	PE-8 (2-1-0-6) or Minor project (6c)	
PE-1 (2-1-0-6)	PE-3 (2-1-0-3) PE-4 (2-1-0-3)	PE-6 (2-1-0-6)	---	---	
Chem Lab I (0-0-3-3)	Chem Lab II (0-0-3-3)	Chem Lab III (0-0-3-3)	Chem Lab IV (0-0-3-3)	---	
33	33	30	27	24	60
ALO-2	ALO-2	ALO-2	ALO-2		

Total credits – 147+60 = 207 (PE=Program Elective; IE: Institute Elective)

Sr. No.	Type of courses	Courses	Credit
1	Institute core	First three semesters	66
		Environmental studies	6
2	Programme Core	Programme core (BSBE+Chem+Math +Phy)	44
		Chemistry major core	69
3	Institute Electives	Institute Electives + HSS electives	42
4	Programme Electives	Departmental electives / minor project	30
5	Major project	----	60
		Total	317

SEMESTER	IC	PC	PE	IE	Total
I	37	0	0	0	37
II	23	15	0	0	38
III	6	29	0	0	35
IV	0	27	6	0	33
V	0	21	12	0	33
VI	6	9	9	6	30
VII	0	3	6	18	27
VIII	0	0	6	18	24
IX	0	0	30	0	30
X	0	0	30	0	30
Total	72	104	99	42	317

Course Structure Mathematics Major

Semester IV	Semester V	Semester VI	Semester VII	Semester VIII	Semester IX	Semester X
Group Theory (2-1-0-6)	Rings and Modules (2-1-0-6)	Measure Theory (2-1-0-6) (Approved)	Numerical Analysis (2-1-0-6)	PE (6)	Project (30 credits)	Project (30 credits)
Real Analysis (2-1-0-6)	Introduction to Complex Analysis (2-1-0-6)	Ordinary Differential Equations (2-1-0-6)	HSS 2 (3-0-0-6)	IE (6)		
Advanced Linear Algebra (2-1-0-6)	Graph Theory (6)	Environmental Studies (3-0-0-6)	PE (6)	IE (6)		
PE (6)	General Topology (2-1-0-6)	HSS 1 (3-0-0-6)	IE (6)	IE (6)		
PE (6)	PE (6)	PE (6)	PE (3)	IE (6)		
30	30	30	27	30	30	30

SEMESTER	IC	PC	PE	IE	Total
I	37	0	0	0	37
II	23	15	0	0	38

III	**6**	**29**	**0**	**0**	**35**
IV	**0**	**18**	**12**	**0**	**30**
V	**0**	**24**	**6**	**0**	**30**
VI	**6**	**12**	**6**	**6**	**30**
VII	**0**	**6**	**9**	**12**	**27**
VIII	**0**	**0**	**6**	**24**	**30**
IX	**0**	**0**	**30**	**0**	**30**
X	**0**	**0**	**30**	**0**	**30**
Total	**72**	**104**	**99**	**42**	**317**

Course Structure Physics Major

Semester	IV	V	VI	VII	VIII	IX	X
Theory	Classical Mechanics (2 1 0 6)	Electrodynamics (2 1 0 6)	Program Elective - 3 (2 1 0 6) OR (3 1 0 4)*2	Program Elective - 4 (2 1 0 6)	Program Elective - 5 (2 1 0 6)	Independent Project (60 credits)	
	Quantum Mechanics – I (2 1 0 6)	Statistical Physics (2 1 0 6)	Environmental Studies (3-0-0-6)	Institute Elective III (2 1 0 6)	Institute Elective VI (2 1 0 6)		
	Mathematical Physics – I (2 1 0 6)	Quantum Mechanics – II (2 1 0 6)	Institute Elective I (2 1 0 6)	Institute Elective IV (2 1 0 6)	Institute Elective VII & VIII OR 2 Minor Project (0 0 12 12)		
	Program Elective - 1 (2 1 0 6)	Program Elective - 2 (2 1 0 6)	Institute Elective II OR Minor Project (0 0 6 6)	Institute Elective V OR Minor Project (0 0 6 6)	Institute Elective VII + (Institute Elective VIII OR 1 Minor Project (0 0 6 6))		
	HSS Elective - I (3 0 0 6)	HSS Elective - II (3 0 0 6)					
Laboratory	General Physics Lab (0 0 3 3)	Devices and Circuits Lab (0 0 3 3)	Advanced Physics Lab (0 0 3 3)	Seminar - I (0 0 3 3)	Seminar - II (0 0 3 3)		
Total Credits	ALO					30	30
	33	33	27	27	27		

The list of courses offered by the department of Physics for this program is as follows:

For foundational courses (I to III Semesters):

- Quantum Physics and Applications (2-1-0-6) - Semester I
- Electricity and Magnetism (2-1-0-6) - Semester II
- Waves, Oscillations, and Optics (2-1-0-6) - Semester III - Semester I
- Hands on Science Laboratory – I (0-0-3-3)
- Hands on Science Laboratory – II /

Physics Lab (0-0-3-3) - Semester III

For Major in Physics (IV to X semesters):

Department Core: All these are compulsory courses for Physics Major

- Classical Mechanics (2-1-0-6) - Semester IV
- Quantum Mechanics - I (2-1-0-6) - Semester IV
- Mathematical Physics - I (2-1-0-6) - Semester IV
- Quantum Mechanics – II (2-1-0-6) - Semester V
- Electrodynamics (2-1-0-6) - Semester V
- Statistical Physics (2-1-0-6) - Semester V
- General physics Laboratory (0-0-3-3) - Semester IV
- Advanced Physics Laboratory (0-0-3-3) - Semester VI
- Seminar – I (0-0-3-3) - Semester VII
- Seminar – II (0-0-3-3) - Semester VIII
- Devices & Circuits Laboratory (0-0-3-3)* - Semester V

* Courses offered by other departments and are relevant to our department.

PHYSICS					
SEMESTER	IC	PC	PE	IE	TOTAL
I	37	0	0	0	37
II	23	15	0	0	38
III	6	29	0	0	35
IV	0	21	6	6	33
V	0	21	6	6	33
VI	6	3	12	6	27
VII	0	3	12	12	27
VIII	0	3	0	24	27
IX & X			60		60
Total	72	95	96	54	317
Percentage	22.71	29.97	30.28	17.03	100.00
	52.68		47.32		

Program Electives

BSBE basket:

1. Ecology and Evolutionary Biology (2-1-0-6)
2. Plant Biotechnology (2-1-0-3)
3. Animal Biotechnology (2-1-0-3)
4. Tissue Engineering (2-1-0-3)
5. Biomedical imaging (2-1-0-6)
6. Developmental Biology (2-1-0-3)

7. Enzymology, Biological thermodynamics and Kinetics (2-1-0-6)
8. Research Methodology and Scientific Writing (2-0-13)
9. Physiology (3-0-0-6)
10. Advance cell biology (2-1-0-3)
11. Cancer Biology (2-1-0-3)
12. Biophysical Methods (3-0-0-3)
13. Bioprocess technology (2-1-0-3)
14. IPR, Biosafety and Bioethics (3-0-0-3)
15. Stem Cells and Regenerative Medicine (2-1-0-3)
16. Biomaterials (3-0-0-3)
17. Neurobiology (3-0-0-3)

Chemistry basket:

1. Advanced organic synthesis **(3-0-0-6)**
2. Advanced Inorganic chemistry **(3-0-0-6)**
3. Quantum chemistry **(3-0-0-6)**
4. Supramolecular chemistry **(3-0-0-3)**
5. Organic chemistry of enzymes and Biosynthesis **(3-0-0-3)**
6. Statistical mechanics **(3-0-0-6)**
7. Introduction to Sophisticated Characterization Techniques **(3-0-0-6)**
8. Sustainable energy and energy materials (CH302) **(3-0-0-6)**
9. Our health and medicine (CH405) **(3-0-0-6)**
10. Materials Science and polymer chemistry **(3-0-0-6)**
11. Solid State Chemistry and its Applications **(3-0-0-6)**
12. X-ray crystallography and applications **(3-0-0-6)**
13. Chemical biology and Medicinal chemistry **(3-0-0-6)**
14. Electrochemistry **(3-0-0-3)**
15. Pericyclic reactions and photochemistry **(3-0-0-3)**
16. Introduction to Computational Chemistry **(3-0-0-3)**
17. **Heterocyclic Chemistry and natural products (3-0-0-3)**
18. **Bioinorganic and biophysical chemistry (2-1-0-3)**
19. **Bioorganic chemistry and chemical biology (2-1-0-3)**

Mathematics Basket

Even Semester electives	Advanced Graph Theory (Already Approved)	Algebraic Topology (Submitted for acceptance)	Differential Geometry (Submitted for acceptance)	Advanced Algebra (Already Approved)	Introduction to Algebraic Geometry (Submitted for acceptance)	Fields and Galois Theory (Submitted for acceptance)	Partial Differential Equation (Submitted for acceptance)	**Statistics (submitted for acceptance)**
Odd semester electives	Introduction to Number theory (Already Approved)	Perfect Graphs (Already Approved)	Differential Topology (Already Approved)	Commutative Algebra (Submitted for acceptance)	Introduction to Graduate Algebra (Already approved)	Stochastic Models (Submitted for acceptance)	Functional Analysis (Already Approved)	Graph Theory and Combinatorics (already approved)

Physics basket

- ➢ Electronic Circuits & Devices (2-1-0-6)* - Semester IV[$]
- ➢ Mathematical Physics - II (2-1-0-6) - Semester V[$]
- ➢ Atomic & Molecular Physics (2-1-0-6) - Semester VI[$]
- ➢ Condensed Matter Physics (2-1-0-6) - Semester VI[$]
- ➢ Introduction to Numerical Linear Algebra (3-1-0-4) - Semester VI[$]
- ➢ Introduction to Numerical Methods (3-1-0-4) - Semester VI[$]
- ➢ Astrophysics (2-1-0-6) - Semester VII[$]
- ➢ Nuclear & Particle Physics (2-1-0-6) - Semester VII[$] - Semester VIII[$]
- ➢ Experimental Techniques (2-1-0-6)
- ➢ Special Theory of Relativity (2-1-0-6) - Semester VI,VII,VIII[$]
- ➢ Photonics (2-1-0-6) - Semester VI,VII,VIII[$]
- ➢ Introduction to Quantum Information & Computation (2-1-0-6) - Semester VI,VII,VIII[$]

[#] The List is not exhaustive, more courses could be offered in due course.

* Courses offered by other departments and are relevant to our department.

[$] Suggested semester.

TEXT Requires Senate approval. All other courses are already approved in previous senate meetings.

The detailed syllabus for the courses which require senate approval is appended separately.

Credit distribution table for all the departments:

Credits up to first 8 Semesters in each Major	**Institute core**	**Programme core**	**Minor Project**	**Institute Elective**	**Programme elective**	**Major project**	**HSS Electives**	**Total Core**	**Total Elective**
BSBE **(total credits-257)**	72	98	---	30	45	60	12	**170**	**147**

With major project-317 credits									
Chemistry **(total credits-257)**	72	104	--	30	39	60	12	**176**	**141**
Math **(total credits- 257)**	72	104	--	30	39	60	12	**176**	**141**
Physics **(total credits-257)**	72	95	---	42	36	60	12	**167**	**150**