

**Quality Improvement Program
IIT Bombay
Full Report of Work Done by the Candidate during the Contact Program**

1. Advanced Admission offered for the year: **July 2004**
2. Name of the Candidate **Arvind Wamanrao Kiwelekar**
3. Roll No. Not Allotted
4. Department **Computer Science & Engineering**
5. E-mail ID **akiwelekar@yahoo.com**
6. Name of the Supervisor **Prof. R. K. Joshi**
7. Name and Address of the Parent Institute: **Dr. Babasaheb Ambedkar
Technological University,
Lonere-402 103 Dist. Raigad M.S.**
8. Dates during which Programme was attended.

From	To	No of Days
1 st September 2003	30 th September 2003	30
3 rd Feb. 2004	3 rd March 2004	30
	Total Number of Days	60

9. Details of Acquaintance with Department's Computing and or lab facilities.
Got login account created on lab machine and got mail ID

10. Objectives and Scope of the Ph. D. Work

The main objective of the proposed research work is to develop category theoretic models for Object Oriented Systems.

Scope the proposed work

Category Theory is a branch of mathematics that provides universal constructions to describe properties of mathematical structures like sets, groups, graphs etc. At the same time, category theory is widely used to describe and formulate concepts in other disciplines also. Application of category theory to computer science in general and programming languages in particular is an active area of research.

Morphism and process of abstraction are two main ingredients of category theory. Categories being a collection of objects and morphisms describe properties of objects in terms of how objects are related with each other through morphisms. Process of abstraction allows us to formulate a recurring phenomenon in system modeling through universal constructions provided by category theory.

At present, Unified Modeling Language (UML) is widely used to model object oriented systems. UML based models acts as a bridging document between designer and developer of a system. UML being a visual modeling tool does not allow us to perform reasoning at design level.

Hence, the main objective of the proposed work is to develop category theoretic models that permit us to carry out reasoning at design level. Categorical semantics for OO concepts like inheritance and composition has already been provided. The main emphasis of the proposed work will be to apply and provide categorical semantics for Design patterns, Frameworks and Object Oriented software Architecture.

11. Details of the Literature Review made

During contact programme, basics of category theory have been studied. The books referred for this purpose are-

- Benjamin Pierce, Category Theory for Computer Scientist, Prentice Hall.
- Michel Barr, Category Theory and Computer Science, Mc Graw Hill
- Andrea Asperti, Categories, Types and Structure, MIT Press
- D. Pitt, Category Theory and Programming Languages.

12. Work Plan giving Various Activities

Sr. No.	Activity	Year I		Year II		Year III	
		Sem I	Sem II	Sem I	Sem II	Sem I	Sem II
1.	Completion of Course Work and Seminar	XXX					
2.	Providing Categorical Semantics for Design Patterns, Components and Framework		XXX				
3.	Identifying Types of connectors found in OO Software Architecture			XXX			
4.	Providing Categorical Semantics to architectural connectors				XXX		
5.	Development of Category Theory based tools for architectural reasoning.					XXX	XXX

13. Candidates Signature

14. **Remarks of the supervisor:** The work done by the candidate as above has been satisfactory/unsatisfactory. (Pl. retain one option)