Paper Code: CS-065 **oll No.** | | | | | | | | | | |

B.Tech.
(SEM VI) EVEN SEMESTER EXAMINATION 2015-16
CONCURRENT SYSTEM

[Time: 3 hrs.] **[Max. Marks: 100]**

Note: - Attempt All questions.

Q1. Answer any FOUR parts out of the following: - **[5x4=20]**

(a) Define following terms:
  (i) *Syntax*
  (ii) Structural Equivalence
(b) Write down the complete syntax of pi-calculus for expressing concurrent large systems.
(c) Explain with an example why a process can't be treated as a function?
(d) Define following terms:
  (i) Bound names
  (ii) Free names
(e) Define following terms:
  (i) Reduction semantics
  (ii) Structural equivalence

Q2. Answer any Two parts out of the following:- **[10x2=20]**

(a) Prove that in any labelled transition system (lts) ~ is an equivalence relation.
(b) Model a protocol, in pi-calculus, for verifying password data through a separate server from a computational machine. You may make suitable abstractions.
(c) Provide that if $P \xrightarrow{(\tilde{b})c!\langle V\rangle} Q$ then P is structurally equivalent to $(\text{new } \tilde{b})(c!\langle V\rangle|Q)$.

Q.3. Answer any TWO parts out of the following:- **[10x2=20]**

(a) Explain an action semantics or lts for asynchronous pi-calculus. What is the significance of labelled transition semantics?
(b) Define following terms:
  (i) Strong and weak bisimulations
  (ii) Simple bisimulations
(c) Prove that in asynchronous pi-calculus(API), $P \rightarrow Q$ implies $P \xrightarrow{\tau} Q'$ for some Q' such that $Q \equiv Q'$

Q4. Answer any TWO parts out of the following:- **[10x2=20]**

(a) Prove (new n)P ≡ P if n does not appear in the free variables of P.
(b) Suggest the properties needed for defining the touchstone equivalence for the behavioural equivalence between processes.
(c) Prove that in API, $P \approx_{bis} Q$ implies (new n)P ≈bis (new n)Q.

Q5. Answer any TWO parts out of the following. **[10x2=20]**

(a) Design the syntax for an extension of asynchronous pi-calculus to describe explicitly distributed computations.
(b) Show that the relation ≡ is transitive, and therefore is an equivalence relation.
(c) Write down the short notes on the following:
  (i) MWB and CWB-NC
  (ii) Scope extrusion with an example