ID number: *Second Semester-2005*

BITS, PILANI – DUBAI CAMPUS

Course No: EEE UC-417
Class: BE (Hons.)-IVYear (ELECTIVE)
Course Title: Computer Based Control Systems

COMPREHENSIVE EXAMINATION (Closed Book)-REGULAR

Date: May 29, 2005 **Time: 3 Hours** **M.M. = 80**

NOTE:

(i) **Answer all the questions.**

(ii) **All questions to be answered in the answer sheet only.**

(iii) **Question paper contains four pages.**

(iv) **Answer all the parts of a question in continuation.**

(v) **Do not leave any blank space/page(s) in between the answers.**

(vi) **Do not write any thing on the question paper except your ID No.**

(vii) **Cross the blank space/page (s), if any.**

Q.1 *(a)* What are the main requirements or objectives of any industrial control systems? Discuss in brief. **[5]**

(b) A stirred tank with steam temperature and liquid level control is shown in **Figure-1** **[6]**

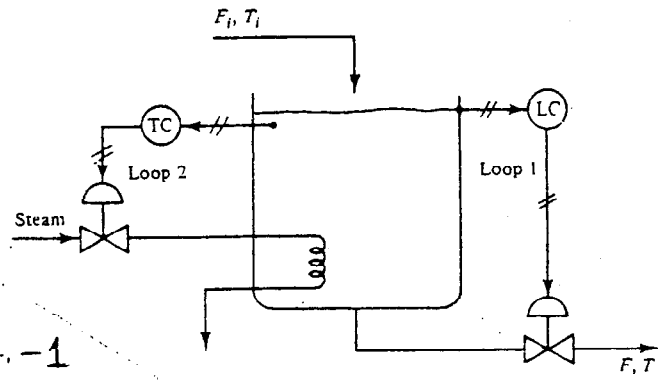

Fig. -1

(i) Explain the function of control loop-1 and control loop-2 as shown in the **Figure-1**.
(ii) Discus how two loops interact each other?
(iii) Is the performance of loop-1 affects loop-2?

(c) Compare the characteristics of simple PD over PI control mode. Justify with example when PI performs better in achieving control objective than PD? Why? [5]

Q.2 (a) Draw and explain the following circuit/block diagram used in design of PLC. [6]

(i) Power supply circuit
(ii) Input module wiring connection
(iii) Output interface module

(b) Names the different I/O modules used in PLC/DCS. Draw and explain the basic function of analog input cards and comments on the signal transmission. [5]

(c) What is field bus? What advantages we take by using field buses over hard-wire installation in process industry. Justify why PROFI-BUS is most popular than other buses used in process industry? [5]

Q.3 (a) Why we need signal conditioning circuits? Justify your answer with suitable example. What is the role of sample and hold and constant current source in signal conditioning circuits? [5]

(b) In the **Figure-2,** a tank is shown for which liquid level, inflow A, and inflow B are monitored. These measurements are converted to voltage and then to digital signals using comparators, which gives high signals when some limits is exceeded. [5]

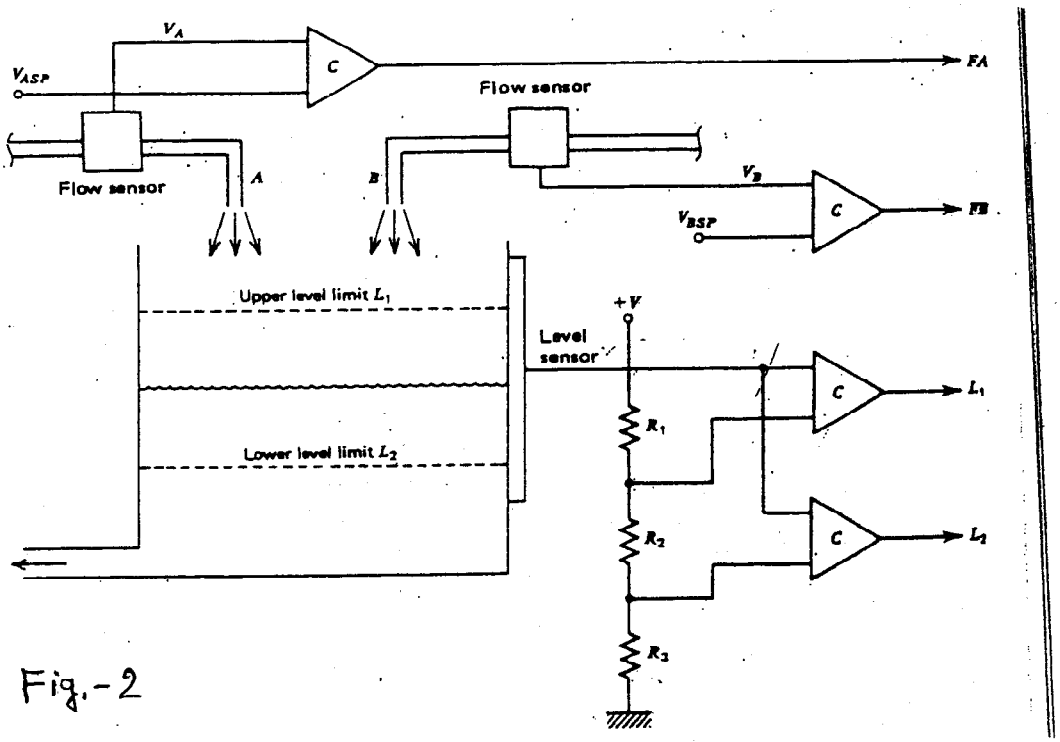

Fig.-2

The flow variables FA and FB will be **zero** for low flow and **one** for high flow. The level variables are such that L_2 is **one** if the level exceeds the lower limit and L_1 will be **one** if the level exceeds the upper limit. The alarm will be triggered if either of the following conditions occurs:

(i) L_2 LOW and neither FA nor FB HIGH

(ii) L_1 HIGH and FA or FB or both HIGH

Implement the above problem with digital logic circuit.

(c) Draw the circuit for current to pressure converter using a nozzle & flapper arrangement. Explain its operation. How gap/ distance between flapper and nozzle vary with signal pressure? [5]

Q.4 *(a)* Indicate the meaning of various symbols, process lines, alphabets and numbers as shown in Process and instrument diagram of **Figure-3.** [5]

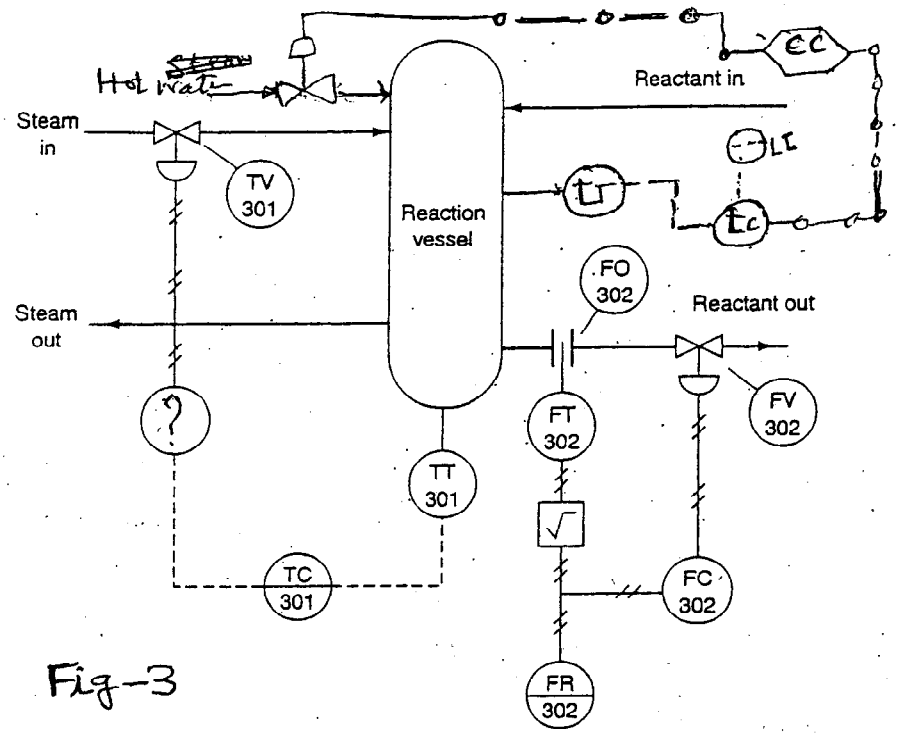

Fig-3

(b) (i) What is a neural network? [5]

(ii) Where can neural network systems help?

(iii) Why would anyone want a `new' sort of computer based on neural network?

(c) Biological neurons have a cell body, axons, dendrites and synapses. Draw a diagram and label these terms on it. Draw the computational equivalent and label it. List the main differences between the computational model and the biological equivalent. [6]

Q.5 *(a)* Why we use Fuzzy Logic in control? Discuss unique features that make fuzzy logic a good choice for many control problems. Write the fuzzy variables and crisp variables with specific and precise instruction, when you drive a car in a traffic where speed limit is posted at 80mph. Draw the membership function. **[6]**

(b) Consider the tank in Fig. 1, which is for feeding a cement mill such that the feed flow is more or less constant. The simplified design in the **Figure-4** consists of a tank, two level sensors, and a control valve. The objective is to control the valve V1, such that the tank is refilled when the level is as low as LL, and stop the refilling when the level is as high as LH. The sensor LL is 1 when the level is above the mark, and 0 when the level is below; likewise with the sensor LH. The valve opens when V1 is set to 1, and it closes when V1 is set to 0. **[5]**

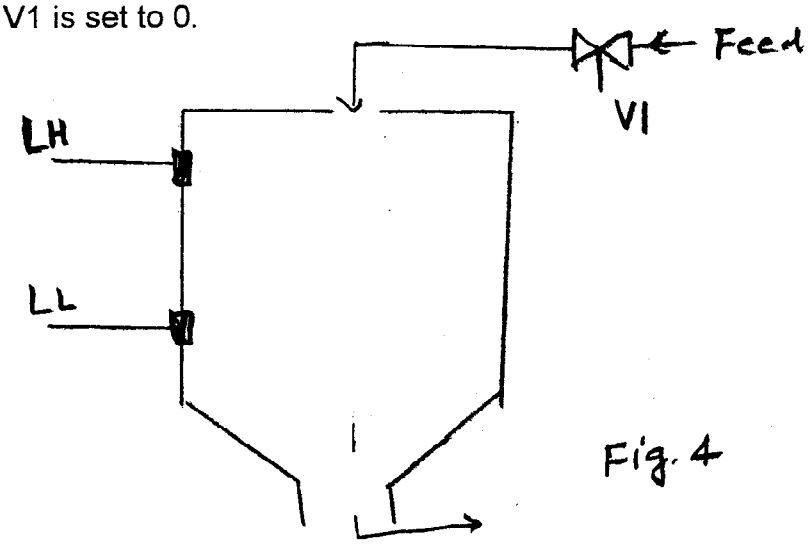

Fig. 4

(i) Write the Boolean logic for PLC for above example.
(ii) Write the rules for fuzzy controller for the same.

(c) Draw the basic process flow diagram of pulp and paper mill. Which control systems you will recommend for the modern paper machine? Justify your answer. **[5]**

—xxx—

ID/hall ticket number *second Semester-2005*

BITS, PILANI – DUBAI CAMPUS

Course No: EEE UC-417
Class: BE (Hons.)-IVYear (ELECTIVE)
Course Title: Computer Based Control Systems

TEST-II (Closed Book)

Date: May 08, 2005 **Time: 50 Minutes** **M.M. = 60 (50%)**

NOTE:

(i) **Answer all the questions.**

(ii) **All questions to be answered in the answer sheet only.**

(iii) **Question paper contains one page.**

(iv) **Answer all the parts of a question in continuation.**

(v) **Do not leave any blank space/page(s) in between the answers.**

(vi) **Do not write any thing on the question paper except your ID/hall ticket No.**

(vii) **Cross the blank space/page (s), if any.**

Q.1 **(a)** Draw the architecture of DCS. Indicate clearly the name and function of each block. [10]

(b) Draw and explain the function of electric relay used in control application. [5]

Q.2 **(a)** Explain the role of SCADA in control? Discuss it is software features in brief. [8]

(b) Draw the multiple position and tendem type hydraulic cylinder and differentiate between them. [7]

Q.3 **(a)** Explain the basic characteristics or feature of control valve, which is mainly used for high pressure, high temperature and corrosive environment. [6]

(b) What parameter we take into account for selection of valve actuator. [4]

(c) Explain the different steps of PLC operation. [5]

ID/hall ticket number *second Semester-2005*

BITS, PILANI – DUBAI CAMPUS

Course No: EEE UC-417
Class: BE (Hons.)-IVYear (ELECTIVE)
Course Title: Computer Based Control Systems

TEST-II (Closed Book)

Date: May 08, 2005 **Time: 50 Minutes** **M.M. = 60 (50%)**

NOTE:

(i) **Answer all the questions.**

(ii) **All questions to be answered in the answer sheet only.**

(iii) **Question paper contains one page.**

(iv) **Answer all the parts of a question in continuation.**

(v) **Do not leave any blank space/page(s) in between the answers.**

(vi) **Do not write any thing on the question paper except your ID/hall ticket No.**

(vii) **Cross the blank space/page (s), if any.**

Q.1 **(a)** Draw the architecture of DCS. Indicate clearly the name and function of each block. **[10]**

(b) Draw and explain the function of electric relay used in control application. **[5]**

Q.2 **(a)** Explain the role of SCADA in control? Discuss it is software features in brief. **[8]**

(b) Draw the multiple position and tendem type hydraulic cylinder and differentiate between them. **[7]**

Q.3 **(a)** Explain the basic characteristics or feature of control valve, which is mainly used for high pressure, high temperature and corrosive environment. **[6]**

(b) What parameter we take into account for selection of valve actuator. **[4]**

(c) Explain the different steps of PLC operation. **[5]**

ID/hall ticket number *Second Semester-2004-05*

BITS, PILANI – DUBAI CAMPUS

Course No: EEE UC-417
Class: *BE (Hons.)-IVYear (ELECTIVE)*

Course Title: Computer Based Control System

TEST-I (Closed Book)

Date: March 27, 2005 **Time: 50 Minutes** **M.M. = 60**

NOTE:

(i) **Answer all the questions.**

(ii) **All questions to be answered in the answer sheet only.**

(iii) **Question paper contains Two Pages.**

(iv) **Answer all the parts of a question in continuation.**

(v) **Do not leave any blank space/page(s) in between the answers.**

(vi) **Do not write any thing on the question paper except your ID/hall ticket No.**

(vii) **Cross the blank space/page (s), if any.**

Q.1 (a) Comments on the significance of "error signal" in Process Control. [5]

(b) Explain briefly the components of automatic feedback control loop given below. [10]

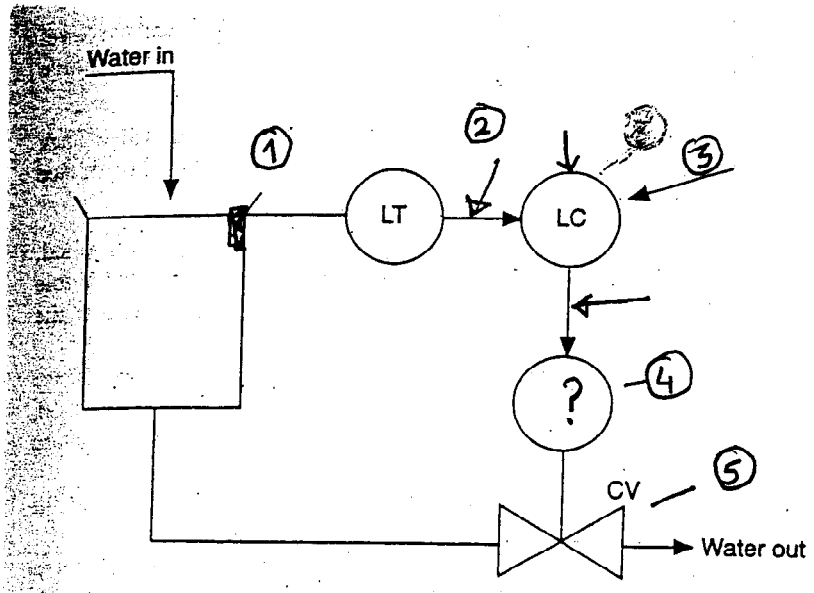

Fig. 1. Level control.

Q.2 (a) Why computer is necessary in process control? Justify your answer. [5]

(b) Draw the block diagram of direct digital control and supervisory control system. Comments on the difference between two control systems. [10]

Q.3 Compare the merit and demerit of the following:

(a) RTD over Thermocouple [5]

(b) Capacitive & Inductive method for Pressure [5]

(c) Feedback and feed-forward control [5]

Q.4 (a) Draw and explain with the help of neat sketch the variation in control variable with valve opening in the following case. [10]

(i) Two position control (with differential gap)

(ii) Multi position control

(b) Discuss in brief the development in direct digital and microcomputer period in control system. [5]