DEPARTMENT OF ENGINEERING SCIENCE

INDIAN INSTITUTE OF TECHNOLOGY
HYDERABAD

1. Institute Background

Inventions and innovations are key words on which the foundation of IIT Hyderabad is based. These are also key drivers for the vision of IIT Hyderabad. Our endeavor is to create an institute that will provide a space for free and uninhibited thinking, a space where faculty and students can experiment with novel ideas without the fear of failure. It is our firm belief that such an ambience will foster highest level of research: blue sky research as well as developmental research leading to proof of concepts and prototypes.

The Institute is organized into the 14 different departments namely Biomedical Engineering, Biotechnology, Chemical Engineering, Chemistry, Civil Engineering, Computer Science & Engineering, Electrical Engineering, Engineering Science, Liberal Arts, Material Science &Metallurgical Engineering, Mathematics, Mechanical & Aerospace Engineering and Physics. The Institute currently, running B.Tech (4 Year) M.Tech (2 Year), M.Tech (3 Year), M.Sc (2 Year), M.Phil (18 months) and Ph.DProgrammes.

2. Course Numbering Scheme

3. Program Background

B.Tech in Engineering Science, at IIT Hyderabad, is unique program offered in India for the first time. It completely opens the doors to different specializations and provides a holistic engineering education. The basic structure is as follows: For the first 2 years (4 semesters) the student does basics courses in Math, Physics, Chemistry, and different fields of engineering. In the last 2 years (4 semesters) the student then specializes in any field of his / her choice -- specialization is completely open: It could be any branch of engineering - Computer Science and Engineering, Electrical, Mechanical, Chemical, Civil, Material Science, BioTech, Biomed -- or Physics, or Mathematics, or Chemistry, or Economics, or Psychology, or Design, etc. The final degree will read: B.Tech in Engineering Science with Specialization in X.

This is the first program that caters to what is often referred to as the "T Education"; the horizontal line in 'T' corresponds to an education giving breadth, while the vertical line in 'T' corresponds to an education giving depth. The new Engineering Science Program achieves breadth as well as depth.

3.1 Objective of the Program

• Engineering science is an interdisciplinary program that emphasizes enhanced understanding and integrated application of engineering, scientific, and mathematical principles.

• The program is unique in providing a broad perspective in the sciences and engineering domain giving students an opportunity to pursue the area of their choice through core option. It is first of its kind in India and new paradigm in engineering education.

• It is based on the concept of 'T Education' where the horizontal line in 'T' corresponds to an education giving breadth, while the vertical line in 'T' corresponds to an education giving depth. The new Engineering Science program achieves both breadth as well as depth.

3.2 Program Outcomes

• Acquire an ability to apply knowledge of mathematics, science, and engineering on day to day problems.

• Acquire an ability to identify, formulate, and solve engineering problems of multi-disciplinary nature.

• Acquire an ability to work in multi-disciplinary teams with special focus on system integration.

• Acquire an ability to use the modern techniques and tools necessary for engineering practice.

3.3 How different is it from conventional B.Tech program?

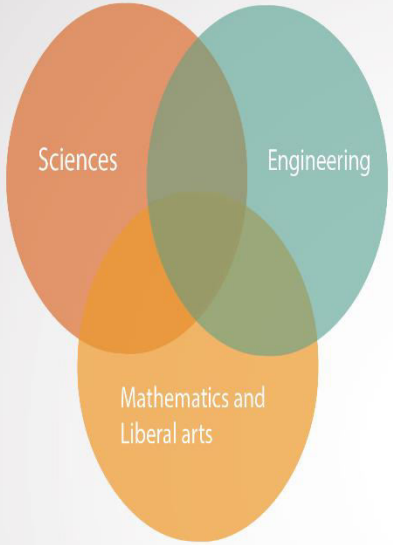
• Apriori students don't choose the core option in this program compared to the conventional one.

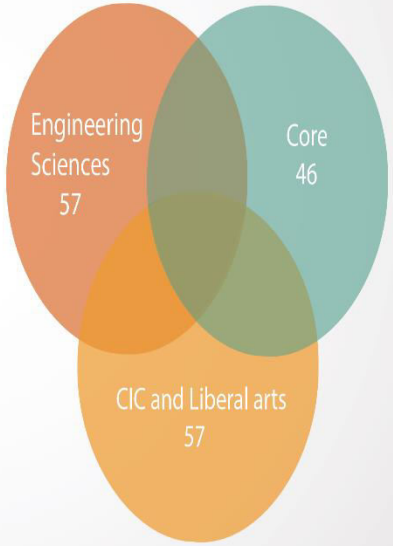
• Common courses across departments are more compared to conventional one and it is for 4 semesters.

• Students choose their core at the end of second year and would focus on their core for 4 semesters.

• They cannot be compared with a conventional branch student but ultimately they have lot of exposure to different disciplines.

3.4 Basis & Credits distribution





4. Core Programs

4.1 Engineering Program

- Computer Science
- Chemical
- Civil
- Electrical
- Mechanical
- Material Science

4.2 Science Program

- Chemistry
- Mathematics
- Physics

5. Faculty Profiles

M.Ramji

Associate Professor and Head Of Department

AOI : Optical Methods in engineering, Finite Element Analysis and Boundary Element Methods, Fracture Mechanics, Inverse problem in solid mechanics.

+91 (40) 2301 6078

ramji_mano [at] iith.ac.in

P. Rajalakshmi

Assistant Professor

AOI : Wireless Communication: Wireless Sensor Networks, Cognitive Radio; Embedded Systems; Optical Networking

+91 (40) 2301 6004

raji [at] iith.ac.in

B. Umashankar

Assistant Professor

AOI : Recyclable Materials in Geotechnics, Reinforced Soil, Soil-Structure Interaction, Experimental Soil Mechanics

+91 (40) 2301 6034

buma [at] iith.ac.in

Ashudeb Dutta

Assistant Professor

AOI : Analog Circuit Design, RFIC, Semiconductor Devices.

+91 (40) 2301 6051

asudeb_dutta [at] iith.ac.in

K. P. Prabheesh

Assistant Professor

AOI : Macro & Monetary Economics, International Finance, Applied Econometrics.

+91 (40) 2301 6013

prabheesh [at] iith.ac.in

Balasubramaniam Jayaram

Assistant Professor

AOI : Fuzzy Logic Connectives, Approximate Reasoning.

+91 (40) 2301 6007

jbala [at] iith.ac.in

Chandrika Prakash Vyasarayani

Assistant Professor

AOI : Structural Dynamics, MEMS, Delay Differential Equations,Parameter Identification and Optimization.

+91 (40) 2301 7070

vcprakash [at] iith.ac.in

Debasish Chaudhuri

Assistant Professor

AOI : Soft condensed matter, Biological Physics, Statistical Physics.

debc [at] iith.ac.in

M.Deepa

Assistant Professor

AOI : Syntheses and electrochemistry of transition metal oxides, conducting polymers and composites, electrochromic films and devices.

+91 (40) 2301 6024

mdeepa [at] iith.ac.in

M. V. Panduranga Rao

Assistant Professor

AOI : Theoretical Computer Science.

+91 (40) 2301 6012

mvp [at] iith.ac.in

Parag D. Pawar

Assistant Professor

AOI : Cell adhesion and motility, multiscale modeling of intercellular interactions in the vasculature.

+91 (40) 2301 6068

parag [at] iith.ac.in

Thenmalarchelvi Rathinavelan

Assistant Professor

AOI : Bacterial glycobiology, Transition state structures of proteins, DNA-protein interaction, DNA structure and dynamics.

+91 (40) 2301 7067

tr [at] iith.ac.in

Ranjith Ramadurai

Assistant Professor

AOI : Multiferroic oxide thin films for fundamentalscience and functional device applications. High-k dielectric thin films for CMOS technology and memory device applications. Surfaces and Interfaces of oxide hetero structures on silicon and single crystalline oxide substrates. Influence of process conditions, strain engineering and interface engineering on domains and domain dynamics of multiferroic thin films utilizing scanning probe microscope.

+91 (40) 2301 7046

ranjith [at] iith.ac.in

Subrahmanyam Kalyanasundaram

Assistant Professor

AOI : Complexity Theory, Probabilistic Techniques, Algebra, Randomized Algorithms.

+91 (40) 2301 7053

subruk [at] iith.ac.in

6. Category-wise Credit Requirements

B.Tech			
Code	Category	Recommended	Optional
BSC	Basic sciences	30 – 40	-
BES	Basic engineering skills	10 – 15	-
AES	Advanced engineering skills	10 – 15	-
DCT	Departmental core theory	40 – 60	-
DCL	Departmental core laboratory	15 – 30	-
DCE	Departmental electives	10 – 20	-
LAE	Liberal Arts electives	10 – 20	-
FRE	Free electives	3 – 10	-
MNC	Minor core		12
MNE	Minor elective	-	
DHC	Honours coursework	-	12
DHP	Honours project	-	
	Total Credits	150-160	

7. B.Tech Course Curriculum

7.1 Overall Program (2012 Batch: Non-Fractal Program)

Semester – 1 (Aug-Dec'12)		
PH1010	Physics I	3
CY1010	Environmental Chemistry	3
MA1010	Calculus I	4
ID1010	Concepts in Engineering Design	4
ID1021	Engineering Practice	4
ID1035	Independent Project	1
PH1031	Physics Lab	2
CY1031	Chemistry Lab	2
	Total =	**23**

Semester – 2(Jan-May'13)		
PH1020	Physics II	3
CY1020	Dynamics of Chemical Systems	3
MA1020	Calculus II	4
BO1020	Concepts in Life Sciences	3
ID1210	Engineering Mechanics	4
ID 1061	Computational Engineering	3
ID1071	Mechanical Workshop	2
ID1121	Engineering Graphics	2
	Total =	**24**

Semester – 3 (Aug-Dec'13)		
ME2110	Mechanics of Solids	4
CS2010	Data Structures and Algorithms	3
ID2030	Fluid Mechanics & Rate Processes	4
LAXxx0	Liberal Arts Elective 1	3
MA2010	Complex Variables, Probability & Transforms	3
CS2011	Data Structures and Algorithms Lab	2
MS5010	Properties of Materials	3
	Total =	**22**

Semester – 4 (Jan-May'14)		
CS2063	Software Technologies	2
LAXxx0	Liberal Arts Elective 2	3
EE2010	Basic Electrical & Electronics Engineering	3
ME2411	ME Lab I (Fluid and Solid Mechanics)	2
ES2125	Project 1/Mini-project	2
ID2120	Engineering Thermodynamics	3
EE1447	Embedded programming	1
EE1097	DSP	1
EE2020	Microprocessors and Computer Organization	3
	Total =	**20**

Semester – 5 (Aug-Dec'14)		
	Department Specific Courses (including Core Compulsory, Core Elective and Free Electives)	3
	Total =	**17**

Semester – 6 (Jan-May'15)		
	Department Specific Courses (including Core Compulsory, Core Elective and Free Electives)	
	Total =	**17**

Semester – 7 (Aug-Dec'15)		
LAxxxx	LA ELECTIVE	3
	Department Specific Courses (including Core Compulsory, Core Elective and Free Electives)	
	Total =	**15**

Semester – 8 (Jan-May'16)		
ID4006	Professional Ethics	3
LAxxxx	LA ELECTIVE	3
	Department Specific Courses (including Core Compulsory, Core Elective and Free Electives)	
	Total =	**14**

Total Credits : 152

7.2 Overall Program (2013 Batch: Non-Fractal Program)

Semester - 1			
CIC	PH1010	Physics I	3
	CY1010	Environmental Chemistry	3
	MA1010	Maths I	4
	ID1011	Concepts in Engineering Design	3
	ID1021	Engineering Practice	4
	ID1035	Independent Project	1
	PH1031	Physics Lab	2
	CY1031	Chemistry Lab	2
		Total -	22

Semester - 2			
CIC	PH1020	Physics II	3
	CY1020	Dynamics of Chemical Systems	3
	MA1020	Maths II	3
	BO1020	Concepts in Life Sciences	3
	ID1061	Computational Engineering	3
ESC	ME1210	Engineering Mechanics	4
	ID1071	Mechanical Workshop	2
	ME1121	Engineering Graphics	2
		Total -	23

Semester - 3			
CIC	MA2010	Maths III	3
	LA2xx0	Liberal Arts Elective 1	3
ESC	MS1047	Properties of Materials	1
	CS2010	Data Structures and Algorithms	3
	CS2011	Data Structures & Programming Lab	2
	ID2030	Fluid Mechanics and Rate processes	4
	ME2110	Mechanics of Solids	4
	EE1110	Boolean Algebra	1
	EE2110	Digital System	1
		Total =	21

Semester - 4			
CIC	LA2xx0	Liberal Arts Elective 2	3
ESC	ME2120	Thermodynamics	3
	EE2010	Electrical & Magnetic Circuits	3
	ME2411	ME Lab I (Fluid & Solid Mechanics)	2
	EE2020	Microprocessors and Computer Organization	3
	EE1300	Digital Signal Processing	1
	ES2125	Project 1/Mini-project	2
	EE1170	Embedded Programming	1
		Total -	18

Semester - 5			
	I	Department Specific Courses (including Core Compulsory, Core Elective and Free Electives)	3
	T		3
	T		3
	I		3
	T		3
	Lab 1		2
		Total =	17
		Minor 1	3
		Honours 1	3

Semester - 7			
CIC	LA4xx0	Liberal Arts Elective 3	3
	T		3
	Proj/CE -2		3
	FE-1		3
	Lab 3		2
		Total -	31 11
		Minor 3	3
		Honours 3 (Project Stage-1)	3

Semester - 6			
	T	Department Specific Courses (including Core Compulsory, Core Elective and Free Electives)	3
	T		3
	T		3
	T		3
	CE-1		3
	Lab 2		2
		Total =	17
		Minor 2	3
		Honours 2	3

Semester - 8			
CIC	xx4xx0	Professional Ethics	2
	LA4xx0	Liberal Arts Elective 4	3
	T	Department Specific Courses (including Core Compulsory, Core Elective and Free Electives)	3
	Proj/CE -3		3
	FE-2		3
		Total=	5 + 9
		Minor 4	3
		Honours 4 (Project Stage-2)	3

Core Department		54
Minors		12
Honors		12

CIC	Common Institute Courses (including LA & Free Electives)	54
ESC	Engineering Sciences Courses	39

Total Credits : 147

CE Core Elective
FE Free Elective
T Compulsory Core courses

** Free electives has to be between 3 - 10 credits total
CIC Common Institute Core Courses
ES Engineering Science Core Courses

7.3 Engineering Science Fractal Curriculum (2014 Batch)

Semester 1		17	Slot
	Free Elective	2	
EE	Boolean Algebra	1	12
ID	Digital Fabrication	2	16
CS	Introduction to programming	2	16
CS	Introduction to programming Lab	1	16
ID	Independent Project	1	16
MA	Calculus-I	1	12
MA	Calculus-II	2	36
EE	Computer Organization	1	12
LA	Liberal & Creative Arts Electives	2	12 or 56
CY	Environmental Chemistry-1	1	12
PH	Photonics	1	56

Semester 2		17	Slot
CS	Introduction to Data Structures	2	14
CS	Data Structures Lab	1	14
ME	Thermodynamics - I	1	12
	Free Electives	2	
MA	Vector Calculus	1	12
MA	Linear Algebra	1	34
MA	Differential Equations	1	56
PH	EM & Maxwell's equation	1	34
CY	Dynamics of Chemical Systems 1	1	12
BO	Introduction to Life Sciences	1	34
LA	Liberal & Creative Arts Electives	2	TBD
EE	Embedded programming	1	56
PH	Quantum Physics	1	12
BM	Brain Machine Interface	1	12

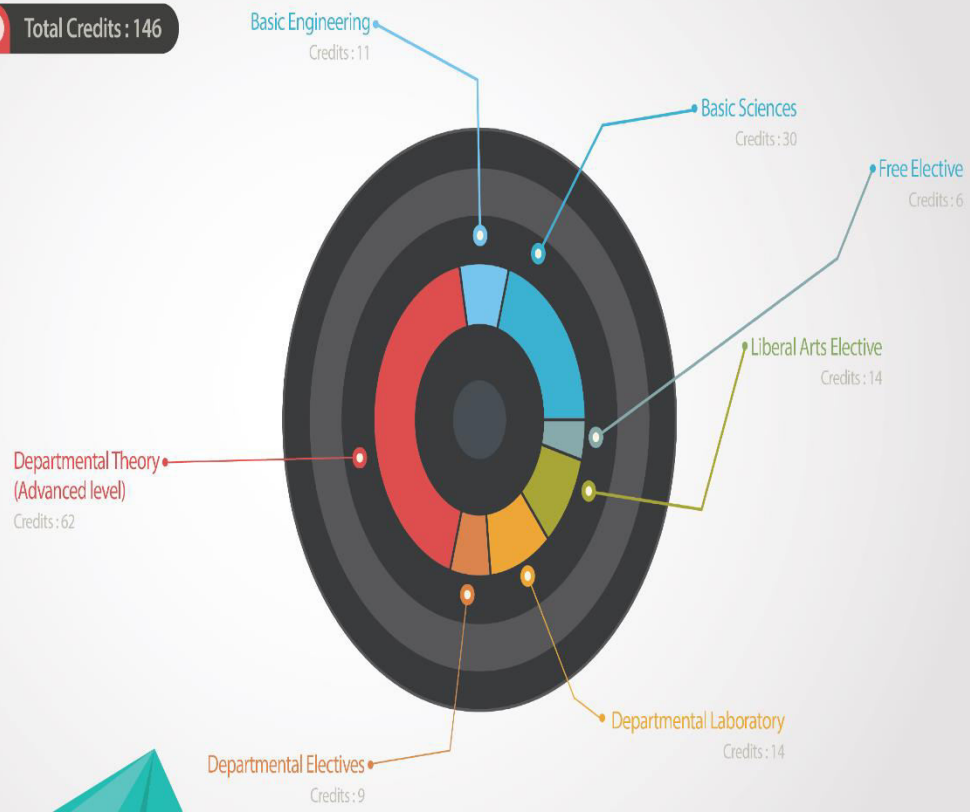
Semester 3		20	Slot
EE	Electric Circuits	1	34
MS	Physics of Solids	1	56
CY	Environmental Chemistry-II	2	12
PH	Classical Physics	1	34
BM	Bio engineering	1	56
ME	Fluid Mechanics-1	2	46
	Free Electives	2	
LA	Liberal & Creative Arts Electives	2	TBD
EE	Device Physics	2	14
EE	Digital Systems and Design	1	12
CS	Theory of Computation-1	1	56
CS	Algorithms-1	1	56
CS	Computer Networks-1	1	34
CH	Numerical Methods 1	2	TBD

Semester 4		20.5	Slot
MA	Statistics	1	56
MA	Complex Variables	1	34
MA	Probability	1	34
ME	Introduction to Mathematical Modeling	1.5	TBD
CS	Algorithms- II	2	36
CS	Theory of Computation II	2	14
	Free Electives	2	
LA	Liberal & Creative Arts Electives	2	TBD
ME	Dynamics	2	36
BM	Neuromuscular Physiology	1	12
EE	Embedded Programming	1	56
EE	CMOS Fabrication	1	34
EE	Control systems	1	TBD
EE	Optimization	1	TBD
MS	Semiconductor Materials	1	TBD

8. Fractal System

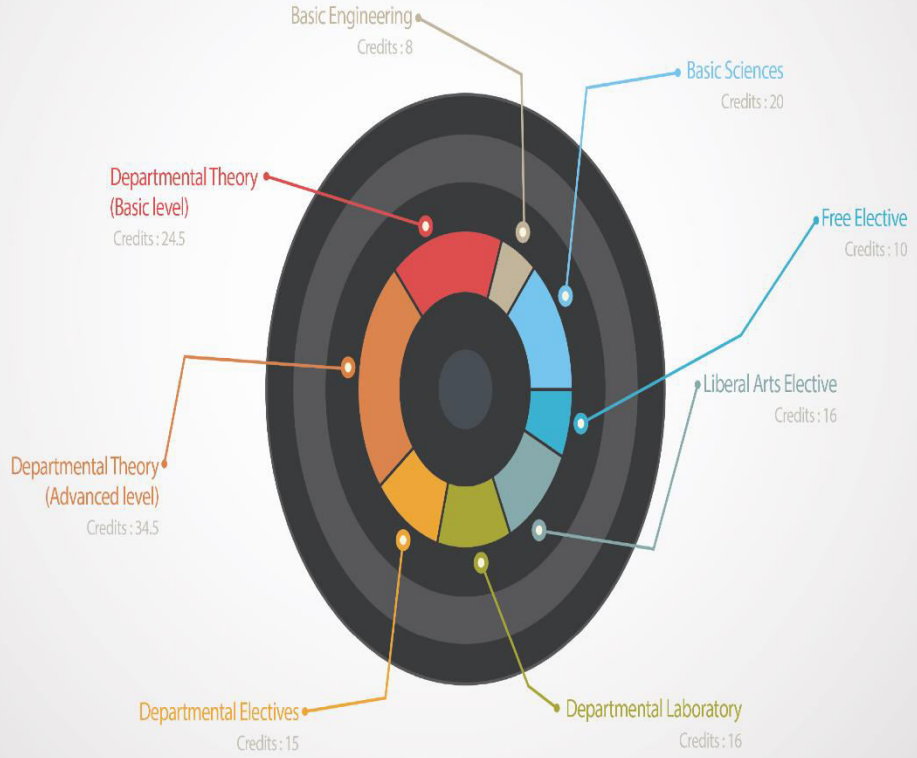
Difference between the Current System and Fractal System

Total Credits : 146



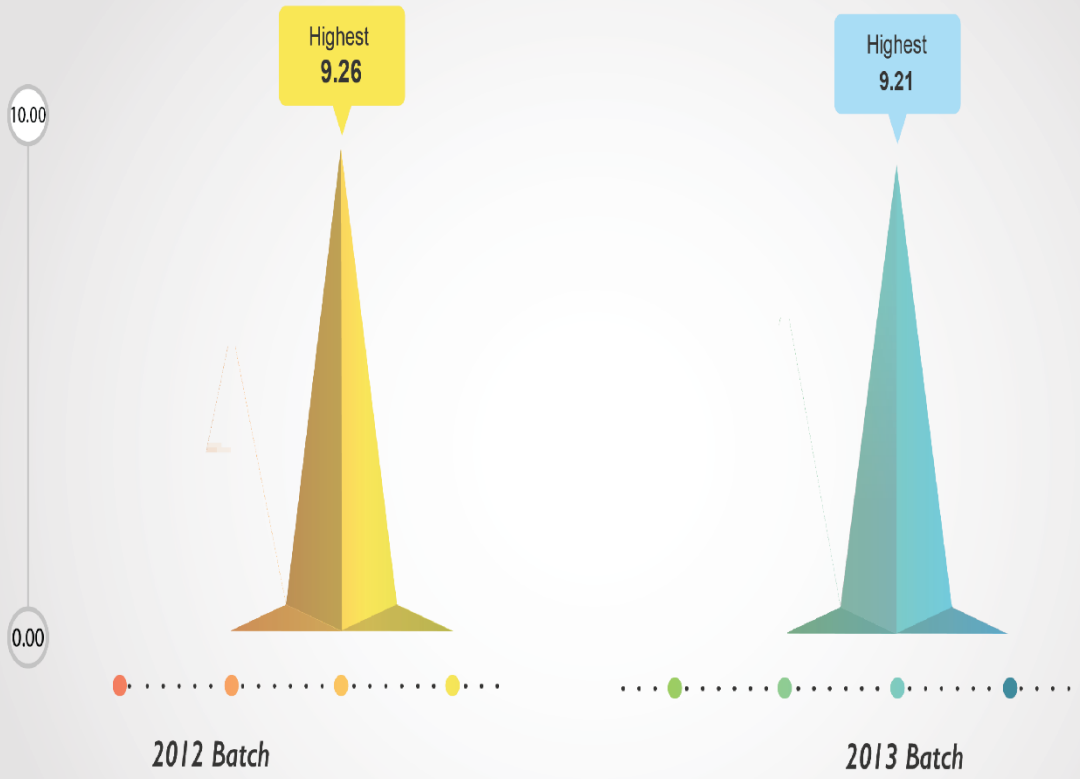
Non-Fractal System

Total Credits : 144

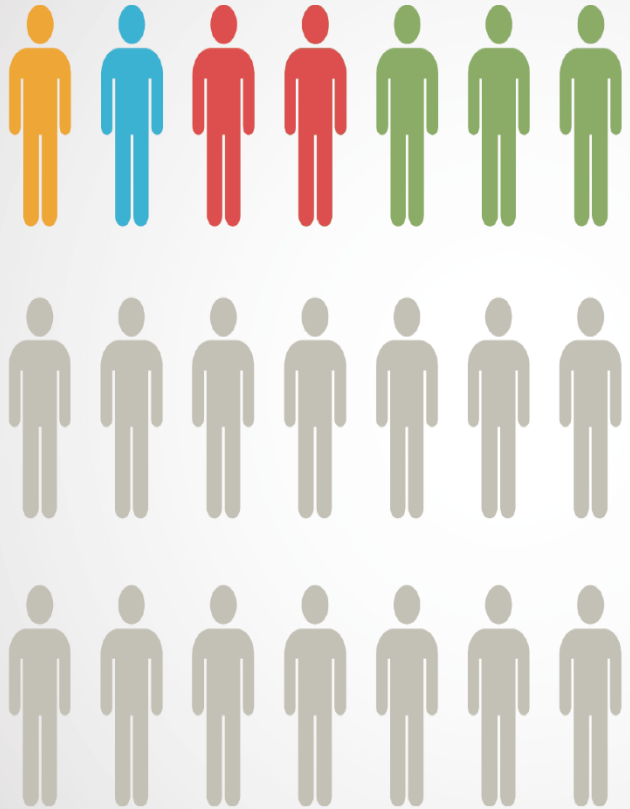


Fractal System

9. Student Statistics



Student CGPA Statistics.



Computer Science and Engg.
Mechanical Engg.
Electrical Engg.
Chemical Engg.
Maths Dept.

Students core branch selection statistics.

10. Honors and Minors

Minor/Honors are optional features of the BTech program aimed at providing credit based incentives and additional learning opportunities for academically motivatedstudents. In order to earn a minor/honor a student has to earn a minimum of 12 extracredits.

A student can enroll for Minor in fifth semester only; a student can enroll for Honors in fifth or sixth semester (depending on the policy of the department). She/he can also enroll for both Minor & Honors or for two Minors. There is CGPA criterion to enroll for Minor/Honors. However, a student must have cleared all outstanding backlogs by thetime of enrolment into Minor/Honors. The final transcript will only show the basicCGPA corresponding to the minimum requirement for the degree. The Minors/Honorswill be indicated by a separate CGPA. The additional courses taken will also findseparate mention in the transcript.

Honors will be reflected in the degree certificate as "BTech (honors) in XYZ Engineering". Similarly, Minor as "BTech in XYZ Engineering with Minor in ABC". If a student has done both honors & minor, it will be acknowledged as "BTech (honours) in XYZ Engineering with Minor in ABC". Two minors will be reflected as ""BTech in XYZ Engineering with Minor in ABC and Minor in DEF".

Minor courses

Computer Science & Engineering

No.	Title	Credits
CS3019	Data Structures and Algorithms	3
CS3029	Design and Analysis of Algorithms	3
CS4xx9	Elective	3
CS4xx9	Elective	3

Physics *

No.	Title	Credits
PH3102	Quantum Physics	3
PH3202	Solid State Physics	3
PH4102	Elective-I	3
PH4202	Elective –II	3

Electrical Engineering

No.	Title	Credits
EE6310	Image and video prccessing	3
EE2040	Electromagnetic Energy Conversion	3
VLSI Technology	Elective	3

Liberal Arts (Economics)

No.	Title	Credits
LA5010	Macroeconomics	3
LA5020	Industrial Organization	3
LA5030	Basic Econometrics and Forecasting	3
LA5040	International Finance	3

Entrepreneurship		
No.	Title	Credits
VI	Innovations, IP & Patenting	1
VII	Business Plan Development (Project)	3
VIII	HR and Leadership	1
	Accounting and Auditing	1
	Risk Management	1

No.	Title	Credits
V	Introduction to Finance and Economy	1
	Introduction to Sales &Marketing	1
	Introduction to Entrepreneurship	1
VI	Strategic Innovative Entrepreneurship	1
	Introduction to Business plan	1

* Electives available:
(1) Fundamentals of MEMS fabrication
(2) Physics & Technology of Thin Films
(3) Physics & Applications of Advanced Functional Materials
(4) Biological Physics
(5) Semiconductor Physics & Devices

11. Advanced Level Fractional Credit Courses

In addition to the courses offered by various departments, IITH also offers Advanced level fractional credit courses covering a wider spectrum of subjects. These courses have significant contribution from the external scientific & industrial community and are open to students of all programs.

Note: Fractional credit courses are subject to availability of the instructors and may change every year.

12. Course Descriptions

ID1010 Concepts of Engineering

This course is fundamentally a motivational course for first-year undergraduates. It is meant to offer a broad view, in the context of real-world engineering problems, of the subjects they would cover in the later years of their program. It would take up everyday applications and show how the various academic subjects lead back to the application. The aim is to inspire and edify, not to overwhelm with technical detail. Hence, more time will be spent on elucidating and exploring the implications and scope of fundamental concepts, rather than in establishing their validity, or in analysis
Two examples will be taken up: (a) A mobile phone (b) An Aircraft

ID1021 Engineering Practice

Workshop:Introduction to wood work: hand tools & various operations. Introduction to pattern making: types of patterns, allowances etc. Introduction to bench work &fitting: tools & operations.

Engineering Drawing:
Introduction of drawing instruments.lettering, line and dimensioning. Construction of simple geometrical figures. Simple orthographic projections, first and third angle. Missing views and lines. Isometric views. Projection ofpoints and lines. Projection of planes and solids.Section of solids. Orthographic projections of simple machine elements.Using half.full sections. Most drawing exercises will be by free-hand in this course.

ID1035 Independent Project

'This course is envisioned to familiarize students with basic project work. The theme may be from a selection of broad engineering topics.

ID1061 Introduction to Computer Programming

Problem solving and algorithms. Introduction to C language covering input and output operations, decision control structure, loop control structure, functions & pointers, arrays, strings, structures and unions, file operations.
Introduction to data structures.

ID1071 Mechanical Engineering Practice

Workshop: Introduction to safety measures, introduction to the principles of working,construction, operation, types of cutting tools, selection of cutting speeds and feedsetc. regarding basic machine tools e.g. lathe, shaping, slotting, milling and grindingmachines, etc. Introduction to gas and arc welding processes, soldering and brazing. Exercise; Simple jobs on centre lathe and shaping machines and welding. Demonstrations; Slotting, milling and grinding machines.

ID2030 Fluid Mechanics & Rate processes

Fluid Mechanics: Introduction of fluids, Fluid statics: pressure as a scalar, monometry,forces on submerged surfaces. Description of flows: field approach, Euler acceleration formula, streamlines, streak lines, path lines.

Reynolds transport theorem:
Conservation of mass, stream function, linear momentum equation, Navier-Stokes'(NS) equation: elementary derivation, application, Poiseuille flow, Couette flow, Energy equation-Bernoulli equation, applications including flow measurement (Pitot tube,Orifice meters), pipe flows and losses in fittings.

.

Similitude and modeling:
using non-dimensionalization of NS equations and boundary conditions, simplifications for cases without free surfaces and without cavitation. High Reynolds number flow: Prandtl's approximation, basic inviscid flow, need for boundary layer, Magnus effect, boundary layers-elementary results for flat plates, separation, flow past immersed bodies (bluff, streamlined).

Heat transfer:
Introduction, rate law and conservation law, conduction equation; nondimensionalization, various approximations, steady state conduction-concept of resistances in series and of critical thickness of insulation, unsteady conduction; significance of Biot and Fourier numbers, Heissler charts; low Bi case; penetration depth, essential nature of convection: transpiration cooling; writing energy equation without dissipation and pressure terms; non-dimensionalisation, Nusselt number and correlations.

Mass transfer: Simple ideas of mass transfer; definitions, similarity with heat transfer, Use of steady 'conduction', concept to solve simple steady cases in dilute solutions as well as in stationary solids.

13. Photo Gallery

14. Universities Abroad

Major Universities abroad offering Engineering Science program.

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

INDIAN INSTITUTE OF TECHNOLOGY HYDERABAD

Ordnance Factory Estate, Yeddumailaram – 502 205, Telangana, India
Tele: +91-40-23010000 Fax: +91-40-2301 6032
Email: hod_es@iith.ac.in