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

		Basket 1						
6	AM5190	Haptics in Biomedical Engg	3	0	0	0	6	9
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
14	OE5310	Guidance & Control of Marine Vehicles	3	0	0	0	6	9
15	ME6221	Theory of Mechanisms	3	0	0	0	6	9
16	AS5570	Principles of Guidance for Autonomous Vehicles	3	0	0	0	6	9
		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
7	ID5030	Machine Learning for Engineering and Science Applications	3	1	0	0	6	10
		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
8	EE6415	Nonlinear Control Systems	3	0	0	0	6	9