Paper Code: PCS-01	Roll No.										

PrePhD
Odd SEMESTER EXAMINATION, 2016-17
AN INTRODUCTION TO FORMAL METHOD

[Time: 3 Hours] [Max. Marks: 100]

Note:- Attempt All questions. All questions carry equal marks. Assume suitable data if required.

1. Attempt any three parts of the following:- **[10x3=30]**

(a) If n does not appear in the free names of P show that (new n)P ≡ P.
(b) In context of APi, prove that reduction barbed congruence implies the synchronous weak bisimulation.
(c) What is the analogy between π-calculus and λ-calculus?

(d)]If a language is obtained by omitting the matching construct from APi then show that full abstraction for this new language will not hold.

(e) Prove that in a synchronous pi-calculus, P ≈ Q implies P|R ≈ Q|R.

2. Attempt any two parts of the following:- **[10x2=20]**

(a) Prove that if Γ |-- (new n : D)R then D is to be channel type in R.
(b) Prove that bi-simulation equivalence is still an equivalence RELATION in a typed setting.
(c) Provide an example to demonstrate the justification for two syntactic categories in distributed pi-calculus.

3. Attempt any two parts of the following:- **[10x2=20]**

(a) Suppose in typed pi calculus setting c |-- M is used to explain a pi calculus process M with respect to a cost of communication along a channel. The cost setting c is pre defined and analogous to the typed setting. Can you develop a LTS for such pi calculus?

(b) With a suitable example, show that how the typical π-calculus can implement a mobile phone token handover from one base station to another base station. What were the limitations with in CCS/CSP to implement the same?

(c) Justify why graph isomorphism or automata equivalence are not sufficient to establish concurrent process equivalence.

4. Attempt the following:- **[30x1=30]**

Let us define a mini asynchronous pi-calculus process as P : =?c(x)|!c < v > |P|Q| if u = v then P else Q|0 using simple values u,v,... and channel name c [notations have usual meanings]. The reduction semantics has usual communication, contextual and value match/mismatch rules. Develop an appropriate

(i) Reduction Semantics

(ii) Action Semantics

and show that a touchstone equivalence (defined over reduction semantics) as "observational equivalence" coincides with asynchronous bi-simulation (defined over action semantics).