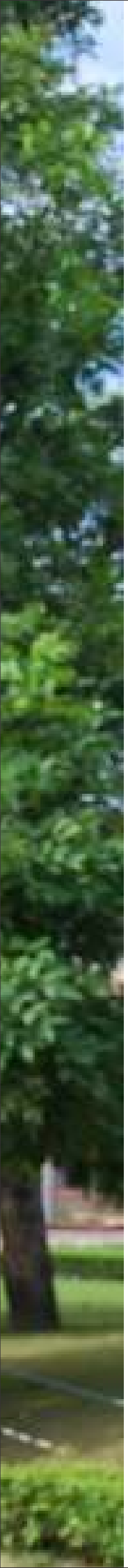
Jan 2012

Report for Academic Review

Design Programme
Indian Institute of Technology, Kanpur

Design Programme
Indian Institute of Technology
Kanpur


DESIGN PROGRAMME
IIT KANPUR



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overview

The design-phase of a product is like a womb of a mother where the most important attributes of a life are concieved. The designer is required to consider all stages of a product-life like manufacturing, marketing, maintenance, and the disposal after completion of product life-cycle. The design-phase, which is based on creativity, is often exciting and satisfying. But the designer has to work hard worrying about a large number of parameters of man.

In Indian context, the design of products is still at an embryonic stage. The design-phase of a product is often neglected in lieu of manufacturing. A rapid growth of design activities in India is a must to bring the edge difference in the world of mass manufacturing and mass accessibility. The start of Design Programme at IIT Kanpur in the year 2001, is a step in this direction.

The Design Program at IIT-Kanpur was established with the objective of advancing our intellectual and scientific understanding of the theory and practice of design, along with the system of design process management and product semantics.

The programme, since its inception in 2002, aimed at training post-graduate students in the technical, aesthetic and ergonomic practices of the field and to help them to comprehend the broader cultural issues associated with contemporary design.

True to its interdisciplinary approach, the faculty members are from varied fields of engineering like mechanical, computer science, bio sciences, electrical and chemical engineering and humanities. Currently there are 16 faculty members associated with Design Programme.

The students for Design Programme are a chosen mix of designers, engineers and architects. Currently there are 26 Master's students and 3 Research Associates.

The Design programme of IITK is unique in offering its students an opportunity to get soaked in all the elements and principles of design . They are introduced to the core aspects of User interface design, Visual Design and Product design through class room sessions and workshops . This has been helping the students to explore themselves and pursue their calling.

Now, with globalization and the resultant economic and strategic affiliations have influenced India in many ways. Design Programme students are able to interact and work with students across the globe through Design Students get involved in industry sponsored projects in collaboration with Design Factory, Aalto Univerity,Helsinki, Finland, DAAD exchange programme and internship in various institutes like ENSAM, France; MIT, USA and NUT, Singapore etc.

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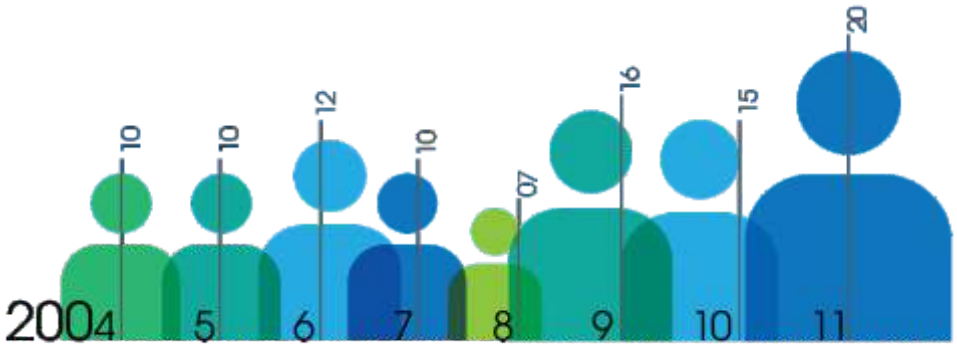
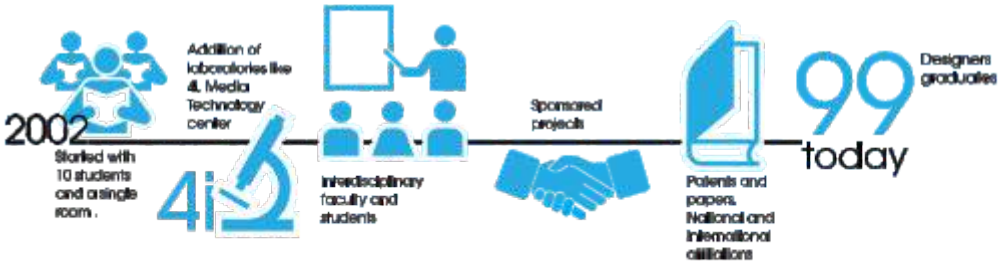


No. of students graduated over the last 8 years



Graduation Statistics

Placements

The all round emphasis on every aspect of design have paved the way for students of the Design programme to step into all the renowned design houses in India like Onio Design, Videocon, Elephant Design, Tata Elxsi, Honeywell, to name a few. Students who are interested in User interface Design are currently working in major players like Microsoft, Yahoo etc. Many students have pursued further research in sustainability design and visual design. A few of them have started enterprises. One such venture is being incubated in SIDBI incubation center at IITK.

M.Des students' placement

Interaction Design and User Experience Design	Product Design	Visual Communication	Automobile	Startups
•Cognizant	•Videocon	•E-mantras	•Eischer	•Hexolabs- media and technology
•Nokia	•Haier India	•Dentsu	•Ashok Leyland	•Red Studio
•Oracle	•Forbes Marchall	•Tata Elxsi	•JCB	•D Cube
•Yahoo	•Elephant Design	•Pencil Sauce	•Tata motors	•Indesign
•Infosys (CDG)	•Godrej		•Forbes motors	•Thinking Threads Pvt. Ltd.
•Honeywell	•Tata Elxsi		•DC Studio	
•Hewlett Packard	•Ingersoll Rand		•Bajaj	
•Cordys	•ITC		•Hero Honda	
•Tata Consultancy Services	•LG		•TVS	
•RIM (Research in Motion)				
•Loud Cloud				
•Ibibo interactives				

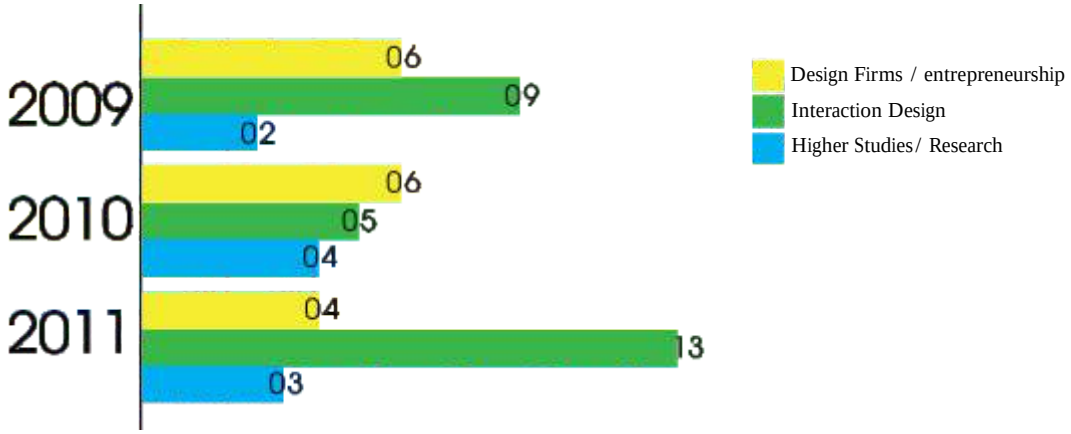
M.Des students' internships

MNCs	Design Studios	Institutes
Cognizant	Onio Design	IDC
Oracle	Elephant Design	NID
Yahoo	Tata Elexsi	Stanford, D School
Infosys (CDG)	DC Studio	MIT, US
Honeywell	Design Directions	KTH, Sweden
HP	Desmania	Aalto, Finland
Videocon	Hexolabs	
Haier India	Thinking Threads	
Forbes Marchall		
E-mantras		
Dentsu		
Tata motors		
JCBL		

Further Studies (PhD and Graduate Programs)

Institutes:

MIT
Georgia Tech
Savannah Collage of Art
Aalto University, Finland
University of Illinois



Placement of Students

Design is in everything we make, but it's also between those things. It's a mix of craft, science, storytelling, propaganda, and philosophy.

— Erik Adigard

Students who explore an issue and find solutions for the observed problem with the user and production aspects in mind.

Research

In Design Programme, research has been two fold. One driven by professors based on their area of specialization, trying to integrate their findings into solutions that take a product or visual form. Manufacturing and material research, Smart systems research, Bio materials and Bio-mimetic have been some of the research areas of the faculty. A major area has been to explore innovative product design suiting Indian needs.

The second means of research has been that of students who explore an issue and find solutions for the observed problem with the user and production aspects in mind. Contemporary problems of India like socio-economic problems, ecofriendly transport system, mobility for the physically handicapped, design interventions in the form or toys for mentally challenged children are some of them. In addition, there have been extensive research done by students in sustainability issues and applications on internet for education. All these have been done as a part of the M.Des Thesis. Research emphasis is mostly on user research and solution conceptualization.

Many of the concepts get transformed as products , such as soft products or lab fabricated ones like a energy efficient mobile charger, a helmet that maintains optimum temperature for the motor cycle driver at all climates or a seed de-husker.

Students as a part of research are encouraged to do lot of user testing and field surveys. Lot of design solution formulation techniques is practiced as a part of searching for the best fit solution. Many of the research that has been done had been India centric. More importance is given to cognition, ergonomics , culture and sustainability.

Future Research Plans

The research activity in Design Programme for the next 5 years will focus on the below:

Transportation and Product Design

Satellite and Spacecraft Design

Innovation Management & New Product Design

Media and Interaction Design

(a) Transportation and Product Design – Numerous research activities are going on in the Design Programme related to Transportation and Product Design. These are related to a long range of design parameters starting from product stylization, functional design and safety system design. In collaboration with the GM, India Science laboratory, Design Programme has developed regular workshops on Advanced Automobile Design. A research project on automobile accessory design has been successfully completed in this direction. Students are involved with Maruti for developing a new generation of advanced automobiles. A group of students is associated with the design of Intermediate Public Transports (IPTs) for the Kanpur City. Student and Faculty members of Design Programme are working on the development of Green Vehicles based on Hybrid Power supply. They have also developed a mobility solution in the form of stair climbing vehicle. The product has been patented and the design incubation is going on the product. Design Programme Students are also involved with the Boeing project related to the form design of unmanned vehicles.

(b) Satellite and Spacecraft Design –Research on design of satellites, lunar rover and satellite antenna morphing systems have been initiated at the institute. Such projects are generally sponsored through the Space Technology Cell and ISRO. A few projects are directly undertaken from the Satellite Applications Centre, ISRO. Students of Design Programme are currently involved in the design of inflatable space antenna design and shape control of flexible parabolic antenna system projects.

(c) Innovation Management & New Product Design – A Generic academic program on Product Design and Design management has already been initiated at the Design Programme in collaboration with the Design Institute of Finland. Design Factory, Finland and our students are actively participating in different global projects of Nokia.

(d) Media and Interaction Design - These are design projects related to the fields of user experience (UX) and interaction design (UI), game design, edutainment products etc. Some of the key partners here are Nokia Research Center, Design Factory, Finland, INFOSYS, Oracle India Development Centre, Funschool, Panasonic Research Center etc.

Stair Climbing Wheel Chair

Seminars

The “Bucky-talk series”, named after Buckminster Fuller, inspired by his quote, “All things regardless of their dissimilarity can somehow be linked together either in a physical, psychological or symbolic way” which portrays the program’s true interdisciplinary spirit has been instituted in 2011. This enables students to meet and exchange their thoughts with academicians and design practitioners.

Another notable event is the Gurukul based week long workshop, that has already been held twice under the patronage of Design Programme jointly with HSS brings designers, students and academicians from India as well as abroad. There were students and academicians from Design factory, Aalto University, Finland, KTH Royal Institute of Technology Stockholm, Sweden. Design practitioners from Microsoft, Yahoo etc were part of the workshop .

All these efforts have been fruitful in driving students, faculty and the programme towards a path of growth and learning. A sizeable number of students have worked hard to find solutions for contemporary problems for our nation:

An eco-efficient three wheeler, a stair climbing wheel chair and toys for mentally challenged children are to name a few. These efforts have resulted in patents and presentations in national and International seminars.

Workshops

Academic study at Design Programme is not only pursued through course work; but it is also imbibed through various workshops, conducted by designers from industry and other visiting faculty to nurture the M.Des students. Being a highly inter-disciplinary course, these workshops are mostly conducted by other faculty from other departments within the institute like Industrial and Management Engineering, Computer Science and Engineering etc. Visiting faculty from IISc, IIT Guwahati, NID and Aalto Design Factory, Helsinki have also conducted workshops on topics like defining the design problem, ergonomics, visual design, product development in a day, etc.

This helped students to explore the world of design in various fields. These workshops help students to understand numerous design processes and its execution within a time frame.

Bucky Talk Seminars

Speaker	Topic	Date
Dr. Kaushal Kishore Mani Pandey, National University of Singapore	Magnetic Hard Disk Drive, Past, Present & Future	August 3, 2011
Dr. A.K.Bagchi Director, Resistoflex	Design of Vibration management systems	August 10, 2011
Dr Amaresh Chakrabarti Head, CPDM IISc	Sustainability Design- An IISc Perspective	September 1st, 2011
Dr. Amit Ray Shantiniketan	Minimalism in Design	October 22, 2011

Workshops are broadly divided into three categories: Product Design, Visual Design and Interaction Design

Workshops at Design Programme

Workshops conducted by experts from the industry, academia and other disciplines from within the institute to nurture the budding students. These workshops help students to understand various design processes and their execution within a time frame.
Workshops are broadly divided into three categories: Product Design, Visual Design and Interaction Design. Besides the regular workshops, USID (Universal, Sustainable, Innovative Design for social change) GURUKUL workshop is also organized in partnership with IIT Kanpur.

Product Design Workshop:

Workshops are conducted to identify various elusive problems and to generate appropriate need statements. These workshops help in developing skills in student to effectively and strategically use different design processes and methods to become creative problem solvers. Besides learning to visualize a given problem in its context, the students learn mechanical and ergonomic functions of a product also.

Visual Design Workshop:

Workshops are conducted to understand various features and principles of visual elements. To understand the importance of a critical study of elements such as form, shape and the spatial relationship between motifs, colours, patterns and abstraction in order to direct the human eye has been the attempt of most such workshops. Different grids, compositions, viewpoints, point of reference and framing are taught to understand the visual language which is later applied in instruction manuals, advertising campaigns and GUI.

Interaction Design Workshop:

Workshops are conducted to understand human interaction with different objects, its improvisation with new emerging technologies and medias. In the workshops, students are taught designing of various mobile applications and interactive interfaces for software applications and products.

USID GURUKUL 2010 & 2011:

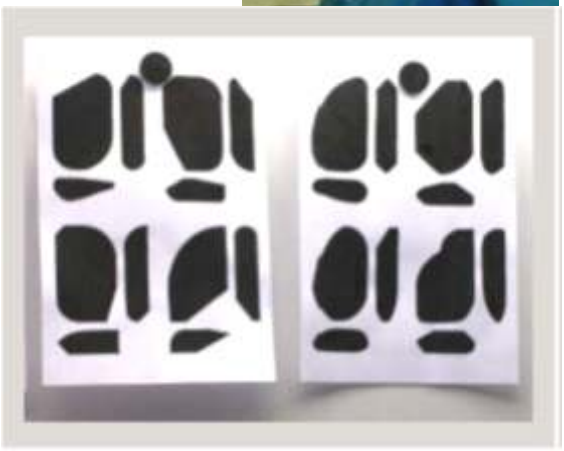
USID Gurukul is being organised in partnership with Design Programme, IIT Kanpur. USID Gurukul is an inspiration taken from "Gurukul", a school concept from the ancient times in India. USID Gurukul brings together Shishyas selected from India as well as other countries representing the students and professionals from the disciplines of Design, Technology, Management and Social Sciences. These Shishyas attend Gurukul to learn under the mentorship of eminent academicians & researchers and experienced practitioners representing 15 + institutions including NID -Gandhinagar, NID-Bangalore, IIT-Kanpur, IIT-Guwahati, IIM-Bangalore, Sristhi School of Arts and Design Bangalore, Symbiosis Institute of Design, DA-IICT-Gandhinagar, Delhi School of Economics, Delhi University, IM&T Gurgaon, Amity University etc.

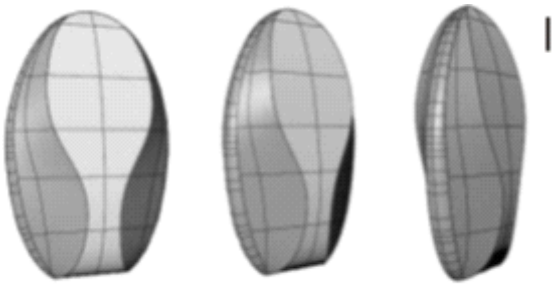
“Workshops are conducted to identify various elusive problems and to generate its need statements.”

Representative List of Workshops conducted in Design Programme

Sl No	Title	Workshop Detail	Conducted By	Year
1.	Design Project	Design Approach, Identifying the Need and design problem solving	Bernard Roth, Stanford	2005
2.	Form Development	Exercise In Form Development and visualisation	Alexander Bosnjak, IIT Guwahati	2005
3.	Ergonomics/ Human Factors : Human Aspect Of Technology	Ergonomic study for Product design	Debkumar Chakrabarti, IIT Guwahati	2005
4.	Form Follows Function	Exercise In integrating Form Development with its Function	Yogesh Maralkar, Elephant Design Kunal Ghate, Forbes Marshall	2009
5.	Product development	Problem Identification, Need statement, Collecting design relevant Information, product research, product development	Prantik Banerjee	2009
6.	Interface Designing	UX Design Process	Sharbari, Yahoo	2009
7.	Application Development	UX Design Process, Interface Development,	Oracle	2009
8.	User Centred Design Process	Design Process	Prashant Kumar	2009 & 2010
9.	PD6 workshop: (product design in 6 hours)	Integrated New Product for Home Care Brand	USID GURUKUL 2010- Sponsored by Hindustan Unilever Limited	2010
10.	Design Innovation	Evolution in Design Process	Mr. Narendra Kumar Ghate, Tata Elexsi	2010
11.	Design Ergonomics	Packaging Design With Human Factor	Debkumar Chakrabarti, IIT Guwahati	2010
12.	Elements Of Design	Visual Design Elements	Dr.Anil Kumar Sinha, NID Ahmedabad	2010
13.	Creative Engineering Design	Problem Identification, Need statement, Concept generation , Design Evaluation, Prototype	Prof. Amresh Chakrabarti , IISC Bangalore	2011
14.	Minimalism	Packaging Design With Human Factor	Amit Ray	2011
15.	User Experience Design	User Behaviour, Industrial Methodology, User Centric Design Process, Design Brief, Data Gathering and Research, Concept design, User Testing	Jhumkee Iyengar, Principal Consultant, User in Design	2011 & 2012

1. Form Development by Prof. Alexander Bosnjak, IIT Guwahati (2005)





Designers are responsible for giving form, function and meaning to a wide range of products that colour our everyday lives. They undertake research on the use of a product and assess the customer needs and marketing issues; they also understand materials properties and production methods. These skills enable them to create functional, appealing and competitive designs. Hence form development is one of the most important parts of the product design process. It involves not only aesthetic and cognitive abilities but also ergonomics and knowledge of fabrication methods to give the product a final form.

A workshop on form development, to provide opportunities for hands experience to M.Des students in form development, was conducted by Prof. Alexander Bosnjak. Alexander has received his Diploma in Product Design from Hochschule für Gestaltung, Germany. He has a teaching experience of 2 years at the National Institute of Design, Ahemdabad and is presently a part of faculty at IIT Guwahati. His areas of expertise include Elements of Form, Colour Form, Nature and Form, Craft Documentation, CAD Applications and Solid Work. He is also the founding member of product development group 'Multi Media Muell'.

The assignment for the workshop was 'Exercise in Form Development: Transistor Radio Casing'. The workshop was designed for M.Des students, to train their perceptual and aesthetic sensibilities. The final deliverables were 2D and 3D explorations, final model, and workshop documentation. The evaluation criteria were aesthetic sensibility and innovativeness of exploration, logic of concept development, precision and neatness in execution and articulation and presentation of ideas.

An introductory explanation was given over form development. Students were given the problem to design transistor radios, using the given internal components (circuit board, speaker, antenna, etc.), incorporating some given internal components (dimensional, technical, manufacturing) with a prototype outcome.
Students were asked to work individually on a 2D format composing forms in black and white on the given grids. Each piece of work was displayed and most appealing forms were selected based on various justifications. Brainstorming session was kept to understand the various distinct forms and their attributes that made them different. Alexander also explained the various attributes of visual balance, positive and negative spaces, unit, etc.

The 2D forms were further visualized as 3D. It was instructed to individually explore the forms with little variations using 3D modelling software.

Second round of brainstorming was conducted to understand the various different forms that were created. Detailed observation was done to understand the small change in the angle of fillets and chamfers, a nudge or a small attention to detail which had produced many variations in the forms. Few forms were chosen by popular vote for further development. At the end of day 1 a discussion on how to consider, analyze and use range of aesthetic considerations for meeting design requirements was discussed. Brief design requirements were listed down. These were:
1. Formal qualities (e.g. appearance, finish or surface decoration)
2. Aesthetic qualities (e.g. avant garde, postmodern or traditional)
3. Utilitarian properties (e.g. functional needs or practical intended use).

Beginning of 2nd day was with a display of different objects to know the "form of a particular product". Each student was asked to display their cell phones from different companies. A healthy conversation was made to identify the unique identity of each phone and companies. It was also explored that how mobile phones from the same company have similarities with other phones from the same product line. Product identity on the basis of product graphics, forms, user interface, and user experience were discussed.
The forms relate the attributes that the customers would understand and relate them to the design of the product. The development of a product's visuo-spatial and material appearance is controlled by the understanding that, in the relation between (a) the function of a product, (b) the form of a product and (c) the meaning of the product. It was observed that these elements are reflected in the salient features of the product's appearance, defining the product's typicality regarding function, form and use.

Small groups of 4 were formed based on similar focus. The entire process was again repeated broadly to be much more focused on the functionality of the product. Individual groups chose one derivative; these derivatives were discussed among group members and with Alexander. The key points were further discussed with other group members. Close discussions were held by Alexander with each of the group members how fillets and chamfers could be utilized as operations to generate form. Each group was asked to develop the derivatives of the particular form chosen. At the end of the day all the forms were placed together and we studied the developments.
For representing their designs, students were asked to either explore the possibilities of rapid prototyping and/or vacuum forming. Among the derivatives developed, each group were asked to finally choose one form after a focused brainstorming session among the group members. Then they were asked to start 3D modelling in computers to fit the circuit provided with the transistor kit. Simultaneously, the groups were also asked to created final models with MDF board. Product graphics were designed which would appear on the surface of the form. Students were told to consider and apply appropriate materials for their final forms related to:
1. Design context
2. Functional requirements of the design.
Alexander guided student to select and use specific structural, visual and tactile qualities of materials to meet design intentions. These include:
a. Structural qualities (e.g. strength, weight, flexibility, durability or malleability)
b. Visual qualities (e.g. colour, surface, texture, opacity, transparency or pattern)
c. Tactile qualities (e.g. texture, smooth, warm, cold, comfortable, hard, soft, soothing or exciting).

A workshop on form development, to provide opportunities for hands experience to M.Des students in form development, was conducted by Prof. Alexander Bosnjak.

The models were made in MDF and were polished with fine sand paper to give an exquisite surface finish which would help to give a smooth surface on the vacuum formed model. Groups produced two sets of the vacuum formed models with polystyrene sheet. As final finish the formed parts were spray painted and internal components were mounted inside the casing. Alexander pointed out the links and interactions between the Different processes involved in form development. He also gave few tips on product photography and project documentation. The workshop covered the crucial relationships between aesthetics/form and function and the technology of production. Though the workshop was intensely structured, it weaved relevant issues in and out.

2. Design Ergonomics by Prof. Debkumar Chakrabarti, IIT Guwahati (2010)

A workshop on Ergonomics by Prof. Debkumar Chakrabarti intended to educate M.Des students to understand human interaction with product, value of ergonomics in design, its benefit and implication in design.

Ergonomics scopes the bridge between design parameters and human compatibility factors. Usage of ergonomics in design provides a sound quantitative basis of human aspects of problems and possibilities of usability testing, human product usage and the future of product design and development.

Technological advancement has led us to the use of many things that do not go along with human capabilities. Quite often we experience human errors while using many man-made items that are basically intended to help man for better performance. It tires, provides discomfort, and in the long run threatens our well being. For example, people do not use safety facemasks and helmets; they say these do not fit properly and are uncomfortable.

A workshop on Ergonomics by Prof. Debkumar Chakrabarti intended to educate M.Des students to understand human interaction with product, value of ergonomics in design, its benefit and implication in design. Dr. Debkumar Chakrabarti is currently Professor in Department of Design at IIT Guwahati and looking after Design Ergonomics activities. He has 30 years experience since 1981 with various capacities covering various aspects of Ergonomics / Human Factors and Design at various levels.

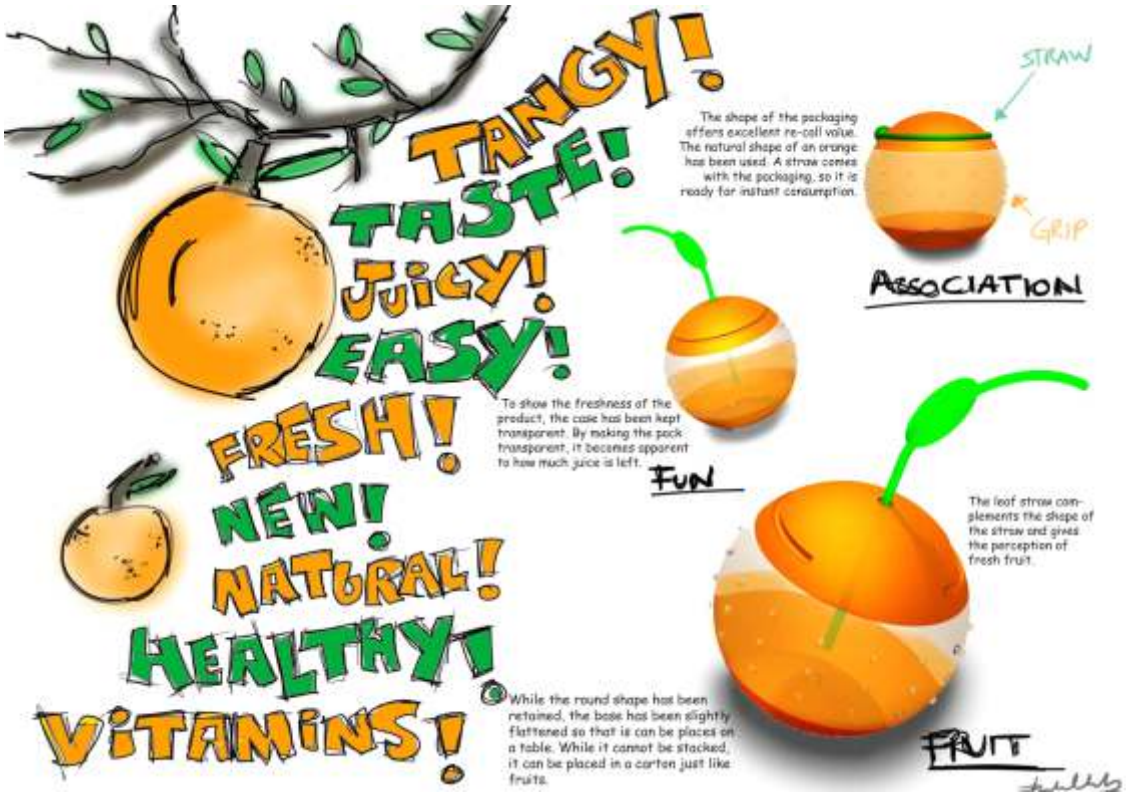
The assignment for the workshop was 'To design a fruit juice packaging considering human factors'. The workshop was designed for M.Des students, to make them understand the importance of human factors in design with aesthetic sensibility. Human factors in fruit packaging like form, texture, holding aspect, drinking aspect and visual perception was covered. The final deliverables were 3D explorations, final model, and workshop documentation. The evaluation criteria were logic of concept development and resemblance of fruit packaging.

An introductory presentation about importance of ergonomics in design was given. Initially each student was asked to choose a fruit of their choice. Then they were asked to understand the various packaging available in market and problem related to it.

Each student was asked to explore the natural form of their chosen fruit. All the shapes and the unique features of the fruits were discussed which included the layers of fruit, texture and colour. After understanding the nature of fruits, students were asked to explore the form. These forms were generated based on:

1. Fruit shape
2. Stacking- ability
3. User friendly in terms of size, holding, opening.
4. Re-usability

Individual students' forms explorations were discussed with other members and with Prof.Debkumar Chakrabarti. The key points were further discussed individually. How small fillets and chamfers could be utilized to form better grip and holding were discussed. Debkumar Chakrabarti even taught the pros and cons of various postures in which a particular fruit juice can be consumed. he also taught the visual perception in packaging design and how these small hints give direction to user to open the packet.



A few of the products developed during the workshop

3. Elements of Design by Prof. Anil Kumar Sinha, NID Ahmadabad (2010)

Dr. Anil Sinha is Graphic Principal Designer, Faculty of Communication Design at National Institute of Design Ahmedabad. He is also Activity Chairperson of IDS and IP&P at NID.

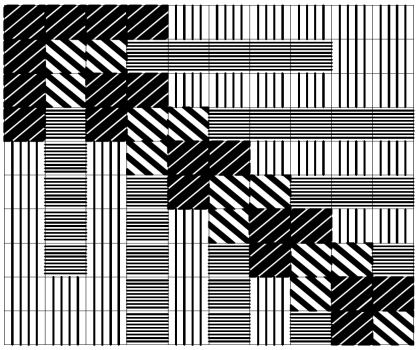
Dr. Anil Sinha is Graphic Principal Designer, Faculty of Communication Design at National Institute of Design Ahmedabad. He is also Activity Chairperson of IDS and IP&P at NID.
Workshop started with an introduction of visual elements with a small game. All the students were give an A4 paper and were asked to close their eyes. They were asked to follow the instructions. Prof. Sinha asked everyone to fold the paper to its half, then join the corners and cut out one semicircle. Then he asked to open the eyes and observe each other's paper. Surprisingly, all the students paper were having different pattern. The aim of this experiment was to make the students understand that the same concept can lead to various designs and also that the same elements placed in different position leads to different visual perception.

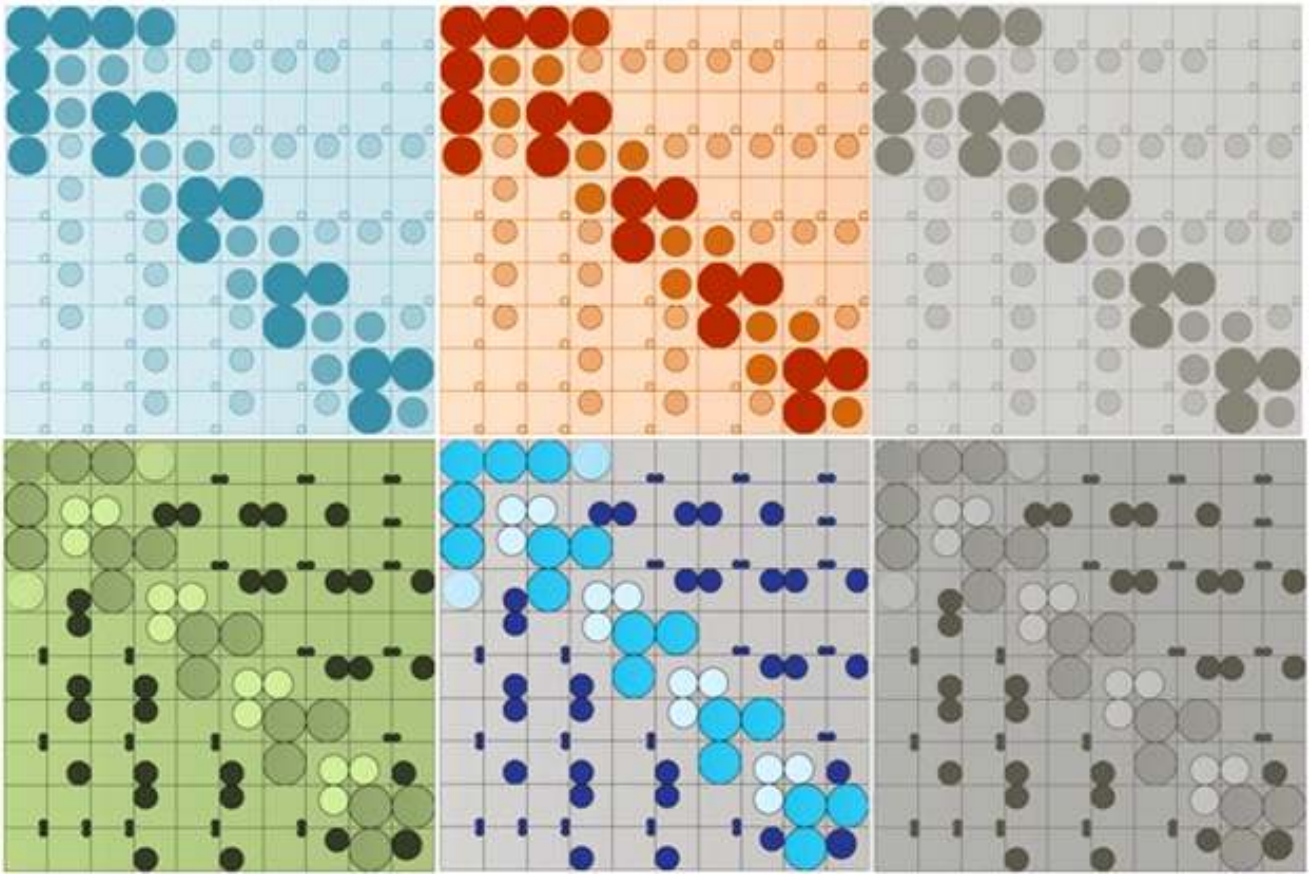
The workshop further continued into the understanding of Gestalt principles. The key principles of Gestalt were taught elaborately and how it is implied in visual design. Various examples of his own work were shown and how he has used these laws of closure, similarity, proximity, symmetry, continuity and common fate in his design was explained.
An overnight task was given for the further exploration of the gestalt principles. Students were asked to make 5 squares of size 50 X 50 cm and further subdivide them in either grid of 5 cm or 2.5 cm. Students were asked to use only black and white portion of newspaper with text. Students were suppose to cut out squares of 5cm or 2.5 cm out of newspaper and stuck them on grids in such a way that it would form a pattern which gives a unique direction to see the big square.

On the 2nd day all the 5 designs of each student were discussed and were reviewed individually by each student. This was very helpful to understand how different people think of the same pattern. It also helped to understand how promising were the designs created by student with respect to other students views. The most exciting design pattern of each student was selected for further development. Further Dr. Anil Sinha suggested replacing each text type with a different line thickness and pattern. Based on the new pattern the Gestalt principals were understood. It was easy to understand how negative and positive space together gives a direction to look at the square.

3rd task was to replace again the different line thickness small squares with circles. Then Dr. Anil Sinha asked to explore the position of circles in the small squares without changing the order of replacement.

4th task was to observe the various variations just by changing the colour. Both multi coloured and monochrome colour were asked to explore.
The entire workshop was self explanatory and well planned.





A few of the exercises during the workshop

Students working for PD 6

4. PD6 workshop: (Product Design in 6 hours) at USID Gurukul 2010, sponsored by Hindustan Unilever Limited

User Survey l Requirements l Concept generation l Prototype l Branding

Product Design workshop cum competition was conducted by HUL during USID GURUKUL 2010. The need statement was given by HUL for their various products related to home care. The workshop was for 6 hrs with intermediate deadlines. The workshop was mentored by faculty of Aalto Design Factory and Marketing Team from HUL.

The aim of the workshop was to understand the importance of user surveys, development of product and its marketing in a limited time frame for delivery.

5. Creative Engineering Design by Prof. Amresh Chakrabarti, IISC Bangalore (2010)

The goal of the 5 day workshop was to make the students aware of the life cycle of a product, what (engineering) design is, what the role of design is in the whole life cycle of a product and the various stages of design in detail. Simultaneously it aimed at giving students some basic creative skills besides exposing them to methods for problem solving.

Dr. Amresh Chakrabarti is currently a professor at Centre for Product Design and Manufacturing, IISc, Bangalore. His areas of interest are Functional Synthesis, Design Creativity, Design Methodology, Collaborative Design, Eco-design, Engineering Design, Design Synthesis, Requirements Management, Knowledge Management, Computer Aided Design, Design for Variety.

An introduction to various design methods was followed with the exploration of a need statement. The workshop started with having a discussion on what is design and what is the design process. Students were split into groups. The first task was to go to different locations observe things around there for 1 hour without interacting with the users. Every team had returned with good observations at two different locations.

Further the students were asked to highlight the key problem areas and verify them with users by a small questionnaire. The second task was to categorize the problems in two parts. Firstly with problems with obvious solution and secondly with non obvious solution problems. After segregation, the problems were clustered. There were presentation reviews at the end of each stage to get feedback. This was very helpful to understand mistakes and alternatives at each stage.

After identifying the problems the next task was to form problem statements by the method of abstraction. The statements had to be as broad as possible covering all the major problems. After having the neutral problem statement, the first brainstorming session was conducted on how those problems could be solved. A requirement document was made wherein the solutions had to be divided in demand (essential) and wishes (desire).

The next task was to brainstorm on each and every demand and come up with different solutions for the problems. A morphological chart was created to see which idea would solve the problem in a better manner. The morphological chart helped in making further concepts being combination of various ideas. A new method of ranking your concepts on basis of design parameters was taught.

Each group boiled down to 3 best concepts and further proceeded with making a small prototype of the final concept. At the end of the workshop every team had their presentations. The workshop was well planned and made students think from both creative and engineering point of view.

One of the projects

6. Workshop On User Experience Design by Jhumkee Iyengar,

User In Design (2011 & 2012)

The workshop was split in 3 parts having a month's gap in each phase. Workshop started with a broad introduction to user experience design.

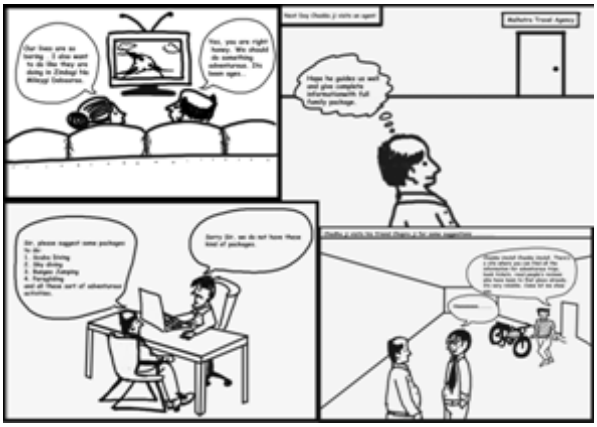
The workshop was conducted to provide opportunity for hands on experience to M.Des students in user experience design. It was conducted by Jhumkee Iyengar. Jhumkee holds a Masters in Human Factors Engineering Design from Tufts University, USA, a Masters in Industrial Design from Indian Institute of Technology, Bombay, India and a B.Tech in Mechanical Engg. from College of Engineering, Pune, India.

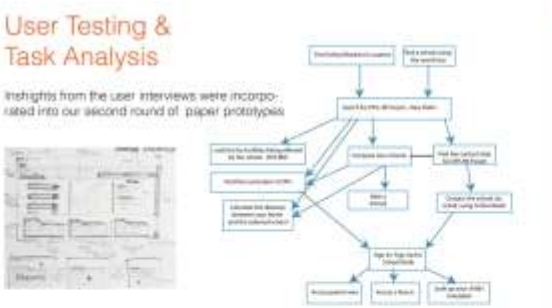
The workshop was split in 3 parts having a month's gap in each phase. It started with a broad introduction to user experience design. The terminologies of UX design were explained by practical exercises. We were given short class assignments at end of each topic to get a clear understanding of the theory taught in the module.

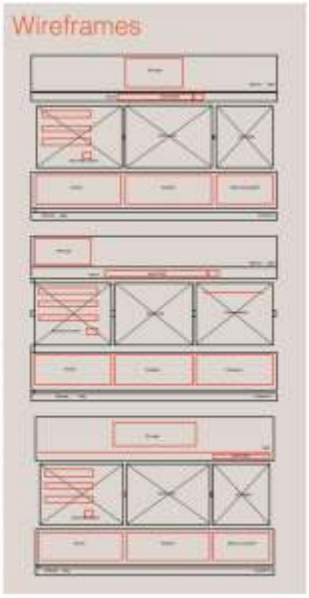
The first phase was getting theoretical knowledge about the subject with small exercises. At the end of the first phase we were supposed to think of our passions and then come with problems faced in real world. Some of the statements were shortlisted .We were split in groups of four. Each group was given a need statement. We had live clients for every project who went through the process of client interviewing which helped us in refining our need statement. A one month gap was given to us to take user surveys, Field study, and literature study, make personas and scenarios.

After a month, second phase started where we were supposed to present the work during the break. The second phase comprised of more of practical exercise and less of theoretical. The next step was to generate concepts based on our research. We had made paper prototypes to test on the users. Students went through the live process of user testing and got valuable feedbacks to improve their design. Designs were revised on basis of the user testing.

At the end we had presentations with other groups. Students were evaluated by their own batch mates to know how they should ahead towards the next phase.







Various projects explaining the UX Designing

Design Projects

Bernard Roth

At Stanford University, I am part of a group that uses project-based education in order to actively engage students in the process of learning and creating. The main strength of our program is the dedication of the entire community (students, faculty and staff) to the development of a culture that thrives on defining and solving meaningful design problems, and to producing real working solutions to real problems. The duration of the projects vary from a few hours to an entire academic year.

As part of their education students need experiences that enhance their self reliance and take them through a set of processes that make them autonomous, creative professionals.

Prof. Bernard Roth interacting with several project groups of M.Des students on a short design project

The basic methodology that we try to encourage in our students and colleagues can be summarized as: 1) Identify a need. 2) Commit YOURSELF to satisfying the need. 3) Be Stupid! 4) Express, Test, Cycle. 5) Question the process.

Students generally have the little previous experience with need identification. The basic ideas we advance here is to find a need (that can be either a problem or an opportunity) one is interested in working on, and then to learn everything possible about it. Most importantly, it is necessary to understand the context of the need, and what the problem or opportunity really is.

The second item in our methodology is in some ways the hardest to execute. It requires making a personal commitment to see the solution through to the end. What comes to mind here is to be honest about one's motivation, and to realize that some things are not worth doing. Self motivation is probably the single most important factor that differentiates between highly successful and less successful outcomes.

The third item (Be stupid!) is simply a reminder that in order to get information from other people it is not necessary to show them how smart you are. In fact, if you don't know about it, experts will gladly tell you what they know. If you already know it, why should they bother telling you anything?

The Express, Test, Cycle sequence represents a design process we call ETC. The basic idea is to solve problems by quickly generating ideas (Express), then building a quick and dirty (crap-up) prototype to test your ideas, and then repeating this process (Cycle) until time runs out. The basic concept here is to use enlightened trial and error.

It is expected, and entirely nor mal, for the designer to make mistakes early in the solution process, and to learn from the mistakes. This is the strength of the ETC way of approaching problems.

> We strongly urge our students to not to trust any one process, including the ones we teach them.

Finally, we strongly urge our students to not trust any one process, including the ones we teach them. Each person needs to evolve their own set of processes, and many problems require special approaches. The total list of known problem solving strategies is quite large. However, when it comes to good strategies there is no one right answer regardless of the fad of the day and the number of testimonials generated for that strategy.

In education it is impor tant to realize that students are people, and to be aware that how things are done can be as important as what is done. It is not simply a matter of passing knowledge to students. As part of their education students need experiences that enhance their self reliance and take them through a set of processes that make them autonomous, creative professionals. Well chosen and organized design projects can provide such experiences.

About the author:
Bernard Roth is a professor in the Faculty of Design Division, Dept. of Mechanical Engineering, Stanford University. He received his B.S. From City College of New York and M.S. and PhD from Columbia University. His research interests include Analytical Methods in Design, Technology and Society, Design and Creative Problem Solving. He is in wide demand as a lecturer and speaker throughout the world. He has served as an industrial consultant IBM, FMC, Hitachi and Toyota.

(A Guest Faculty to IIT Kanpur)

" Source: Directions / March 2005-07, IIT Kanpur "

Ergonomics / Human Factors : Human aspect of technology

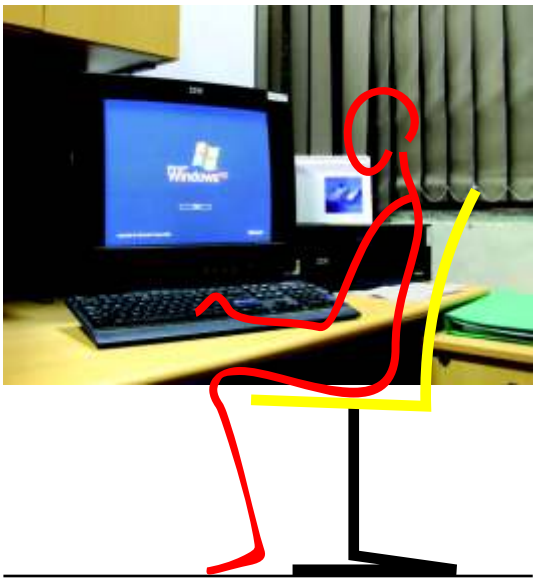
Debkumar Chakrabarti

Technological advancement has led us to the use of many things that do not go along with human capabilities. Quite often we experience human errors while using many man-made designed items that are basically intended to help man for better performance. It tires, provides uneasiness and discomfort, and in a long run threatens us for health (physical and mental) hazards, and might cause inattentive accidents also. As for example, people do not use safety facemasks and helmets; they say these do not fit with the body and are uncomfortable.

Ergonomics scopes the bridge between design parameters and human compatibility factors. Usage of ergonomics in design provides a sound quantitative basis of human aspects of problems and possibilities of usability testing, human product usage and the future of product design and development.

People fail to notice some important message, as the information system does not draw their attention properly and in time. Accidents took place because the operator can not easily switch off the machine in time, may be a case of specific component location problem. Psychological problems appear due to difficulty in understanding the proper use mode of the product, distraction due to lack of privacy in work place environment and mismatch of the work context to the behaviour of users

It is quite often seen that in certain workplaces people need to adopt either an awkward static posture for a long time or need to do lot of stretching and bending. People are not motivated enough to use or work in certain workplaces allotted to them where it does not give personalized satisfaction and/or the work component placement locations do not match with his body dimensions both in static and dynamic conditions. Very well decorated home kitchens also do not invite housewives. To work with the kitchen interior arrangements, she has to do a lot of stretching as well as bending exercises very often.



Designer is expected to consider human behavior , abilities, limitations (physical, physiological, behavioral) and other context specific characteristics.

Incorrectly designed-systems induce improper posture leading to operational uneasiness and musculoskeletal and some physiological disorders. It is obvious that work components must be placed within comfortable reach and should be kept within his functional workspace envelope limits.

Even after a whole night's sleep on an overly soft and inviting bed, instead of feeling afresh we feel body ache. It is said that to cope with modern materialistic development our assorted sized body needs help from various body supportive and structural aids, but many a times these do not satisfy the purpose to meet our body need, they create unforeseen problems. Though chairs are good in appearance and have all the features to function as a chair, we do not feel comfort while sitting and working, rather it tires. Posture should allow spine to follow its natural curvature that quite often gets disturbed by lousy backrests.

Why does it happen? Many more, almost everywhere these types of situations can be cited. People intentionally have not invited the above problems. Probably, man's natural limitations, aspirations and needs do not match with the system that he has developed and is using.

Application of best scientific principles and appropriate technologies may generate a design better to deliver function, still its users, (the prime system component), ultimately has to feel comfort while using it to qualify the same to be a good design.

What can be done? As an answer it can be said use human compatibility features concerning

1. Physical structure / dimensions

2. Behavior- personal / group, and

3. Physiological endurance / safe limits.

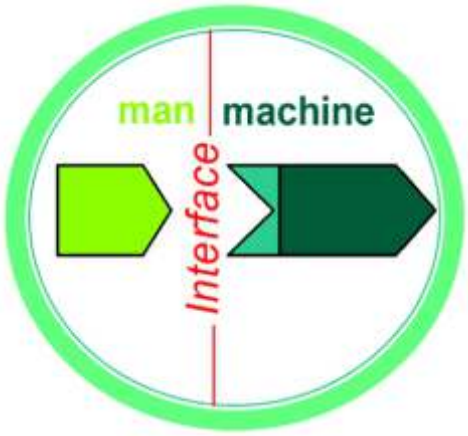
Man develops many things to meet his requirements and make his life easy, modify mistakes, and make necessary changes that suit him - a human nature. Attempts for continuous design development are a result of a combination of need and aspiration.

Design of a product or a system must yield maximum comfort, efficiency, and safety to its users. Design is basically a creative endeavour with a history of art origin. The variety and complexity of design issues today, both in industrial design as well as in communication design, emphasize on more advanced ecological balance between human beings (the ultimate user) and their socio-cultural and natural environment.

Usage of ergonomics in design provides a sound quantitative basis of human aspects of problems.

Boundaries between disciplines are becoming more fluid. To look into these issues and to find out relevant solutions a specialized area has come in front with organized multidisciplinary inputs named as 'Ergonomics' also known as 'Human Factors'.

It is the science, arts and technology of man at work for better performance. Ergonomics has scientific and technology pride comprising both physical and social sciences.



Man-machine-environment interface: to be studied to extablish compatibility between man and machine / usable commodities

Ergonomics thus scopes the bridge between design parameters and human compatibility factors. Usage of ergonomics in design provides a sound quantitative basis of human aspects of problems and possibilities of usability testing, human product usage and the future of product design and development.

Ergonomics deals with

- Science & Arts of Man: Fundamentals & aesthetics studying human behavior, abilities, limitations and other context specific characteristics.
- Technology for human use: Practical applications aspects with discovery of appropriate applications of the same information (after proper analysis of context) to the design of tools, machines, systems, tasks, jobs and environment; and Methodology to evaluate the benefits thereby.

This discipline has a Military origin way back to World War II and has Art & Design movement and management influence from time to time.

Four domains of Ergonomics

1. Hardware Ergonomics:

the Human machine interface. It deals with:

- Control design and location parameters and functional aspects for communication and easy operation
- Visual displays, codes, scales and markings Anatomical and anthropometric (static & dynamic) match establishment
- Working posture, body supportive devices match along with context fit and workstation
- Range of body movement characteristics and thus limitations of man.

2. Environmental Ergonomics:

Human environment interface concerning human capabilities and limitations with respect to the demands imposed by various environmental modalities and relevant

A common concern, inadequate space to operate floppy disc

applications.

Physiological and performance effect in occupational settings pertaining to:

- Ventilation and pollutants
- Heat stress and Humidity
- Illumination, glare etc.
- Psychophysical quantification of sound level
- Vibration full or partial, self and/ or work items

Work place and work components/ items locations, effects of working in various environmental conditions and shift work concerns this aspect.

Need for hand gloves (personal protective/safety device)

3. Cognitive Ergonomics:

- Human perception and information processing to reduce error, and system mismatch to increase usability, functional reliability and safety (stereotype behaviour)
- Cognitive task analysis, qualitative and quantitative perspective to human system reliability analysis
- Users' behavioral demands in designing consumer products
- Stimuli and effect reaction
- Influence of cognitive demands on performance
- User-centered interface- computer simulation
- Effect of psychological stressors on human performance; etc.

Imbalance between task demand and work posture adaptation & body supportive devices often leads to occupational stress

4. Macro ergonomics:

It is Human Organization. Interface technology, and covers application of ergonomics principles in organized sectors for better productivity and safe operation, and office and corporate ergonomics & its cost effectiveness. It deals with specific aspects of:

- Workstation design
- Work process design
- Work organization
- Shift work
- Manual lifting methods
- Job design and work methods Management of occupation related stress, safety and health hazards
- Multiple workplaces and workspace
- Machine and tool design for multiple function
- Design of public places
- Envelope of postural orientations
- Biomechanical efficiency assumptions.
- Risk and system safety;

Office and interior design, and formal to informal approach of design; etc.

Human compatibility factors

Body size and ability

- The geometry of a product/ workspace and user's body dimensions (Assorted human body shape, size, anatomy, biomechanics and movement, and growth pattern) while operating must fit each other to ensure safety as well as better functioning.

Physiological threshold/ tolerance limit, i.e.

- Cardio-respiratory system and its impacts on work performance, energy requirement, musculoskeletal system, posture effects and manual material handling
- Sensory aspects, stimuli-effect relation and fatigue, comfort and physiological stress factors. etc.
- Poor posture and movement can lead to local mechanical stress on the muscles and joints, resulting in complaints of the neck, back, shoulder, wrist and other parts of the musculoskeletal system
- Uncomfortable adaptation of ill postures and awkward movement also increases expenditure of energy on the part of the muscles, heart and lungs
- Should be considered for optimizing tasks and the workplace are presented for commonplace postures and movements e.g., sitting, standing, lifting, pulling and pushing.

Formal Behaviour

Semi-formal Behaviour

Informal behaviour

Behaviour aspect

- Cognitive capabilities of people
- Sensation and perception and impact on information perception and processing, human error analysis and prediction and mental fatigue, psychomotor skill
- Attention, learning and memory
- Language and communication
- Problem solving and decision making, etc.

Philosophy of design ergonomics

It operates on the premise "Better design for people." Whatever is designed should cater to the needs and aspirations of the anticipated users.

Objectives

- To enhance in a humane way
- Productivity
- Safety, and
- Comfort for effective use

It establishes

- User-friendliness, and
- Compatibility between man and articles for his use and his surroundings.

Fields of ergonomics application

As man is the prime system component and all the developmental activities are centered on him, ergonomics is applicable to every sphere of his life. Mostly perceived applications are practiced in design, management, occupational health where it is preferred to optimize the use of his internal resources,, and at the same time for sports it aims to increase endurance and theys and means to get the maximum out of his resources.

Design features of product and human body dimesions and functional need match is the key to develop a good design.

Ergonomics contribute to the design and evaluation of tasks, jobs, products, environments and systems in order to make them compatible with the needs, abilities and limitations of people

Thus the discipline can be defined as

Through its continuous dev elopment as a discipline; it is defined/ described as the appropriate application of available scientific information about human beings to design, thereby enriching the same by establishing an optimum interaction between man and the usable things developed by him.

It requires a multidisciplinary, scientific approach towards studying the work method and accessories in the context of physical, physiological and psyc ho-sociological capabilities of people.

It also means evaluating the facilities, environment, jobs, training methods and equipment to match with the capabilities of the users, and thereby reduces the potential for fatigue, errors, discomfort, and unsafe acts.

Contributors in the field

Many related subject emphasis enri ches the Ergonomics, which ultimately leads to various design applications.

R&D sections with Industrial Design activities of many leading Indian industries are conscious about ergonomics need in their products.

Industrial Engineering concerns the plant layout with its facilities and the arrangement of individual components in workspaces, which aims to develop the work and performance links in shop floor design.

Industrial hygiene & safety, and occupational health concern the work environment and work methods to eliminate the causes of health problems and occupational safety hazards that originate from faulty design use.

Sociologists, as well as anthropologists deal with the cultural and sociological relevance of design.

Behavioral sciences and industrial psychology are concerned with improving the design features with a view of enhancing motivation, satisfaction and the product usage attitudes by the users of different background, intellectuality and individuality. Expertise from fields as diverse as engineering, architecture, health sciences, human resource management, biology, environmental sciences, design, fields of arts & crafts, - the list may go on, enrich this field.

Ergonomics Applications:

Applications are mostly in

i) Occupational stress, health hazards and safety.
ii) Management
iii) Design

Application areas specific to Occupational Health and safety:

- Occupational risk management
- Work schedule & sustained performance
- Psychosocial approach occupational health
- Manual material handling
- Work related musculoskeletal disorders
- Warning and risk perception
- Safe design, etc.

Application in management:

- Work process management, efficiency
- Productivity and human resource utilization
- Work study and time study
- Management of work / rest cycle
- Personnel deployment and Shift work
- Human cost of work and cost benefit effects for the modifications done
- Manual material handling
- Work ambient environment monitoring
- Human work and efficiency

Human compatible design development and ergonomics

The form, function and the needs of human being together make an integral concept of designing a 'Human compatible' product and/or a complete system. It is responsible for "design for human use"

- A product/designed space should establish compatibility between human factors principles and product/ system features, comfort of use and functional reliability.
- Product reliability and safety.

Conclusion

Ergonomics make design more successful for user's acceptance. It is not only product- user relationship, but design ergonomics (e.g., design for functional consistency, users' compatibility and feedback) is also an advancement in its journey crossing the concept of user, product and function, to look at user, product and relationship in totality. It should look beyond usability. Man is not a physical and cognitive processor, his needs are to be addressed in tune with his emotions, values, hopes, fears, and anxiety over new adaptations in life.

Ergonomics and design both need to work hand in hand to achieve this. More research work is necessary to unfurl yet to be known facts of human information and compatibility factors; incorporation of which in design will comfort customers as well as keep manufacturers in fore front of the competition with good design products.

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Dr. Debkumar Chakrabarti is an Associate Professor (Ergonomics) of Department of Design, IIT Guwahati, since 1998. He did his B.Sc (hons) in Physiology, M.Sc in Physiology with specialization in Ergonomics and Work Physiology, and PhD in Science (Physiology, in the subject area Ergonomics) from Calcutta University. He has experience of working as a faculty member at National Institute of Design, Ahemdabad.His research area and interest lies in the various application aspects of Ergonomics. He has around 55 publications and research project reports and a book 'Indian Anthropometric dimensions for ergonomic design practice'.

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Dr. Amit Ray (Left)
Dr. Prashant Kumar (Right)

Former Faculty

Dr. Prashant Kumar

Dr. Prashant Kumar was the founder head of the department of Design programme at IITK. He served in that position from 2002-2005

Qualifications:

Dr Prashant Kumar is an alumni of IIT Kanpur. He did his B.Tech in Mechanical Engineering. He pursued his M.S in Mechanical Design in University of California, Berkeley, USA. Dr. Prashant Kumar obtained his doctorate in solid Mechanics from Brown University, Rhode Island, USA.

Area of Interest:

Dr. Prashant Kumar was interested in Product design, the process and manufacturing of products. His emphasis as an academician was on rapid protoyping. Dr. Prashant Kumar had a special interest in bi-cycles and sustainable design. In Mechanical engineering, he is interested in Polymer composites and Fracture mechanics.

Work at Design Programme: Dr.Prashant Kumar was the founder head of the department of Design Programme at IITK. He worked in that capacity from 2002-2005. He was instrumental in building the skeleton on which the programme exists today.

Workshops, Papers and patents

“Vision of Design Programme at IIT Kanpur” Indo-US workshop on Design Engineering, Bangalore 2006, 5th – 7th January 2006, Bangalore

“Product Design-Formulation and Forms”, Institution of Engineers (India), Vol 81, September 2000, pp 62-65

"Product Design - Formulation and Forms", Conference on "Emerging Trends in Design Engineering" MNR Engineering College, Allahabad, Jan.31 - Feb.2, (1997).

“Design as and Interdisciplinary academic activity Proc. of National Conference on Product Design, Oct20, 1994, IIsc, Bangalore, Publication Design Guild of India, Bangalore, (with Amit Ray).

Work at Design Programme

- Prayag Udhyog Limited, Faizabad: Designed the steel body of Tata trucks.
- Hind Cycle Company, Bombay: Improved Designs of Caliper Brakes
- Nath Opticians, Kanpur: Design and Fabricated a prototype of a lens Grinder
- Design and Fabricated a Prototype of an Improved Tricycle for Handicapped Persons (mass manufactured)
- Infothela: Takes benefits of IT to the door steps of villagers. Extensively covered in National and International Newspapers and Magazines.
- Prepreg making machine
- An improved solar cooker
- Many models of bicycles and tricycles (covered in national magazines and news papers)
- New techniques to make polymer composite products in vacuum chamber for better quality
- Development of an artificial aortic hear valve
- Design of an attractive light weight refrigerator body using FRP
- Cloth drying unit "Hangyo"

He was the guide of 5 students for their M.Des thesis.

Dr. Prashant Kumar was interested in Product design, the process and manufacturing of products, whereas, Dr.Amit Ray's areas of interests were Design Curriculum Development, Emotion in Design, Art & Design, Environmental Design, Design and Aesthetics, Product Design.

Dr Amit Ray

Dr. Amit Ray was a member of the faculty team that founded Design programme at IITK. At Design programme, Dr.Amit Ray went on to become "Emeritus fellow" and head of Design Programme at IITK.

Qualifications:
Dr Amit Ray has done his Diploma in Fine Arts & Crafts,Kala-Bhavana (The College of Fine Arts & Crafts), Visva-Bharati University, Santiniketan, West Bengal, Post-Diploma in Fine Arts (Mural Design) from Faculty of Fine Arts M.S. University of Baroda,M.F.A. (Community Mural Design, History of Art,Painting), The Art Institute of Chicago,Chicago, U.S.A., Environmental Ethics Graduate Certificate program,Department of Philosophy, The University of Georgia,Athens, GA. U.S.A., Ph.D. (Environmental Design, Environmental Ethics, Art and Design), The Department of Visual Arts (The Lamar Dodd School of Art),The University of Georgia, Athens, Georgia, U.S.A.

Area of Interest:
Dr.Amit Ray's areas of interests were Design Curriculum Development, Emotion in Design, Art & Design, Environmental Design, Design and Aesthetics, Product Design.

Work at Design Programme:
As an academician in Design programme at IITK, was responsible for designing the course content for the M.Des Programme and establishing the arts and design studio which is used for material exploration and hands on prototyping bye students.

Dr. Amit Ray guided 14 students in their M.Des thesis.

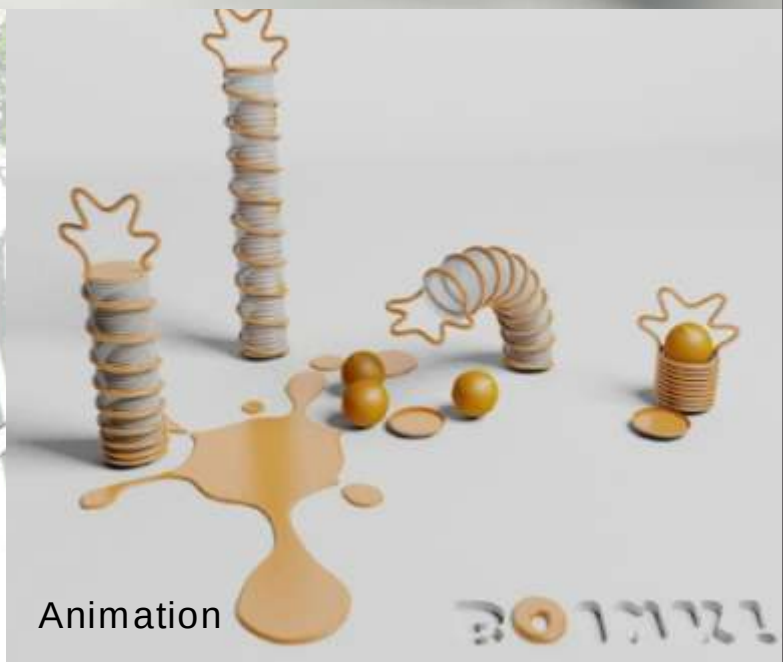
Product Design

Design for Sustainability

Interaction Design

Transportation Design

Service Design



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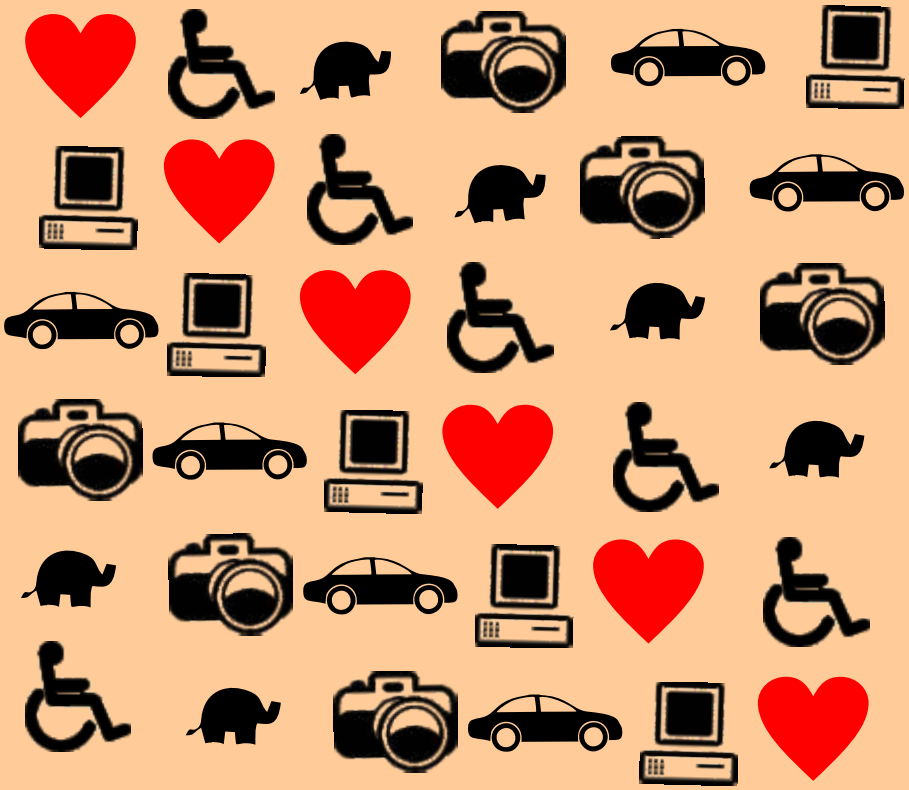

We do what we love

02

academic profile

The Master of Design postgraduate degree offered at IIT Kanpur is developed to meet the need of specially trained graduates in the field of Design for innovative developments of new products and processes in the national and international industries. The programme is interdisciplinary in nature with a strong emphasis on a balanced curriculum of theory and practice. Admission is made once a year through the CEED or GATE examination, followed by interviews.

The programme has the following concentrations:
Product design, Visual communication and Interaction design.

Candidates with a background of engineering discipline, design or architecture are eligible for the programme.

M.DES programme in IIT Kanpur is interdisciplinary.

Structure of the (M.DES.) programme

I SEMESTER
DES 601 Design Theory
DES 602 Design Practice -I
DES 681 Design Project -I
One elective

II SEMESTER
DES 603 Design Practice -II
DES 682 Design Project -II
Two electives

III SEMESTER
DES 699 M.Des. Thesis (16 Units)

IV SEMESTER
DES 699 M.Des. Thesis (16 Units)

ELECTIVES
DES 621 Creative Visualization
DES 622 2D and 3D Visual Design
DES 623 Topics in Motion Pictures
DES 624 Elements and Principles of Design
DES 625 Studies in Form and Style
DES 626 Interaction Design
DES 627 Management of Design and Innovation
DES 628 Design Culture and Society
DES 629 Introduction to Critical Art Appreciation
DES 631 Psychological Principles & Design
DES 635 Methods for Design Research
DES 698 Special Studies/Project Course in Design
DES 633 Integrated New Product Development

DES 601 DESIGN THEORY, 2-0-2-4

Design: Topics on Design Philosophy, History of Design, Art design and Society; Form, Space and Texture; 2D and 3D Form Analysis in Product Design and its Architecture; Theory of Colour, Colour Aesthetics; Introduction to Computer Art, Human Experience in Design, Indian Tradition and Product; Environmental Design.
Studio: Form, Space and Texture; 2D and 3D Form Analysis, Colour and Texture in 2-D & 3D surface, Colour Aesthetics, Computer and Composition, Product Analysis and Ergonomics, Environmental Design Model.

DES 602 DESIGN PRACTICE-I, 3-0-0-4

Stages of a product and concurrent engineering; Problem Formulation, Specifications and Constraints; Creating Forms; Configuration Optimisation; Coupled, Decoupled and Uncoupled Designs; Product of Static and Dynamic Societies; Material Experimentation; Construction Technique; Model Building;
Decision Making; Addressing Failures and Courage to Create; Interpersonal Skills; Robust Design; Incubation; Economic Considerations; Micro and Macro Designs; Introduction to Electronics; Laboratory on Problem Formulation, Innovation, Decision Making, Inter-personal skills, etc., through group discussion, case studies, books and journals review.

Students would be introduced to contemporary and historical directions, key concepts and methodologies through seminar lectures, research presentations, practical exercises and a final project. Classes would be supplemented with viewing a range of productions, individual and group critics, presentations, demonstrations and practical exercises to explore both technical and creative approaches to the medium. The course will also include short workshops supported by specialized professionals in the related fields.

DES 624 ELEMENTS AND PRINCIPLES OF DESIGN, 2-0-2-4-4

(i) Elements of design: value, color, form, shape, line and texture.
Each element is to be examined theoretically along with studio exercises and evaluated through consumer products (2D & 3D).
(ii)Principles of design: evaluate contrast, rhythm, unity, emphasis, pattern, movement and balance on the basis of Design Elements. The course proposes to develop through understanding of the elements and principles of design and their co-relationship.

DES 625 STUDIES IN FORM AND STYLE, 2-0-2- 4

Theory: Form envelops and assists function and in the process creates a 'network of values' that is termed as Style. 'Studies in form and style' concerns the conceptualization, exploration, and development of form and style in both product design and visual communication. The course will explore various bases for creative visualization like Fantasy, Metaphors, Cultural connotations and Bionics in the context of form- making.

Studio: Form development assignments in both product and visual communications will deal with the evolution of form in relation with exploration and function. Each assignment will complete the design process and its various stages from conceptualization, comparative studies, and usability issues to market trends as related to the study of Form. The study of the design process will help in understanding the shift between analytical and creative phases in different stages of design that is conceptualization and manufacturability.

DES 628 DESIGN, CULTURE AND SOCIETY, 2-0-2-4

The aim of the course is to understand the nature and structure of design in the context of Indian society and its cultural framework; to explore methods of cultural anthropology as a tool for observing user experience; to examine some specific case studies in the light of cross-cultural and comparative concerns; to explore the process of trend mapping; and to develop appropriate designs.

DES 633 INTEGRATED NEW PRODUCT DEVELOPMENT 2-0-2-4

Product development is an intensely multi-disciplinary process. This is even more so in case of new product conceptualization, design, and development. This is primarily because of two reasons – new technologies in themselves are highly multi-disciplinary in nature, and new product conceptualization not only requires a solid understanding of diverse multidisciplinary technologies, but also firm grounding in understanding of market needs (latent and explicit), product costs, financial planning, and national and international regulatory frameworks.

These realities make team-work absolutely essential for successful launch of a new product. The new product has to offer significant value which is rooted in market realities. It should be technologically manufacturable, and should also have a sound business case. During the product conceptualization and design cycle, the team engages in severe negotiations, because the requirements of each team member act as operational constraints for others. This course (and its second level as well) aims to fulfill the following objectives:

1. Expose the student to diverse elements of the "Integrated New Product Design Process" as they relate to business planning, market understanding, technology, costing and diverse regulatory frameworks.
2. Encourage the students to work in teams so that they can:
   a. Conceptualize a new product of their choice which offers unique value to the "customer"
   b. Work towards a committed budget and project schedule
   c. Develop a detailed business plan for this product and product layout.
   d. Conduct a detailed technological review of the product design.

DES 629 INTRODUCTION TO CRITICAL ART APPRECIATION, 2-0-2

The world over, fine art has stood as a symbol of refinement and taste. Of late, the globalized world is witnessing an increasing awareness and recognition of the practice, production and circulation of the Fine Arts. Distinct from the functioning of applied and the industrial arts, fine arts play a crucial role in shaping our vision and culture. Thus a critical appreciation of fine arts would lead to an in-depth understanding of our 'visual culture' as a whole.

Topics

Contemporary Art – Theory & Practice
Art and its implications – Society & Culture
Role of Art and Artist in Socio Cultural Framework
Understanding Visual Culture – Historical and Global Perspective
Methodology for Critical Thinking in the context of Art Appreciation
Principles and Norms of Art
Communication in Visual Arts
Mediums of Art
Elements of Art
Relative studies in diverse cultural expressions

DES 631 PSYCHOLOGICAL PRINCIPLES & DESIGN , 2-0-2-0

Cognitive Development: During infancy, early childhood, later childhood, adolescence and adulthood. Implications of stage-specific cognitive development for design. Cognitive Issues and design I: Sensation and perceptual processes, perceptual-cognitive styles, cognitive learning and human information processing.
Cognitive Issues and design II: Memory systems- sensory, STM, LTM, working memory; information processing, storage and retrieval; implicit and explicit memory; Imagery and memory.
Cognitive Issues and design III: Emotion expressions- human and machine; emotions and product/ graphic design.
Research Techniques- experimental design for exploring/ understanding cognitive factors pertaining to design to empirically validate application of psychology in design.

DES 635 METHODS FOR DESIGN RESEARCH , 2-0-1-0-4

Research Process and Problems – Stages in social research; socially relevant design problems; propositions; verification; pure and applied research; value free research; values and perception;
Sampling – Probability and non-probability
Data Collection Techniques – Survey, questionnaire, interview, focused group discussion, observation, case study, experimentation
Data Analysis and Interpretation – Quantitative and qualitative
Ethics in Research – Privacy; deception; plagiarism; informed consent; directed research; professional codes of ethics
Thesis writing – Technical writing, reports, and presentations
Lab: Related exercises and field exploration

DES 681 DESIGN PROJECT-I, 0-0-6-4

Design: Introduction to basic concepts of Graphic Design; CAD Application to Design; Material Experimentation- wood, steel, plastic, etc.; Styling; Space, Form and Colour Experimentation; Visual Communication.

DES 682 DESIGN PROJECT-II, 0-0-6-4

Manufacturability Studies, User/ Consumer Interaction Study; Ergonomics; Embedded Products; Animations; Multimedia Applications.

DES 689 TOPICS IN DESIGN, 2-0-3-0-4

Lectures and workshops on various topics in Design like ergonomics, Graphic Design and Typography, Design Management, Visual Image Design, Composition and Media Art, Aesthetics and Forms, Role of Design in ICT, Auto Design, Product Simulation, Packaging Design, Sustainable Design through Practical Exercises, Studio Projects, Field Trips.

DES 698 SPECIAL STUDIES / PROJECT COURSE IN DESIGN ,0-0-0-0-4

Cognitive Design; Design Management; Human factors in Ergonomics Design; Usability & user-centric Design; Axiomatic Design; Human Computer Interface Design (HCI) etc.

DES 699 M. DES. THESIS

Achievements

over the last 5 years


Nokia Resear
03

Competitions

Entry	Designer/ Student	Year of Achievement	Specialization
1st Prize, Winner, TRAI Logo	Himesh Singh	2012	Graphic Design
1st Prize,Samsung's Splash India on T.V.	Bidisha, Paritosh Praveen, Saptarishi,	2012	Interaction Design
Best Apps Samsung's Splash India on T.V.	Ekta Sachdev, Priyanka Bharti,Jivtesh, Himesh Singh	2012	Interaction Design
2nd Prize,Packinnova	Prasoon Kumar and Vikas Chopra	2011	Packaging Design
Finalist, 3 Teams	Rahul, Saptarshi, Mayuk, Paritosh	2011	Packaging Design
2nd Runnersup, Nokia Bhasha 2011	Rahul, Madhavan, Meenakshi, Aravind, Nishant	2011	Interaction Design
Best Developer Award, Nokia Bhasha 2011	Vivek, Richa, Nutan, Abitosh	2011	Interaction Design
1st Prize, SAE Design Challenge	Rahul, Nishant	2010	Product Design

Entry	Designer / Student	Year of Achievement	Specialization
ICSIR Robot Design, 2010, Finalist	Atul Sultane, Satish Shekhar	2010	Product Design
USID Gurukul Bad Design Contest 2010 1st Prize	Himesh Singh	2010	Product Design
USID Gurukul Bad Design Contest 2010 2nd Prize	Madhavan	2010	Product Design
USID Gurukul Bad Design Contest 2010 2nd Prize	Vikas	2010	Product Design
Solidworks Design Competition 1st Prize for Power Pro	Atul Sultane	2010	Product Design
UNICEF Worldwide Video contest Finalist	Siddharth Bathala	2009	Visual Communication
Escorts Tractor of 2020 Design contest, 2nd Prize (CAD Modelling)	Atul Sultane, Kiran Bajpe	2009	Transport Design

Entry	Designer / Student	Year of Achievement	Specialization
Escorts Tractor of 2020 Design contest, 1st Prize (CAD Modelling)	Satish Shekhar	2009	Transport Design
Electrolux Design Contest finalists	Prithu Paul, Ankit Kumar	2009	Product Design
Design Challenge 1st Prize 2009, IISc Bangalore	Umang Shah	2009	Product Design
3rd prize, USID NOKIA Challenge	Umang Shah	2009	Visual Communication
UMO Boycott Bad Design, 1st Prize	Alap Shah	2009	Design Criticism
1st Prize, Design Challenge-09, IISC, Bangalore	Umang Shah	2009	Product Design
2nd Prize, National Design Challenge-09, IIT Kanpur	Umang Shah	2009	Strategy Design
3rd Prize, Nokia USID International Design Challenge, USID 2009	Umang Shah	2009	Visual Communication
1st Prize ADEX 2008 for 'Bullus'	K K Balakrishna, Sneh Singh	2008	Product Design
Forum NOKIA- USID Challenge (2nd Prize)	Himanshu Agarwal)	2008	Product Design

Entry	Designer/ Student	Year of Achievement	Specialization
WUD '08 2nd Prize	Neha Kiran Singh	2008	Product Design
Design of Transit System for Pune Festival (2nd Prize)	Prantik Banerjee, Payal Chowdhury	2008	Service Design
UMO Boycott Bad, Bangalore,'08 Design Contest	Stuti Shalini Guria	2008	Design Criticism
1st Prize, Teqnix-08, LDCE, Ahmedabad	Umang Shah	2008	Product Design
1st Prize, RE-Kriti-08, DAIICT, Gandhinagar	Umang Shah	2008	Product Design
1st Prize, Design Challenge-08, Yahoo R&D, Bangalore	Umang Shah	2008	Product Design
THE PATRIOT awarded 4th best concept vehicle in	Saurabh Karwal	2008	Transport Design
RGB 2007 1st Prize in 'Just Design' for Waste Disposal System	Yogesh G Maralkar,Alok Agashe, Payal Chowdhury	2008	Product Design
RGB 2007, 1st Prize for 'Rang De Basanti'	Prantik Banerjee, Meera Mangrulkar, Jayesh Pillai	2008	Visual Communication
1st Prize, Autofest-07, NIT, Surat	Umang Shah	2008	Transport Design

Publications, Patents and Representative Projects

Braj Bhushan

Ph.D., BRAB University

Cognitive Neuropsychology, Clinical Psychology, Cognitive Engineering

Publications

Books

Bhushan, B. (Ed.) (2010). Communication in Perspective. Amani International Publishers, Kiel-Germany (ISBN: 978-3-938054-30-7).

Book Chapters

Bhushan, B. (2011). Traditional knowledge, cultural practices, modern bio-behavioural methods: Reflections from India. (forth-coming)

Conference Papers

Rane, M. & Bhushan, B. (2012). Studying perceptual differences between designer and non-designer: A visual identity design problem. 6th International conference on design principles and practices, University of California, Los Angeles, January 20-22 (scheduled).

Invited Lectures

Psychology & design: Applying the principles of perception (19th August, 2003), Department of Design, Indian Institute of Technology, Guwahati.

Sameer Khandekar

Ph.D., Uni-Stuttgart, Germany

Thermal Management, Passive Heat Transfer, Heat Pipes, Energy Systems.

Conference Papers and referred Publication

- Sikarwar B. S., Khandekar S., Agrawal S., Kumar S. and Muralidhar K., Dropwise Condensation Studies on Multiple Scales, Heat Transfer Engineering, Special Issue: Advances in Heat Transfer, Vol. 33, Issue 4-5, pp. 301-341, 2012.
- Moharana M. K., Singh P. K. and Khandekar S., Optimum Nusselt Number for Simultaneously Developing Internal Flow under Conjugate Conditions in a Square Microchannel, ASME Journal of Heat Transfer, Accepted for publication, Article in press, December 2011.
- Khandekar S., Mamila R., Agnihotri V. and Ramkumar J., Nano-Cutting Fluid for Enhancement of Metal Cutting Performance, Materials and Manufacturing Processes, Accepted for publication, Article in press DOI: 10.1080/10426914.2011.610078 (July 2011).
- Moharana M. K., Agarwal G. and Khandekar S., Axial Conduction in Single-phaseSimultaneously Developing Flow in a Rectangular Mini-channel Array
- International Journal of Thermal Sciences, Vol. 50, pp. 1001-1012, 2011.
- Hemadri V. A., Gupta A., Khandekar S., Thermal Radiators with Embedded Pulsating Heat Pipes: Infra-red Thermography and Simulations, Applied Thermal Engineering, Vol. 31, pp. 1332-1346, 2011.
- Moharana M. K., Peela N. R., Khandekar S. and Kunzru D., Distributed Hydrogen Production from Ethanol in a Microfuel Processor: Issues and Challenges, Renewable and Sustainable Energy Reviews, Vol. 15, pp. 524-533, 2011.
- Sikarwar B. S., Battoo N. K., Khandekar S. and Muralidhar K., Dropwise Condensation underneath Chemically Textured Surfaces: Simulation and Experiments, ASME Journal of Heat Transfer, Vol. 133, Issue 2, pp. 021501 (1-15), 2011.

- Khandekar S., Silwal V., Bhatnagar A. and Sharma P., Global Effectiveness of Pulsating Heat Pipe Heat Exchangers: Modeling and Experiments, Heat Pipe Science and Technology, An International Journal, Vol. 1, Issue 3, pp. 279-302, 2010
- Khandekar S., Panigrahi P. K., Lefevre F. and Bonjour J., Local Hydrodynamics of Flow in a Pulsating Heat Pipe: A Review, Frontiers in Heat Pipes, Vol. 1, pp. 023003(1-20), 2010.
- Das S. P., Nikolayev V. S., Lefevre F., Pottier B., Khandekar S. and Bonjour J., Thermally Induced Two-phase Oscillating Flow inside a Capillary Tube, International Journal of Heat and Mass Transfer, Vol. 53, pp. 3905-3913, 2010.
- Bansal G. D., Khandekar S. and Muralidhar K., Measurement of Heat Transfer during Dropwise Condensation of Water on Polyethylene, Nanoscale and Microscale Thermophysical Engineering, Vol. 13, Issue 3, pp. 184-201, 2009.
- Revellin R., Lips S., Khandekar S. and Bonjour J., Local Entropy Generation for Saturated Two-phase Flow, Energy-The International Journal, Vol. 34, Issue 9, pp. 1113-1121, 2009.
- Rao M. and Khandekar S., Simultaneously Developing Flows under Conjugate Conditions in a Mini-channel Array: Liquid Crystal Thermography and Computational Simulations, Heat Transfer Engineering Journal, Vol. 30, Issue 9, pp. 751-761, 2009.
- Yang H., Khandekar S. and Groll M., Performance Characteristics of Pulsating Heat Pipes as Integral Thermal Spreaders, International Journal of Thermal Sciences, Vol. 48, Issue 4, pp. 815-824, 2009.
- Khandekar S., Gautam A. P. and Sharma P., Multiple Quasi-Steady States in a Closed Loop Pulsating Heat Pipe, International Journal of Thermal Sciences, Vol. 48, Issue 3, pp. 535-546, 2009.
- SoundraPandian K. K., Rao M. and Khandekar S., Remote Access Real Time Laboratory: Process Monitoring and Control through Internet Protocol, International Journal of Mechanical Engineering Education, Vol. 36, Issue 3, pp. 207-220, 2008.
- Khandekar S., Joshi Y. and Mehta B., Thermal Performance of Closed Two-Phase Thermo-syphon using Nanofluids, International Journal of Thermal Sciences, Vol. 47, Issue 6, pp. 659-667, 2008.
- Yang H., Khandekar S. and Groll M., Operational Limit of Closed Loop Pulsating Heat Pipes, Applied Thermal Engineering, Vol. 28, Issue 1, pp. 49-59, 2008.

Invited Talks

- Dropwise Condensation on Horizontal Substrates with and without a Wettability Gradient, 8th Minsk International Seminar (Heat Pipes, Heat Pumps, Refrigeration and Energy Systems), Minsk, Belarus, September 2011.
- Pulsating Heat Pipe Based Heat Exchangers. Proc. 21st International Symposium on Transport Phenomena, Kaohsiung City, Taiwan, November 2-5, 2010.
- Dropwise Condensation on Textured Surfaces: Issues and Prospects, 9th International ASME-ISHMT Heat and Mass Transfer Conference, Mumbai, India January, 2010.
- Roadmap to Realistic Modeling of Pulsating Heat Pipes,9th International Heat Pipe Symposium, Kuala Lumpur, Malaysia, November 2008.
- Multiple Steady States of Pulsating Heat Pipes and Modeling Strategies, 7th Minsk International Seminar (Heat Pipes, Heat Pumps, Refrigeration and Energy Systems), Minsk, Belarus, September 2008.
- Opportunities for Interdisciplinary research in Energy Technology, National Conference of Electrical and Mechanical Engineering, Guru Ramdas Khalsa Institute of Technology, Jabalpur (MP), March 2006.
- Introduction to Fuel Cell Technology: Energy Outlook and Research Directions, National Workshop titled Fuel Cells: Power Device of the Future, IIT Kanpur, Kanpur (UP), February, 2006.

Bisakh Bhattacharya

Ph.D., IISc Bangalore

Smart Structures, Active / Passive Vibration Control, Active Shape Control & Adaptive Structures.

Patents

Patent 1: A Novel Non-contact damping technique using magnetostrictive particulate Coatings, GB2365376, Bishakh Bhattacharya, Geof Tomlinson and Jem Rongong, The Patent and Design Journal No 5986.

Patent 2: Vibration dampning system and a method of damping vibrations, United States Patent 6688439, Bishakh Bhattacharya, Geof Tomlinson and Jem Rongong.

Applied for 5 new Patents

- A green energy harvesting device for Low Power Electronic Equipments – Atul Sultane and Bishakh Bhattacharya
- A smart drug infusion system using SMA – Vimal Kumar and Bishakh Bhattacharya
- A smart sensor based pipe crawling robot for health monitoring – Harutoshi Ogai and Bishakh Bhattacharya
- A new macro and micro shape control system for Adaptive Antenna – Bishakh Bhattacharya, Gurkirt Singh, B. S. Munjal and A. C. Mathur
- A new self-configurable modular robot – Ankur Agarwal and Bishakh Bhattacharya

Selected Publications and Journals in Conferences

- Experimental Modal Analysis for Damage Detection in Composite Plates using Laser Doppler Vibrometer , AROB, International Conference on Research in Structural Health Monitoring, IPS Waseda, A. Kumar and B. Bhattacharya, 2011
- Cultural Influence in Aesthetic Design: A Case Study based on Intermediate Public Transport Vehicle , ICROD-11, International Conference on Research in Design, IISc Bangalore, M. Arun. and B. Bhattacharya, 2011
- Inspection of Pipe Inner Surface using Advanced Pipe Crawler Robot with PVDF Sensor based Rotating Probe, Sensors and Transducers, Vol. 4, No. 127, 2011, pp.45-56. V Agarwal, H Ogai, K Nishijima and B Bhattacharya, 2011
- Vibration suppression and damage detection in smart composite laminate using high precision finite element, Proc. SPIE, Vol. 7982, 798214, pp. 1-16, A Kumar, P. Fleming and B. Bhattacharya, 2011
- Optimum discrete location of a shape memory alloy wire for discrete actuation of a compliant link, Journal of Mechanical Design, Vol.132, Issue 2, A. Banerjee, B. Bhattacharya, and A.K. Mallik, February 2010
- Pseudo-rigid Body Modelling of IPMC for a Partially Compliant Four-bar Mechanism for Work-volume generation, Intelligent Material Systems and Structures, Vol. 20, No.1, pp. 51-62, D. Bandopadhyay, B. Bhattacharya and A. Dutta, 2009
- Characterization of IPMC as passive and active damper as an alternative novel smart actuator, Journal of Reinforced Plastics and Composites Vol. 28, 2: pp. 183-200, D. Bandopadhya, B. Bhattacharya and A. Dutta , 2009
- Design and Development of a Partially Compliant 4-bar using IPMC for Work Volume Generation, Proceedings of AIP, Vol. 1029, pp. 171-182, 2008, D. Bandopadhya and B. Bhattacharya, 2008

- Structural Health Monitoring of Ribbon Reinforced Composite Laminate using Piezoelectric Sensory Layer, International Journal of COMADEM, Vol.11, No.1, January 2008, PP.09-17, 2007, Jaiswal, V., Anand K. and Bhattacharya, B., 2008

Invited Lectures / Key note Address

- Redesign of a mass-transport system - IISc Bangalore 2010, India
- India centric design of Automobiles – IISc Bangalore 2011, India
- Intelligent System Design – Inspirations from Nature – DMSRDE 2011, India
- Design of Intelligent Gripper with slip sensing – University of Verona, 2006, Itally
- Design and Development of Pipe Health Monitoring Robot – IPS, Waseda University, 2009,Japan
- Health Monitoring of Intelligent Composites – University of Sheffield, 2009, UK
- Design of Development of Structural Health Monitoring System – IPS, Waseda University, 2010,Japan
- Design of New Energy Harvesting Devices – IPS, Waseda University, 2011, Japan
- Crawling Robot Design based on Smart Sensors – University of Sheffield, 2011, UK

Jayanta Chaterjee

Ph.D., IIT Delhi
eMarketing, Knowledge Management, IPR, Intelligent Business Decisions

Visiting Faculty at Aalto Design Factory

Papers and Book Chapters

- Strategic approach to Product Design, Page 63 to 73 in the book Technical Entrepreneurs published by Global Business Press, 1992. (Chapter in a boo
- User oriented Information design for eMarketing, a chapter in 'A compendium on Technology, Innovation and Flexibility', Tata McGraw Hill, 2004. (Book Chapter)
- Marketing Rural Digital Services in India – Design Challenges for SST, International Conference on Services Marketing & Technology Applications, TAPMI, Manipal, February 15-16, 2008. (Conference Plenary)
- Innovating Telecom Service Design for customer satisfaction at the bottom of the revenue pyramid, Dhawan.P and Chatterjee,J.,Directions, 2010, IITK Research Journal

Seminars and Talks

- Multi-disciplinary Processes for Problem Based Learning of Design and Management at the MOA 2009 Seminar on “Beyond Tomorrow – Responsibility for the Future” at Helsinki University of Design & Art, Helsinki Finland, 18th May, 2009

Workshops and other Educational activites

- “Product Design & New Product Management” for Visionary Leaders of Manufacturing IIM-IIT Diploma programme , July- August 2007 to 2010 (four batches)

Manindra Agarwal

Ph.D., IIT Kanpur
Complexity Theory, Computational Number Theory

Publications

The Isomorphism Conjecture for NP

- Computability in Context: Computation and Logic in the Real World, Eds: Barry Cooper and Andrea Sorbi, World Scientific, 2011.
  Classifying Polynomials and Identity Testing
- (with Ramprasad Saptharishi). Current Trends in Science (Platinum Jubilee Special, Indian Academy of Sciences), 2009.
- Primality Testing Based on Fermat's Little Theorem, ICDCN 2006.
- Determinant verus Permanent, ICM 2006.
- Proving Lower Bounds via Pseudo-Random Generators, FSTTCS 2005.
- Automorphisms of Finite Rings and Applications to Complexity of Problems (with Nitin Saxena). STACS 2005.

Computational Number Theory and Algebra

- Manindra Agrawal, V Vinay, Arithmetic Circuits: A Chasm at Depth Four, FOCS 2008.
- Manindra Agrawal, Nitin Saxena, Equivalence of F-algebras and Cubic Forms, STACS, LNCS 3884: 115-126, 2006.
- Manindra Agrawal, Neeraj Kayal, Nitin Saxena, PRIMES is in P, Annals of Mathematics 160(2): 781-793, 2004. The original version of the paper is here.
- Manindra Agrawal, Somenath Biswas, Primality and Identity Testing via Chinese Remaindering, Journal of the ACM 50(4): 429-443, 2003.

Derandomization

- Manindra Agrawal, On Derandomization Tests for Certain Polynomial Identities, Invited Talk at CCC 2003: 355-359.
- Manindra Agrawal, Hard Sets and Pseudo-random Generators for Constant Depth Circuits, FSTTCS 2001, LNCS 2245: 58-69.

Isomorphism Conjecture; Likely Structure of NP-complete Degree

- Manindra Agrawal, Osamu Watanabe, One-Way Functions and the Berman-Hartmanis Conjecture. CCC 2009.
- Manindra Agrawal, Pseudo-random Generators and the Structure of Complete Degrees, CCC 2002: 139-146.

Complete Degrees Under AC^0 Reductions

- Manindra Agrawal, The Isomorphism Conjecture for Constant Depth Reductions, JCSS 77 (special issue on Karp's Kyoto Prize): 3-13, 2011.
- Manindra Agrawal, The First-Order Isomorphism Theorem, FSTTCS 2001, LNCS 2245: 70-82.
- Manindra Agrawal, Towards Uniform AC^0-Isomorphisms, CCC 2001: 13-20.
- Manindra Agrawal, Eric Allender, Russell Impagliazzo, Toniann Pitassi, Steven Rudich, Reducing the complexity of reductions, Computational Complexity 10(2): 117-138, 2001.
- Manindra Agrawal, Eric Allender, Steven Rudich, Reductions in Circuit Complexity: An Isomorphism Theorem and a Gap Theorem, JCSS 57: 127-143, 1999.

Complete Degrees Under 1-L and 1-NL Reductions

- Manindra Agrawal, On the Isomorphism Conjecture for Weak Reducibilities, JCSS 53(2): 267-282, 1996.
- Manindra Agrawal, Somenath Biswas, Polynomial Isomorphism of 1-L Complete Sets, JCSS 53(2): 155-160, 1996.
- Manindra Agrawal, DSPACE(n) ?= NSPACE(n): A Degree Theoretic Characterization, JCSS 54(3): 383:392, 1997.

Complete Degrees Under Other Weak Reductions

- Manindra Agrawal, For completeness, sublogarithmic space is no space, Information Processing Letters 82(6): 321-325, 2002.
- Manindra Agrawal, S. Venkatesh, On the Isomorphism Conjecture for 2DFA Reductions, Intl Journal on Foundations of Computer Science 7(4): 339-352, 1996.

Hybrid Systems

- Manindra Agrawal, Frank Stephan, P S Thiagarajan, Shaofa Yang, Behavioural Approximations for Restricted Linear Differential Hybrid Automata, HSCC 2006, LNCS 3927: 4–18.
- Manindra Agrawal, P S Thiagarajan, The Discrete Time Behavior of Lazy Linear Hybrid Automata, HSCC 2005, LNCS 3414: 55–69.
- Manindra Agrawal, P S Thiagarajan, Lazy Rectangular Hybrid Automata, HSCC 2004, LNCS 2993: 1–15.

Problems in NC

- Manindra Agrawal, T M Hoang, Thomas Thierauf, The Polynomially Bounded Perfect Matching Problem is in NC^2, STACS 2007, LNCS 4393: 489-499.
- Manindra Agrawal, Eric Allender, Samir Datta, On TC^0, AC^0, and Arithmetic Circuits, JCSS 60(2): 395-421, 2000.
- Manindra Agrawal, Thomas Thierauf, "The Satisfiability Problem for Probabilistic Ordered Branching Programs", Theory of Computing Systems 34: 471-487, 2001.
- Manindra Agrawal, Eric Allender, Samir Dutta, H Vollmer, C Wagner, Characterizing Small Space and Small Depth Classes by Operators of Higher Types, Chicago Journal on Theoretical Computer Science, 2000.

Problems in NP and Higher Classes

- Manindra Agrawal, Thomas Thierauf, "The Formula Isomorphism Problem", SIAM J. Comput. 30(3): 990-1009, 2000.
- Manindra Agrawal, V Arvind, A Note on Decision versus Search for Graph Automorphism, Information and Computation 131(2): 179–189, 1996.
- Manindra Agrawal, Somenath Biswas, NP-creative Sets : A New Class of Creative Sets in NP, Mathematical Systems Theory 29: 487–505, 1996.
- Manindra Agrawal, V Arvind, Quasi-linear Truth-table Reductions to P-selective Sets, Theoretical Computer Science 158: 361–370, 1996.
- Manindra Agrawal, Richard Beigel, Thomas Thierauf, Pinpointing Computation with Modular Queries in the Boolean Hierarchy, FSTTCS 1996, LNCS 1180: 322–334.
- Manindra Agrawal, Somenath Biswas, Universal Relations, CCC 1992: 207–220.

P Sensharma

Ph.D. IISc. Bangalore

Power Electronic Applications to Power Systems, Power Quality, FACTS devices

Publications

- "Self excitation and control of an induction generator in a stand-alone wind energy conversion system", S. Hazra and P.Sensarma, IET Renewable Power generation , July 2010, Vol 4, Issue 4, pp 383-393
- " A Multiband Shunt Hybrid Active Filter with Sensorless Control", Surendra Kumar S and Partha Sarathi Sensarma, Journal of Power Electronics , Vol. 8, No. 4, October 2008, pp. 317-324. (ISSN 1598-2092
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Publications

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Papers

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- ‘User Centric Designed Mechanism for Stairs-Climbing Wheel Chair (Manual)’, NaCoMM; Authors: Shatarupa Thakurta Roy, J Ramkumar, Shanu Sharma
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Patents

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- SME for a Web Course on Theory of Design and Aesthetics, NPTEL Phase II, IIT Kanpur; Sponsored by MHRD

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- Design Bank, Office of the Commissioner of Handicrafts, 2008
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Journals and Proceedings

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Micro / Nano-Fabrication and finishing, Nano Composites and Tribology

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Invited talks

- M.Ravishankar, V.K.Jain and J.Ramkumar "Abrasive flow machining (AFM): An Overview", INDO - US WORKSHOP on Smart Machine Tools, Intelligent Machining Systems and Multi-scale Manufacturing. December, 2008.
- Mamilla Ravi Sankar, J.Ramkumar and V.K.Jain, "Abrasive finishing processes ", Central Mechanical Engineering Research Institute, Durgapur, June 29-30, 2009.
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- Mamilla Ravi Sankar, J.Ramkumar and V.K.Jain, Nano finishing of advanced materials using Visco-Elastic abrasive fluids, Fourth National symposium on Frontiers of Engineering (NaFOE 4)), Indira Gandhi Centre for Atomic Research, Kalpakkam, September 16-18, 2009
- J.Ramkumar, Recent Trends in Manufacturing Technology in the Present Global level Competitions, Roever Engineering College, Perambalur, Tamilnadu, December 21, 2009

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- New media for AFM machining , 2005
- oining of Dissimilar Pipes thro adhesive joining, 2007
- Magnetic Float Levitative Finishing, 2007
- A novel viscoelastic media used for a nano-finishing of materials through abrasive flow machining process and method of manufacture therefore , 2007
- Fabrication of Jute fiber sandwitch composites, 2008
- A device for magnetic abrasive finishing of a workpiece and magnetic abrasive finishing process, 2008
- Rotatory abrasive flow finishing process for finishing and texturing of internal and external surfaces of hard and composite materials and an apparatus therefore, 2009
- A Multipurpose transporter with modular configuration, 2010
- Modular transporter for material handling and personalized riding, 2010
- The Drift-Battery Operated Campus Vehicle, 2011

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M.DES Thesis

Submission Date	Title of Thesis	Author(s)	Supervisor(s)
01-Jul-04	Design of a kiosk enclosure for an interactive navigation system	Jaiswal, Vijay	Bhattacharya, Bishakh
14-Jul-04	Culture, competition and product design	Ghosh, Sharvari	Dhande, Sanjay Govind; Prabhakar, T V
14-Jul-04	Culture, computation and product design	Sonkar, Amarjeet	Dhande, Sanjay Govind
15-Jul-04	Bomb disposal and bomb squad carrier vehicle	Bagai, Hitesh	Ray, Amit
15-Jul-04	Design and development of electrothermal jacket	Narsian, Sushil	Ray, Amit
16-Jul-04	User interface design for touch screen based navigation systems	Singh, Adesh Kumar	Bhattacharya, Bishakh
19-Jul-04	Design of an effortless vertical upright (hard baggage) internal space organization	Shah, M M	Roy, Satyaki
20-Jul-04	Design of an attractive frp body for a refrigerator	Sanandan, U V	Kumar, Prashant
23-Jul-04	Edutainment- multimedia educational content development for school children	Rajamanohar, K S	Roy, Satyaki
27-Jul-04	Design and development of light weight automobile panels with sandwich composite materials	Pahlajani, Vinay	Kumar, Prashant
20-May-05	Instructional aids for special education	Manjiri, Arvind Joglekar	Roy, Satyaki
01-Jun-05	Design of bus fascia made of sandwiched frp	Sharma, Rajeev	Kumar, Prashant; Ramkumar, J
14-Jun-05	Saksham-a documentry film about spastic children	Verma, Paridhi	Dhande, Sanjay Govind; Roy, Satyaki
16-Jun-05	Design and development of graphical user interface brihaspati - the virtual classroom	Partha, Siddhartha	Roy, Satyaki
29-Jun-05	Innovation in handicrafts design	Bhoyar, Parag M	Dhande, Sanjay Govind
25-Jul-05	Intelligent product design using sma based technology	Neema, Manish Kumar	Bhattacharya, Bishakh
02-Aug-05	Developement of antitheft device for cars- an embedded systems approach	Hari, Vivek	Kumar, Prashant; Sensarma, Partha Sarathi
08-Aug-05	Golden section a notation of aesthetics	Jain, Prachi	Kumar, Prashant; Roy, Satyaki
10-Aug-05	Design and development of a mobility device for a spastic child	Kumar, Aakash	Ray, Amit
10-Aug-05	Design and development of lightweigth back-pack tent for indian army	Chaudhary, Ruchin	Ray, Amit
17-Apr-06	Redesign of a gas chromatograph	Roy, Shoubhik Dutta	Ray, Amit
05-May-06	Images of thought	Rodrigues, Neves Purificacao	Ray, Amit
17-May-06	Design cell: a user centered design toolkit	Chaudhary, Shibika	Roy, Satyaki

19-May-06	A conceptual model of information architecture - cyber pathshala	Ghosh, Mainak	Roy, Satyaki
19-May-06	Design principles for print – a contextual model as cookbook	Solanki, Mona	Roy, Satyaki
19-May-06	Emotional design and its applications	Azeez A, Adil Ahmed	Ray, Amit
26-May-06	Information visualization and design for ancient nalanda university	Patsute, Rajendra	Bhattacharya, Bishakh
26-May-06	Virtual reconstruction of architecture of nalanda university based on information visualization	Upadhyay, Abhishek	Bhattacharya, Bishakh
03-Jun-06	Carry-away package for cooked indian food	Kastha, Anindya	Ray, Amit
23-Jun-06	Design of staircase climber trolley	Lone, Girish Ishwar	Ray, Amit
28-Jul-06	Web based interaction design modal to help reading disabled children in india	Tiwari, Mayank	Bhattacharya, Bishakh
04-Aug-06	Design of a sitting module	Gadaria, Dharmeshkumar Pratapsinh	Bhattacharya, Bishakh
08-May-07	Communication design and media services for children with special needs	Rangnekar, Parul	Roy, Satyaki
09-May-07	Games as interactive systems	Ahuja, Simarjeet Singh	Roy, Satyaki
10-May-07	Design of a web portal for campus relations, oracle	Subramanya, T N	Roy, Satyaki
10-May-07	Product usability design with endearment qualities	Bairagi, Abhijit Kumar	Dhande, Sanjay Govind
11-May-07	Mobile smart kitchen workstation	Thakur, Vishal	Dhande, Sanjay Govind
15-May-07	Primary packaging of itra	Soni, Himanshu Shekher	Ray, Amit
15-May-07	Redesign of a scanning tunneling microscope	Khandekar, Ameya Sudhir	Ray, Amit
15-May-07	Virtual set design and extension of agra fort for the pre production and postproduction of 'jodhaa akbar' an aggpl production	Chokhawala, Riddhi Jaydeo	Ray, Amit
19-May-07	Conceptualizing information and communication devices for applications in india	Srivastava, Gorky	Dhande, Sanjay Govind
26-Jun-07	Building an interactive visual archive of the indian heritage – an information portal	Dutta, Sourav	Roy, Satyaki
06-May-08	Culture and emotions in indian product design	Ghate, Kunal S	Ray, Amit
09-May-08	Luxury coach design	Karwal, Saurabh	Dhande, Sanjay Govind
12-May-08	A new design solution for reducing scratches in small indian cars	Vemuri, V S Haveesh	Bhattacharya, Bishakh
13-May-08	Illustration as visual essay	Mallya, Prabha	Roy, Satyaki
02-Jun-08	Design of a low cost cooling and preservation device for vegetables suitable for developing countries.	Dubey, Deepa	Dhande, Sanjay Govind

05-Jun-08	Major factors in the design of an in vehicle interface to support non driving tasks	Pratap , K S	Ray, Amit
07-Aug-08	3d child virtual platform for evaluation of products for children	Pillai, S Jayesh	Roy, Satyaki
11-May-09	Aesthetic explorations of advanced automobile design and balanced interior design of an intermediate public transport	M, Arun	Bhattacharya, Bishakh
12-May-09	Design of a phototherapy device	Patra, Binapani	Patil, Koumudi
12-May-09	Redesigning the instruction of a ncert textbook	Mangrulkar, Meera Sudhir	Patil, Koumudi
13-May-09	Board game for indian family	Karnika	Roy, Satyaki
13-May-09	Design of classroom chair for student with cerebral palsy	Roy, Adita	Roy, Satyaki
13-May-09	Design of signages and wayfinding system of kanpur zoological park	Abbas, Butool	Roy, Satyaki
13-May-09	U.p. handloom: a neo -retail experience	Singh, Akanksha	Jha, Munmun; Roy, Satyaki
20-May-09	Discourse on holistic stratgic packaging design	Singh, Sneh	Bhattacharya, Bishakh
20-May-09	Graphic adaptation of “the conqueror worm” by edgar allan poe	Dasgupta, Kaustav	Roy, Satyaki; Mathur, Suchitra
28-May-09	Application ui design for a collaborative network portal	Kumar, Senthil	Roy, Satyaki
02-Jun-09	Design of bus interiors	Krishnan, Bala	Dhande, Sanjay Govind
26-Jun-09	Designing a mobile school communicator device with special emphasis on developing a collaborative gui	Banerjee, Prantik	Roy, Satyaki
01-Jul-09	Application of photovoltaic technology for socially viable product design	Agashe, Alok Padmakar	Dhande, Sanjay Govind
07-Jul-09	Design & development of products for promotional marketing of higher edcuation	Yadav, Alok	Roy, Satyaki
20-Jul-09	Codesigning a learning device for children with emphasis on product semantics	Chowdhury, Payal	Chatterjee, Jayanta; Roy, Satyaki
30-Jul-09	Designing of intercity bus in indian context	Gomango, Ranjit	Dhande, Sanjay Govind
06-May-10	Citiscapes-data visualization on urbanization	V, Nachiket	Roy, Shatrupa Thakurta
07-May-10	An awareness through print media	Singh, Neha Kiran	Roy, Sa tyaki
07-May-10	Design of future magazine (sense service) and user experience and user interface design of interactive magazine (mag x)	Shah, Alap Harshad	Roy, Satyaki
07-May-10	A set of handbooks for amateur designers	Guria, Stuti Shalini	Roy, Shatrupa Thakurta
07-May-10	Study of 3d technology and application in visualization and tele-immersion	Desai, Niral Ajaybhai	Roy, Satyaki
07-May-10	Touch-screen applications for kids learning (a project on user experience and user interface design)	Agrawal, Himanshu	Roy, Shatrupa Thakurta
10-May-10	Graphical user interface study of academic campus automation software	Agrawal, Vaishali	Bhushan, Braj

13-May-10	Concurrent engineering and industrial design for the development of an edutainment product	Shah, Umang Arvindkumar	Bhattacharya, Bishakh
17-May-10	Design of vegapatra- new media mailing service for india post	V M, Joshima	Dhande, Sanjay Govind; Tiwari, Nachiketa
31-May-10	Brand development of india post through product and store layout design	Sonawane, Yogesh Ramesh	Dhande, Sanjay Govind; Tiwari, Nachiketa
14-Jun-10	Design and development of a new energy harvesting device for mobile phones	Sultane, Atul R	Bhattacharya, Bishakh
12-Jul-10	Smart drug infusion : a new product design	Kumar, Vimal	Bhattacharya, Bishakh
21-Jul-10	" Disruptive product design through task flow analysis of the laundry process "	Bajpe, Kiran Anand	Patil, Koumudi
29-Dec-10	Design of an automated accounting interface for a rural low literacy user	Kulkarni, Nitin Vijay	Patil, Koumudi
03-May-11	Iserve: a smart phone application	Varma, Kratika	Roy, Satyaki
04-May-11	“Design for barriers”-staris climbing manual wheel chair	Sharma, Shanu	Roy, Satyaki; Roy, Shatarupa Thakurta
04-May-11	“Drift…” – three wheeler for a green ride	Sekar, Sathish	Roy, Satyaki; Ramkumar, J
11-May-11	Urban mobility solution	Das, Sandipan	Bhattacharya, Bishakh
18-May-11	Creativity intercrossed	Khera, Richa	Roy, Satyaki
18-May-11	Mobile applications in the realm of location based services	Kumar, Ankit	Roy, Satyaki
26-May-11	Studies in asynchronous web-based learning	Paul, Prithu	Bhattacharya, Bishakh
10-Jun-11	Designing post disaster temporary settlements for indian scenario	Mundhada, Mukund Dinesh	Patil, Koumudi
21-Jun-11	Impact of social media on design	Sawant, Nutan	Roy, Shatarupa Thakurta; Roy, Satyaki
21-Jun-11	Information design for kanpur railway station	Sarika Bahaley, Sarika Madhukarrao	Patil, Koumudi
29-Jun-11	Applying user centric design to architecture	Bathla, Siddharth	Roy, Satyaki
01-Jul-11	Urban housing eco-system of low income groups: a human centric exploration	Rathore, Pragam	Roy, Shatarupa Thakurta; Roy, Satyaki
13-Jul-11	Development of an india-centered inspiration process for automobiles	Raghuvanshi, Rohit	Bhattacharya, Bishakh
25-Jul-11	Play and body image of special children: a design intervention	Johry, Aakash	Patil, Koumudi
26-Jul-11	Design for frugal sustainability: a constraint-based product development tool	Shah, Neel	Patil, Koumudi
03-Aug-11	Exploring vehicular movements and behavior at t intersections	Ghongade, Abhitosh	Ramkumar, J; Bhushan, Braj

04-Aug-11	Design and development of a grain cleaning appliance for household purpose	Thorat, Sandeep Netaji	Tiwari, Nachiketa
05-Aug-11	Design and development of an interactive board game, taking inspiration from ideas of indian logics	Jagatani, Sairam	Ramkumar, J; Guha, Nirmalya
05-Aug-11	An idea generation technique based on an evolutionary perspective for communication systems	Lokeshwar, V K	Patil, Koumudi
27-Sep-11	Networking for social issues: a search app for socially motivated users	Singh, Shuchi	Patil, Koumudi

Think● Ideate● Speak● Communicate

04

Design Infrastructure


DESIGN PROGRAMME
IIT KANPUR

The Smart Materials and Structures (SMS) Laboratory at IIT Kanpur provide state-of-the-art facilities for research and development

Design Progr

Futuristic Lab in the process of development

Intelligent product design lab
2d/3d Modeling software
Responsive system design
Transportation design
Rapid 3D model makers
Interaction design lab
Animation workbench (includes software/modeling work bench)
User experience design workbench
User testing laboratory

Design program is well equipped to meet the needs of students in their academic pursuits.

There are studios for immediate model making and material explorations as well as associated laboratories equipped with advanced equipment.

The following is a snapshot of the facilities:
7000 sq ft of space for class room and interaction.
SMSS lab
4i lab
Fine arts studio
Media technology center.

amme Facilities

Smart Materials Structures and Systems Laboratory

About Lab:
The Smart Materials and Structures (SMS) Laboratory at IIT Kanpur provide state-of-the-art facilities for the research and development of novel smart materials and sensors technologies, and to design and implement smart devices for enhancing the adaptability, functionality, and precision of structural systems.

About Smart Materials
Smart materials are those that can alter their shape, stiffness or other properties when they are subjected to changes in loading temperature, electrical or magnetic field. For example, shape memory alloy is malleable at low temperatures, but above its "transformation temperature", it becomes hard to deform and transforms back to its predetermined shape. This temperature responsive actuator can be used for robotic muscles , grippers etc. Without electricity it can also be used as a thermostat for an electronic device. The other smart material which is used frequently in our laboratory is called piezoelectric material. These materials expand when a voltage is applied and contract when it is reversed. The converse is also true - pressure applied to them creates a potential difference across the surface. These materials can be used in products like sensors, every harvesting devices, vibration control etc.

The facilities in the Design Programme includes a lot of high end machineries.

Facilities at SMSS Laboratory

CONCORD d METER

Specifications:
Accuracy:± 2.5% with optimum sizes and shapes.
± 5.0% generally feasible with care.
± 10.0% with most optional measurements of d_{31}andg_{31}.
Resolution :± 1 count up to ± 3.
Frequency : 25, 50,100, 200 and 290 Hz (60 Hz line);
Force:Factory set at approximately 0.2 Newtons.
Capicitance Load:1.01µF (0.01 to 111.1µF with optional DC-1 and with d_{31} / d_{33} switch set in d_{31} position).

HIGH POWER AMPLIFIERS

Specifications:
Output Voltage Range: 0-15 V RMS
Output current Range: 2 Amps RMS
Input Voltage Range: 0V to +- 10V
Bandwidth 10Hz - 5.0 KHz
Output Impedance 4Ω
Intput Impedance 20Ω

PSD9000 SERIES PROGRAMMABLE POWER SUPPLY

Specifications:
Programmable DC 0 to 30V- 2A , Auxiliary 5V- 2A (PSD9001 & PSD9002)
Programmable Dual DC 0 to 30V - 2A (PSD9003 & PSD9004)
Electronic Fuse for output
Last setup save
Serial Interface RS232 standard, USB Interface (optional)

DIGITAL STRAIN INDICATOR

Specifications:
Range 1,000 and 10,000 μ strains
Bridge 1 Arm, 2 Arm and 4 Arm
Bridge resistance 120 Ω / 350 Ω
Bridge balance by 2 Nos. of 10 K 10 T Potentiometer
Resolution 1 μ strains and 10 μ strains
Accuracy Less than 0.1%

SMA MODULE

Specifications:
Input mode: Mannual and remote
Manual Mode: Internal reference 0-10 V which can be varied by 10K 10T pot
Maximum current: 0-2 A for 0-10V input (load 1Ω – 10Ω)
Resolution 10 m V for Voltage, 1mA for Current
Accuracy: Better than 0.5 % for Current and Voltage
Input Power: 230V, 50 Hz, AC
.

PIEZO ACTUATION SYSTEM ALONG WITHSENSING AND FILTER UNIT

Specifications:
Sensor: Piezo electric crystal
Output: sine/random
No of channels:4
Frequency range:10-2000 Hz
Maximum Output voltage: 200 volts (RMS)
Input/Output connection: PT 10 terminals/ B&C connectors
Input power: 230V, 05 Hz AC

DISPLACEMENT INDICATOR

Specifications:
Input : LVDT coil, 0-10mm
Excitation Range 1 volts at 4KHz
Range Calibrated for +/- mm
Accuracy Better than 0.5%
Output 0+/- volts C across 1K load
Input connections through 5pin MS connector
Power Supply 230 Volts 50 Hz

Other Facilities

Dynamic mechanical thermal analyzer

Brabender plastic order labstation

Innovation, Integration, Incubation and Implementation | 4i

4i Laboratory

4i-Lab is a recent initiative at the Indian institute of Technology, Kanpur. It is an enabling laboratory with an objective to facilitate design evolution into complete products. The four i s stand for *Innovation, Integration, Incubation and Implementation*. The laboratory is envisaged as a central facility for concept design and product realization. The laboratory environment is structured to digitally integrate the processes of design, simulation and manufacturing. The facility has been designed to take care of professional course requirements of students and to provide infrastructural facilities for sponsored research and industrial consultancy.

Layer Thickness: 0.005 inch(0.125 mm)
Build Size: 16 x 14 x 16 inches
(406 x 355 x 406 mm)

Design Competence

Rapid product development capability is a crucial factor in an increasingly competitive global manufacturing market. Design competence and capabilities are integral to product development process. Design is also the key to value enhancement of the product. The 4i-Lab houses state-of-art CAD / CAM tools with latest capabilities in shape acquisition, modeling and prototyping that significantly expand the domain of geometrical shapes that can be realized for any product.

Computer Aided Engineering

CAD software such as I-DEAS, Imageware, Uni-Graphics, Pro-Engineer, CATIA are used for modeling to describe product structure and associated data with visual representations. With powerful geometric modeling, assembly modeling, 3D annotation and 2D drafting, a product's attributes can be fully documented and communicated in an interactive, innovative and understandable environment.

Rapid Prototyping Facility

Prototyping is the crucial stage between transformation of a design process into a product. It exposes and facilitates the elimination of design errors early in the product development stage and before any significant investment is made. Rapid Prototyping (RP) fabricates physical parts layer by layer. It uses additive manufacturing processes, which do not require any tools and setups as compared to the subtractive techniques used in the traditional machining operation and thus reduces the prototype development time

Computer Aided Machining and Turning

The lab is equipped with the latest multi-axis milling and turning machines. CNC milling from DECKEL MAHO & Turning center from GILDMEISTER controlled by a central computer have been integrated with the modeling environment. Machining needs are met with a complete selection of cutting patterns that include highly automated roughing and finishing approaches as well as curve and edge based machining. Using the Software and Hardware facilities, fixture and tool designs can be completed and manufacturing processes can be optimized in an integrated, CAD associative environment. Delcam , Master Cam softwares are used to generated the CNC code for complicated profiles and then transferred to the machine controller.

DMC 63V DECKEL MAHO
Speed Range10, 000 rpm
Controls Heidenhain TNC 426
Working Bed Size: 630x500x500mm

CTX GILDMEISTER TURNING CENTER
Spindle Speed 4,500 rpm
Controls Fanuc 21i T
Turning length-600mm, Dia-305mm

Water-Jet Machining

Abrasive Water Jets are used to create precision parts from hard to cut materials. Water is pressurized to 40,000-55,000 psi and then forced through a small orifice along with an abrasive (Garnet). Cutting action is a grinding process and is designed to complement or replace existing processes like milling, laser, wire EDM and fine plasma. Advantages over other machining methods include wide range of materials, quality finish, low heat in machining process and no tool changing.

Model OMAX 2652 (above)
Speed: 200 in / min; X-Y Travel: 52" x 26"
Accuracy: 0.051 mm per1' travel

Laser Engraving & Cutting (left)
Epilog CO2 Pulse Laser
Bed Size: 2'x1'
Laser Beam Size: 0.1mm
Resolution: 600 DPI
Power: 35 Watts
Materials: Wood, Polymers, Nylon, Plastics, Anodized Aluminum, Marble, Glass etc.

Grinding machine
A two grain grinder for polishing cast iron moulds and other Chamfering wood and MDF jobs

Drilling machine
Electric power drilling machine to bore holes and shafts in jobs like wood and MDF.

Lathe
Used mainly for wood turning and metal working and spinning operations.

Wood Sander

Vacuum forming machine

This is used for form making using glass fiber reinforced composites. Students use this machine to rigig forms like car fenders and unique shells like helmet, coffee cups etc.

Wood cutting machine
Student use this machine predominantly for sheet metal jobs while working on aluminum and steel sheet jobs.

Manual milling machine

Radial Milling machine

Fine Arts Studio

The Fine arts workshop is envisaged as a central facility for product visualization and quick prototyping. The facility has been designed to give hands on experience in form and material exploration. The facilities within this lab such as CNC machine, Lathe machine and vacuum foaming, etc allow students to iteratively evolve the products. Emphasis is given more on aesthetics and finishing. Individual and group projects help students to sharpen their brainstorming

Thermocol cutting machine for shaping very soft grained thermocol.

Press Printing Machine
This is used by students impress images on soft solids like aluminum sheets.

Computer controlled Milling machine with the ability to move the spindle vertically along the Z-axis. This extra degree of freedom permits their use in diesinking, engraving applications, and 2.5D surfaces such as relief sculptures. When combined with the use of conical tools or a ball nose cutter, it also significantly improves milling precision without impacting speed, providing a cost-efficient alternative to most flat-surface hand-engraving work. Students mostly work with hard jobs like Wood and Medium Density fibre (MDF). The fine arts studio is equipped with machines that enable students to make fine finished scaled down prototypes. The practices made here help students to explore various materials like MDF, Thermocol, wood, steel, cast iron and PUF. Emphasis is specially made on the finish and aesthetics of the object being made. Individual and group projects enable students to sharpen their brainstorming process and creativity.

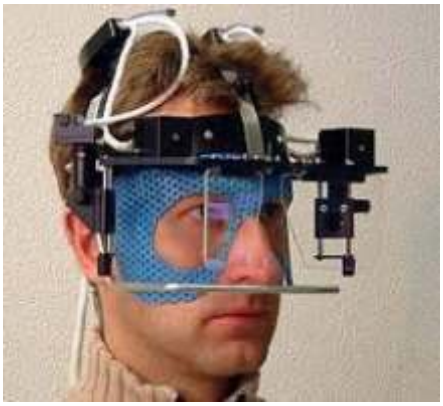
Media Technology Center

The Media & Technology Center is an attempt to encourage and cultivate a sense of appreciation and explore the skills involved in the new media for creative expressions. The center aims to provide a meaningful platform for the students of the Indian Institute of Technology Kanpur to foster their creative potentials and merge it with their gradual process of acquiring and exchanging knowledge with technology based education at the institute. One of the major on going projects of the center involves faculty across the institute in production of quality video based courseware to generate resources and aids for supporting the engineering, sciences and technology based education that can reach out to the larger Education system through television or other communication media. The initiative under the auspicious of National Program on Technology Enhanced learning (NPTEL) is supported by the Ministry of Human Resource and Development.

We have made IIT Kanpur the first amongst all the IIT's to own a community radio service of its own.

Proposed New Additions

Based on the current research growth, the design programme aspires to acquire the following
equipments for enhancing the research activity:



Equipment for the study of human computer Interaction and usability

1) Eye Tracker for usability research and interaction design

Eye-tracking is extensively used in the scientific community, marketing, and in usability studies today. This instrument as the name suggests helps to follow the eye position and movement, record the same and present the users' interaction with different devices and products. There are several varieties of eye trackers available in the market. The instrument that we are looking for is in the category of video-based eye trackers. In this system, a camera focuses on one or both eyes and records their movement as the viewer looks at some kind of stimulus. The stimulus is generally displayed in the computer monitor. This kind of eye-trackers uses "contrast to locate the center of the pupil and use infrared and near-infrared non-collimated light to create a corneal reflection (CR). The vector between these two features can be used to computer gaz intersection with a surface after a simple calibration for an individual". The design program would need two such eye trackers for the study of product usability and the visual interaction design group.

EQUIPMENTS FOR ADVANCED PRODUCT DESIGN

1) Studio Lighting for Product Photography

This facility is needed to show/observe the details of an object clearly. Lighting an object well brings out details and provides pleasing highlights. Most common method for uniformly lighting small objects is to surround the object in a light box. For professional uses we would need a range of the following equipments –
(a) Lighting Tent – This facilities will be used for detailing small products. This ranges
from thin budget nylon to the top of the range velvet lined Nylon. The thicker the material, the greater the diffusion effect and velvet lined will add anti reflective properties.
(b) Illuminated Background - This is a relatively new equipment introduced by Lastolite in 2006. In this type of equipment, the backgrounds (also called Hilites) are side illuminated and throw pure white light forwards making for High Key (white background) pictures . This ideally needs 4 heads (2 at the front and 2 in the Hilite).

2) Cintiq Wacom for Product, Animation and Transportation design

The Cintiq family of interactive pen-display enables creative professionals to work naturally and intuitively, by using Wacom's patented, professional pen technology directly on the surface of an
LCD Display. Currently, the design students work on papers for concept sketching and only at the final stage the drawing is transferred to soft-copy for rendering. This is a very time
consuming process. The use of this Wacom technology on the other hand would help them in fast rendering and product stylization.

(3) Industrial Modeling Clay Studio
Currently the Design Program does not have a clay modeling studio for interacting with product stylization. A fully equipped Clay Studio for Transportation and Product design including Tape Drawing Board, Stylization tools & Modelling Materials is urgently required for the students.

(4) 3D Scanner for Product, Animation & Transportation design
A 3D Scanner captures objects in full color with multi-laser precision. The Output of the 3D scan models can be exported to popular design software like SolidWorks, 3ds Max, ZBrush, Rhino, Mathematica etc.

(5) Desktop 3D Printer for Product and Transportation design
Likewise a 3D scanning system for the becnchmarking of existing products, the advanced design lab
would need Desktop 3D printer to rapidly prototype design models.

(6) Desktop 5-axis and 3-axis milling machines
(7) Bippac wireless ELECTROMYOGRAPHY (recording surface, needle and fine wire EMG)

Equipment for animation design studio

1) Animation desk for Animation

2) Clay Animation Skeletons
Clay Animation Skeletons are very useful to develop quick animation models.


users

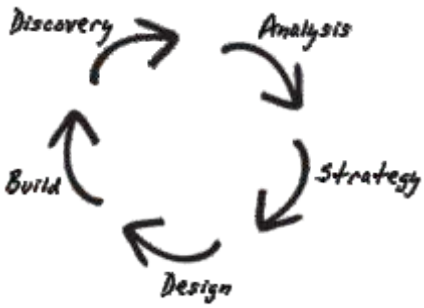
05

proposal for Phd program

Introduction

The Design Program at IIT-Kanpur is established with an objective of advancing our intellectual and scientific understanding of the theory and practice of design, along with the system of design process management and product semantics. The program, since its inception in 2002, aimed at training post-graduate students in the technical, aesthetic and ergonomic practices of the field and to help them to comprehend the broader cultural issues associated with contemporary design through the *Master of Design* program. It has been amply understood now that the program should focus on investigating and articulating the principles and methodology behind the design through systematic research, experimentation, intellectual inquiry and theoretical speculation. This also complies with the current National Design Policy(attached herewith for reference) which directs us in "laying special focus on up-gradation of existing design institutes and faculty resources to international standards ... with a view to spreading quality education in design to all regions of India, …". It also suggests that "the possibility of new models for setting up of such institutes, in keeping with the current economic and educational paradigms, will be explored.'

The field of Design is opening up new vista for interdisciplinary studies at a dramatic pace all over the world. International Design Schools like Stanford D-School, School of Design atIllinois, USA, Millano School of Design in Italy, Alto University, School of Designin Finland, and many such similar schools have been established in the last decade. Doctoral level programs are already established in these schools. The starting of such Ph.D. programmes was a step in the recognition that design research can be fruitfully carried on within doctoral curricula, where research-oriented activities may converge and cluster, independently from the applied research carried on within companies or professional laboratories. Also, the Ph.D. programme was developed as a highly focused and intensive programme for generating advanced knowledge in design theory, methods, processes and practice.



In fact, the introduction of a research Ph.D. programme in design at IITK will meet the explicit demand for high profile design researchers, and will positively contribute in developing the required human resource in Deign; as mandated by the National Design Policy. There is an explicit need for creating well trained human resources in Design to meet growing requirements. From sample data collected (see Table 1) across all the design institutes of the country, it is evident that only three schools are currently offering Ph.D. in Design, these are IISc Bangalore, IITG and IIT Bombay. There is a growing demand among the post graduate students to go for higher study; the proposed Ph.D. program would be able to meet this demand. Needless to say that the present level of post-graduate teaching in the Design Program will also get immensely enriched by an active research program.

Table 1: Comparative figures of MDes and Ph.D. students for the year 2010

Institute	MDes Students	PhD Students
Industrial Design Centre (IIT Bombay)	117	35
Department of Design (IIT Guwahati)	35	12
Industrial Design Programme (IIT Delhi)	36	NA
Centre for Product Design & Manufacturing (IISC Bangalore)	27	40
Design Programme (IIT Kanpur)	34	35 Proposed

Extensive use of the present state-of-the-art facilities like 4-i laboratory, Media Technology Center, CAD centre, Intelligent Product Design laboratory and Psychology laboratory, is already underway for the present ongoing M. Des. Program. This present infrastructure can efficiently and adequately support students of the doctoral program also. In addition, the outreach of the present contacts and collaborations with international design research centers, like Nokia Research Centre, Panasonic Research Centre, GM Science Labs, Design factory, Finland etc., can be substantially augmented by establishing a doctoral program. Thus, a viable eco-system is envisaged to thrive and expand on long term sponsored and collaborative research aspirations, which can only be materialized by introduction of a vibrant doctoral program. By virtue of establishing a doctoral program will enhance our national and international visibility.

In the following section we outline the admission/eligibility criteria for our proposed Ph.D. programme.

Admission/Eligibility criteria for Ph.D. Programme in design:

The field of Design having an intrinsic multidisciplinary character has a very large and broad base of students from various disciplines. Master and Bachelor Students from IITK and other equivalent institutes, aiming at a broad interdisciplinary research in design, matching the research interests and disciplines of the participating faculty members, are eligible for admission to the Ph.D. programme. In this background, regular students coming from the following backgrounds will be considered for Ph.D. admissions:

- Bachelors degree in engineering/Technology/Architecture or Equivalent
- Bachelors and/or Masters degree in design or Equivalent
- Masters degree in engineering/technology (M.E./M.Tech.) or Equivalent
- Masters degree in Fine Arts (M.F.A.) or Equivalent
- Master of Science (MSc) or Equivalent

The program would also encourage existing teachers to apply through the CDTE/QIP programme, and professionals through external and sponsored research categories. The minimum CPI/Marks/performance criteria will be in-line with the existing PG manual of the institute.

Desired Strength of the Ph.D. programme

The number of students for a new PhD programme should be typically large enough to create a significant impact in the proposed directions of research, subject to the availability of supervisors. There are currently fourteen faculty members directly associated with the design programme. A list of the faculty members has been provided earlier. These faculty members are from varied backgrounds like Mechanical Engineering, Humanities and Social Science, Computer Science and Engineering, Chemistry, Chemical Engineering, Electrical Engineering, Biology, etc. There are also a large number of faculty members actively collaborating with the Design programme faculty members in relation to different ongoing research projects. A brief outline of such activities is given later. A healthy pool of PhD students would facilitate the active research interests of all these faculty members.

In view of these facts, we propose Ph.D. student intake strength of 35.

Course Requirements

Program	**Minimum number of courses**	**Semester I**	**Semester II**	**Semester III**	**Semester IV**	**Semester V**	**Semester VI**
PhD students with B.Tech/ B.Arch/ MSc/ B.Des or equivalent	10	DES601, DES602, DES681, One Elective	DES603, DES682, Two Electives	Two Electives + 8 units of Research	16 units of Research	16 units of Research	16 units of Research
PhD students with M.E. or M.Tech. (Engineering) or equivalent	4	DES601, DES602, Two Electives	16 units of Research	16 units of Research	16 units of Research		
PhD students with M.F.A or equivalent	4	DES633, Two Open Science/ Engineering Electives, 4 units of research	One elective, 12 units of research	16 units of research	16 units of research		

Financial Requirements:

For successful implementation of the doctoral program, regular scholarship for the new students, as per the existing institute norm is requested.

Current Activities at the Design Programme

Students of Design programme are particularly looking for options to extend their research into PhD as this is considered to be a good value addition to their portfolio. Other M. Tech Students from various departments with a motivation of synthesis and product development will find this as an interesting avenue to fulfill their desire. In the last few years, new challenges in design have emerged out in our institute in diverse areas like:

(a) Automobile Design – Numerous research projects are going on in the Design Program related to Automobile Design. These are related to a long range of design parameters starting from product stylization, functional design and safety system design. In collaboration with the GM, India Science laboratory, Design Program has developed regular workshops on Advanced Automobile Design. A research project on automobile accessory design has been successfully completed in this direction. Students are also involved with Maruti for developing a new generation of Hybrid Cars. A group of student is associated with design of Intermediate Public Transports (IPTs) for the Kanpur City. Students are also involved with the Boeing project related to the form design of unmanned vehicles.

(b) Satellite and Spacecraft Design –Researches on design of satellites, lunar rover and satellite antenna morphing systems have been initiated at the institute. Such projects are generally sponsored through the Space Technology Cell and ISRO. A few projects are directly undertaken from the Satellite Applications Center, ISRO. Students of Design Program are currently involved in the design of inflatable space antenna design and shape control of flexible parabolic antenna system projects.

(c) Innovation Management & New Product Design – A Generic academic program on Product Design and Design management has already been initiated at the Design Program in collaboration with the Design Institute of Finland. Design Factory, Finland and students of our programme are actively participating in different global projects of Nokia.

(d) Media and Interaction Design - Media and Interaction Design - These are design projects related to the fields of User Experience (UX) and interaction design (UI), game design, edutainment products etc. Some of the key partners here are Nokia Research Center, Design Factory, Finland, INFOSYS, Oracle India Development Centre, Funschool, Panasonic Research Center etc.

In all these endeavors, it is felt that while the students have fairly adequate technical background of a project, the concepts of design needs to be honed substantially for developing successful products. Typically, our students are found to be very efficient in analyzing a problem while less initiated to the areas like inventive problem solving, creativity, ergonomics, user interfacing, stylization, patenting and copyrighting procedures and finally marketability of a product. Often an amateurish effort of integrating these concepts during product design has stymied the student community. It is therefore, absolutely necessary to provide a common platform for formal training through the PhD program for the interested students.

06

vision

" The Design Programme at IIT Kanpur envisions evolving into a premier centre for education and research in the essence of holistic design thinking through excellence in Post Graduate education and high quality research."

Introduction

Pursuing the spirit of IIT Kanpur, in providing a comprehensive engineering education with a flavor of arts and science, the Design Programme at IIT Kanpur is distinct from other generic design institutions in the country. Since our intake, comprises of students from varied backgrounds, the program focuses on initially imparting the essence of design thinking, while subsequently encouraging the students to liberally pursue their own interests within the design domain.

Design Programme at IITKanpur was started in July 2002 with ten graduate students and four faculty members, broadly in the specializations of product design and visual communication design. It has been amply understood that a new product development, requires understanding a broad range of aspects such as functional, ergonomic, aesthetic, emotional, economic viability of materials and manufacturing processes and study of user experience. The academic program here has adopted a strategy of holistic training of an aspiring design graduate, encompassing all these aspects of design. The program has successfully implemented this vision through a balanced mix of discourse based learning and experiential learning.

Education at Master's level

With a prime focus on areas such as Product Design, Visual Communication and Interaction design, students are initially introduced to these areas through specialized modules and workshops. Since, the curriculum imbibes, critical design thinking, students are taught courses related to Design Theory and Design Practice, where they learn through application on projects. Since, the need for the development aspect of this particular field is very high, demand for the best trained and critically tuned minds are in fact even higher than what we can offer at our masters level. This reinforces our belief for the need to embark onto PhD program to train future minds.

The Design Program at IIT-Kanpur is established with an objective of advancing our intellectual and scientific understanding of the theory and practice of design, along with the system of design process management and product semantics.

Our Vision

Our vision serves as a guiding light for all activities and initiatives of Design Programme at IIT Kanpur such as the PhD prgram.With such a vision, we:

- Enrol all those who are not only the best and brightest, but also deeply passionate about design, into our postgraduate program. Realizing that creativity and innovation grows best in an atmosphere which is rich and diverse, we encourage students with a diversity of majors and experiential backgrounds to join the program.
- Recruit faculty cutting across disciplines and institutions: We draw our faculty from a large number of departments and institutions. Every faculty member of our program not only has an area of specialization, but also proven expertise in trans-disciplinary knowledge and work experience. Thus, our academic program covers all aspects of design including aesthetics, technology, ethics, social relevance, and business viability.
- Offer an open, dynamic, and flexible work environment which nourishes imagination, curiosity, and design leadership. Our carefully designed processes, systems, and work spaces positively promote collaboration, passion, and lateral thinking.
- Provideworld class facilities so that our designers can quickly translate their dreams into actual working prototypes. We continually upgrade our laboratory facilities so that powerful ideas could be quickly transformed into actual working solutions.

Design research is highly connected with the industrial development, application and social entrepreneurs hip.

Research infrastructure development

•Design Programme is well equipped to support its students in their academic pursuits. With dedicated model making studios, materials exploration studios and classrooms located on-site, students are given unobstructed access to advanced equipment and computer facilities. Listed below are some of the facilities, which are currently available:

- Smart Materials and Structures Laboratory
- 4i Lab
- Fine Arts Studio
- Media Technology Center

Sponsored research

Design research is highly connected with the industrial development, application and social entrepreneurship. Design Programme will actively promote student involvement in live projects sponsored by large and small scale industries along with sponsored projects from various governmental organizations.

Planned research activities in next decade

With the introduction of the PhD program, Design Programme intends to embark upon investigating the following emerging avenues within the design domain:

Interaction Design - Interaction design shapes the experiences of people as they interact with products in order to achieve their goals and objectives. It is the practice of designing interactive digital products, environments, systems, and services. Like many design disciplines, interaction design is concerned with form. Interaction design focuses on something that traditional design disciplines do not often explore: the design of behaviour.

Instructional Design - Instructional design is by definition the process by which instruction is improved through the analysis of learning needs and systematic development of learning materials. Instructional designers often use technology and multimedia as tools to enhance instruction.

Information Design - Information design is one of the newest disciplines in design. It deals in preparing and communicating information so people can use it with efficiency and effectiveness. A popular part of information design is INFOGRAPHICS- visual representations of information, data or knowledge - are often used to support information, strengthen it and present it within a provoking and sensitive context, depending on designer's creativity.

Recreational /Game Design - An indispensable ingredient of successful learning is motivation: a motivated learner can't be stopped. Unfortunately, till this day much of the content that needs to be learned by students is not directly motivating to them, and are usually considered too “dry” or “technical”, whether the learners are in school, college, corporations, professions, or even, the military (Brensky, 2003). For more than 20 years, educationalist have been discussing the potential that exists for the application of games to learning.

Optoelectronic Design - Given the exponential growth of photonics, and nanotechnology, Nano photonic building blocks can be used through network on- chip architecture design to achieve the goal of communication and computing architecture. An ultimate molecular design could perhaps lead to a practical quantum computer.

Intelligent System Design/ Emergent Design - Involves design of a system capable of generating dynamic behavior in a structure or a system. Integrating the adaptive capability of smart materials, the emergent design system can generate various forms and functions as a design solution.

Visual Culture - Visual Culture is a newly established interdisciplinary domain. Study in Visual Culture provides a Design Researcher to a wide range of possibility in the field of :

a) Mapping a global history and theory of visual culture
b) Matching the challenges of interpreting globalization and localization scrutinizing the most essential terms and the debates that surrounds the cultural scenario
c) Addressing the Cross-Cultural Issues in the time specific vicinity : interpreting aesthetics within and beyond the traditional theory and conventional standards.
d) Reassessing the need to operate and control change to maintain the cultural health

Bio-inspired design

Bio inspired endeavors integration of methods inspired by the fundamental processes occurring in nature which can be used to solve challenging engineering problems. Bio inspired engineering design paradigm focuses on addressing the following design objectives

a) New innovative design
b) Efficient design optimization
c) Design robustness
d) Sustainable design

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