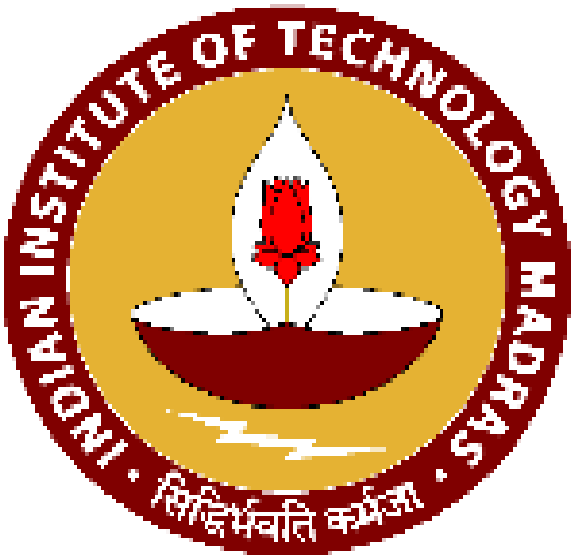


INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI 600 036

Curriculum for
Dual Degree Programme
2018 Batch

INDIAN INSTITUTE OF TECHNOLOGY MADRAS

Curriculum for Dual Degree Programme

2018 Batch

Dual Degree Programme
Category and Branch-wise credit requirements
2018 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	69+9	72	**551**
ED (Biomedical)	44	217 + 27 + 86	27	78	72	**551**
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
2018 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
2018 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
2018 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: AE21

Dual Degree (B.Tech. & M.Tech.) Aerospace Engineering

2018-Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AM1100	Engineering Mechanics	3	1	0	0	6	10	E
2	CY1001	Chemistry I	3	1	0	0	6	10	S
3	MA1101	Functions of Several Variables	3	1	0	0	6	10	S
4	ME1120	Engineering Drawing	1	0	0	3	3	7	E
5	PH1010	Physics I	3	1	0	0	6	10	S
6	PH1030	Physics Lab I	0	0	0	3	1	4	S
7	GN1101	Life Skills I	0	0	0	0	2	0	
8	ID1200	Ecology and Environment	0	0	0	0	2	0	
9		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :						**51**	

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	AS1300	Thermodynamics for Aerospace engg.	3	1	1	0	6	11	E
2	CS1100	Introduction to Programming	3	0	0	3	6	12	E
3	CY1002	Chemistry Lab	0	0	0	3	0	3	S
4	EE	Electrical Engineering Elective $	3	1	0	0	6	10	E
5	MA1102	Series and Matrices	3	1	0	0	6	10	S
6	PH1020	Physics II	3	1	0	0	6	10	S
7	GN1102	Life Skills II	0	0	0	0	1	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Total Credits :						**56**	

$ Students to choose between EE1100 and EE1101

Summer

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

Semester 3

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS1020	Fluid Mechanics	3	1	1	0	6	11	P
2	AS2010	Basic Strength of Materials	3	1	1	0	6	11	P
3	AS2100	Basic Aerospace Engg. lab.	1	0	0	2	2	5	P
4	AS2101	Introduction to Aerospace Engg.	1	0	0	2	2	5	P
5	MA2010	Complex Variables	3	0	0	0	6	9	S
6	HSE1	Humanities I	3	0	0	0	6	9	H
		Total Credits :						**50**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS2030	Gas Dynamics	3	1	1	0	6	11	P
2	AS2050	Aerodynamics	3	1	1	0	6	11	P
3	AS2070	Aerospace Structural Mechanics	3	1	0	0	6	10	P
4	AS2080	Vibrations	3	1	0	0	6	10	P
5	AS2510	Low speed lab.	1	0	0	2	2	5	P
6	MA2020	Differential Equations	3	0	0	0	6	9	S
		Total Credits :						**56**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS2040	Flight Dynamics I	4	1	0	0	7	12	P
2	AS3020	Aerospace Structures	3	1	1	0	6	11	P
3	AS3270	Propulsion I	3	1	0	0	6	10	P
4	AS3510	Aero. Lab. I	1	0	0	2	2	5	P
5	AS2520	Propulsion Lab	0	0	0	3	0	3	P
6	MA	Math elective	3	0	0	0	6	9	S
		Total Credits :						**50***	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS3050	Flight Dynamics II	4	1	0	0	7	12	P
2	AS3271	Propulsion II	3	1	0	0	6	10	P
3	AS3520	Aero. Lab. II	1	0	0	2	2	5	P
4	BT1010	Life sciences	3	0	0	0	6	9	S
5		Design elective ^	2	1	2	3	4	12	P
		Total Credits :						**48***	

^Restricted elective: students choose between AS5211 Design of Subsonic aircraft, AS5212 Design of Supersonic aircraft, AS5213 Design of UAVs and MAVs.

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
	AS3500	**Summer Internship**	0	0	0	0	20	**0**	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS5100	Mini Project	1	2	1	3	5	12	P
2	HSE2	Humanities II	3	0	0	0	6	9	H
		Total Credits						**21***	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HSE3	Humanities III	3	0	0	0	6	9	H
2	AS5190	DD Project Proposal	0	0	0	0	4	**	P
3	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Total Credits :						**9***	

* Indicated credits are only for core program. In addition, students are required to take 99 elective credits during semesters V-VIII, with atleast 27 of those credits in Aerospace Engg. Remaining 72 can be from any dept. including aerospace engg. Electives can be taken in semesters V-VIII, subject to maximum of 60 credits per sem. ***Suggested elective credits***: 9 each in V & VI sem; 36 in VII sem. & 45 in VIII sem.

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS5191	DD Project	0	0	0	0	20	**	P

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS5192	DD Project	0	0	0	0	27	**	P
2		M.Tech. Electives in Aerospace Engg.						18	P
		Total Credits :						**18**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	AS5193	DD Project	0	0	0	0	38	89	P
		Total Credits :						**89**	

Semester	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
Credits	51	56+6	50	56	50*	48*	21*	9*	18	89	553

** Credits and grades for DD Project (AS5190&, AS5190#, AS5190+ and AS5190 together) will be awarded at the end of X semester.

Category	Engg. (E)	Professional (P) Core+(UG elect.+PG elect.)+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	56	171+(27+18)+89	27	93	72	553

BTech (honours) + MTech. program: (Total credit requirement: 553 + 27 = **580)**

- ***Eligibility***: minimum CGPA of 8.5 at the end of 5th semester without U or W grade in any course. They need to maintain these conditions until graduation.
- ***Extra credit requirement***: 27 elective credits over and above regular program. These credits ***have*** to be completed in VI, VII and VIII semesters.
- 54credits (instead of 27 for regular) out of 99 B.Tech elective credits to be taken in Aero. Dept. at 5000 level or higher.

Branch Code: BT22

Dual Degree (B.Tech. & M.Tech.) in Biological Engineering
2018 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	0	0	0	0	2	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
2018 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	0	0	0	0	2	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

Branch Code: CH21
Dual Degree (B.Tech. & M.Tech.) in Chemical Engineering
2018 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CY1001	Chemistry I	3	1	0	0	6	10	S
2	CY1002	Chemistry Laboratory I	0	0	0	3	0	3	S
3	MA1101	Functions of Several Variables	3	1	0	0	6	10	S
4	ME1100	Thermodynamics	3	1	0	0	6	10	E
5	PH1010	Physics I	3	1	0	0	6	10	S
6	PH1030	Physics Lab I	0	0	0	3	1	4	S
7	ID1200	Ecology and Environment	0	0	0	0	2	0	
8	GN1101	Life Skills I	0	0	0	0	2	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :						**47**	

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	AM1100	Engineering Mechanics	3	1	0	0	6	10	E
2	MA1102	Series and Matrices	3	1	0	0	6	10	S
3	PH1020	Physics II	3	1	0	0	6	10	S
4	CS1100	Introduction to Programming	3	0	0	3	6	12	E
5	CH1020	Principles & Calculations in Chemical	3	1	0	0	6	10	P
6	GN1102	Life Skills II	0	0	0	0	1	0	
7		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Total Credits :						**52**	

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	CH2010	Chemical Engineering Thermodynamics	3	1	0	0	6	10	P
2	CH2012	Continuum Mechanics & Transport Phenomena	3	1	0	0	6	10	P
3	CH2013	Computational Programming & Process Simulation Lab	1	0	0	2	2	5	P
4	CH2061	Computational Techniques	3	1	0	0	6	10	P
5	MAE1	Maths Elective 1	3	0	0	0	6	9	S
6	HSE1	Humanities I	3	0	0	0	6	9	H
		Total Credits :						**53**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CH2014	Fundamentals of Heat & Mass Transfer	3	1	0	0	6	10	P
2	CH2015	Fluid and Particle Mechanics	3	1	0	0	6	10	P
3	CH2016	Thermodynamics Lab	0	0	0	3	2	5	P
4	CY2010	Kinetics and Catalysis	3	0	0	0	6	9	S
5	EE1100	Basic Electrical Engineering	3	1	0	0	6	10	E
6	HSE2	Humanities 2	3	0	0	0	6	9	H
		Total						**53**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT1010	Life Sciences	3	0	0	0	6	9	S
2	CH3030	Applications of Mass Transfer	3	1	0	0	6	10	P
3	CH3010	Chemical Reaction Engineering	3	1	0	0	6	10	P
4	CH3510	Momentum Transfer & MO Lab	0	0	0	3	2	5	P
5	CH3520	Heat and Mass Transfer Lab	0	0	0	3	2	5	P
6		Dept. Elective 1	3	0	0	0	6	9	P
		Total						**48**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CH3052	Materials Science for Chemical Engineers	3	1	0	0	6	10	P
2	CH3050	Process Dynamics and Control	3	1	0	0	6	10	P
3	CH3521	Heat and Mass Transfer Lab 2	1	0	0	3	2	6	P
4	CH3021	CRE Lab	0	0	0	3	2	5	P
5		Dept. Elective 2	3	0	0	0	6	9	P
		Total						**40**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
	CH3500	**Summer Internship**	0	0	0	0	20	**0**	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CH4010	Process & Product Design	3	1	0	0	6	10	P
2	CH4050	Chemical Technology and Equipment Design	3	1	0	0	6	10	P
3	CH4030	Process Control Lab	0	0	0	3	2	5	P
4		Humanities 3	3	0	0	0	6	9	H
5		Dept. Elective 3	3	0	0	0	6	9	P
		Total						**43**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Dept. Elective 4	3	0	0	0	6	9	P
2		Dept. Elective 5	3	0	0	0	6	9	P
3		Dept. Elective 6	3	0	0	0	6	9	P
4		Restricted Core – 1*	3	0	0	0	6	9	P
5		Restricted Core – 2*	3	0	0	0	6	9	P
6	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Total						**45**	

* A restricted set of core courses is available for the students in the areas of a. fluid dynamics b. process modeling and simulation and c. energy. Students will take two courses from these categories only. Further, they may take maximum ONE from each of these categories. The restricted core courses in each category are as follows

I. Fluid Dynamics

CH5100 Multiphase Systems
CH5541 Advanced Topics in Momentum Transfer
CH6020 Computational Fluid Dynamics Techniques

II. Modeling and Simulation

CH5140 Process Analysis and Simulation
CH5230 System Identification
CH5180 Steady State & Dynamic Analysis of Physiochemical Systems
CH5440 Multivariate Data Analysis for Process Modeling
CH6531 Multiscale Modeling of Heterogeneous Catalytic Systems

III. Energy

CH5013 Principles of Fuel Cells
CH5018 Biomass Conversion Processes and Analysis
CH5023 Unconventional Oil and Gas Resources
CA5350 Catalysis in Petroleum Technology

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CH5681	Project 1	0	0	0	0	25	**25**	P
		Total						**25**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Dept. Elective 7	3	0	0	0	6	9	P
2	CH5682	Project 2	0	0	0	0	25	**25**	
		Total						**34**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CH5683	Project 3	0	0	0	0	40	**40**	P
		Total						**40**	

Semester	I	II	III	IV	V	VI	VII	VIII	Summer	IX	X	Total
Credits	47	52+6	53	53	48*	40*	43*	45*	25	34	40	558

* Indicated credits are only for core program including Department Electives 7. In addition, students are required to take 72 elective credits (13%) during semesters V-VIII from any dept. including Chemical Engineering, subject to maximum of 60 credits per semester.
***Suggested elective credits*: 9cr. in V, 18cr. each in VI & VII sem; 27 cr. in VII sem.**

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	48	174+63+90	27	84	72	558

B.Tech (Honours) + M.Tech.: (Total credit requirement: 558 + 27 = **585)**

- ***Eligibility***: Minimum CGPA of 8.5 at the end of 4th semester without U or W grade in any course.
- **Extra credit requirement**: 27 credits total in VII & VIII semesters over and above the regular B.Tech requirement. (13+14 infeasible as specified in curriculum)
- **27 credits of free electives have to be from CH5000+ (elective courses in the department)**
- Thus, professional credits for Dual Degree (B.Tech. (Honours) & M.Tech.) program is 381 credits, of which 90 credits are as Dual Project.
- Category-wise Credit Distribution for Dual Degree (B.Tech. (Honours) & M.Tech.) program

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	**48**	**134+90+90**	**27**	**75+9**	**45**	**585**

BRANCH CODE: CE23
Dual Degree (B.Tech. & M.Tech.) in Civil Engineering
2018 Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MA1010	Functions of Several Variables	3	1	0	0	6	10	S
2	PH1010	Physics. I	3	1	0	0	6	10	S
3	PH1030	Physics Lab.1	0	0	0	3	1	4	S
4	CE1010	Introduction to Civil Engg	2	1	1	0	4	8	P
5	CS1100	Introduction to Programming	3	0	0	3	6	12	E
6	ME1120	Engg. Drawing	0	1	0	3	3	7	E
7	ID1200	Ecology and Environment	0	0	0	0	2	0	
8	GN1101	Life Skills I	0	0	0	0	2	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :						**51**	

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. II	3	1	0	0	6	10	S
3	AM1100	Engg. Mechanics	3	1	0	0	6	10	E
4	CY1001	Chemistry I	3	1	0	0	6	10	S
5	CY1002	Chemistry Lab	0	0	0	3	0	3	S
6	CE2330	CE Materials and Construction	3	0	0	0	6	9	P
7	GN1102	Life Skills II	0	0	0	0	1	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Total Credits :						**52**	

Summer

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

Semester 3

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Math. 3	3	0	0	0	6	9	S
2	CE2310	Mechanics of Materials	3	1	1	0	6	11	E
3	CE3010	Transportation Engineering – 1	3	0	0	0	6	9	P
4	CE2040	Hydraulic Engineering	3	1	1	0	6	11	P
5	CE2080	Surveying	2	1	0	3	4	10	P
6		**Total Credits**						**50**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CE2020	Structural Analysis	3	1	1	0	6	11	P
2	CE2060	Geotechnical Engineering - 1	3	1	1	0	6	11	P
3	CE3020	Transportation Engineering - 2	3	0	0	0	6	9	P
4	CE3040	Environmental Engineering	3	1	0	0	6	10	P
5		Science Elective (Maths/Physics/Chemistry)	3	0	0	0	6	9	S
6		Humanities Elec. 1	3	0	0	0	6	9	H
		Total Credits						**59**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT1010	Life Sciences	3	0	0	0	6	9	S
2	CE3350	Geotechnical Engineering – 2	3	1	1	0	6	11	P
3	CE3030	Water Resources Engineering	4	0	0	0	8	12	P
4	CE3060	Basic RC Design	3	1	1	0	6	11	P
5	CE4030	Hydraulic & Environ. Engg. Lab	0	0	0	3	1	4	P
6	CE3410	Construction Material Lab	0	0	0	3	1	4	P
		Total Credits						**51**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CE3050	Basic Steel Design	3	1	1	0	6	11	P
2	CE4010	Construction Project Mgmt.	3	1	0	0	6	10	P
3		Humanities Elec. 2	3	0	0	0	6	9	H
		Total Credits	**9**	**2**	**1**	**3**	**19**	**34**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CE3100	Structural Engg. Lab *	0	0	0	3	1	4	P
2	CE3280	**Summer Internship**	0	0	0	0	20	**0**	

** To conduct CE3100 during Summer (6 days after the end semester of 6th semester courses)*

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Humanities Elec. 3	3	0	0	0	6	9	H
		Total Credits	**3**	**0**	**0**	**0**	**6**	**9**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Total						0	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CE4801	Project (Summer)	0	0	0	0	0	25	P
		Total						**25**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CE4802	Project	0	0	0	0	0	20	P
		Total						**20**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CE4803	Project	0	0	0	0	0	40	P
		Total						**40**	

Semester	I	II	III	IV	V	VI	VII	VIII	summer	IX	X	Total
Credits	51	52+6	50*	59*	51*	34*	9*	*	25	20*	40*	553

***Please note that the indicated credits are only for core program.**

- The students are required to take **120 + 36 = 156 elective credits during semesters III-X**, with at least 66 of those credits in Civil Engineering, and at least 4 electives (36 credits) in DD stream of specialization. The remaining credits can be from any department including Civil Engineering
- Electives can be taken in semesters III-VIII, limiting to about 60 credits per semester.

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	46	155+66+85	27	75+9	90	553

B.Tech (Honours) + M.Tech. : (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 should maintain the same until graduation.
- An Honours student should satisfy a total credit requirement of 553+27=580 credits. These additional 27 credits should be completed in the VI, VII and VIII semesters, limiting to about 60 credits per semester.
- 63 (27 + 36) of the elective credits to be taken in CE courses at 5000-level or higher, of which, at least 4 electives (36 credits) in stream of specialisation
- Honours student should carry out a B.Tech. project worth 13 credits in VII and 14 credits in VIII semester in department including Civil Engineering.

BRANCH CODE: CS21
Dual Degree (B.Tech. & M.Tech.) in Computer Science & Engineering
2018-Batch

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. I	3	1	0	0	6	10	S
3	PH1030	Physics Lab.1	0	0	0	3	1	4	S
4	AM1100	Engineering Mechanics	3	1	0	0	6	10	E
5	CY1001	Chemistry 1	3	1	0	0	6	10	S
5	CS1111	Problem solving using computers	3	0	0	3	6	12	E
6	GN1101	Life Skills I	0	0	0	0	2	0	
7	ID1200	Ecology and Environment	0	0	0	0	2	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :						**56**	

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. II	3	1	0	0	6	10	S
3	CS1200	Discrete Mathematics for CS	3	1	0	0	6	10	P
4	ME1480	Engineering Drawings	1	0	0	3	3	7	E
5	CY1002	Chemistry Lab	0	0	0	3	0	3	S
6	EE1100	Basic Electrical Engineering	3	1	0	0	6	10	E
7	GN1102	Life Skills II	0	0	0	0	1	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Total Credits :						**50**	

Summer

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

Semester 3

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MA2130	Basic Graph Theory	3	0	0	0	6	9	S
2		Humanities Elective 1	3	0	0	0	6	9	H
3	CS2700	Programming and Data Structures	3	1	0	0	6	10	P
4	CS2710	Programming and Data Structures Lab	0	0	0	3	3	6	P
5	CS2300	Foundations of Computer Systems Design	3	0	0	0	6	9	P
6	CS2310	Foundations of Computer Systems Design Lab	0	0	0	3	1	4	P
		Total Credits :						**47**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CS2200	Languages, Machines, and Computations	3	1	0	0	6	10	P
2	CS2800	Design and Analysis of Algorithms	3	1	0	0	6	10	P
3	CS2600	Computer Organization and Architecture	3	1	0	0	6	10	P
4	CS2610	Computer Organization and Architecture Lab	0	0	0	3	3	6	P
5	CS2810	Object-Oriented Algorithms Implementation and Analysis Lab	1	0	0	2	3	6	P
6	MA 2040	Probability, Stochastic Process and Statistics	3	0	0	0	6	9	S
		Total Credits :						**51**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CS3100	Paradigms of Programming	3	0	0	0	6	9	P
2	CS3500	Operating Systems	3	0	0	6	6	15	P
3	CS3300	Compiler Design	3	0	0	6	6	15	P
4		**Total Credits :**						**39**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT1010	Life Sciences	3	0	0	0	6	9	S
		Total Credits :						**9**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CS3660	Summer Internship	0	0	0	0	20	0	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Humanities Elective 2	3	0	0	0	6	9	H
		Total Credits :						**9**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HS3050	Professional Ethics	2	0	0	0	0	0	H
2		Humanities Elective 3	3	0	0	0	6	9	H
3	CS5705	Dual Degree Project I *	0	0	0	0	12	12	P
		Total Credits :						**21**	

The DD students will NOT be allowed to register for UGRC credits in their 8th semester

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CS5715	Dual Degree Project II *	0	0	0	0	33	33	P
		Total Credits :						**33**	

** Grading to be done for 45 credits (CS5705 and CS5715) of Dual Degree project phase-1 done from 1st February to 1st November. The same grade will be recorded for CS5705 and CS5715. Those with a grade of 'D', 'E','U' will have to take three CSE electives in their final semester in lieu of CS6008*

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CS5815	Dual Degree Project III #	0	0	0	0	40	40	P
		Total Credits :						**40**	

 # Viva voce exam to be completed in or after May

Semester	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
Credits	56	50+6	47*	51*	39*	9*	9*	21*	33*	40*	553

***Please note that the indicated credits are only for core program.**

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	45	120+120+85	27	84	72	553

- Dual Degree students should complete a total of 192 credits of electives out of which a minimum of 120 Credits must be completed through CSE Dept. Electives.
- Semesters marked with '*': students should take appropriate number of electives after consulting faculty advisor. The students are free to take the elective courses in different semesters, so that the total number of credit hours per semester does not normally exceed 60. B Tech final-year project is optional and may be carried out in the CSE Dept. or in any other Department at IIT Madras.
- CS1200 is equivalent to MA2060**:** Discrete Mathematics. CSE students are not allowed to credit MA2060 course as a free elective.

B.Tech (Honours) + M.Tech.: (Total credit requirement: 553 + 36 = **589**

- ***Eligibility***: minimum CGPA of 8.5 at the end of 5th sem without U or W grade in any course.
- Students must complete an additional 36 credits of Department Electives with respect to the regular B.Tech. program.
- Semesters marked with '*': students should take appropriate number of electives in consultation with faculty advisor.
- Honors students may exceed the 60-credit limit per semester, after discussing with the faculty advisor.

Branch Code: ED
Dual Degree (B.Tech. & M.Tech.) in Engineering Design
2018-Batch

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	AM1100	Engineering Mechanics	4	0	0	0	8	12	E
3	ME1120	Engineering Drawing	1	0	0	3	3	7	E
4	ED1021	Intro. to Computation & Visualization	3	0	0	3	3	9	E
5	ED1031	Creative Design	0	0	0	3	0	3	P
6	PH1010	Physics I	3	1	0	0	6	10	S
7	ID1200	Ecology and Environment	2	0	0	0	0	0	
8	GN1101	Life Skills I	0	0	0	0	2	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :	**16**	**2**	**0**	**9**	**30**	**51**	

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	PH1030	Physics Laboratory	0	0	0	3	0	3	S
3	ED1011	Functional and Conceptual Design	2	0	0	3	4	9	P
4	ED2090	Geometric Modelling and CAD	3	0	0	3	6	12	P
6	ED1033	Form and Aesthetics in Design I	1	0	0	3	2	6	P
5	EE1101	Signals and Systems	3	1	0	0	6	10	E
6	GN1102	Life Skills II	0	0	0	0	1	0	
7		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Total Credits :	**12**	**2**	**0**	**12**	**27**	**50**	

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	ED1034	Form and Aesthetics in Design II	1	0	0	3	2	6	P
2	ED2141	Physics of Measurement	3	0	0	0	6	9	S
3	ED2012	Manufacturing Processes	2	0	0	0	4	6	P
4	ED2011	Design of Mechanical Systems 1	4	0	0	3	8	15	P
5	MA2020	Differential Equations	3	0	0	0	6	9	S
6	ED2130	Analog and Digital Electronics	3	1	0	3	6	13	P
		Total	**16**	**1**	**0**	**9**	**32**	**58**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CY1050	Macromolecules as Engg Materials	3	0	0	0	6	9	S
2	ED4040	Design of Thermal and Fluid Systems	4	0	0	3	8	15	P
3	ED2040	Control Systems	3	0	0	3	6	12	P
4	ED4060	Design of Mechanical Systems 2	4	0	0	3	8	15	P
		Free Elective							F
		Total	**14**	**0**	**0**	**9**	**28**	**51**	

Branch Code: ED21
Dual Degree (B.Tech. & M.Tech.) in Engineering Design

Stream: Automotive Engineering
2018-Batch

(Curriculum for the first four semester is common – refer Page No. 22)

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED3010	Human Factors in Design	3	0	0	0	6	9	P
2	ED	Professional Elective I							P
3	BT1010	Life Sciences	3	0	0	0	6	9	S
4	ED5160	Automotive Engines and Systems	4	0	0	3	8	15	P
5	ED5052	Electromagnetic Compatibility for Product Design	3	1	0	0	6	10	P
6	ED5080	Mechatronics System Design	2	0	0	3	4	9	P
		Total	**15**	**1**	**0**	**6**	**30**	**52**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Electives (Maths / Science)							S
2	ED5015	Computational Methods in Design	3	1	0	0	6	10	P
3	ED5220	Vehicle Dynamics	3	0	0	3	6	12	P
4	ED5017	Digital Signal Processing for Engineering Design	3	1	0	0	6	10	P
5	ED5013	Analytical and Experimental Techniques in Vibration	2	0	0	3	4	9	P
6	ED	Professional Elective II							P
		Total	**11**	**2**	**0**	**6**	**22**	**41**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED5200	Summer internship	0	0	0	0	20	0	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED	Professional Elective III							P
2		Free Elective							F
3		Free Elective							F
4	ED5050	Structural and Component Design of Vehicles	4	0	0	0	8	12	P
5	ED5330	Control of Automotive Systems	3	0	0	0	6	9	P
6	HS	Humanities I	3	0	0	0	6	9	H
		Total	**10**	**0**	**0**	**0**	**20**	**30**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED5601	Project I (Industry)	0	0	0	31	0	31	P
		Total	**0**	**0**	**0**	**31**	**0**	**31**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED5602	Project II	0	0	0	20	0	20	P
		Total	**0**	**0**	**0**	**20**	**0**	**20**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED5603	Project III	0	0	0	35	0	35	P
	HS	Humanities II	3	0	0	0	6	9	H
		Total	**3**	**0**	**0**	**35**	**6**	**44**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HS	Humanities III	3	0	0	0	6	9	H
2	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Free Electives							
		Total	**3**	**0**	**0**	**0**	**6**	**9**	

Semester	I	II	III	IV	V	VI	VII	VIII	summer	IX	X	Total
Credits	51	50+6	58	51*	52*	41*	30*	31*	20	44*	9*	551

***Please note that the indicated credits are only for core program.**

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	44	217+27+86	27	69+9	72	551

* Indicated credits are only for core program. In addition, 108 credits of electives have to be taken in semesters IV-X,

- Out of which at least 27 credits should be from the list of professional elective courses prescribed by the Department of Engineering Design.
- 9 credits from Maths/Science category
- The remaining 72 credits constitute free electives. The presence of the terms "Free Elective" and "Professional Elective" in the tables is meant to remind the students regarding the same.

B. TECH (HONOURS) + M. TECH PROGRAM
(Total credit requirement: 551 + 27 = **578)**

Eligibility: minimum CGPA of 8.5 at the end of 5th semester without U or W grade in any course. They need to maintain these conditions until graduation.

Extra credit requirement: 27 elective credits over and above regular program from the courses prescribed by the Department of Engineering Design. These credits ***have*** to be completed in VI, VII and IX semesters.

Branch Code: ED22
Dual Degree (B.Tech. & M.Tech.) in Engineering Design

Stream: Biomedical Engineering
2018-Batch

(Curriculum for the first four semester is common – refer Page No. 22)

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED3010	Human Factors in Design	3	0	0	0	6	9	P
2	ED	Professional Elective I							P
3	BT1010	Life Sciences	3	0	0	0	6	9	S
4	ED5040	Human Anatomy Physiology and Biomechanics	3	0	0	3	6	12	P
5	ED5052	Electromagnetic Compatibility for Product Design	3	1	0	0	6	10	P
6	ED5080	Mechatronics System Design	2	0	0	3	4	9	P
		Total	**14**	**1**	**0**	**6**	**28**	**49**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	CY6108	Medicinal Chemistry	3	0	0	0	6	9	S
2	ED5015	Computational Methods in Design	3	1	0	0	6	10	P
3	ED5020	Design of Implantable and Surgical Devices	3	0	0	0	6	9	P
4	ED5017	Digital Signal Processing for Engineering Design	3	1	0	0	6	10	P
5	ED5070	Design of Monitoring and Diagnostic Systems	4	0	0	0	8	12	P
6	ED5060	Medical Equipment Dissection Lab	0	0	0	3	0	3	P
7	ED	Professional Elective II							P
		Total	**16**	**2**	**0**	**3**	**34**	**53**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
	ED5200	**Summer Internship**	0	0	0	0	20	**0**	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED	Professional Elective III							P
2		Free Elective							F
3		Free Elective							F
4	ED6001	Medical Image Analysis	3	0	0	3	6	12	P
5	BT5011	Biomaterials Engg.	3	0	0	0	6	9	P
6	HS	Humanities I	3	0	0	0	6	9	H
		Total	**9**	**0**	**0**	**3**	**18**	**30**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED5601	Project I (Industry)	0	0	0	31	0	31	P
		Total	**0**	**0**	**0**	**31**	**0**	**31**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED5602	Project II	0	0	0	20	0	20	P
		Total	**0**	**0**	**0**	**20**	**0**	**20**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ED5603	Project III	0	0	0	35	0	35	P
	HS	Humanities II	3	0	0	0	6	9	H
		Total	**3**	**0**	**0**	**35**	**6**	**44**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HS	Humanities III	3	0	0	0	6	9	H
2	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Free Electives							
		Total	**3**	**0**	**0**	**0**	**6**	**9***	

Semester	I	II	III	IV	V	VI	VII	VIII	summer	IX	X	Total
Credits	51	50+6	58	51*	49*	53*	30*	31*	20	44*	9*	551

***Please note that the indicated credits are only for core program.**

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	44	217+27+86	27	78	99	551

* Indicated credits are only for core program. In addition, 99 credits of electives have to be taken in semesters IV-X,

- Out of which at least 27 credits should be from the list of professional elective courses prescribed by the Department of Engineering Design.
- The remaining 72 credits constitute free electives. The presence of the terms "Free Elective" and "Professional Elective" in the tables is meant to remind the students regarding the same.

B. TECH (HONOURS) + M. TECH PROGRAM
(Total credit requirement: 551 + 27 = **578)**

Eligibility: minimum CGPA of 8.5 at the end of 5th semester without U or W grade in any course. They need to maintain these conditions until graduation.

Extra credit requirement: 27 elective credits over and above regular program from the courses prescribed by the Department of Engineering Design. These credits ***have*** to be completed in VI, VII and IX semesters.

Branch Code: EE25
Dual Degree (B.Tech. & M.Tech.) in Electrical Engineering
2018-Batch

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 I	3	1	0	0	6	10	S
3	CY1001	Chemistry I	3	1	0	0	6	10	S
4	EE1102	Introduction to Programming	3	0	0	3	6	12	E
5	PH1030	Physics Lab I	0	0	0	3	1	4	S
6	CY1002	Chemistry Lab	0	0	0	3	0	3	S
7	ID1200	Ecology and Environment	0	0	0	0	2	0	
8	GN1101	Life Skills I	0	0	0	0	2	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Total Credits :						**49**	

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 II	3	1	0	0	6	10	S
3	EE2001	Digital Systems & Lab	3	1	1	3	8	16	P
4	EE1101	Signals & Systems	3	1	0	0	6	10	E
5	HS	Humanities 1	3	0	0	0	6	9	H
7	GN1102	Life Skills II	0	0	0	0	1	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Total Credits :						**55**	

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	EE2015	Electric Circuits & Networks	3	1	1	0	6	11	P
2	EE2016	Microprocessor Theory + Lab	2	0	0	3	7	12	P
3	EE2025	Engineering Electromagnetics	3	1	0	0	6	10	E
4	HS	Humanities 2	3	0	0	0	6	9	H
		Total Credits :	**11**	**2**	**1**	**3**	**25**	**42**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	EE2005	Electrical Machines & Lab	3	1	1	3	7	15	P
2	EE2019	Analog Systems & Lab	3	1	1	3	9	17	P
3	EE2004	Digital Signal Processing	3	1	1	0	6	11	P
4	EE3001	Solid State Devices	3	1	1	0	6	11	P
5	EE2703	Applied Programming Lab	0	0	0	3	3	6	P
		Total Credits :	**12**	**4**	**4**	**9**	**31**	**60**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	EE3004	Control Engg	3	1	1	0	6	11	P
2	EE3006	Principles of Measurement	2	0	0	3	3	8	P
3	BT1010	Life sciences	3	0	0	0	6	9	S
		Total Credits :	**8**	**1**	**1**	**3**	**15**	**28**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME3100	Basic Thermal Engineering	3	1	0	0	6	10	E
		Total Credits :						**10**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	EE3500	Summer internship	0	0	0	0	20	0	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Humanities Elective 3	3	0	0	0	6	9	H
		Total Credits :						**9**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Total Credits :						**0**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	EE6901	DD Project	0	0	0	0	25	25**	P
		Total Credits :						**25****	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	EE6902	DD Project	0	0	0	0	30	30**	P
		Total Credits :						**30****	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	EE6903	DD Project	0	0	0	0	30	30**	P
		Total Credits :						**30****	

****Credits and grades for DD Project will be awarded at the end of X semester.**

Semester	I	II	III	IV	V	VI	VII	VIII	Summer	IX	X	Total
Credits	49	55+6	42	60	28*	10*	9*	0*	25	20*	45*	551

***Please note that the indicated credits are only for core program.**

Category	Engg. (E)	Professional (P) Core+(Elect.+Stream Elec.)+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	**48**	**118+(65+36)+85**	**27**	**66+18**	**88**	**551**

DD students are required to earn an additional 36 (171+36=207) credits more than their B.Tech counter parts (annexure A), out of which 36 elective credits will be take from Elec. Engg. (or equivalent) at the 5000 level or higher, and can be taken in any semester subject to course prerequisites.

85 credits of DD project will be taken in the summer after the VIII semester, and in the IX and X semesters. Elective credits can be taken subject to maximum of 60 credits per semester. All elective lab courses will also be eligible.

BTech (honours) + M.Tech program: (Total credit requirement: 551 + 27 = **578)**

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:
27 elective credits over and above regular BTechprogram at the 5000 level or above.

Annexure A

B.Tech. credit requirement

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	49	55+6	42*	60	28*	10*	9*	0*	430

*** Indicated credits are only for core programme. In addition, 171 credits of electives have to be taken in semester III and semesters V-VIII,** of which

a) at least 9 credits should be from Mathematics and
b) at least 9 credits should be from Basic Science courses (Mathematics, Physics, Chemistry or Biological sciences)
c) at least 29 credits should be from Electrical Engineering courses (or equivalent). All elective lab courses will also be eligible.
d) at least 4 courses that together carry at least 36 credits should be taken from courses in the following EE Stream elective basket:

Odd semester:	Even semester:
EE2003 Computer Organization	EE3007 RF and Optical Communication
EE3002 Analog Circuits	EE3110 Probability Foundations for Electrical Engineers
EE3003 Power Systems	EE3203 Power Electronics
EE3005 Communication Systems	EE3402 Sensing Techniques and Sensor Systems
EE3313 Device Modelling	ID4100 Creative Engineering Project
EE4502 Optics for Engineers	
EE5311 Digital IC Design	
EP3200 Photonics	
ID4100 Creative Engineering Project	

For the course ID4100 Creative Engineering Project, the project must be on a topic that is core to Electrical Engineering."

^Courses in the stream elective basket other than those chosen to satisfy requirement in (d) above can also be taken as general EE electives to satisfy requirement in (c) above.

Remaining 88 credits can be from any dept. including Electrical Engineering. Electives can be taken subject to a maximum of 60 credits per semester.

Minimum number of credits in each category: S ≥ 84, E ≥ 45, H ≥ 27, P ≥ 180

Suggested:

III sem: 9 Maths elective and 9 Humanities elective credits
V sem : 22 Stream elective credits and 9 other elective credits
VI sem: 14 Stream elective credits, 9 BS elective credits, 9 other elective credits and 9 EE elective credits
VII and VIII sem: 20 EE elective credits and 70 other elective credits

Project: An optional B.Tech project can be taken in lieu of 27 elective credits. Project can be taken in any department including Electrical Engineering. If the project is done in Electrical Engineering Department, credits may be counted against 27 of the 29 Electrical Engineering non-stream elective credits mentioned above.

Branch Code: ME25
Dual Degree (B.Tech. & M.Tech.) in Mechanical Engineering
2018-Batch

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	CS1100	Introduction to programming	3	0	0	3	6	12	E
4	ME1100	Thermodynamics	3	1	0	0	6	10	P
5	PH1030	Physics lab	0	0	0	4	0	4	S
6	CY1002	Chemistry lab	0	0	0	3	0	3	S
7	ID1200	Ecology and Environment	2	0	0	0	0	0	
8	GN1101	Life Skills I	0	0	0	0	2	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Credits for semester 1						**49**	

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	CY1001	Chemistry	3	1	0	0	6	10	S
4	AM1100	Engineering Mechanics	3	1	0	0	6	10	E
5	ME1480	Engineering drawing	1	0	0	3	3	7	E
6	HS	Humanities elective 1	3	0	0	0	6	9	H
7	GN1102	Life Skills II	0	0	0	0	1	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Credits for semester 2						**56**	

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	MA2020	Differential equations	3	0	0	0	6	9	S
2	EE1100	Basic electrical engineering	3	1	0	0	6	10	E
3	AM2200	Strength of materials	3	1	0	0	6	10	P
4	AM2530	Foundations of fluid mechanics	3	1	0	0	6	10	P
5	ME2201	Kinematics and dynamics of machinery	3	1	0	0	6	10	P
6	AM2540	Applied mechanics/ Fluid mechanics lab	0	0	0	3	0	3	P
		Credits for semester 3						**52**	

Semester 4

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	ME2100	Applied thermal engineering	3	1	0	0	6	10	P
3	ME2200	Materials and design	3	1	0	0	6	10	P
4	ME2300	Manufacturing processes	3	1	0	0	6	10	P
5	ME2400	Measurements and instrumentation	3	0	0	2	6	11	P
6	HS	Humanities elective 2	3	0	0	0	6	9	H
		Credits for semester 4						**59**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME3101	Heat transfer	3	1	0	0	6	10	P
2	ME3103	Energy conversion systems	3	1	0	0	6	10	P
3	ME3201	Design of machine elements	3	1	0	0	6	10	P
4	ME3301	Manufacturing technology	3	1	0	0	6	10	P
5		Free elective 1	3	0	0	0	6	9	
6	ME3481	Mechanical engineering lab 1	0	0	0	3	0	3	P
7	ME3281	Machine drawing practice	1	0	0	3	3	7	P
		Credits for semester 5						**59**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME	Professional elective 1	3	0	0	0	6	9	P
2		Free elective 2	3	0	0	0	6	9	
3		Free elective 3	3	0	0	0	6	9	
4	BT1010	Life sciences	3	0	0	0	6	9	S
5	ME3302	Automation in manufacturing	3	1	0	0	6	10	P
6	ME3482	Mechanical engineering lab 2	0	0	0	3	0	3	P
7	ME3484	Mechanical engineering lab 3	0	0	0	3	0	3	P
		Credits for semester 6						**52**	
		Honors elective 1	3	0	0	0	6	9	
		Credits for semester 6 for honors						**61**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
	ME3500	**Summer Internship**	0	0	0	0	20	**0**	

Branch Code: ME22

Dual Degree (B.Tech. & M.Tech.) in Mechanical Engineering

(Curriculum for the first six semester is common – refer Page No. 31 & 32)

STREAM: Mechanical Design

2018-Batch

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME	Professional Elective 2	3	0	0	0	6	9	P
2	ME5205	Theory of Vibration	3	0	0	0	6	9	P
3	ME5207	Design with Advanced Materials	3	0	0	0	6	9	P
4		Free Elective 4	3	0	0	0	6	9	
5		Free Elective 5	3	0	0	0	6	9	
6	HS	Humanities Elective-3	3	0	0	0	6	9	H
7	HS3050	Professional Ethics	2	0	0	0	0	0	H
8	ME5281	Mechanical Design Laboratory	0	0	0	3	0	3	P
		Credits for semester 7						**57**	
	ME	Honours Elective 2	3	0	0	0	6	9	
		Credits for semester 7 for Honours						**66**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME5203	Advanced Mechanics of Solids	3	0	0	0	6	9	P
2		Professional Elective 3	3	0	0	0	6	9	P
3		Professional Elective 4	3	0	0	0	6	9	P
4		Free Elective 6	3	0	0	0	6	9	
5		Free Elective 7	3	0	0	0	6	9	
6	ME5280	Design Practice with CAD Tools	1	0	0	3	2	6	P
		Credits for semester 8						**51**	
	ME	Honours Elective 2	3	0	0	0	6	9	
		Credits for semester 8 for Honours						**60**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6491	Project phase 1	0	0	0	0	22	22	
		Credits for summer						**22**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6492	Project phase 2	0	0	0	0	23	23	
2	ME	Professional Elective 5	3	0	0	0	6	9	P
3		Free Elective 8	3	0	0	0	6	9	
4	ME5204	Finite Element Analysis	3	0	0	0	6	9	P
		Credits for semester 9						**50**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6493	Project phase 3	0	0	0	0	40	40	
		Credits for semester 10						**40**	

Semester	I	II	III	IV	V	VI	VII	VIII	summer	IX	X	Total
Credits	49	56+6	52	59	59	52	57	51	22	50	40	553

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	**45**	**195+45+85**	**27**	**84**	**72**	**553**

DD Curriculum Mechanical Design

Category	ME
Basic Science (S)	84
Basic Eng. (E)	45
Profession (P)	240
Humanities (H)	27
Unallocated and project credits	72 + 85
Total	**553**

DD Category wise credit Requirements

Category	ME	
	Electives	**Total**
Basic Science (S)	10	84
Basic Eng. (E)	0	45
Profession (P)	45	240
Humanities (H)	27	27
Unallocated and project credits	72 + 85	72 + 85
Total	**144+ 85**	**468 + 85**
Percentage		

Note:

- **Professional Elective 1 - to be chosen from 4000 level;**
- **Professional Elective 2-4 - to be chosen from 5000 + level.**

BTech (honours) + M.Tech: (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***: Additional 27 credits to be taken in VI-VIII from Mechanical department (or equivalent);

Branch Code: ME23

Dual Degree (B.Tech. & M.Tech.) in Mechanical Engineering

(Curriculum for the first six semester is common – refer Page No.31 & 32)

STREAM: Intelligent Manufacturing
2018-Batch

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME7240	Modeling and Simulation in Manufacturing	3	0	0	0	6	9	P
2	ME7040	Computer Aided Design in Manufacturing	3	0	0	0	6	9	P
3	ME7010	Microprocessors in Automation	3	0	0	0	6	9	P
4	ME7050	Computer Numerical Control and Adaptive Control	3	0	0	0	6	9	P
5		Free Elective 4	3	0	0	0	6	9	
6	HS	Humanities Elective-3	3	0	0	0	6	9	H
7	HS3050	Professional Ethics	0	0	0	0	2	0	H
		Credits for semester 7						**54**	
	ME	**Honours elective 2**	3	0	0	0	6	9	
		Credits for semester 7 for Honours						**63**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Free Elective 5	3	0	0	0	6	9	
2		Free Elective 6	3	0	0	0	6	9	
3	ME7430	Oil Hydraulic and Pneumatic Systems	3	0	0	0	6	9	P
4	ME7120	Sensors for Intelligent Manufacturing and Condition Monitoring	3	0	0	0	6	9	P
5	ME7060	Manufacturing and Precision Engineering Lab	0	0	0	4	0	4	P
6	ME	Professional Elective 2	3	0	0	0	6	9	P
		Credits for semester 7						**49**	
		Honours elective 3	3	0	0	0	6	9	
		Credits for semester 8 for Honours						**58**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6591	Project phase 1	0	0	0	0	42	21	
		Credits for summer						**21**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6592	Project phase 2	0	0	0	0	24	24	
2	ME	Professional Elective 3	3	0	0	0	6	9	P
3	ME	Professional Elective 4	3	0	0	0	6	9	P
4		Free elective 7	3	0	0	0	6	9	
5		Free elective 8	3	0	0	0	6	9	
		Credits for semester 9						**60**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6593	Project phase 3	0	0	0	0	40	40	
		Credits for semester 10						**40**	

Semester	I	II	III	IV	V	VI	VII	VIII	summer	IX	X	Total
Credits	49	56+6	52	59	59	52	54	49	21	60	40	557

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	45	208+36+85	27	84	72	557

DD Curriculum Intelligent Manufacturing

Category	ME
Basic Science (S)	84
Basic Eng. (E)	45
Profession (P)	244
Humanities (H)	27
Unallocated and project credits	72 + 85
Total	**557**

DD. - Category wise credit Requirements

Category	ME	
	Electives	Total
Basic Science (S)	10	84
Basic Eng. (E)	0	45
Profession (P)	36	244
Humanities (H)	27	27
Unallocated and project credits	72 + 85	72 + 85
Total	**135 + 85**	**472 + 85**
Percentage		

BTech (honours) + M.Tech: (Total credit requirement: 557 + 27 = **584)**

- ***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***: Additional 27 credits to be taken in VI-VIII from Mechanical department (or equivalent);

Branch Code: ME24

Dual Degree (B.Tech. & M.Tech.) in Mechanical Engineering

(Curriculum for the first six semester is common – refer Page No. 31 & 32)

STREAM: Thermal Engineering
2018-Batch

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6080	Measurement in Thermal Engg	2	0	0	3	5	10	P
2	ME6150	Numerical Methods in Thermal Engg	2	0	0	3	5	10	P
3		Professional elective 2	3	0	0	0	6	9	P
4		Free elective 4	3	0	0	0	6	9	
5		Free elective 5	3	0	0	0	6	9	
6	HS	Humanities elective 3	3	0	0	0	6	9	H
7	HS3050	Professional ethics	2	0	0	0	2	0	H
8		**Credits for semester 7**						**56**	
		Honors elective 2	3	0	0	0	6	9	
		Credits for semester 7 for honors						**65**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1		Professional elective3	3	0	0	0	6	9	P
2		Professional elective 4	3	0	0	0	6	9	P
3		Professional elective 5	3	0	0	0	6	9	P
4		Professional elective 6	3	0	0	0	6	9	P
5		Professional elective 7	3	0	0	0	6	9	P
6		**Credits for semester 8**						**45**	
		Honors elective 3	3	0	0	0	6	9	
		Credits for semester 8 for honors						**54**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6691	Project phase 1	0	0	0	0	42	21	
		Credits for summer						**21**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6692	Project phase 2	0	0	0	0	24	24	
2		Free elective 6	3	0	0	0	6	9	
3		Free elective 7	3	0	0	0	6	9	
4		Free elective 8	3	0	0	0	6	9	
5		Professional elective 8	3	0	0	0	6	9	P
		Credits for semester 9						**60**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	ME6693	Project phase 3	0	0	0	0	40	40	
		Credits for semester 10						**40**	

Semester	I	II	III	IV	V	VI	VII	VIII	summer	IX	X	Total
Credits	49	56+6	52	59	59	52	56	45	21	60	40	555

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	**45**	**170+72+85**	**27**	**84**	**72**	**555**

DD Curriculum Thermal stream

Category	ME
Basic Science (S)	84
Basic Eng. (E)	45
Profession (P)	242
Humanities (H)	27
Unallocated and project credits	72 + 85
Total	**555**

DD. - Category wise credit Requirements

Category	ME	
	Electives	**Total**
Basic Science (S)	10	84
Basic Eng. (E)	0	45
Profession (P)	72	242
Humanities (H)	27	27
Unallocated and project credits	72 + 85	72 + 85
Total	**181 + 85**	**470 + 85**
Percentage		

BTech (honours) + M.Tech: (Total credit requirement: 555 + 27 = **582)**

- ***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***: Additional 27 credits to be taken in VI-VIII from Mechanical department (or equivalent);

Branch Code: MM21

Dual Degree (B.Tech. & M.Tech.) in Metallurgical and Materials Engineering

2018-Batch

Semester 1

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PH1010	Physics I	3	1	0	0	6	10	S
2	ME1100	Thermodynamics	3	1	0	0	6	10	E
3	MA1010	Functions of several variables	3	1	0	0	6	10	S
4	CS1100	Introduction to programming	3	0	3	0	6	12	E
5	PH1030	Physics Lab I	0	0	3	0	1	4	S
6	GN1101	Life Skills I	0	0	0	0	2	0	
7	ID1200	Ecology and Environment	2	0	0	0	0	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Credits for semester 1						**46**	

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	PH1020	Physics II	3	1	0	0	6	10	S
2	MA1020	Series and Matrices	3	1	0	0	6	10	S
3	CY1001	Chemistry I	3	1	0	0	6	10	S
4	AM1100	Engineering Mechanics	3	1	0	0	6	10	E
5	MM1001	Introduction to Metallurgical and Materials	1	0	2	0	2	5	P
6	ME1480	Engineering Drawing	0	1	3	0	3	7	E
7	GN1102	Life Skills II	0	0	0	0	2	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Credits for semester 2						**52**	

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		Elective under S category	3	0	0	0	6	9	S
2	HS****	Humanities Elective I	3	0	0	0	6	9	H
3	MM2013	Structure of Materials	3	0	0	0	6	9	P
4	MM2010	Principles of Physical Metallurgy	3	0	0	1	8	12	P
5	MM2015	Thermodynamics of Materials	3	1	0	0	6	10	P
6	CY1002	Chemistry Lab	0	0	3	0	0	3	S
		Credits for semester 2						**52***	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	-	Elective under 'S' cateogory	3	0	0	0	6	9	S
2	HS****	Humanities Elective II	3	0	0	0	6	9	H
3	MM2060	Phase Transformations	3	0	0	0	6	9	P
4	MM2041	Transport Phenomena in Materials	3	1	0	0	8	12	P
5	MM2020	Deformation and failure of Materials	3	0	1	0	8	12	P
		Credits for semester 4						**51***	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MM3030	Materials Characterization	3	0	0	0	6	9	P
2	MM3090	Environmental Degradation of Materials	3	0	1	0	8	12	P
3	MM2080	Principles of Extractive Metallurgy	4	0	0	0	8	12	P
4	MM3010	Physics of Materials	3	0	0	0	6	9	P
5	HS****	Humanities Elective III	3	0	0	0	6	9	H
6	MM3110	Computational Materials Engg Lab++	0	0	0	3	2	5	P
		Credits for semester 5						**56**	

++ Computational Materials Engg Lab is a core course for B.Tech (Hons.) and DD students. It is an elective course for B.Tech students.

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MM3020	Ironmaking and Steelmaking	4	0	0	0	8	12	P
2	MM3070	Solidification Processing and Casting+	3	0	0	0	6	9	P
3	MM3041	Deformation Processing and Forming	3	0	0	0	6	9	P
4	BT1010	Life Sciences	3	0	0	0	6	9	S
5	MM3100	Characterization Lab	1	0	2	0	2	5	P
6	MM3015	Processing Lab	0	0	0	3	2	5	P
		Credits for semester 6						**49**	

+ Solidification Processing and Casting is a core course for B.Tech (Hons.) and DD students. It is an elective course for B.Tech students.

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
	MM4020	**Summer Internship**	0	0	0	0	20	**0**	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MM3330	Nonmetallic Materials	3	0	0	0	6	9	P
2	MM5024	Numerical Methods for Metallurgists	3	0	0	0	6	9	P
		Total						**18***	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HS3050	Professional Ethics	2	0	0	0	0	0	H
		Total						**0***	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MM5090	Dual Degree Project Summer Phase	0	0	0	0	20	20	P
		Total						**20**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MM5091	Dual Degree Project Phase I	0	0	0	0	40	40	P
		Total						40*	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MM5092	Dual Degree Project Phase II	0	0	0	0	40	40	P
		Total						40*	

Semester	I	II	III	IV	V	VI	VII	VIII	Summer	IX	X	Total
Credits	46	52+6	52*	51*	56*	49*	18*	0*	20	40*	40*	555

* Indicated credits are only for core program. In addition, Dual Degree students need to take all the three phases of project, 34 credits of elective courses from "P" category and 91 credits of free elective courses.

* Students can enroll for elective credits subject to a maximum work load of 60 hours per week.

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	45	171+34+100	27	66+18	91	555

B.Tech (Honours) + M.Tech. : (Total credit requirement: 555 + 27 = **582)**

1. ***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.
2. **Extra credit requirement**: 27 elective credits over and above regular program. These credits **have** to be completed in VI, VII and VIII semesters.
3. B. Tech (Hons) students need to take both the phase of B.Tech Project, 61 credits (34+27) of elective courses from "P" category and 91 credits of free elective courses.
4. Students can enroll elective credits subject to a maximum of 60 hours of work load per semester.

Partial List of elective courses under category "P"

All MM5XXX and higher series of courses are deemed as part of this list. Any other course approved by the Department can be added to this list.

S.No	Course No	Course Name	L	T	E	P	O	C
1	MM4110	B.Tech Project – Phase I	0	0	0	3	6	9
2	MM4120	B.Tech Project – Phase II $$	0	0	0	6	12	18
3	MM3050	Creep, Fatigue and Fracture Mechanics	3	0	0	0	6	9
4	MM3160	Electronic Materials	3	0	0	0	6	9
5	MMXXXX	Introduction to undergraduate research	0	0	0	3	6	9
6	MM3060	Joining of Materials	3	0	0	0	6	9
7	MM4070	Modern Materials	3	0	0	0	6	9
8	MM3200	Surface Modifications	3	0	0	0	6	9
9	MMXXXX	Particulate processing	3	0	0	0	6	9
10	MT4110	Computational Techniques in Materials Engg	3	0	0	0	6	9
11	MM4150	Defects and Failures in Manufacturing and Service	3	0	0	0	6	9
12	MM4050	Materials Selection and Design	3	0	0	0	6	9
13	MM3***	Metallurgical Plant Design	0	0	0	0	9	9
14	MM4010	Powder Metallurgy, Refractories and Ceramics	3	0	0	0	6	9
15	MM4130	Sintering Technology	3	0	0	0	6	9
16	MM4170	Magnetic Materials	3	0	0	0	6	9
17	MM3180	Advanced Materials & Processes	3	0	0	0	6	9

The core curriculum specified is identical for the first 6 semesters for all the above programmes. The credits for the S, H and E categories are also identical for all these programmes as given below.

Category	Credits	Remarks
S	84	18 credits are elective
H	27	All courses are elective
E	45	All courses are core
TOTAL (S+H+E)	156	

The remaining credit distribution is as follows:

Programme	Overall Credit Requirement (S+H+E+P+Free electives)	Credits under P category			**Elective credits under free electives**	Remarks
		Core	Elective	Total		
B.Tech + M.Tech	555	283	25	308	**91**	Project for 100 credits is core
B.Tech(Hons) + M.Tech	582	283	52	335	**91**	Project for 100 credits is core

Summary of specification of credits and hours for all the Dual Degree programmes:

Semester	Theory courses specified in core curriculum	Practical (lab) courses specified in core curriculum	Hours specified in core curriculum	Credits specified in core curriculum	Programme
	5	1	60	46	B. Tech + M. Tech & B. Tech (Hons) + M. Tech
Winter-1	-	1	3	3	
2	5	2	55	52	
Summer-1	-	1	3	3	
3	5	1	50	52	
4	5	0	51	51	
5	4	1	47	56	
6	4	2	49	49	
7	4	0	29	27	B.Tech + M. Tech & B.Tech (Hons) + M. Tech
8	1	0	2	0	B.Tech + M. Tech & B. Tech (Hons) + M.Tech
Summer-4	0	1	20	20	B.Tech + M. Tech & B. Tech (Hons) + M.Tech
9	0	1	40	40	
10	0	1	40	40	

Branch Code: NA21

Dual Degree (B.Tech. & M.Tech) in Naval Architecture and Ocean Engg. 2018-Batch

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 I	3	1	0	0	6	10	S
3	AM1100	Engineering Mechanics	3	1	0	0	6	10	E
4	CS1100	Introduction to Programming	3	0	0	3	6	12	E
5	ME1100	Thermodynamics	3	1	0	0	6	10	E
6	OE1101	Introduction to Naval Architecture & Ocean Engineering	2	0	0	0	4	6	P
7	GN1101	Life Skills I	0	0	0	0	2	0	
8	ID1200	Ecology and Environment	2	0	0	0	0	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Credits for semester 1	**19**	**4**	**0**	**3**	**38**	**58**	

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 II	3	1	0	0	6	10	S
3	PH1030	Physics Lab	0	0	0	3	1	4	S
4	CY1001	Chemistry I	3	1	0	0	6	10	S
5	CY1002	Chemistry Lab	0	0	0	3	0	3	S
6	HSxxxx	Humanities Elective - I	3	0	0	0	6	9	H
7	OE1012	Ship Hydrostatics and Stability	3	1	0	0	6	10	P
8	GN1102	Life Skills II	0	0	0	0	1	0	
9		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Credits for semester 2	**17**	**4**	**0**	**6**	**33**	**56**	

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	MA	Mathematics Elective-I	3	0	0	0	6	9	S
2	EE1100	Basic Electrical Engg.	3	1	0	0	6	10	E
3	HSxxxx	Humanities Elective - II	3	0	0	0	6	9	H
4	AM2200	Strength of Materials	3	1	0	0	6	10	P
5	OE2013	Ship Drawing and Calculations	1	3	0	3	3	10	P
6	OE2023	Marine Instrumentation Lab	0	0	0	2	0	2	P
7	OE2044	Ship Hydrodynamics	3	1	0	0	6	10	P
		Credits for semester 3	**16**	**6**	**0**	**5**	**33**	**60**	

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	MA	Mathematics Elective - II	3	0	0	0	6	9	S
2	BT1010	Life Sciences	3	0	0	0	6	9	S
3	OE2014	Marine Engineering	3	1	0	0	6	10	P
4	OE2024	Analysis of Structures	3	1	0	0	6	10	P
5	OE2034	Ship Resistance and Propulsion	3	1	0	1	6	11	P
6	OE2054	Ocean Wave Hydrodynamics	3	1	0	0	6	10	P
		Credits for semester 4	**18**	**4**	**0**	**1**	**36**	**59**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	OE3015	Ship Structural Analysis	3	1	0	0	6	10	P
2	OE3016	Ship Design	3	0	0	1	6	10	P
3	OE3035	Motion of Ships & Floating systems	3	1	0	1	6	11	P
4	OExxxx	Professional Elective-1	3	0	0	0	6	9	P
5		Free Elective - I	3	0	0	0	6	9	F
6		Free Elective - II	3	0	0	0	6	9	F
		Credits for semester 5	**18**	**2**	**0**	**2**	**36**	**58**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	OExxxx	Professional Elective - II	3	0	0	0	6	9	P
2	OE3036	Maneuvering & Control of Marine Vehicles	3	1	0	0	6	10	P
3	OE3046	Ship Structural Design	3	1	0	0	6	10	P
4		Free Elective – III	3	0	0	0	6	9	F
5		Free Elective – IV	3	0	0	0	6	9	F
6		Free Elective – V	3	0	0	0	6	9	F
		Credits for semester 6	**18**	**2**	**0**	**0**	**36**	**56**	
		Honours Elective 1	3	0	0	0	6	9	
		Totral credits for (Hons.) students	**21**	**2**	**0**	**0**	**42**	**65**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	OE3026	Shipyard Training (Summer)	0	0	0	0	6	6	P
		Total						6	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	OExxxx	Professional Elective – III	3	0	0	0	6	9	P
2	OE5320	Non-linear Problems in Ocean Engg.	3	0	0	0	6	9	P
3	OE6200	Design of Offshore Structures	3	0	0	0	6	9	P
4	HS3050	Professional Ethics	2	0	0	0	0	0	H
5		Free Elective-VI	3	0	0	0	6	9	F
6		Free Elective-VII	3	0	0	0	6	9	F
		Credits for semester 7	**17**	**0**	**0**	**0**	**30**	**45**	
		Honours Elective 2	3	0	0	0	6	9	
		Totral credits for (Hons.) students	**20**	**0**	**0**	**0**	**36**	**54**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	HSxxxx	Humanities Elective – III	3	0	0	0	6	9	H
2	OExxxx	Professional Elective – IV	3	0	0	0	6	9	P
3	OE5230	Foundation of Offshore structures	3	0	0	0	6	9	P
4	OE5500	FEM Applied to Ocean Engineering	3	0	0	0	6	9	P
5		Free Elective – VIII	3	0	0	0	6	9	F
		Credits for semester 8	**15**	**0**	**0**	**0**	**30**	**45**	
		Honours Elective 3	3	0	0	0	6	9	
		Totral credits for (Hons.) students	**18**	**0**	**0**	**0**	**36**	**54**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	OE5371	DD Project – Phase1	0	0	0	15	10	25	P
		Total						**25**	

*Credits and grades for DD Project (OE5371) will be awarded at the end of X semester.

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	OE5372	DD Project – Phase 2	0	0	0	10	10	20	P
2		Professional Elective - V	3	0	0	0	6	9	P
3		Professional Elective - VI	3	0	0	0	6	9	P
		Credits for semester 9	**6**	**0**	**0**	**10**	**22**	**38**	

*Credits and grades for DD Project (OE5372) will be awarded at the end of X semester.

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	OE5373	DD Project – Phase 3	0	0	0	25	15	40	P
		Credits for semester 10	**0**	**0**	**0**	**25**	**15**	**40**	

Semester	I	II	III	IV	V	VI	Sum	VII	VIII	Sum	IX	X	Total
Credits	58	56+6	60	59	58	56	6	45	45	25	38	40	552

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	48	182+54+85	27	66+18	72	552

BTech (Honours)+ M.Tech. : (Total credit requirement: 552 + 27 = **579)**

- **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**: 27 elective credits over and above regular program. These credits **have** to be completed in VI, VII and VIII semesters.
- 45 credits (instead of 18 for regular) out of 90 BTech elective credits to be taken in OE. Dept. at 5000 level or higher.

Semester and Category-wise Credit Distribution – B.Tech (NA&OE)

category	S1	Wi	S2	Su	S3	S4	S5	S6	Su	S7	S8	Su	S9	S10	Total	CTF
S	20		37		9	9+9									84	**84**
E	32	3		3	10										48	**45**
H			9		9						9				27	**27**
P	6		10		32	41	31 +9	20+ 9	6	18+ 9	18+ 9	25	20+18	40	322	
Total	**58**	**3**	**56**	**3**	**60**	**59**	**40**	**29**	**6**	**27**	**36**	25	38	40	**480**	
Free Electives (**F**) **(suggested)**							**18**	**27**		**18**	**9**				72	**72-96**
Overall	**58**	**3**	**56**	**3**	**60**	**58**	**56**	**47**	**6**	**45**	**45**	**25**	**38**	**40**	**552**	**553**
EL & HS			**9**		**18**	**9**	**27**	**36**		**27**	**27**		**18**		**171**	**172**
Honors*								**9**		**9**	**9**				**27**	**27**

*** OE courses of 5000 & above**

LIST OF ELECTIVES

NOTE: More electives can be included from the list of courses offered by other departments

No	Title	L	T	Ext	Lab	Home	Cr
	ELECTIVE (A) – Mathematics						
MA2010	Complex Variables	3	0	0	0	6	9
MA2030	Differential Equations	3	0	0	0	6	9
MA2040	Probability, Stochastic Process & Statisics	3	0	0	0	6	9
MA2060	Discrete Mathematics	3	0	0	0	6	9
MA2130	Basic Graph Theory	3	0	0	0	6	9
ELECTIVE (E) – Professional for NA&OE (BTech&DD)							
ME3350	Design of Machine Elements	3	0	0	0	6	9
MM3012	Joining and NDT Lab	3	0	0	0	6	9
MM3060	Metal Joining Technology	3	0	0	0	6	9
MM5320	Corrosion Engineering	3	0	0	0	6	9
MM5750	Welding Application Technology	3	0	0	0	6	9
OE3190	Design of Ocean Structures	3	0	0	0	6	9
OE4300	Ocean Energy	3	0	0	0	6	9
OE4400	Drilling vessels and Support Crafts	3	0	0	0	6	9
OE4600	Advance ship Hydrodynamics	3	0	0	0	6	9
OE4xxx	Shipbuilding Material & Production Processes	3	0	0	0	6	9
OE5011	Marine Robotics	3	0	0	0	6	9
OE5080	Marine Instrumentation	3	0	0	0	6	9
OE5170	Ocean Acoustics	3	0	0	0	6	9
OE5230	Foundation of Offshore Structures	3	0	0	0	6	9
OE5310	Guidance and control of Marine Vehicles	3	0	0	0	6	9
OE5320	Nonlinear Problems in Ocean Engineering	3	0	0	0	6	9
OE5330	Advanced Marine Structures	3	0	0	0	6	9
OE5xxx	Advanced Structural Analysis Of Marine Vehicles	3	0	0	0	6	9
OE5xxx	Design Of Fishing Vessels	3	0	0	0	6	9
OE4xxx	Design Of Ship Outfit Systems	3	0	0	0	6	9
OE5xxx	Design Of Submarine And Submersible	3	0	0	0	6	9
OE5xxx	Marine Corrosion, Prevention And Control	3	0	0	0	6	9
OE4xxx	Ship Electrical And Electronic Systems	3	0	0	0	6	9
OE4xxx	Ship Positioning Systems	3	0	0	0	6	9

ELECTIVE (E) – Professional for NA&OE (BTech&DD)							
OE5xxx	Design Of High Speed Vessels	3	0	0	0	6	9
OE5xxx	Warship Design	3	0	0	0	6	9
OE4xxx	Analysis And Design Tools In Marine Hydrodynamics	3	0	0	0	6	9
OE4xxx	Laboratory Modelling In Marine Hydrodynamics	3	0	0	0	6	9
OE5xxx	Design, Construction and Operation of LNG Carriers and Terminals	3	0	0	0	6	9
OE5450	Numerical Techniques in Ocean Hydrodynamics	3	0	0	0	6	9
OE5500	FEM Applied to Ocean Engineering	3	0	0	0	6	9
OE5600	Advanced Wave Dynamics	3	0	0	0	6	9
OE5800	Coastal Engineering	3	0	0	0	6	9
OE6005	Reliability of Offshore Structures	3	0	0	0	6	9
OE6020	Mesh-free Methods Applied to Hydrodynamics	3	0	0	0	6	9
OE6200	Design of Offshore Structures	3	0	0	0	6	9
OE6300	Plated Structures and Shells	3	0	0	0	6	9
OE6930	Modeling of Offshore and Coastal Processes	3	0	0	0	6	9
OE6980	Computer Aided Surface Development of Marine	3	0	0	0	6	9
OE6990	Advanced Marine Vehicles	3	0	0	0	6	9
PE6060	HSE Management in Petroleum and Offshore Engineering	3	0	0	0	6	9

Branch Code: PH21

Dual Degree (B.S & M.S) in Physics
2018 Batch

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 I	3	1	0	0	6	10	S
3	CY1001	Chemistry I	3	1	0	0	6	10	S
4	CS1100	Introduction to Programming	3	0	0	3	6	12	E
5	PH1080	Thermodynamics	3	1	0	0	6	10	P
6	PH1030	Physics Lab	0	0	0	3	1	4	S
7	GN1101	Life Skills I	0	0	0	0	2	0	
8	ID1200	Ecology and Environment	2	0	0	0	0	0	
		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	2	0	
		Credits for semester 1	**17**	**4**	**0**	**6**	**35**	**56**	

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 II	3	1	0	0	6	10	S
3	CY1051	Chemistry II	3	0	0	0	6	9	S
4	CY1002	Chemistry Lab	0	0	0	3	0	3	S
5	PH1040	Physics Lab II	0	0	0	3	1	4	S
6	HSE-1	Humanities Elective - I	3	0	0	0	6	9	**H**
7	GN1102	Life Skills II	0	0	0	0	1	0	
8		NCC (NC1010)/NSO (NS1020)/NSO(NS1030)	0	0	0	0	3	0	
		Credits for semester 2	**12**	**2**	**0**	**6**	**28**	**45**	

Semester 3

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	EP2110	Introduction to Mathematical Physics	3	1	0	0	6	10	**P**
2	MAE-1	Mathematics Elective-I	3	0	0	0	6	9	**S**
3	PH2170	Basic Electronics	3	0	0	0	6	9	**P**
4	HSE-2	Humanities Elective - II	3	0	0	0	6	9	**H**
5	PH2050	Physics Lab - III	0	0	0	6	2	8	**P**
6	PH2140	Maths on Computer (Lab)	0	0	0	3	1	4	**P**
		Total (Semester-3)	**12**	**1**	**0**	**9**	**27**	**49**	**0**

Semester 4

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PH2070	Introduction to Biophysics	3	0	0	0	6	9	**P**
2	HSE-3	Humanities Elective - III	3	0	0	0	6	9	**H**
3	MAE-2	Mathematics Elective-II	3	0	0	0	6	9	**S**
4	FE 1	Free Elective-1	3	0	0	0	6	9	**F**
5	FE 2	Free Elective -2	3	0	0	0	6	9	**F**
6	PH2080	Physics Lab - IV	0	0	0	6	2	8	**P**
		Total (Semester-4)	**15**	**0**	**0**	**6**	**32**	**53**	

Semester 5

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	BT1010	Life Sciences	3	0	0	0	6	9	**S**
2	PH5030	Classical Mechanics	3	1	0	0	6	10	**P**
3	PH5100	Quantum Mechanics - I	3	1	0	0	6	10	**P**
4	PH5040	Electronics	3	0	0	0	6	9	**P**
5	PH5050	Mathematical Physics-II	3	0	0	0	6	9	**P**
6	PH5060	Physics Lab – I (PG)	0	0	0	9	3	12	**P**
		Total (Semester-5)	**12**	**2**	**0**	**9**	**27**	**59**	

Semester 6

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PH5020	Electromagnetic Theory	3	1	0	0	6	10	**P**
2	PH5080	Statistical Physics	3	0	0	0	6	9	**P**
3	PH5160	Condensed Matter Physics -I	3	1	0	0	6	10	**P**
4	PH5170	Quantum Mechanics - II	3	0	0	0	6	9	**P**
5	FE-3	Free Elective - 3	3	0	0	0	6	9	**F**
	PH5120	Physics Lab - II (PG)	0	0	0	9	3	12	**P**
		Total (Semester-6)	**15**	**2**	**0**	**9**	**33**	**59**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
	PH4500	**Summer Internship**	0	0	0	0	20	**0**	

Semester 7

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PHE-1	DP-I Department Elective-I**	3	0	0	0	6	9	**P**
2	PHE-2	DP-II Department Elective-II**	3	0	0	0	6	9	**P**
3	PHE-3	DP-III Department Elective-III	3	0	0	0	6	9	**P**
4	PH5410	Nuclear, Atomic and Molecular Physics	3	1	0	0	6	10	**P**
5	FE-4	Free Elective - 4	3	0	0	0	6	9	**F**
6	PH5270	PH5060: Physics Lab – III (PG)	1	0	0	6	2+2	11	**P**
7		**Total (Semester-7)**	**16**	**1**	**0**	**6**	**30**	**57**	

Semester 8

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PHE-4	DP-12 Credit Elective-IV (Experimental / Computational Stream) *	**3**	**0**	**0**	**3**	**6**	**12**	**P**
2	PHE-5	DP - V Department Elective - V	3	0	0	0	6	9	**P**
3	PHE-6	DP - VI Department Elective VI	3	0	0	0	6	9	**P**
4	FE-5	Free Elective -5	3	0	0	0	6	9	**F**
5	PHE-7	DP-VII Course OR Elective Mini Project§	0	0	0	0	9	9	**P**
6	PH5400*	Viva-Voce	0	0	0	0	3	3	**P**
7	HS3050	Professional Ethics	2	0	0	0	0	0	**H**
		Total (Semester-8)	**14**	**0**	**0**	**3**	**36**	**51**	

Summer

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PH5221	Summer Project	**0**	**0**	**0**	**0**	**15**	**15**	**P**
		Total						**15**	

Semester 9

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	PHE - 8	Departmental Elective - VIII	3	0	0	0	6	9	**P**
2	FE-6	Free Elective - 6	3	0	0	0	6	9	**F**
3	FE-7	Free Elective - 7	3	0	0	0	6	9	**F**
4	PH5222	Project	0	0	0	0	30	30	**P**
5		**Total (Semester-9)**	**9**	**0**	**0**	**0**	**48**	**57**	

Semester 10

S.No	Course No	Course Name	L	T	E	P	O	C	Cat
1	FE-8	Free Elective - 8	3	0	0	0	6	9	**F**
2	PH5223	Project	0	0	0	0	40	40	**P**
3	PH5400*	Comprehensive Viva-Voce	0	0	0	0	4	4	**P**
		Total (Semester-10)	**3**	**0**	**0**	**0**	**50**	**53**	

Semester	I	II	III	IV	V	VI	VII	VIII	IX	Sum	X	Total
Credits	56	45	49	53	59	59	57	51	57	15	53	554

Category	Engineering (E)	Professional (P) Core+Elective+Project	Humanities (H)	Sciences (S)	Un-allotted credits	Total
Credits	12	186+75+85	27	97	72	554

18 (Science) + 72 (FE) + 27 (Hum.) + 75 (Dept. P Elec.) + 85 (DD Project)
= 277/554
= 50 % Electives

Total no. of S credits	97
Total no. of E credits	12
Total no. of P credits	346 [*186 core + 85 project + 75 electives*]
Total no. of F elective credits	72
Total no. of H elective credits	27
Total no. of S elective credits	18

MICRO-DETAILS:

* Choice between PH5720 Numerical Methods and Programming /
PH 5520 Advanced Electronics for pursuing either experimental or computational streams of specialization.

** PHE-1,2: Student has to do any 2 out of the following 3 courses
1. CMP-2
2. Optics & Photonics
3. HEP)

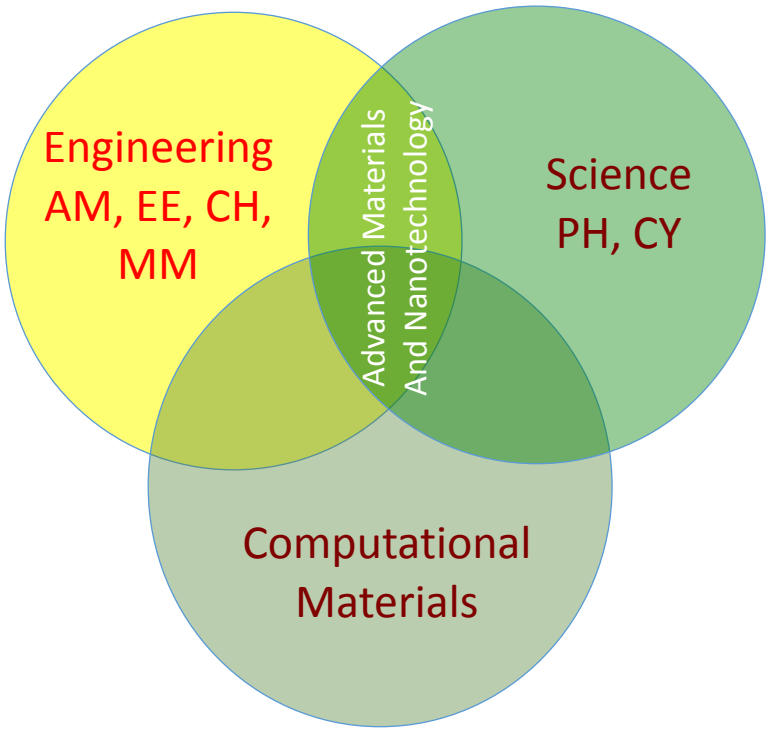
§ Student can do Mini Project (counted as Elec) or any other Dept. Elective Course

BTech (Honours): (Total credit requirement: 554 + 27 = **581)**

- **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**: 27 elective credits over and above regular program. These credits **have** to be completed in VI, VII and VIII semesester.

Interdisciplinary Dual Degree in Advanced Materials and Nano Technology

The world around us is made of materials of various kinds and many of these are at the heart of great technological innovations. In the recent times, with the development of nanotechnologies, the functionalities of conventional materials have advanced further and many novel applications are now being explored. Such advanced materials, both in the conventional (bulk) and nano form, are important in several fields such as energy conversion (solar cells) and storage (batteries), microelectronic devices, multiferroic materials, bio-compatible coatings and implants, high strength materials and functional materials for sensors, membranes *etc*. This interdisciplinary Dual Degree (ID-DD) program aims at equipping the students with an understanding of the fundamental science behind advanced materials and also training them with the practical tools and techniques of fabrication (materials and devices). The Department of Physics, IIT Madras is coordinating this new program with the active participation of several other departments.



The programme

The ID-DD programme in Advanced Materials and Nanotechnology designed with inputs from Engineering and Science disciplines. Departments currently offering courses towards this program are Applied Mechanics, Chemical, Chemistry, Electrical, Materials and Metallurgy, Physics. It is typically coordinated by one of these departments. Currently it is coordinated by the Department of Physics.

Eligiblity

B.Tech students (all branches) of IIT Madras can opt for this program. The minimum eligibility criteria prescribed by the senate is that the student should have a minimum of 8 CGPA at the end of 5th semester.

Curriculum

The Curriculum is designed with the understanding that the modern field of Advanced materials and Nanotechnology is based on the exchange of ideas between sciences and Engineering branches.

Synthesizing novel materials involves a good knowledge of chemistry and the physical properties exhibited by these novel materials are studied by the Material Scientist (cutting across Physics, Chemistry and Materials departments). Application of these materials for wider usage needs the involvement of Engineers. Computational material science forms an integral part of the field of advanced materials both in terms of the design and understanding of the physics involved. Application of these materials encompasses a wide range of fields: Energy generation and storage materials, batteries, micro electronic devices, magnetic materials, water purification, high strength materials, sustainable plastics, sensors, etc.

The curriculum is expected to facilitate both short/long term internships with private and public companies having strong research and development wings. These internships can lead to final-year projects towards the Dual Degree programme. These internships and projects are expected to enhance industry-academia collaboration for development of novel engineering products based on advanced materials and nano systems

The list of courses to be offered for students opting for DD in Advanced Materials and Nano Technology will have both core courses and electives. The students are allowed to choose four electives out of a total of 33 electives cutting across different disciplines. There will be four core courses that include a course on the Science and Technology of Solid State, two courses on nanomaterial's and nanotechnology and a Laboratory course aimed at giving hands-on experience on Advanced materials and nano systems (36 credits of DD core course).

Those students who opt for the Dual Degree program will do the courses from their 7th Semester as prescribed below.

S.No	Course No.	Course Name	L	T	E	P	O	C
Semester VII								
1	PH5011	*Core 1:* Science and Technology of Solid State	3	1	0	0	6	10
2	PH6022	*Core 2:* Introduction to Nanoscience	3	0	0	0	6	9
Total credits			6	1	0	0	12	19
Semester VIII								
1	*PH6011*	*Core 3: Nano materials and nanotechnology*	3	0	0	0	6	9
2	Elective 1	To be taken from the list of Electives mentioned	3	0	0	0	6	9
3	Elective 2	To be taken from the list of Electives mentioned	3	0	0	0	6	9
4	PH6015	*Core 4:* Advanced Materials and Nanotechnology Lab	0	0	0	6	2	8
Total Credits			9	0	0	6	20	35
Semester IX								
1	PH5361	Project-I (Summer)/Summer internship	0	0	0	0	25	25
2	Elective 3	To be taken from the list of Electives mentioned	3	0	0	0	6	9
3	Elective 4	To be taken from the list of Electives mentioned	3	0	0	0	6	9
3	PH5362	Project II (In the institute)	0	0	0	0	20	20
Total Credits			6	0	0	0	57	63
Semester X								
1	PH5363	Project III (in the Institute)	0	0	0	0	40	40
Total Credits			0	0	0	0	40	40

Core Courses								
1	PH5011	Science and Technology of Solid State	3	1	0	0	6	10
2	PH6022	Introduction to Nanoscience	3	0	0	0	6	9
3	PH6011	Nano materials and nanotechnology	3	0	0	0	6	9
4	PH6015	Advanced Materials and Nanotechnology Lab	0	0	0	6	2	8

List of Electives								
1	PH5310	Synthesis of Functional Materials	3	0	0	0	6	9
2	PH5320	Techniques of Physical measurements	3	0	0	0	6	9
3	PH5730	Methods of Computational Physics	3	0	0	0	6	9
4	PH5670	Physics and Technology of Thin Films	3	0	0	0	6	9
5	PH5690	Applied Magnetics	3	0	0	0	6	9
6	PH5600	Physics at Low Temperatures	3	0	0	0	6	9
7	PH5680	Superconductivity and applications	3	0	0	0	6	9
8	PH6013	Functional materials, Sensors and Transducers	3	0	0	0	6	9
9	PH5813	Principles of nanophotonics	3	0	0	0	6	9
10	PH5462	Magnetism in solids	3	0	0	0	6	9
11	PH6012	Semiconductor Physics and devices	3	0	0	0	6	9
12	PH5660	Non-linear Optical Processes & Devices	3	0	0	0	6	9
13	EE5347	Electronic and Photonic nanoscale devices	3	0	0	0	6	9
14	EE6500	Integrated Optoelectronics Devices and Circuits	3	1	0	0	6	10
15	ID6102	Principles and techniques of Transmission Electron Microscopy	3	0	0	0	6	9
16	ID5010	Advanced materials and processing	3	0	0	0	6	9
17	ID6050	Chemical Physics of Modern Technical Ceramics	3	0	0	0	6	9
18	MM5210	X-ray diffraction techniques	3	0	0	0	6	9
19	MM5680	Smart Materials	3	0	0	0	6	9
20	MM5700	Topics in nanomaterials	3	0	0	0	6	9
21	MM5017	Electronic materials devices and Fabrication	3	0	0	0	6	9
22	ME7023	Foundations of Computational Materials Modeling	3	0	0	0	6	9
23	CY6380	A Chemical Approach to Nanomaterials	3	0	0	0	6	9
24	CH5012	Modeling and Simulation of Particulate Processes	3	0	0	0	6	9
25	CH5021	Molecular Simulation of Soft Matter	3	0	0	0	6	9
26	CH5270	Polymers for Devices	3	0	0	0	6	9
27	CY6118	Experimental methods in chemistry	3	0	0	0	6	9
28	ID6030	Introduction to nano science and nanotechnology	3	0	0	0	6	9
29	EE5343	Solar Cell Device Physics and Materials Technology	3	0	0	0	6	9
30	EE5346	Introduction to plastic electronic	3	0	0	0	6	9
31	EE5340	MicroElectroMechanical Systems	3	0	0	0	6	9
32	EE5312	VLSI Technology	3	1	0	0	6	10

33	CH5190	Introduction to Macromolecules	3	0	0	0	6	9
34	MM5041	Medical Materials	3	0	0	0	6	9
35	MM5460	Physical Ceramics	3	0	0	0	6	9
36	AM5470	Analysis & Design of Smart Material Structure	3	0	0	0	6	9
37	AM6190	Cellular structures and mechanics	3	0	0	0	6	9
38	AM6512	Application of Molecular Dynamics	3	0	0	0	6	9

Potential recruiters

Based on the specialization the students opt for, they can be recruited by one of the private or public sector companies mentioned below. They will be perfectly suited to the research and product innovation wings of these companies.

1. Nissan
2. CUMI
3. Samsung
4. Honeywell
5. MRF
6. Saint Gobain
7. Titan
8. Aditya Birla Science and Technology Private Limited
9. IBM (R & D)
10. TATA Centre
11. SITAR, Bangalore
12. SAMEER, Chennai
13. APPLIED MATERIALS
14. DRDO, CSIR, ISRO, BHEL, DMRL, NML, NAL, ARCI, HAC

Interdisciplinary Dual Degree in Biomedical Engineering (ID-DD-BME)

The Interdisciplinary Dual Degree programme in Biomedical Engineering is intended to produce graduates with up-to-date and fundamental understanding of biomedical engineering, by integrating various engineering disciplines with biomedical sciences. This programme aims to produce graduates who are ready to hit the ground running in industry, as well as foster new knowledge and evolve leadership in biomedical engineering research and entrepreneurship.

Who offers the programme?

The ID-DD programme is championed by the Dept of Applied Mechanics together with Depts. of Biotechnology, Electrical Engineering, Computer Science and Engineering, Mechanical Engineering, Materials and Metallurgical Engineering, Physics and Mathematics. The true interdisciplinary nature of Biomedical Engineering is reflected in the joint programme collectively offered by various allied Depts.

Who can enrol in this programme?

A B. Tech student of IIT Madras in any discipline is eligible to upgrade to this programme provided the students meets certain minimumm academic norms. Selection of applicants will be based on academic performance and an interview to ascertain aptitude.

What is the curriculum?

The students graduating under this programme are trained in fundamental engineering sciences as well as application oriented skills in specific areas of biomedical engineering. This programme includes an optional introductory section in the form of elective modules for the entire undergraduate community of IIT Madras. These modules enable students to appreciate the exciting possibilities in Biomedical Engineering and explore the option of further studies in the form of a dual Masters' degree by enrolling in the programme.

ID-DD-BME has a very flexible curriculum. The programme spans a period of the last two years of a five-year dual degree programme. Five out of seven theory courses are flexible, in order to enable the students to choose from four major streams of biomedical engineering such as biomaterials, bioinstrumentation, image and signal processing and medical physics. This curriculum enables the students to explore diverse fields of biomedical engineering matched to the skills acquired as part of their UG curriculum. The interdisciplinary lab sessions in the curriculum range from circuit building exercises to cutting edge research-oriented experiments at various participating laboratories.

Frequent field visits to reputed medical educational institutions, research centres as well as hospitals help the students to understand the current clinical needs to evolve ideas for product oriented research. These students will emerge as an excellent fit for application-oriented product development. The curriculum also allows short term (1-3 months)/ long term (up to 6 months) internships with potential companies / research organizations which could be extended to a full-year project to meet part of their credit requirements, wherever the project is deemed to fit our academic standards. Such projects could enable industrial collaboration for the development of indigenous products in the healthcare industry.

Interdisciplinary DD in Biomedical Engineering-course curriculum

	Semester 7							
1	AM5119	Core 1: Physiology for Engineers	3	0	0	0	6	9
2	AM5010	Core 2: Biomechanics	3	0	0	0	6	9
3	Elective 1	Elective 1: To be selected from BME / core basket	3	0	0	0	6	9
4	AM5023	Physiological measurements and Instrumentation Laboratory	0	0	0	2	2	4
		Total credits						**31**

	Semester 8							
1	MM5040	Core 3: Medical materials	3	0	0	0	6	9
2	AM5XXX	Core 4: To be selected from basket of core courses	3	0	0	0	6	9
3	Elective 2	Elective 2: To be selected from BME / core basket	3	0	0	0	6	9
4	AM5019	Advanced BME lab	0	0	0	3	2	5
		Total Credits :						**32**

	Semester 9							
1	AM5210/ AM5200	Project-I (Summer) / Summer internship	**0**	**0**	**0**	**0**	**15**	**15**
2	Elective3	Elective 3: To be selected from BME / core basket	3	0	0	0	6	9
3	AM5401	Project II	0	0	0	0	30	30
		Total Credits :	**3**	**0**	**0**	**0**	**54**	**54**

	Semester 10							
1	AM5402	Project III	0	0	0	0	40	40
		Total Credits :						**40**

Total credits for the DD programme: 157

		Basket of core courses	**L**	**T**	**+**	**P**	**O**	**C**
1	AM 5160	Biomedical Imaging systems	3	0	0	0	6	9
2	AM5130	Quantitative physiology	3	0	0	0	6	9
3	AM5140	Biomedical instrumentation	3	0	0	0	6	9
4	AM5510	Biomedical Signals and Systems	3	0	0	0	6	9
5	AM 5050	Biomedical sensors and measurements	3	0	0	0	6	9

		Elective streams (Basket of Biomedical Electives)						
	Stream 1	**Biomechanics**						
1	PH5730	Methods of Computational Physics	3	0	0	0	6	9
2	ME6000	Computational Methods in Engg	3	0	0	0	6	9
3	MA6270	Numerical solutions of partial differential equations	3	0	0	0	6	9
4	MA5890	Numerical linear algebra	3	0	0	0	6	9
5	AM 7010	Classics in Neuroscience	3	0	0	0	6	9
6	AM 5170	Orthopedics Mechanics	3	0	0	0	6	9
7	AM 6190	Movement disorders and neurorehabilitation	3	0	0	0	6	9
8	AM 5190	Haptics and biomedical engineering	3	0	0	0	6	9
9	AM 5060	Psycophysics	3	0	0	0	6	9
10	AM 6516	Neuromechanics of human movement	3	0	0	0	6	9
11	ME6012	Mechanics of human movement	3	0	0	0	6	9
12	AM 5110	Biofluid mechanics	3	0	0	0	6	9
	Stream 2	**Biomedical instrumentation**						
1	AM 5050	Biomedical sensors and measurements	3	0	0	0	6	9
2	AM 5140	Biomedical instrumentation	3	0	0	0	6	9
3	AM 5100	Biomedical laser instrumentation	3	0	0	0	6	9
4	AM5160	Biomedical imaging systems	3	0	0	0	6	9
5	AM 5013	Operating theatre instrumentation and surgical tech	3	0	0	0	6	9
6	AM 5115	Systems approach in Biomedical engineering	3	0	0	0	6	9
10	EE6403	Transducers for instrumentation	3	0	0	0	6	9
11	EE6402	Biomedical electronic systems	3	0	0	0	6	9
12	EE6501	Optical sensors	3	1	0	0	8	12
13	EE5502	Optical engineering	2	3	0	0	7	12
	Stream 3	**Medical Physics**						
1	AM 6518	Biophysical aspects of tumor microenvironment	3	0	0	0	6	9
2	AM 5190	Cellular structures and mechanics	3	0	0	0	6	9
3	AM 5120	Biomaterials	3	0	0	0	6	9
4	BT5011	Biomaterials engineering	3	0	0	0	6	9
5	EE5500	Introduction to photonics	3	0	0	0	6	9
6	EE6506	Computational electromagnetics	4	0	0	0	0	12
	Stream 4	**Image and Signal processing in Biomedical Engineering**						
1	AM4010	Biomedical signal processing	3	0	0	0	6	9
2	CS6300	Speech Technology	3	0	0	0	6	9
3	CS6690	Pattern recognition	3	0	0	0	6	9
4	AM5020	Biomedical Ultrasonics	3	0	0	0	6	9
5	EE4240	Image signal processing	3	0	0	0	6	9

Who are the potential recruiters?

There are several leading companies who actively recruit students with knowledge of biomedical engineering. Some of the companies are:

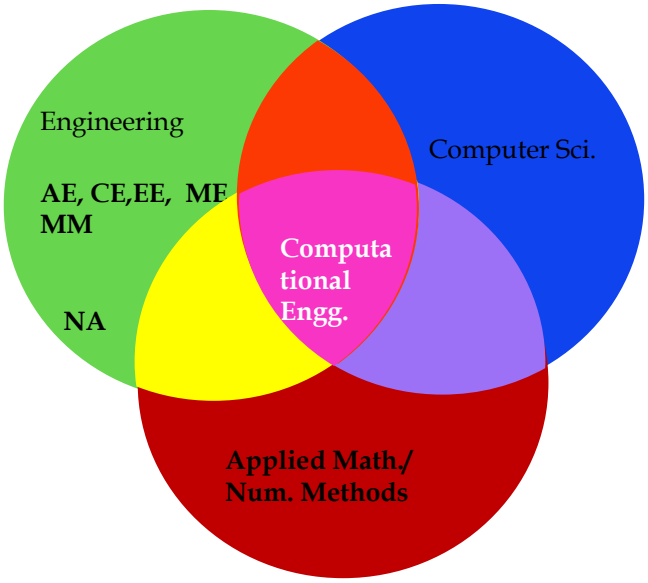
• Accenture Solutions Pvt Ltd
• American Express
• Analog Devices
• Biocon Ltd.
• Cerner
• Ernst and Young
• Flutura Business Solutions Pvt. Ltd.
• GE Healthcare
• Grind Master Machines Pvt. Ltd.
• J Mitra
• Johnson and Johnson
• Medtronic
• Olympus medical systems India Pvt Ltd.
• Philips India Ltd (Philips healthcare)
• Schlumberger
• Siemens Technology and Services Pvt. Ltd.
• Stryker
• TCS Labs

There are several renowned universities which have strong biomedical engineering research programmes, some of whom collaborate with IIT Madras. Some of them are:

- Queensland University of Technology
- RWTH Aachen

Interdisciplinary Dual Degree in Computational Engineering (ID-DD-CE)

The development of Engineering Analysis and design tools for solving Complex Engineering problems is facilitated in the Interdisciplinary Dual Degree programme in Computational Engineering. Computing tools for Engineering software that involve CPU intensive calculations as their backbone are pervasive in disciplines such as, Aerospace, Civil, Chemical, Electrical, Mechanical, Materials, Naval Engineering etc. The graduates from this ID program will strengthen their Simulation and Mathematical modelling expertise in the core Engineering discipline by learning relevant tools and techniques from Computer Science and Applied Mathematics in a structured and systematic way.



Who offers the programme?

The ID-DD programme in Computational Engineering is drawn from a wide spectrum of disciplines in Engineering and Science. Some of the Departments who are offering these courses include, Mechanical, Materials & Metallurgy, Mathematics, Physics, Ocean, Applied Mechanics, Civil, Chemical, etc. For the purpose of administrative ease, it is typically governed by one of these participating departments.

Who can enrol in this programme?

A B. Tech student of IIT Madras from any discipline is eligible to upgrade to this programme provided the student meets certain minimum academic norms. Selection of applicants will be based on the CGPA cut off.

What is the curriculum?

The core philosophy of the curriculum is that, complex Engineering problems do not have simple closed form solutions. Hence, advanced numerical methods (such as, Finite Volume and Finite Element Methods) need to be used for solving these problems. The analysis and design of such systems necessitate solving a system of linear/ non-linear simultaneous equations running into millions/ billions of degrees of freedom. Hence, the computational skill set of understanding algorithms and deployment of suitable data structures to implement them into useful codes is necessary. Furthermore, tools and techniques from high performance computing will facilitate efficient computation and code parallelization. Similarly skill set from discretization methods Engineering Mathematics will be imparted.

The IDDD-CE curriculum facilitates short term (1-3 months)/ long term (up to 6 months) internships with potential companies / research organizations which could be extended to a full-year project to meet part of their credit requirements, wherever the project is deemed to fit our academic standards. Such projects would promote industry-academia collaboration for the development of practical engineering solutions. .

The curriculum for the IDD - Computational Engineering

Sl. No	Course No	Course Name	L	T	E	P	O	C
	Semester7							
1	Core - 1	**CORE-1 basket**	3	0	0	0	6	9
2	Core - 2	**CORE-2 basket**	3	0	0	0	6	9
3	Elective - 1	Elective 1: Preferably chosen from a chosen elective stream	3	0	0	0	6	9
4	AM5801	Computational Laboratory	0	0	0	2	2	4
		Total credits						**31**

	Semester 8							
1	Core – 3	**CORE - 3 basket**	3	0	0	0	6	9
2	AM5080	**CORE – 4** High Performance Computing for Engineering Applications	3	0	0	3	8	14
3	Elective- 2	Elective 2: Preferably chosen from the same Elective stream	3	0	0	0	6	9
		Total Credits :						**32**

	Semester 9							
1	AM5210/ AM5200	Project-I (Summer) / Summer internship	**0**	**0**	**0**	**0**	**15**	**15**
2	Elective - 3	Elective 3: Preferably chosen from the same Elective Stream	3	0	0	0	6	9
3	AM5401	Project II	0	0	0	0	30	30
		Total Credits :	**3**	**0**	**0**	**0**	**54**	**54**

	Semester 10							
1	AM5402	Project III	0	0	0	0	40	40
		Total Credits :						**40**

- Total credits for the DD program : 157 (121+36)
- #, *Project grade assigned at the end of10th semester
- Electives / cores from below list or any relevant courses from other Departments could be chosen in consultation with Faculty Advisor.

Basket of courses for CORE - 1 : Numerical Methods

1	AM5600	Computational Techniques in Applied Mechanics	3	0	0	0	6	9
2	ME6000	Computational Methods in Engineering	3	0	0	0	6	9
3	ME6150	Numerical Methods in Thermal Engineering	3	0	0	6	6	10
4	MA5470	Numerical Analysis	3	0	0	0	6	9
5	PH5730	Methods of Computational Physics	3	0	0	0	6	9
6	CH6060	Numerical Techniques for Engineers	3	0	0	0	6	9
7	MM5024	Numerical Methods for Metallurgists	3	0	0	0	6	9
8	OE5450	Numerical Techniques in Ocean Hydrodynamics	3	0	1	0	6	12

Basket of courses for CORE - 2 : Computational Implementation

1	MA5901	Data Structures and Algorithms	3	0	0	0	6	9
2	ID6105	Computational Tools: Algorithms, Data Structures and Programs	3	0	0	0	6	9

Basket of courses for CORE - 3: Discretization Methods

1	CE5610	Finite Element Analysis	3	0	0	0	6	9
2	AM5450	Fundamentals of Finite Element Analysis	3	0	0	0	6	9
3	CH6110	Finite Element Methods in Engg	3	0	0	0	6	9
4	ME6800	Finite Element Analysis	3	0	0	0	6	9
5	AM5630	Foundations of Computational Fluid Dynamics	3	0	0	0	6	9
6	OE5500	FEM applied to Ocean Engineering	3	0	0	0	6	9
7	CH6020	Computational Fluid Dynamics Techniques	3	0	0	0	6	9

		Elective streams						
	Stream 1	**Computational Fluid Dynamics**						
1	AM5630	Foundations of Computational Fluid Dynamics	3	0	0	0	6	9
2	AM5570	Introduction to Turbulence	3	0	0	0	6	9
3	AM6513	Advanced Computational Fluid Dynamics	3	0	0	0	6	9
4	AM 5640	Turbulence Modeling	3	0	0	0	6	9
5	ME6650	Computational Fluid Dynamics of Turbomachinery	3	0	0	0	6	9
6	ME6006	Computational Heat and Fluid Flow	3	0	0	0	6	9
7	CH6020	Computational Fluid Dynamics Techniques	3	0	0	0	6	9
8	AM6512	Application of Molecular Dynamics	3	0	0	0	6	9
9	ME6280	Design and Optimization of Energy systems	3	0	0	0	6	9
10	OE6020	Meshfree methods applied to hydrodynamics	3	0	3	0	6	12
11	PE6031	Reservoir Simulation	3	0	0	0	6	9
12	AM5530	Advanced Fluid Mechanics	3	0	0	0	6	9
13	CH 5140	Process Analysis and Simulation	3	0	0	0	6	9
14	CH 5541	Advanced Momentum Transport	3	0	0	0	6	9
	Stream 2	**Computational Solid Mechanics**						
1	AM5450	Fundamentals of Finite Element Analysis	3	0	0	0	6	9
2	AM6512	Application of Molecular Dynamics	3	0	0	0	6	9
3	AM6291	Computational Structural Dynamics	3	0	0	0	6	9
4	ME7680	Optimization Methods for Mechanical Design	3	0	0	0	6	9
5	ME6280	Design and Optimization of Energy systems	3	0	0	0	6	9
6	CE7730	Advanced Finite Element Analysis	3	0	0	0	6	9
7	AM5390	Advanced Structural Mechanics	3	0	0	0	6	9
	Stream 3	**Computational Materials Engineering**						
1	ME7023	Foundations of Computational Materials Modeling	3	0	0	0	6	9
2	MM6010	Computational Materials Thermodynamics	3	0	0	0	6	9
3	ME7160	Computational Methods in Design & Mfg.	3	0	0	0	6	9
4	AM6512	Application of Molecular Dynamics	3	0	0	0	6	9
5	MM5011	Modeling of Transport Phenomena in multi-phase	3	0	0	0	6	9
6	MM5003	Atomistic Modeling of Materials	2	1	0	0	6	9
	Stream 4	**Computational Biology**						
1	BT6090	Intro. to Bioinformatics & Computational Biology	3	0	0	0	6	9
2	BT6270	Computational Neuroscience	3	0	0	0	6	9
3	BT5420	Computer Simulations of Biomolecular Systems	3	0	0	0	6	9
4	BT5240	Computational Systems Biology	3	0	0	0	6	9
5	ME5560	Heat and Mass Transfer in Biological Systems	3	0	0	0	6	9

Who are the potential recruiters?

Depending the path the students build for themselves, they are expected to be placed in most of the private and public sector companies mentioned below. They will be mostly working in the R&D group and/or Analysis and Design groups of these industries.

(i) GE Air-craft engines, GE health care

(ii) General Motors, Tata Motors, TVS, Mahindra & Mahindra,

(iii) Forbes-Marshal, FL Smidt, Reliance, Thermax, Alpha-Laval,

(iv) Tata Steel, Bao Steel, Mittal Steel, Coal India

(v) Fluent, ANSYS, ABACUS, Numeric, ,

(vi) TRDDC, TERI, NPCIL, NTPC, GTRE, CVRDE, BDL, BHEL, BEL, CDAC

(vii) ONGC, OIL, HP, BP, GAIL

(viii) Engineering divisions of Software companies: TCS, Infosys, Wipro, Hexaware,

There are several renowned universities which offer strong Computational engineering Courses and research based programmes, some of them are:

- UIUC
- MIT
- Georgia Tech
- Texas A & M
- NUS

Interdisciplinary Dual Degree in Data Science
(IDDD-DS)

With the tremendous availability of large volumes of data across several domains there has been an explosion of interest in all aspects of handling and understanding data. Data Science brings together all aspects of technology required for gathering, storing, analyzing and understanding data. This includes storage technology, distributed computing, data driven modeling, data analytics and mining, visualization, security, etc. Given that proper interpretation and modeling requires good domain understanding this becomes inherently an interdisciplinary endeavour.

Who offers the programme?

The goal of this program is to give basic background to students from different disciplines in data science and provide ample opportunity for them to specialize in a particular aspect of data science through the electives and the project. Given that often data science is associated with computing, and given that advances in computing technology have enabled the whole field, Computer Science Engineering (CSE) is the natural department to host this program. The program will have a strong interdisciplinary flavor with many departments participating in the teaching of the courses and guidance of the students.

Who can enrol in this programme?

A B. Tech student of IIT Madras from any discipline is eligible to upgrade to this programme provided the student meets certain minimum academic norms. Selection of applicants will be based on the CGPA cut-off of 8.0 at the end of the 5th semester.

What is the curriculum?

The curriculum has a core component that covers the fundamental theoretical concepts and tools required. The student is then free to choose 3-4 electives from the prescribed list. These electives are a mix of advanced algorithmic or theoretical courses and applied data science courses. Depending on the interests of the students one can choose to specialize in a specific application area or acquire deeper grounding the fundamentals of data science.

THE CURRICULUM FOR THE IDDD – DATA SCIENCE

6th Semester

S.No	Course No.	Course Name	L	T	E	P	O	C
1	CH5019	Mathematical Foundations for Data Science	4	0	0	0	8	12
		Total Credits :						**12**

7th Semester

S.No	Course No.	Course Name	L	T	E	P	O	C
1	MS4110	Introduction to Data Analytics	4	0	0	0	8	12
2	EE4708	Data Analytics Laboratory Offered by Department of Electrical Engg. Covers basics of python or R. Simple analytics tasks - regression, classification, clustering, associations, etc. Emphasis will be on choice of models, evaluation of results, significance analysis, visualization and interpretation of results.	0	0	0	3	3	6
		Total Credits :						**18**

8th Semester

S.No	Course No.	Course Name	L	T	E	P	O	C
1	CS4830	Big Data Laboratory Offered by Department of Computer Science and Engineering Will cover basics of Map-Reduce, Distributed data storage, Spark/Hadoop; Working on the cloud - Amazon Web Services or Azure as a case study; Emphasis would be on data analytics use cases.	0	0	0	3	3	6
		Total Credits :						**6**

SUMMER

S.No	Course No.	Course Name	L	T	E	P	O	C
1	CS5610	Project I	0	0	0	0	20	20
		Total Credits :						**20**

9th Semester

S.No	Course No.	Course Name	L	T	E	P	O	C
1	CS5620	Project II	0	0	0	0	30	30
		Total Credits :						**30**

10th Semester

S.No	Course No.	Course Name	L	T	E	P	O	C
1	CS5630	Project I	0	0	0	0	35	35
		Total Credits :						**35**

Electives: 36 credits from the approved list of electives. Can be taken in the **7th, 8th and 9th semesters**.

Suggested Electives (Will be updated when newer electives are offered)

Odd Semester

Course No.	Course Title	Faculty
CH5170	Process Optimization	Sridharakumar Narasimhan
CHXXXX	AI in Process Engineering	Raghunathan Rengasamy
CH5350	Applied Time-Series Analysis	Arun K. Tangirala
CH5020	Statistical Analysis and Design of Experiments	Arun K. Tangirala / A. Kannan
CS5011	Introduction to Machine Learning	B. Ravindran
CS6370	Natural Language Processing	Sutanu Chakraborti
CS6740	Searching and Indexing in Large Datasets	Sayan Ranu
CS6310	Artificial Neural Networks	Anurag Mittal
MA5750	Applied Statistics	Neelesh Upadhye
MA5014	Applied Stochastic Processes	Neelesh Upadhye
MA5013	Applied Regression Analysis	Neelesh Upadhye
EE5177	Machine Learning for Computer Vision	Kaushik Mitra
CE7011	Advanced Transportation Network Analysis	Karthik Srinivasan/ Gitakrishnan Ramadurai

Even Semester

Course No.	Course Title	Faculty
BT5240	Systems Biology	Karthik Raman
CH5440	Multivariate Data Analysis	Shankar Narasimhan
CH5230	System Identification	Arun K. Tangirala
CH5470	Graph Theory & Its Applications in Process Design	Sridharakumar Narasimhan
CS6720	Data Mining	Sayan Ranu
CS6700	Reinforcement Learning	B. Ravindran
CS6011	Kernel Methods for Pattern Analysis	Chandrasekhar C.
CS6770	Knowledge Representation & Reasoning	Deepak Khemani
CS6730	Probabilistic Reasoning in AI	B. Ravindran
CS6012	Social Network Analysis	B. Ravindran
EE5154	Complex Network Analysis	Venkatesh R
MS6032	Predictive and Prescriptive Data Analytics	Nandan Sudarsanam
CS6741	Algorithms for Big Data	John Augustine
CHXXXX	Manufacturing Analytics	Raghunathan Rengasamy
CS7015	Deep Learning	Mitesh Khapra
CE5390	Analytical Techniques in Transportation Engineering	Karthik Srinivasan
CE5290	Transportation Network Analysis	Karthik Srinivasan

Interdisciplinary Dual Degree in Energy Systems (ID-DD-ES)

The Interdisciplinary Dual Degree Programme in Energy Systems is intended to equip the student with the necessary skills to deal with the fast evolving energy related technologies of our time. The need for an interdisciplinary approach in the energy domain is increasingly felt, since the technology of energy conversion should necessarily involve considerations of usage, materials needed and the commercial and environmental aspects of the processes. Towards this end, this programme enables the student to understand the various dimensions of energy usage and conversion and makes them ready to tackle the complex realities that exist in the field.

Who Offers the Programme?

Many Departments in IITM have come together to offer this programme. The Departments of Aeronautical, Applied Mechanics, Chemical, Civil, Electrical, Mechanical, Metallurgical and Materials Engineering, Ocean Engineering, along with the Departments of Chemistry, Physics, Humanities and Social Sciences, have all come together to enable a grasp of the multidimensional aspect of energy, technology and society.

Who is Eligible to take the Programme?

Any BTech student of the Institute with certain minimum norms of academic performance can apply for this programme in their fifth semester.

What is the Curriculum?

The curriculum consists of eight courses. These are done in the seventh to tenth semesters of the dual degree programme. There are four core courses which will be taken by all entrants: Principles of Thermal Energy Conversion, Renewable Energy Technology, Materials for Energy Storage and Conversion, and Energy Economics. These subjects enable the student to get an exposure to the vast and multidimensional impact that the energy domain has.

The courses on Thermal Energy Conversion and Materials are to be done in the seventh semester. The former enables an understanding of various gas and vapour cycles and focusses for a large part on Thermal power plants and coal combustion. Nuclear Reactor principles are also included in this. The latter course enables the student to get a good understanding of materials and technologies for material synthesis. Materials for batteries, fuel cell technologies and supercapacitors are also part of this course.

The course on Renewable Energy Technology deals with various types of renewable energy sources and their usage, ranging from solar, wind to geothermal and bio-fuels. The Energy Economics course, which is again in the eighth semester deals with pricing, taxation, energy markets, economics of various types of sources, climate change and policy aspects.

While the core courses are designed to give a complete overview of the entire domain, the students are free to choose electives that will enable them to chalk out a further path of their choice. A large set of carefully selected electives are provided which will enable the student to explore a particular aspect of the energy domain in greater detail. The curriculum also stipulates that one elective be done from a basket of courses dealing with the final utilization of energy.

As an example, a student interested in wind power may choose the following electives: Wind Turbines, Power Electronics, Power Quality and Distributed Generation. On the other hand, doing all electives in Stream C (Wind and Ocean Energy Systems) together with Powering and Propulsion of Marine Vehicles would prepare the student for more details of possible energy activities off-shore. A set of electives such as Principles of Fuel Cells, Chemical and Electrochemical Energy Systems, Power Electronics and Intelligent Transportation may ready a student more towards the automotive uses of energy. It is also of course possible to take electives from a specific stream as listed (see below in List of Courses) to take advantage of a homogenous and planned set of courses. The possibilities are many. The courses may require pre-requisites which the student has to plan ahead and take through the free credits that are available in the overall programme. Two of these electives are to be taken in the seventh semester and two in the eighth semester.

The ninth and tenth semesters of the programme are devoted to doing a project in an area of energy.

No.	Course No	Course name	L	T	E	P	O	C
	Semester VII							
1	ME5129	Principles of Thermal Energy Conversion	3	0	0	0	6	9
2	ID6106	Materials for Energy Storage and Conversion	3	0	0	0	6	9
3		Elective	3	0	0	0	6	9
4		Elective	3	0	0	0	6	9
		Total credits	12	0	0	0	24	**36**
	Semester VIII							
1	ME6148	Renewable Energy Technology	3	0	0	0	6	9
2	ID5070	Energy Economics	3	0	0	0	6	9
3		Elective	3	0	0	0	6	9
4		Elective	3	0	0	0	6	9
		Total Credits :	12	0	0	0	24	**36**
	Semester VIII							
1	EE5910	Project I (summer)	0	0	0	0	15	15
	Semester IX							
2	EE5920	Project II (during semester)	0	0	0	0	30	30
		Total Credits :						
	Semester X							
1	EE5930	Project III	0	0	0	0	40	40
		Total Credits :						**157**

		CORE COURSES						
	New	Principles of Thermal Energy Conversion	3	0	0	0	6	9
	ME6148	Renewable Energy Technology	3	0	0	0	6	9
	New	Materials for Energy Storage and Conversion	3	0	0	0	6	9
	New	Energy Economics	3	0	0	0	6	9
	Stream A	**Energy Storage Systems**						
	CH5013	Principles of Fuel Cells	3	0	0	0	6	9
	CY6114	Chemical and Electrochemical Energy Systems	3	0	0	0	6	9
	CH5022	Solar Photoelectrochemistry	3	0	0	0	6	9
	Stream B	**Materials**						
	PH 6013	Functional Materials, Sensors and Transducers	3	0	0	0	6	9
	ID6050	Chemical Physics of Modern Technical Ceramics	3	0	0	0	6	9
	MM3180	Advanced Materials and Processes	3	0	0	0	6	9
	MM 5030	Materials in Renewable Energy Technologies	3	0	0	0	6	9
	MM5460	Physical Ceramics	3	0	0	0	6	9
	Stream C	**Solar Energy Systems**						
	ME6005	Solar Energy for Process Heat & Power Generation	3	0	0	0	6	9
	EE5343	Solar Cell Device Physics and Materials Technology	3	0	0	0	6	9
	ME6580	Utilization of Solar Energy	3	0	0	0	6	9
	Stream D	**Wind and Ocean Energy Systems**						
	AS5450	Wind Turbines	3	0	0	0	6	9
	OE4340	Ocean Energy Systems	3	0	0	0	6	9
	OE5030	Wave Hydrodynamics	3	0	0	0	6	9
	Stream E	**Combustion**						
	ME6110	Combustion Technology	3	0	0	0	6	9
	ME6020	IC Engine Combustion and Pollution	3	0	0	0	6	9
	ME6440	Alternative Fuels for IC Engines	3	0	0	0	6	9
	Stream F	**Thermal Energy**						
	ME6570	Thermal Energy Conservation	3	0	0	0	6	9
	ME6004	Micro and Nanoscale Energy Transport	3	0	0	0	6	9
	ME6030	Refrigeration and Cryogenics	3	0	0	0	6	9
	ME5134	Process Simulation	3	0	0	0	6	9
	ME6280	Design and Optimization of Energy Systems	3	0	0	0	6	9
	New	Geothermal Energy	3	0	0	0	6	9
	Stream G	**Fuels**						
	AM5114 / PE6030	Flow Through Porous Media / Reservoir Engineering	3	0	0	0	6	9
	PE6320	Subsea Engg for Oil and Gas fields	3	0	0	0	6	9
	PE6060	Off shore Oil and Gas Production Systems	3	0	0	0	6	9
	PE6080	Petroleum Refining Technology	3	0	0	0	6	9
	PE6312	Enhanced Oil Recovery	3	0	0	0	6	9
	CH5018	Biomass Conversion Processes and Analysis	3	0	0	0	6	9

	Stream H	**Electrical Power**						
	EE3203	Power Electronics	3	0	0	0	6	9
	EE5257	Energy Management Systems and SCADA	3	0	0	0	6	9
	EE5260	Power Quality	3	0	0	0	6	9
	Stream I	**Energy utilization**						
	ME6530	HVAC Systems and Applications	3	0	0	0	6	9
	CE6011	Smart Buildings and Automation	3	0	0	0	6	9
	CE5900	Intelligent Transportation Systems	3	0	0	0	6	9
	OE6310	Powering and Propulsion of Marine Vehicles	3	0	0	0	6	9
	EE6261	Restructured Power Systems	3	0	0	0	6	9
	EE5262	Distributed Generation and Microgrid Systems	3	0	0	0	6	9

The potential recruiters from such a programme are

• ABB	• KIE Solatherm
• Amat Engineering	• Larsen and Toubro
• Abener	• NPCIL
• Abengoa	• NTPC
• Altius Consulting	• ONGC
• Applied Materials	• Powergrid
• Ather	• Reliance Industries
• Bharat Petroleum	• Schlumberger
• Bosch	• Shakti Sustainable Energy Foundation
• Cummins	• Siemens
• EESL	• Suzlon
• Forbes Marshall	• Tata BP Solar
• GE	• Tata Motors
• ICICI Lombard	• Thermax
• Indianoil	• TCE

Several renowned universities offer research programmes in energy, some of whom collaborate with IIT Madras. A few of the Universities are:

- Cornell University, Ithaca, New York, USA
- Georgia Institute of Technology, Georgia, USA
- Iowa State University, Ames, Iowa, USA
- North Carolina State University, Raleigh, USA
- RWTH Aachen, Aachen, Germany
- Texas A & M University, College Station, Texas, USA
- TU Munich, Munich, Germany
- University of Colorado at Boulder, USA
- University of Melbourne, Australia
- University of Queensland, Australia
- University of Western Australia

Interdisciplinary Dual Degree in Robotics (ID-DD-Robotics)

The Interdisciplinary Dual Degree programme in Robotics is proposed to nurture and develop the next-generation professionals in the area of robotics who can contribute in the design, development, and implementation of robotic systems in the industry and help the industry to improve their productivity, leading to the overall economic growth of the country. IIT Madras has faculty working in the area of robotics spread across various departments. Since no single department has the critical mass to offer a dual degree program in Robotics, an interdisciplinary dual degree program is proposed. The dual degree program in Robotics will be having its focus on Design, Analysis, and Application development (new system development) and the curriculum has been developed with this focus.

Learning Outcomes:

Students graduating with a dual degree in Robotics shall be capable of understanding and analyzing the following:

1. Basic robotic technologies used across various applications
2. Kinematics, dynamics, and control of Industrial and field/service robots
3. Sensing, perception, planning, and control applied to autonomous robots
4. Application of Artificial Intelligence, Neural Networks and Reinforcement learning in Robotics
5. Hardware systems and controllers used in robotics
6. Design of robotic systems for new applications

Who offers the programme?

The ID-DD programme is offered by faculty from the departments of Aerospace Engineering, Applied Mechanics, Civil Engineering, Computer Science and Engineering, Electrical Engineering, Engineering Design, Mechanical Engineering and Ocean Engineering. The true interdisciplinary nature of Robotics is reflected in the joint programme collectively offered by faculty from various Depts.

Who can enrol in this programme?

A B. Tech student or a Dual Degree student of IIT Madras in any discipline (except biosciences) is eligible to upgrade/opt for this programme provided the student has a CGPA of 8.0 or above up to 5th semester. Total number of seats will be fixed at 25 and allocation of dual degree specialization and award of the degree will be governed by the rules of the Institute.

What is the curriculum?

ID-DD-Robotics has a very flexible curriculum. The programme spans a period of five semesters of the five-year dual degree programme. There will be a bridge course covering the basics of electrical, mechanical, and computer science fundamentals applicable to robotics. This course will ensure that the students who enters into this specialisation from different streams have the basic understanding of robotics. The curriculum also allows short term (1-3 months)/ long term (up to 6 months) internships with potential companies / research organizations.

In tune with the overall structure of the dual degree program being offered in the Institute, the number of courses to be offered and the credit distribution are as follows:

Total Credits required: **155 to 160**
No. of PMT CORE courses to be offered: 3 (33 credits)
No. of electives to be offered: 4 (36±2 credits)
No. of labs. to be offered: 1 (6 credits)
Project work/internship 1 (85 credits)
Total credits for the ID-DD specialization: 160

Interdisciplinary DD in Robotics -course curriculum

Sl. No	Course No	Course Name	L	T	E	P	O	C
	Semester 6							
1	ID6040	Core 1: Introduction to Robotics	4	0	0	0	8	12
		Total credits						**12**
	Semester 7							
1	ED5260	Core 2: Mechanics and Control of Manipulators	4	0	0	0	8	12
		Electives						
		Total Credits :						**12**
	Semester 8							
		Internship/Summer Project (Project I)						
		Electives						
	Semester 9							
1	ED5315	Core 3: Field and Service Robotics	3	0	0	0	6	9
2	IDXXXX	Core Lab1: Robotics Laboratory	0	0	0	3	3	6
		Project II						
		Total Credits :						**15**
	Semester 10							
1	YYXXXX	Project III						
		Total Credits :						

Project: 85 credits to be completed in 8th, 9th and 10th semester
Electives: 36±2 credits to be completed from the approved list in 7th, 8th, and 9th semester

Total credits for the DD programme: 160

ELECTIVE COURSES
Electives will be offered in three baskets. Students need to choose the electives from at least two baskets (no student will be allowed to choose all the electives from one basket). Faculty/Dept. consent has been received for all the electives.

		Basket 1						
1	AS5012	Dynamics and control of rotorcraft	3	0	0	0	6	9
2	AS5040	Flight Mechanics	4	0	0	0	8	12
3	AS 5010	Aerodynamics and Aircraft Performance	3	0	0	0	6	9
4	AS5340	Advanced flight mechanics	3	0	0	0	6	9
5	AM5010	Biomechanics	3	0	0	0	6	9
6	AM5190	Haptics in Biomedical Engg	3	0	0	0	6	9

		Basket 1						
7	AM5011	Virtual Reality Engg.	3	0	0	0	6	9
8	ED5314	Design, analysis and control of Robot Manipulators	3	0	0	0	6	9
9	OE 5011	Marine Robotics	3	0	0	0	6	9
10	ME7010	Microprocessor in automation	3	0	0	0	6	9
11	CE6011	Smart buildings and automation	3	0	0	0	6	9
12	ED5040	Human Anatomy Physiology and Biomechanics	4	0	0	0	8	12
13	ED5160	Automotive systems	4	0	0	0	8	12
		Basket 2						
1	CS5011/ EE5177	Machine Learning for Computer Vision	4	0	0	0	8	12
2	CS6380	Artificial intelligence	4	0	0	0	8	12
3	CS6700	Reinforcement learning	4	0	0	0	8	12
4	CS7015	Deep Learning	4	0	0	0	8	12
5	CS6350/ EE5175	Computer Vision/ Image Signal Processing	4	0	0	0	8	12
6	CS6777	Optimisation for computer vision applications	4	0	0	0	8	12
		Basket 3						
1	EE5541	Synthesis of control systems	3	0	0	0	6	9
2	EE6417	Allied topics in control systems	3	0	0	0	6	9
3	EE6412	Optimal Control	4	0	0	0	8	12
4	EE5340	Micro-electro mechanical systems	3	0	0	0	6	9
5	EE5410	Introduction to DSP	4	0	0	0	8	12
6	EE5177/ CS5011	Machine Learning for Computer Vision	4	0	0	0	8	12
7	EE5175/ CS6350	Image Signal Processing	4	0	0	0	8	12

Who are the potential recruiters?

There are several leading companies who actively recruit students with knowledge of robotics. Some of the companies are:

- Eaton Corporation
- Bosch
- TCS Innovation Labs
- Titan
- ABB Robotics
- Kawasaki Robotics
- Pari Robotics
- DRDO
- CSIR
- Systemantics
- HiTech Robotics
- Stryker

Setting up of New Laboratory.

Hands-on experience is a vital component in learning robotics. Keeping this in mind, a laboratory course has been proposed. The laboratory experiments will give practical exposure on various types of robots and their design, programming, and control. The laboratory may be setup in the new academic block to make it accessible to all the faculty involved in robotics teaching/research. Following experiments are proposed in the newly proposed laboratory course.

Experiments:

1. Sensors and Actuators: Integration of various types of sensors, programming, data analysis
2. Serial Manipulators: Forward and Inverse Kinematics, Path Planning, Trajectory tracking, Singularity analysis
3. Parallel Manipulators: Forward/Inverse kinematics, singularity analysis, Path planning
4. Wheeled Mobile Robots: Design, control, motion planning
5. Robotic vision system: Programming, image processing, obstacle detection
6. Underwater robots: Design, modelling and simulation
7. Aerial Robots: design, control, programming (fixed wing/flapping wing/VTOL)
8. Robot calibration: Calibration of industrial robots
9. Surgical robots: Haptic system, RCM design

Facility creation: Investment: 75 lakhs

- Serial robot arm (10 lakhs)
- Parallel robot arm (15 lakhs)
- Mobile manipulator (15 lakhs)
- Haptic system (5 lakhs)
- Mobile robots (10 lakhs)
- Aerial Robot (10 lakhs)
- Robot building kits (10 lakhs)

Conclusions

The structure and curriculum for the interdisciplinary dual degree program in Robotics have been formulated with the objective of leveraging on the academic strengths of each department to ensure the true interdisciplinary nature of the program.

*tech*MBA@IITM

Vision of the program

To develop human capabilities towards better management of corporations using the technological innovations.

Prepare human resources well-poised to create and manage technology-driven businesses.

Mission of the program: To offer cutting-edge management inputs, with best possible curriculum and industry interface to the participants so that they are capable of managing businesses in the world of newer technologies in the most optimal way.

Learning outcomes for the program:

Category	Learning Outcome (The student will be able…)
Functional Core	To gain a multidisciplinary perspective on business functions – both operational and strategic.
	To develop teamwork and leadership skills in a variety of work group settings.
	To assess opportunities and challenges in domestic and international business contexts.
Performance Analytics	To gain insights into models and tools of business research and management practice.
	To model complex business problems by employing qualitative and quantitative techniques.
	To translate findings of analytics projects into effective and efficient action plans.
Transformation Technologies	To demonstrate deep understanding of the enterprise transformation through digital technologies.
	To design innovative solutions to address business and social problems - using technology.
	To comprehend environmental, cultural, social and ethical dimensions of business decision-making.

Why *tech*MBA?

As the organizations move towards decision making using technological advances, it is imperative that the students learn to marry technology with management. The core management ideas may be evergreen and time invariant; one needs to learn how these can help a technology-based organizations. Also, when so much of technological revolution happening around us, business leaders need to harness and manage these technologies optimally to provide value to all the stakeholders.

techMBA is supposed to help students appreciate principles of how to use technology to manage a business; as well as learn how management principles can help technology organizations.

What is `tech' in *tech*MBA?

The focus of this program is not technology per se, but creating and managing technology-based businesses. We focus on *digital technologies*. Curriculum will have coursework preparing and challenging students to manage digital technologies, basic understanding of these technologies would be pre-requisites. For, students may need some exposure for some of the emerging digital technologies before they learn ways to manage these. Curriculum will focus on management technologies (e.g. FinTech, Marketing Tech, etc.).

Curriculum

Curriculum can have four broad categories of courses:

1. Core Management Foundations (50%)
2. Performance analytics (25%)
3. Transformation Technologies (25%)

(Figures in bracket indicate approximate proportion of courses.)

First course for techMBA to be offered in July semester for the 5th semester students to credit. Based on the academic performance on this course, and other additional requirements, the students will be admitted to the program at the end of the fifth semester.

THIRD YEAR

Semester 5

No	Course No	Course Name	L	T	E	P	O	C
1	MS4000	Management Thought and Practice	3	0	0	0	6	9
		Total Credits :						**9**

Semester 6

No	Course No	Course Name	L	T	E	P	O	C
1	MS4010	Quantitative Techniques for Operations	3	0	0	0	6	9
2	MS4510	Marketing Management: Basics & Application	3	0	0	0	6	9
		Total Credits :						**18**

Summer

No	Course No	Course Name	L	T	E	P	O	C
1		Summer Internship	0	0	0	0	20	0

FOURTH YEAR

Semester 7

No	Course No	Course Name	L	T	E	P	O	C
1	MS4210	Modern Corporate Finance	3	0	0	0	6	9
2	MS4310	Managing People in Organizations	3	0	0	0	6	9
3	MS4410	Information Systems for Organisations	3	0	0	0	6	9
		Total Credits :						**27**

Semester 8

No	Course No	Course Name	L	T	E	P	O	C
1	MS5000	Strategic Management	3	0	0	0	6	9
2	MS4610	Introduction to Data Analytics	3	0	0	0	6	9
3	MSxxxx	Digital Economy and Enterprises	3	0	0	0	6	9
		Total Credits :						**27**

FIFTH YEAR

Quarter 1

Sl. No	Course No	Course Name	L	T	E	P	O	C
1	MS6910	Global Business Management	4	0	0	0	8	6
2	MS5790	Marketing Research	4	0	0	0	8	6
3	MSxxxx	Operations and Supply Chain Analytics	4	0	0	0	8	6
4	MSxxxx	Technology Foresight and Innovatioin	4	0	0	0	8	6
5	MS5015	Design Thinking	4	0	0	0	8	6
		Total Credits :						**30**

Quarter 2

Sl. No	Course No	Course Name	L	T	E	P	O	C
1	MSxxxx	Foundations of Business Analytics	4	0	0	0	8	6
2	MSxxxx	Operations Forensics	4	0	0	0	8	6
3	MS5690	Computational Finance	4	0	0	0	8	6
4	MSxxxx	Digital Business Models	4	0	0	0	8	6
5	MSxxxx	Foundations of Technopreunership	4	0	0	0	8	6
		Total Credits :						**30**

Quarter 3

Sl. No	Course No	Course Name	L	T	E	P	O	C
1	MSxxxx	Capstone Project	0	0	0	0	36	18
2	MSxxxx or MS5700	People Analytics or Derivatives and Risk Management	4	0	0	0	8	6
3	MSxxxx or MSxxxx	Managing Digital Products or Digital Marketing	4	0	0	0	8	6
		Total Credits :						**30**

Quarter 4

Sl. No	Course No	Course Name	L	T	E	P	O	C
1	MSxxxx	Industrial Project	0	0	0	0	24	12

Year	3rd Year		4th Year		Summer	5th year				Total
Semester / Quarter	V	VI	VII	VIII		I	II	III	IV	
Credits	9	18	27	27	0	30	30	30	12	183