UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF INDUSTRIAL TECHNOLOGY

FINAL EXAMINATION

JANUARY 2016 SEMESTER

COURSE CODE	:	JCB 10303
COURSE TITLE	:	INSTRUMENTATION AND PROCESS CONTROL APPLICATIONS
PROGRAMME LEVEL	:	BACHELOR
DATE	:	31 MAY 2016
TIME	:	9.00 AM – 12.00 PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consists of ONE (1) section.
4. Answer FIVE (5) questions ONLY in Section A.
5. Please write your answers on the answer booklet provided.
6. Please answer all questions in English only.

THERE ARE 6 PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total : 100 marks)

INSTRUCTION: Answer FIVE (5) questions ONLY.
Please use answer booklet provided.

Question 1

a) Liquid is a very important main medium in industry used in production line. Industry such as plantation and biomedical used neutral liquid with pH 7.0 to keep optimum quality for production use. Explain water quality with an example in term of biomedical industries.

(7 marks)

b) Company XOXO involve into food industry, water monitoring used to monitor the food process from raw material to end production. As an engineer in this industry, explain with example **FIVE (5)** basic type of water monitoring in your company.

(10 marks)

c) Air pollution is one of the fastest medium in spreading all type of disease, it is cause by free molecules movement in free space. Using portable air pollution indicator model AP1036 with accuracy and precision to 90%. Compose THREE (3) expected results using the instrument.

(3 marks)

Question 2

a) Open loop and closed loop system have it is own benefits toward application. It determines the accuracy and capability of handling instrument. Based on your understanding, summarize the open loop and closed loop mechanism.

(4 marks)

b) Given open loop transfer function for quad copter drone application is $y(s) = \frac{20s}{(s+2)(s+1)}$. Using Routh-Hurtwiz stability monitoring system, illustrate the stability of the system.

(10 marks)

c) Explain **THREE (3)** advantages and **THREE (3)** disadvantages of open loop transfer function.

(6 marks)

Question 3

a) Piping is a medium used to transfer or flow gas from one point to other place. A transmission cylinder metal pipe at point A with radius of 2 meter and 3 meter height, while at point B is 3 meter radius and 3 meter height. Speed of the fluid through both pipe are $10\ ms^{-1}$. Calculate the different flow control of the pipe.

(8 marks)

b) A long hexagon pipe use for transmit fluid from point A to point B at same height of 3meter above sea level. Given density liquid at point A is $10gm^{-3}$, gravity acceleration $9.81ms^{-1}$, velocity fluid at point A and point B is $10ms^{-1}$ and $20ms^{-1}$. Calculate different pressure between point A and point B.

(7 marks)

c) Company ABC used aluminum cylinder pipe which is part of a frame with 2 meter diameter and 150 km long. Tensile force acting on pipe is 100 kPa which tends to stretch it. The modulus of elasticity is 100 GPa. Calculate the stress bar in kilo Newton.

(5 marks)

Question 4

a) The Beta line in the Pluto planet spectrum was due to the absorption of solar radiation by sodium atoms. Given the wavelength of the sodium Beta line is 15 nm, speed of light is $3x10^{8}\ ms^{-1}$ and plank constant is $6.626x10^{-34}$ J.s. Compute the frequency and energy of a proton from the X line.

(9 marks)

b) In chemical industry, there are mixtures of several gas substances that constitute sulfur, nitrate and carbon. 30% type of sulfur contain in the mixture, while 30% from the mixture contains nitrate and 40% for carbon.

i. Early experiment, time response for those gas mixtures is 1s, 2s and 3s. During experiment shows that the time response for those gasses factor is 1.5:2.5:3.5 based on sulfur. Calculate the retention time, adjusted retention time, relative retention based on nitrate and capacity factors.

(8 marks)

ii. From the data at (i), sketch a graph to indicate adjusted retention time and time response.

(3 marks)

Question 5

a) Figure 1.0 show a boiler system which include closed loop transfer function. It consist of Proportional, Integration and Derivation.

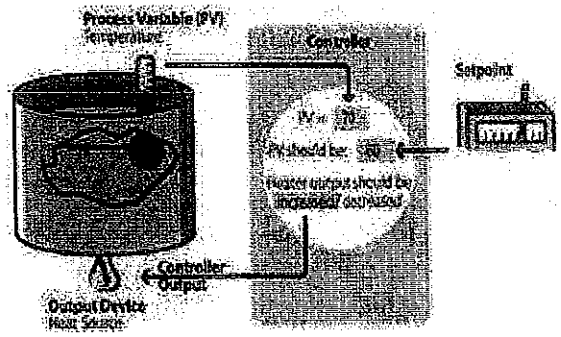

Figure 1.0: Boiler system

From the Figure 1.0. Explain the PID control system.

(6 marks)

b) Application of closed loop transfer function are widely used in most industry because it provide a feedback mechanism and user can monitor error of the system. Illustrate with diagram PID characteristic.

(9 marks)

c) Tenaga Nasional Berhad (TNB) facing difficulties in finding the exact output to be control. As a control engineer at the TNB. Design your own controller using various P, I and D to manage electricity used in power plant, with fulfill all the requirements below:

(5 marks)

Question 6

a) Malakof Berhad spend over 50 million USD in supply electricity to user. Cost of automation electricity controller is used to be very high and require less human contact in every industry. Explain with example **THREE (3)** type of low cost electricity controller.

(9 marks)

b) Automation in air monitoring include several element percentage of particle, which are oxygen and carbon. Illustrate with example **FOUR (4)** different function used air monitoring system.

(5 marks)

c) Figure 2.0 show networking used by company XYZ in telecommunication industry and the communication used to be through local area network (LAN). The company requires buying a new controller to control instrument functionality.

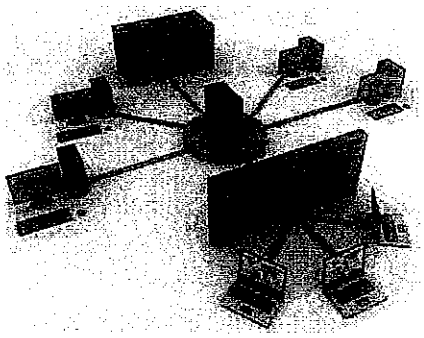

Figure 2.0: Networking Company XYZ

Based on Figure 2.0, suggest the low cost and reliable controller for the company.

(6 marks)

END OF EXAMINATION PAPER