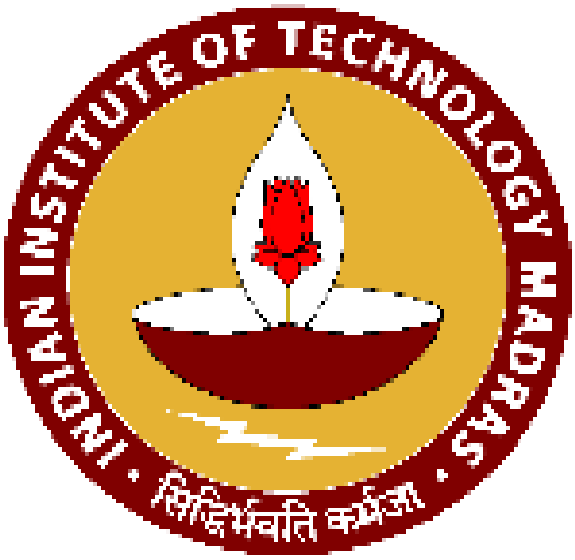

INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI 600 036

Curriculum for
Dual Degree Programme
2019 Batch

INDIAN INSTITUTE OF TECHNOLOGY MADRAS

Curriculum for Dual Degree Programme

2019 Batch

Dual Degree Programme
Category and Branch-wise credit requirements
2019 Batch

Category	Engg. (E)	Professional (P) *Core + Elective +Project*	Humanities (H)	Sciences (S) *Core + Elective*	Un-allotted credits	Total
AE	56	171 + 45 + 89	27	84 + 9	72	**553**
BE	45	124 + 107 + 85	27	75 + 9	81	**553**
BS	22	201 + 54 + 85	27	74 + 9	81	**553**
CH	48	174 + 63 + 90	27	75 + 9	72	**558**
CE	46	155 + 66 + 85	27	75 + 9	90	**553**
CS	45	120 + 120 + 85	27	84	72	**553**
ED (Auto.)	44	217 + 27 + 86	27	70+9	72	**552**
ED (Biomedical)	44	217 + 27 + 86	27	79	72	**552**
EE	48	118 + 101 + 85	27	66 + 18	88	**551**
ME (Design)	45	168 + 72 + 85	27	75 + 9	72	**553**
ME (Intel. Manu.)	45	172 + 72 + 85	27	75 + 9	72	**557**
ME (Thermal)	45	170 + 72 + 85	27	75 + 9	72	**555**
MM	45	174 + 34 + 100	27	66 + 18	91	**555**
NA	48	182 + 54 + 85	27	66 + 18	72	**552**
PH	12	186 + 75 + 85	27	79 + 18	72	**554**

Inter Disciplinary Dual Degree Programme
Category and Branch-wise credit requirements
2019 Batch

Applicable for the following ID-DD programmes

1. **Advanced Materials and Nano Technology**
2. **Biomedical Engineering**
3. **Computational Engineering**
4. **Data Science**
5. **Energy Systems**

Branch	Engg. (E)	Professional (P) *Core + Elective*	Humanities (H)	Sciences (S) *Core+ Elective*	Un-allotted credits	ID-DD Credits	Total
AE	56	159+27	27	84 + 9	31	157	**550**
BE	45	124 + 71	27	75 + 9	42	157	**550**
BS	22	201 + 18	27	74 + 9	42	157	**550**
CH	48	155 + 45	27	75 + 9	34	157	**550**
CE	46	155 + 30	27	75 + 9	51	157	**550**
CS	45	120 + 84	27	84	33	157	**550**
ED	44	181 + 18	27	69+9	45	157	**550**
EE	48	117 + 65	27	66 + 18	52	157	**550**
ME	45	150 + 54	27	75 + 9	33	157	**550**
MM	45	165 + 27	27	66 + 18	45	157	**550**
NA	48	146 + 54	27	66 + 18	34	157	**550**
EP	45	142+63	27	75+9	32	157	**550**

Inter Disciplinary Dual Degree Programme
Category and Branch-wise credit requirements for
IDDD Programme - ROBOTICS
2019 Batch

Branch	Engg. (E)	Professional (P) *Core + Elective*	Humanities (H)	Sciences (S) *Core+ Elective*	Un-allotted credits	ID-DD Credits	Total
AE	56	159 + 27	27	84 + 9	28	160	**550**
BE	45	124 + 71	27	75 + 9	39	160	**550**
BS	22	201 + 18	27	74 + 9	39	160	**550**
CH	48	155 + 45	27	75 + 9	31	160	**550**
CE	46	155 + 30	27	75 + 9	48	160	**550**
CS	45	120 + 84	27	84 + 0	30	160	**550**
ED	44	181 + 18	27	69+9	42	160	**550**
EE	48	117 + 65	27	66 +18	49	160	**550**
ME	45	177 + 27	27	75 + 9	30	160	**550**
MM	45	165 + 27	27	66 + 18	42	160	**550**
NA	48	146 + 54	27	66 + 18	31	160	**550**
EP	45	142 + 63	27	75 + 9	29	160	**550**

Inter Disciplinary Dual Degree Programme
Category and Branch-wise credit requirements for
IDDD Programme - techMBA
2019 Batch

Branch	Engineering (E)	Professional (P) *Core + Elective*	Humanities (H)	Sciences (S) *Core + Elective*	Un-allotted credits	techMBA credits	Total
AE	56	159 +27	27	84 + 9	5	**183**	**550**
BE	45	124 + 71	27	75 + 9	16	**183**	**550**
BS	22	201 + 18	27	74 + 9	16	**183**	**550**
CH	48	156 + 45	27	75 + 9	7	**183**	**550**
CE	46	155 + 30	27	75 + 9	25	**183**	**550**
CS	45	120 + 84	27	84	7	**183**	**550**
ED	44	181 + 18	27	69+9	19	**183**	**550**
EE	48	118 + 65	27	66 + 18	26	**183**	**550**
ME	45	177+27	27	75 + 9	7	**183**	**550**
MM	45	165 + 27	27	66 + 18	19	**183**	**550**
NA	48	146 + 54	27	66 + 18	8	**183**	**550**
EP	45	142 + 63	27	75+9	6	**183**	**550**

Branch Code: BT22

Dual Degree (B.Tech. & M.Tech.) in Biological Engineering
2019 Batch

Semester-wise distribution of credits and time commitment

Semester	I	Win	II	Sum	III	IV	V	VI	Sum	VII	VIII	Sum	IX	X
Credits	55	3	53	3	57	49*	38*	35*	0	24*	4*	25**	20**	85**
Time Commitment per week(based on *recommended*)	60	3	56	3	60	58	57	53	20	60	51	25	47	40

*Credits indicated are only for the core program.*In addition to the indicated credits, students have to earn 147 elective credits during semesters IV - IX, with at least 66 credits from the Department of Biotechnology and the remaining 81 credits from any department including BT.

Recommended: Semester IV - 9 credits; Semesters V & VI - 18 credits; Semester VII - 30 credits; Semester VIII - 45 credits & Semester IX - 27 credits

**Students will be registering for 25 credits of project in summer, 20 credits of project in semester IX and 40 credits of project in semester X. Credits and grades for the dual degree project will be awarded together at the end of semester X.

Category-wise distribution of credits

Category	Abbreviation	Credits	
		Total	**Electives**
Basic Sciences	S	84	9
Basic Engineering	E	45	0
Profession (not including project)	P	231	101
Project	P	85	85
Humanities	H	27	27
Free electives	S/E/P/H	81	81
Total*		**553**	**303**
% electives	**54.79**		
% electives (excluding project)	**39.42**		

*includes 27 elective credits; ^includes 66 unallocated credits

L: Lecture, **T**: Tutorial, **E**: Extended tutorial, **P**: Practical, **O**: Outside class hours, **C**: Credits
Cat: Category (**S**: Basic Sciences, **E**: Basic Engineering, **P**: Profession, **H**: Humanities)

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT1000	Introduction to Biological Sciences and Engg.	3	0	0	0	6	9	S
2	CY1001	Chemistry I	3	1	0	0	6	10	S
3	CS1100	Introduction to Programming	3	0	0	3	6	12	E
4	MA1101	Functions of Several Variables	3	1	0	0	6	10	S
5	PH1010	Physics 1	3	1	0	0	6	10	S
6	PH1030	Physics Lab	0	0	0	3	1	4	S
7	GN1101	Life Skills	0	0	0	0	2	0	
8	ID1200	Ecology and Environment	2	0	0	0	0	0	
9		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :						**55**	

Winter

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	WS1301	Workshop I	0	0	0	3	0	3	E

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MA1102	Series and Matrices	3	1	0	0	6	10	S
2	PH1020	Physics 2	3	1	0	0	6	10	S
3	CY1051	Chemistry 2	3	0	0	0	6	9	S
4	EE1101	Signals and Systems	3	1	0	0	6	10	E
5	BT1020	Material and Energy Balances	3	1	1	0	6	11	P
6	CY1002	Chemistry Lab	0	0	0	3	0	3	S
7	GN1102	Life Skills	0	0	0	0	1	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :						**53**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	WS1302	Workshop I	0	0	0	3	0	3	E

Semester 3

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MAE1	Mathematics Elective ^	3	0	0	0	6	9	S
2	HSE1	Humanities 1	3	0	0	0	6	9	H
3	AM1100	Engineering Mechanics	3	1	0	0	6	10	E
4	BT2010	Microbiology	3	0	0	0	6	9	P
5	BT2030	Biochemistry	4	0	0	0	8	12	P
6	BT2111	Microbiology and Biochemistry Lab	0	0	0	6	2	8	P
		Total Credits :						**57**	

^ To be chosen only from

MA2020 Differential Equations
MA2040 Probability, Stochastic Processes and Statistics
MA2130 Graph Theory
MA2031 – Linear Algebra for Engineers

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HSE2	Humanities 2	3	0	0	0	6	9	H
2	BT2061	Thermodynamics of Biological Systems	3	1	1	0	6	11	P
3	BT2020	Numerical Methods for Biology	3	1	1	0	6	11	P
4	BT2041	Biological Rate Processes	3	1	1	0	6	11	P
5	ME1480	Engineering Drawing	0	1	0	3	3	7	E
		Total Credits :						**49**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT3012	Molecular Biology	3	1	0	0	6	10	P
2	BT5051	Transport Phenomena in Biological Systems	3	1	0	0	6	10	P
3		Stream Elective 1 ^^	3	1	0	0	6	10	P
4	BT2121	Genetic Engineering Lab	0	0	0	6	2	8	P
		Total Credits :						**38**	

^^ If the student opts for no specialization, (s)he can do any elective course among the available ones. But, if the student opts to specialize in a stream, (s)he needs to choose from Bioprocess Engineering (or) Computational Biology (or) Bioengineering streams:

Bioprocess Engineering: BT5071 Bioreactor Design and Analysis (10 credits)
Biomedical engineering: ED5040 Human Anatomy, Physiology and Biomechanics (12 credits)
Computational Biology: BT3051 Data Structure and Algorithms for Biology (9 credits)

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT3020	Structural Biology	3	0	0	0	6	9	P
2		Stream Elective 2 #	3	1	0	0	6	10	P
3	BT3041	Analysis and Interpretation of Biological Data	3	1	0	0	6	10	P
4	BT3110	Biomolecular Analysis Lab	0	0	0	3	3	6	P
		Total Credits :						**35**	

If the student opts to specialize in a stream,

Bioprocess Engineering: BT5041 Downstream Processing (10 credits)
Biomedical engineering: BT5011 Biomaterials Engineering (9 credits)
Computational Biology: BT3040 Bioinformatics (11 credits)

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT3900	Summer Internship	0	0	0	0	20	0	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HS	Humanities 3	3	0	0	0	6	9	H
2		Stream Elective 3 @	3	0	0	0	6	9	P
	BTxxxx	Stream Lab #	0	0	0	3	3	6	P
		Total						**24**	

@ List of possible stream based electives:

Bioprocess Engineering*:*
BT3240 Metabolic Regulation (or) BT4210 Unit Operations in Biochemical Engineering (or) BT5210 Bioprocess Control (or) BT5021 Metabolic Engineering (or) BT5260 Plant Cell Bioprocessing (or) BT6240 Bioprocess Modeling and Simulation (or) BT6250 Process Equipment Design (or) approved courses from other depts.

Biomedical engineering:BT3031 Biosensors and Instrumentation (or) BT3230 Biotechnology for Healthcare (or) BT5270 Principles of Neuroscience (or) BT5130 Tissue Engineering (or) BT5430 Drug Delivery (or) BT6230 Vascular Biology (or) BT6310 Cancer Biology (or) approved courses from other depts.

Computational Biology: BT5240 Systems Biology (or) BT5340 Protein Folding and Stability (or) BT6210 Statistical Mechanics in Biology (or) BT6220 Theoretical Biophysics (or) BT6270 Computational Neurosciencce (or) BT6320 Protein Interations: Computational Techniques (or) BT5420 Computer Simulations of Biomolecular Systems (or) approved courses from other depts

 # If the student opts to specialize in a stream,

Bioprocess Engineering: BT3121 Bioprocess Engineering Lab (6 credits)
Bioengineering: BT4121 Biomaterials Lab (5 credits)
Computational Biology: BT4110 Computational Biology Lab (6 credits)

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT4020	Introduction to Research Methodology	0	0	0	2	2	4	P
2	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Total Credits :						**4***	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT5701	DD Project	0	0	0	0	25	**	P

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT5702	DD Project	0	0	0	0	20	**	P

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT5703	DD Project	0	0	0	0	40	85	P
		Total Credits :						**85**	

Semester	I	II	III	IV	V	VI	VII	S	VIII	S	IX	X	Total
Credits	55	53+6	57	49	38	35	24	0	4	25**	20**	85	553

** Credits and grades for DD Project (BT5701, BT5702 and BT5703 together) will be awarded at the end of X semester.

The project starts in the summer following the fourth year. At the end of the 9th Semester, if a student is underperforming (grade lesser than a 'B'), he/she will be asked to drop the project in 10th Semester. The remaining credit requirement (40 credits) will have to be earned through departmental or professional electives. This will be applicable from the 2015 batch onwards

Credits indicated are only for the core program.*In addition to the indicated credits, students have to earn 147 elective credits during semesters IV - IX, with at least 66 credits from the Department of Biotechnology and the remaining 81 credits from any department including BT.

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	45	124+107+85	27	75+9	81	553

BTech (Honours) + M.Tech. program: (Total credit requirement: 553 + 27 = **580)**

- ***Eligibility***: minimum CGPA of 8.5 at the end of 5th sem without U or W grade in any course. They need to maintain these conditions until graduation.
- ***Extra credit requirement***: Complete 27 credits of professional electives from the Department of Biotechnology at the 5000 level or above, in addition to the 27 credits from the Department of Biotechnology required for the regular dual degree program

Branch Code: BT23
Dual Degree (B.S. & M.S.) in Biological Sciences
2019 Batch

Semester-wise distribution of credits and time commitment

Semester	I	II	III	IV	V	VI	Sum	VII	VIII	Sum	IX	X
Credits	55	51	60	59	29	38	0	21	21	0**	0**	85**
Time Commitment per week(based on *recommended*)	60	54	60	59	56	56	20	57	59	25	38	40

* Credits indicated are only for the core program.*In addition to the indicated credits, students have to earn 135 elective credits during semesters V - IX, with at least 54 credits from the Department of Biotechnology and the remaining 81 credits from any department including BT.

Recommended: Semesters V - 27 credits; VI - 18 credits; VII & VIII - 36 credits, IX - 18 credits

** Students will be registering for 25 credits of project in summer, 20 credits of project in semester IX and 40 credits of project in semester X. Credits and grades for the dual degree project will be awarded together at the end of semester X.

Category-wise distribution of credits

Category	Abbreviation	Credits	
		Total	Electives
Basic Sciences	S	83	9
Basic Engineering	E	22	0
Profession (not including project)	P	255	54
Project	P	85	85
Humanities	H	27	27
Free electives	S/E/P/H	81	81
Total*		**553**	**256**
% electives	**46.3**		
% electives (excluding project)	**30.9**		

L: Lecture, **T**: Tutorial, **E**: Extended tutorial, **P**: Practical, **O**: Outside class hours, **C**: Credits
Cat: Category (**S**: Basic Sciences, **E**: Basic Engineering, **P**: Profession, **H**: Humanities)

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MA1101	Functions of Several Variables	3	1	0	0	6	10	S
2	PH1010	Physics 1	3	1	0	0	6	10	S
3	CY1001	Chemistry 1	3	1	0	0	6	10	S
4	BT1000	Introduction to Biological Sciences and Engg.	3	0	0	0	6	9	S
5	PH1030	Physics Lab	0	0	0	3	1	4	S
6	CS1100	Introduction to Programming	3	0	0	3	6	12	E
7	ID1200	Ecology and Environment	2	0	0	0	0	0	
8	GN1101	Life Skills	0	0	0	0	2	0	
9		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits						**55**	

Semester 2

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MA	Mathematics Elective^	3	0	0	0	6	9	S
2	PH1020	Physics 2	3	1	0	0	6	10	S
3	CY1051	Chemistry 2	3	0	0	0	6	9	S
4	BT1020	Material and Energy Balances	3	1	1	0	6	11	P
5	BT2082	Cell Biology	3	0	0	0	6	9	P
6	CY1002	Chemistry Lab	0	0	0	3	0	3	S
7	GN1102	Life Skills	0	0	0	0	1	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Total Credits :						**51**	

^To be chosen only from

MA1102 Series and Matrices
MA2020 Differential Equations
MA2040 Probability, Stochastic Processes and Statistics
MA2130 Graph Theory

Semester 3

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HSE1	Humanities 1	3	0	0	0	6	9	H
2	BT1022	Organic Chemistry in Biology	4	0	0	0	8	12	P
3	BT2010	Microbiology	3	0	0	0	6	9	P
4	BT2030	Biochemistry	4	0	0	0	8	12	P
5	BT2012	Genetics	3	1	0	0	6	10	P
6	BT2112	Microbiology Lab	0	0	0	6	2	8	P
		Total						**60**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PH2070	Introduction to Biological Physics	3	0	0	0	6	9	S
2	BT2020	Numerical Methods for Biology	3	1	1	0	6	11	P
3	BT2022	Biostatistics	3	1	0	0	6	10	P
4	BT2042	Fundamentals of Biophysical Chemistry	3	1	0	0	6	10	P
5	BT2061	Thermodynamics of Biological Systems	3	0	0	0	6	11	P
6	BT2122	Biochemistry Lab	0	0	0	6	2	8	P
		Total						**59**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT3012	Molecular Biology	3	1	0	0	6	10	P
2	BT3072	Immunology	3	0	0	0	6	9	P
3	BT2062	Analytical Techniques in Biotechnology	3	1	0	0	6	10	P
		Total						**29**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT3020	Structural Biology	3	0	0	0	6	9	P
2	BT3040	Bioinformatics	2	0	0	3	6	11	P
3	BT3022	Genomics and Proteomics	3	1	0	0	6	10	P
4	BT3122	Molecular Biology Lab	0	0	0	6	2	8	P
		Total						**38**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT3900	Summer Internship	0	0	0	0	20	0	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HSE2	Humanities 2	3	0	0	0	6	9	H
2	BT3110	Biomolecular Analysis Lab	0	0	0	3	3	6	P
3	BT4110	Computational Biology Lab	0	0	0	3	3	6	P
		Total	**3**	**0**	**0**	**6**	**12**	**21**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HSE3	Humanities 3	3	0	0	0	6	9	H
2	BT4020	Introduction to Research Methodology	0	0	0	2	2	4	P
3	BT4122	Chemical Biology Lab	0	0	0	6	2	8	P
4	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Total						**21**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT5801	DD Project	0	0	0	0	25	**	P

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT5802	DD Project	0	0	0	0	20	**	P

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT5803	DD Project	0	0	0	0	40	85	P
		Total Credits :						**85**	

Semester	I	II	III	IV	V	VI	S	VII	VIII	S	IX	X	Total
Credits	55	51	60	59	29	38	0	21	21	25**	20**	85	553

** Credits and grades for DD Project (BT5801, BT5802 and BT5803 together) will be awarded at the end of X semester.

Credits indicated are only for the core program.*In addition to the indicated credits, students have to earn 135 elective credits during semesters V - IX, with at least 54 credits from the Department of Biotechnology and the remaining 81 credits from any department including BT.

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	22	201+54+85	27	74+9	81	553

B.S. (Honours) + M.S. Program:(Total credit requirement: 553 + 27 = **580)**

- ***Eligibility***: minimum CGPA of 8.5 at the end of 5th sem without U or W grade in any course.
- ***Extra credit requirement***: Complete 27 credits of professional electives from the Department of Biotechnology at the 5000 level or above, in addition to the 27 credits from the Department of Biotechnology required for the regular dual degree program