

End Semester Examinations - Nov-Dec 2015 Exams

14EI2001 Sensors and Transducers

Set B

Time : 3 hrs
Total Marks: 100

1. a) Draw and explain the various blocks of a generalized instrumentation system with a suitable illustration. (10)
b) Enumerate on the types of errors in measurement. List out the different statistical treatments employed to minimize them. (7)
c) A particular ammeter requires a change of 2A in its coil to produce a change in deflection of the pointer by 5mm. Determine its sensitivity. (3)

OR

2. a) Discuss in detail on the following static characteristics of transducers: Static sensitivity, Linearity, Hysteresis, Threshold, Resolution and Loading effects. (10)
b) Derive the transfer function of a first order system suggesting a suitable example. (7)
c) Differentiate the terms “Accuracy” and “Precision” giving suitable examples. (3)
3. a) Describe the constructional details of a resistance potential divider and derive the expression for its output voltage when connected across a meter of finite resistance. (10)
b) Describe the construction and working of thermistor. Portray the input – output characteristic curve of RTD, thermistor and thermocouple. Comment on them. (10)

OR

4. a) With a neat illustration, describe the application of strain gauge in measuring the weight of a truck before and after loading. Derive the relation between Gauge factor and Poisson’s ratio. (14)
b) Describe the different types of compensations used for thermocouples. (6)
5. a) Describe the construction and working of Linear Variable Differential Transducer. List out its advantages and disadvantages. (10)
b) Elaborate on measurement of acceleration using a variable reluctance accelerometer with a neat portrayal. (10)

OR

6. a) Describe the different principles of working of capacitive transducer. How is differential pressure measured using a capacitive transducer. (10)
b) Explain the construction and working of synchros as a position transducer with a neat sketch. (10)
7. a) Describe the properties of piezo – electric crystals. Derive expressions for voltage and charge sensitivities. (10)
b) Write short notes on generation of ultrasound using magnetostrictive transducer. (5)
c) How is displacement measured using Hall Effect transducer. (5)

OR

8. a) Draw and describe about current measurement using Hall sensor. (8)
b) Describe the different modes of operation of piezo-electric transducers. (6)
c) Define the following: Hall Effect, Villari Effect and piezo-electric effect. (6)
9. a) Write brief notes with a neat diagram on:
 - i. Magnetic Encoder. (5)
 - ii. pH Sensor. (5)

b) Explain the working of digital shaft angle encoder with a neat diagram. (10)

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End Semester Examinations - Nov-Dec 2015 Exams

15EI2002 Medical Electronics

Set B

Time : 3 hrs
Total Marks: 100

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- | | | |
|----|--|------|
| 1. | Explain how zener diode is used in voltage regulation both for varying input and varying load. | |
| | OR | |
| 2. | a. Briefly explain zener diode and its characteristics | (12) |
| | b. Differentiate avalanche and zener break down. | (4) |
| | c. Discuss zener equivalent circuit. | (4) |
| 3. | Explain rectification, types of rectification and rectifier applications | |
| | OR | |
| 4. | a. Explain the construction and internal operation of BJT | (12) |
| | b. Briefly explain transistor amplifying action with an example | (8) |
| 5. | Explain the input and output characteristics in common base configuration | |
| | OR | |
| 6. | a. Explain the construction and internal operation of JFET | (10) |
| | b. Briefly explain UJT and its characteristics? | (10) |
| 7. | Describe the three regions of operation of a UJT with neat diagrams | |
| | OR | |
| 8. | a. Describe the application of optocoupler with relevant diagrams | (6) |
| | b. Explain drain characteristics of a MOSFET | (14) |
| 9. | Explain in brief differential amplifiers, DM and CM | |
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End Semester Examinations - Nov-Dec 2015 Exams

14EI2003 Electrical Measurements

Set A

Time : 3 hrs
Total Marks: 100

1.
 - a. What are the basic blocks of a generalized Instrumentation System? Draw the various blocks and explain their functions. (12)
 - b. Define and explain the following static characteristics of instruments. (8)
 - (i) Accuracy
 - (ii) Resolution
 - (iii) Sensitivity and
 - (iv) Linearity.

OR

2.
 - a. Discuss about the different types of Measurements in Instrumentation. (14)
 - b. Explain the types of possible Errors in instruments. (6)
3. With a help of a neat sketch, describe the construction and working of PMMC instrument. What are its advantages and limitations? (20)

OR

4.
 - a. With the neat diagram explain the constructional features of D'Arsonval Galvanometer. (14)
 - b. Discuss the Loading Effect of the Voltmeter (6)
5.
 - a. Describe the working and construction details of a Moving Iron Instrument. Discuss its advantages and disadvantages. (14)
 - b. Derive the torque equation for Power Factor Meter. (6)

OR

6.
 - a. Describe the construction and working principle of Electrodynamometer Type Wattmeter. (17)
 - b. Draw the symbol for Potential Transformer. (3)
7. Describe the principle of working of Wien's bridge oscillator. Give its advantages and disadvantages. (20)

OR

8. Describe the working of HAY'S bridge for measurements of inductance. Derive the equations for balance and draw the phasor diagram under conditions of balance. Why is this bridge suited for measurement of inductance of high Q Coils? (20)

9.

Write short notes on:

- (i) X - Y recorder (10)
- (ii) Magnetic Tape Recorder. (10)

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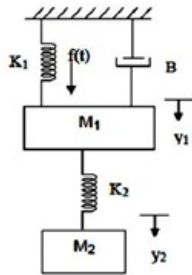
End Semester Examinations - Nov-Dec 2015 Exams

14EI2005 Control System

Set A

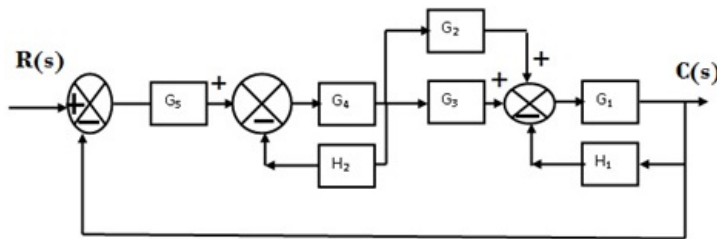
Time : 3 hrs
Total Marks: 100

1. (a) Determine the transfer function $Y_2(S)/F(S)$ of the system shown in fig.(10)
(b) Obtain its electrical equivalent network. (10)

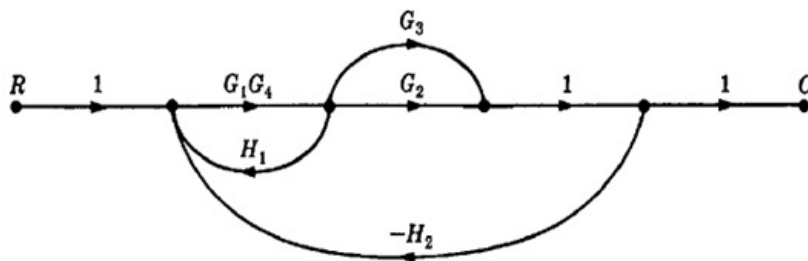


OR

2. (a) Determine the overall transfer function $C(s)/R(s)$ for the system shown in figure below.



2. (b) Using Mason's gain formula obtain the transfer function of the system represented by its Signal Flow Graph given (10MARKS)



3. Derive the expression for step response of the second order under damped system.

Obtain the response of given system, if it is subjected to unit step input. [20]

$$G(s) = 1/(s+7)(s+12)$$

OR

4. Find the time domain parameters of the given open loop unity feedback under damped system having damping factor=0.6 and natural frequency of oscillations = 0.5 [20]

5. State the criterion for stability. Apply Routh criterion and test the stability of system

represented as its characteristic equation $2s^6 + 4s^5 + s^4 - 32s^3 + 51s^2 + 3s + 15 = 0$

Comment on the stability of system. [20]

OR

6. Sketch the root locus of the system whose open loop transfer function is

$$G(S) = K / S (S+1) (S+5) \text{ in the graph sheet. (20)}$$

7. Draw the Bode plot of the transfer function (20)

$$G(s) = 10/s(1+2s)(1+3s)$$

Determine the gain margin and phase margin.

OR

8. The open loop transfer function of a unity feedback control system is given by

$$G(s) = 1/s(s+1)^2, \text{ Sketch the polar plot and determine the gain margin. [20]}$$

9. Determine the observability and controllability of the given system represented

in the following state model [20]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -2 & 0 & 1 \\ 1 & -3 & 0 \\ 1 & 1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} [u], \quad y = \begin{bmatrix} 2 & 1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + [u]$$

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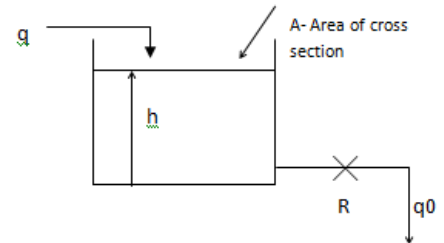
End Semester Examinations - Nov-Dec 2015 Exams

14EI2009 Process Dynamics and Control

Set B

Time : 3 hrs
Total Marks: 100

1.



- a. Derive the Mathematical model for the given process (12)
- b. Explain briefly about self regulation. (8)

OR

2.
 - a. Develop the mathematical model for a Non-Interacting Two Tank Liquid Level System.(16)
 - b. Write the mass balance equation for a mixing process(4)

3. Derrive the transfer functions of given I order thermal processes

- i. Gas Process.
- ii. Flow Process.

OR

4. Bring out the relative advantages and disadvantages of proportional, integral and derivative control actions.

5. Explain in detail about the following control modes:

- a. Multi position control.
- b. Floating control

OR

6.
 - a. How will you select the type of controller for various processes? Justify your answer with examples.(14)
 - b. Describe briefly about the PID controller.(6)

7. With the given values $K_p=5$, $K_D= 0.5$ s and $p_I(0) = 20\%$, design the PD Controller for the error as shown in the

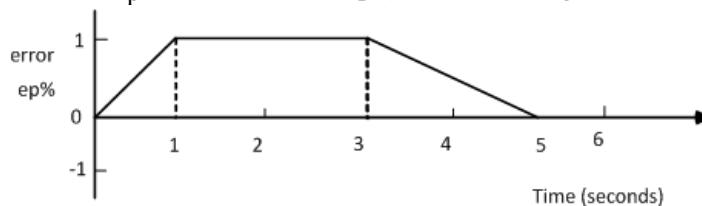


figure below.

OR

8.
 - a. Describe the construction of a control valve.(8)
 - b. Explain the transient response characteristics of the continuous controllers if the input of unit step is applied to it. (12)
9. Explain in detail mathematical modeling of binary distillation Column with relevant diagrams

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End Semester Examinations - Nov-Dec 2015 Exams

14EI2018 Automotive Instrumentation

Set A

Time : 3 hrs
Total Marks: 100

1.
 - a. Explain in detail about evolution of automotive electronics (10marks)
 - b. write short note on four stroke engine(5marks)
 - c. Describe the engagement and disengagement of an inertia starter (5marks)

OR

2.
 - a. illustrate the operation of the steering system (10marks)
 - b. write short note on ignition timing (10marks)
3.
 - a. State five advantages of electronic ignition compared with the contact breaker system (5marks)
 - b. With neat sketch explain construction, operation and working principle of starting system used in automobile (15marks)

OR

4.
 - a. State five disadvantages of fuel injection (5 marks).
 - b. Draw a block diagram of fuel injection system. Describe briefly the purpose of each component (15 marks)
5.
 - a. write short note on four methods of reducing diesel engine emissions (5 marks)
 - b. Explain in detail about combined ignition and fuel management system (15 marks)

OR

6.
 - a. List out five sources of radio interference (5 marks)
 - b. Describe about advance engine management technology with suitable diagram (15 marks)
7.
 - a. Describe the techniques used to prevent wheel spin (5 marks)
 - b. Draw a block diagram of anti lock braking system. Describe briefly the purpose of each component (15 marks)

OR

8.
 - a. what are the advantages of traction control system? (5 Marks)
 - b. Explain in detail about electronically controlled automatic transmission system. (15 Marks)
9.
 - a. write the differences between CAN and Flexray. (5marks)
 - b. Explain in detail about architecture and message format of flexray communication protocol. (15marks)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI2020 Instrumentation and Control in Petrochemical Industries

Set A

Time : 3 hrs
Total Marks: 100

1. a. Draw the P&ID diagram of FRC, which is a part of Distributed control system that is located in the main control room. (1)
- b. Define Dew point. (1)
- c. Draw the Basic Distillation Column with a neat sketch. (2)
- d. Describe the Process variables involved in the Control of Distillation Column. (2)
- e. With necessary diagrams, explain the various Pressure control schemes in Distillation Column. (14)

OR

2. a. Draw the P&ID symbol of Hydraulic line. (1)
- b. Define Distillation. (1)
- c. Write short notes on Column feed temperature control. (2)
- d. List any four by-products obtained from the petroleum refinery process. (2)
- e. Explain the following in detail:
- i) Reboiler control by maintaining boilup rate. (5)
- ii) Thermosyphon reboiler (5)
- iii) Need for P&ID diagrams in the Industries. (4)
3. a. _____ control works according to the error obtained from the error detector. (1)
- b. What is HIC? (1)
- c. What is the use of stirrer in the chemical reactor? (2)
- d. Draw the diagram of Reactor pressure control by modulating gas make-up. (2)
- e. Describe the Control and Instrumentation involved in Reactor temperature control. (14)

OR

4. a. Define Dryer. (1)
- b. List out the parameters to be controlled for the Atmospheric tray dryer. (1)
- c. Draw the basic drying curve graph. Also explain all the sections in the graph. (2)
- d. Distinguish between Batch & Continuous dryers. (2)
- e. i) Describe the working of the Batch Dryers in detail. (9)
- ii) With necessary diagrams, explain the working of Turbo dryers in detail. (5)
5. a. Name the variables involved in Steam Heater. (1)
- b. State the equation obtained from First of Thermodynamics, relating all the variables of Steam. (1)

- c. Define Degrees of freedom. (2)
- d. Draw the P&ID symbols for Condensate, Heating vapour and Process liquid. (2)
- e. i) Explain the Control and Instrumentation involved in Liquid-to-Liquid Heat Exchanger with necessary diagrams. (10)
- ii) Discuss about the Temperature control in Condenser. (4)

OR

- 6. a. Draw the P&ID diagram of Heat Exchanger with its symbol descriptions. (1)
- b. Find the degrees of freedom for a liquid to liquid heat exchanger. (1)
- c. Draw the high-speed hot gas by-pass control of Condenser. (2)
- d. Write short notes on basic feed forward control. (2)
- e. In the control of heat exchanger, elaborate the different types of control strategy used for reboilers and vaporizers. (14)
- 7. a. Define Evaporator. (1)
- b. How many effect evaporation can be found in Paper industry for concentrating Kraft liquor? (1)
- c. What is Boiling point rise? (2)
- d. Distinguish between Single Effect and Multiple effect Evaporators. (2)
- e. i) Explain the working of controller which has two measurements and one manipulated variable. Also demonstrate how it is implemented in the evaporator. (10)
- ii) Illustrate the working of evaporator which is more popular for highly viscous materials. (4)

OR

- 8. a. Define Capacity. (1)
- b. _____ type of evaporator is popular in the sugar industry for concentrating cane sugar juice. (1)
- c. What is Cocurrent operation? (2)
- d. Discuss about the feedback control of Evaporators. (2)
- e. With necessary diagrams, explain the construction and working of various types of Evaporators in detail. (14)
- 9. a. What is the electrode potential of the cyanide waste solution? (1)
- b. Draw the P&ID symbol of condensate. (1)
- c. List the various treatments employed to the influent to avoid water pollution. (2)
- d. How to control the steam heater using level controller? (2)
- e. i) Elaborate the working of Batch Chemical Oxidation in the waste water treatment. (8)
- ii) Describe the reduction of chromium waste with SO₂. (7)

End Semester Examinations - Nov-Dec 2015 Exams

14EI2041 Measurements and Instrumentation

Set A

Time : 3 hrs
Total Marks: 100

1. a. Describe the construction and working of PMMC instrument. Derive its torque equation. (10)
b. Why is damping torque necessary in indicating instruments? Sketch the curves showing the different damping conditions. (6)
c. A 2mA meter with an internal resistance of $100\ \Omega$ is to be converted to 0 – 150 mA ammeter. Calculate the value of the shunt resistance required. (4)
- OR**
2. a. Discuss in detail the different types of systematic errors and the measures taken to minimize these errors. (8)
b. A basic d'Arsonval Movement with an internal resistance of $50\ \Omega$ and a full scale deflection current with an internal resistance of 2 mA is to be used as a multirange voltmeter. Design the series string of multipliers to obtain the voltage ranges of 0-10 V, 0-50V, 0-100V, and 0-500V. (7)
c. Mention the equation for torque for Moving Iron, Moving Coil and Electrodynamometer type instruments. (5)
3. a. Discuss the working of Hay's bridge for measurement of inductance. Derive the equations for balance. (8)
b. Describe the construction and working of a Series Type Ohmmeter. Write down its design equations. How are the adjustments done in case the battery runs down? How are the zero adjustments made? (7)
c. Describe how an unknown capacitance is measured with the help of D'Sauty's bridge. (5)
- OR**
4. a. Describe how low resistance is measured with the help of Kelvin's double bridge. Derive the equation for bridge balance. What are the modifications and additional features incorporated in double bridge with respect to Wheatstone bridge? (10)
b. Describe how an unknown inductance is measured with the help of Maxwell's Inductance- Capacitance Bridge. Comment on its Q factor. Derive the bridge balance condition. (10)
5. a. Discuss the principle and working of different temperature sensors. Sketch their typical characteristics. (10)
b. Differentiate between active and passive transducers citing suitable examples. (5)
c. How is pressure measured using LVDT? (5)
- OR**
6. a. What is a transducer? What are the basic requirements of a transducer? Explain the classification of transducer with suitable examples. (10)
b. Give a brief note any one digital instrument used in speed measurement. (5)
c. Enumerate on measurement of pressure using a capacitive transducer. (5)
7. a. Explain the circuit of RC phase shift oscillators. Describe how Barkhausen criteria are satisfied in this oscillator. (10)
b. Give the block diagram of frequency selective wave analyser and describe its working. (6)
c. Compute the total harmonic distortion of a signal that contains a fundamental signal with an rms value of 10 V, a

second harmonic with an rms value of 3 V, a third harmonic with an rms value of 1.5 V, and a fourth harmonic with an rms value of 0.6 V. (4)

OR

8.
 - a. Describe in detail the circuit and working of an Astable multivibrator. (10)
 - b. Draw and explain the principle of Harmonic distortion analyser. (5)
 - c. Describe the Barkhausen criteria for production of oscillations. How is it met? (5)
9.
 - a. Describe the functioning of a basic type of strip chart recorder. Explain the different types of marking mechanisms used in it. (10)
 - b. Bring out the difference between light scattering and field effect types of LCDs. Mention the advantages of LCDs. (6)
 - c. Enumerate with a block diagram, the various elements involved in a digital data acquisition system. (4)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI2046 Process Control for Food Engineers

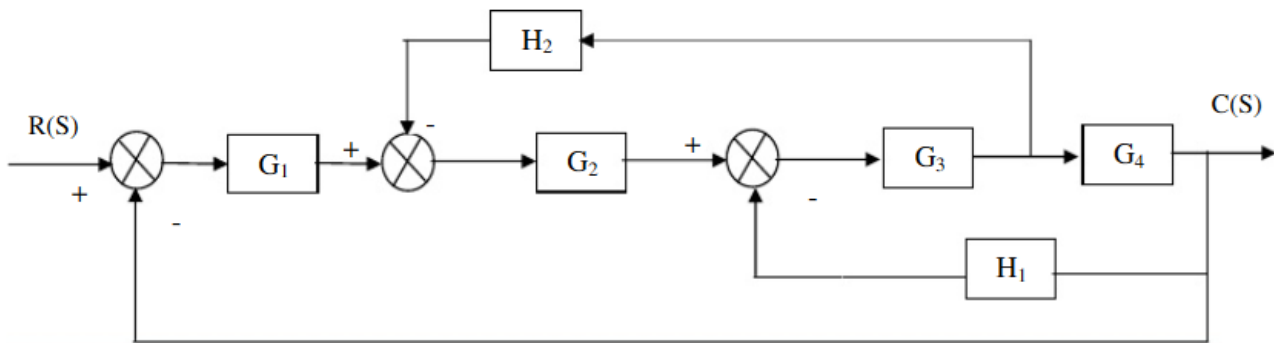
Set A

Time : 3 hrs
Total Marks: 100

1. a. List the Non – contact type of level transducers and Explain with the neat sketch, the construction and working principle. (12 marks)
- b. Write the working principle of Mass spectrometer with neat diagram. (8 marks)

OR

2. a. Summarize about the Density measurement using Air bubbler system and photoelectric transducer. (12 Marks)
- b. Discuss in detail about the classification and principle of transducers. (8 Marks)
3. a. Determine the overall transfer function $C(S)/R(S)$ for the system shown in fig. (12 marks)

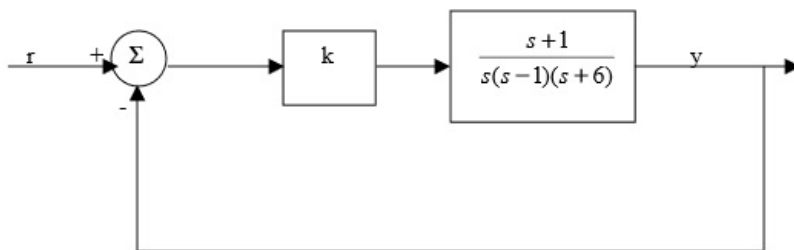


- b. Using Routh criterion determine the stability of the system whose characteristics equation is

$$S^4 + 8S^3 + 18S^2 + 16S + 5 = 0 \quad (8 \text{ marks})$$

OR

4. a. Consider the system shown below. The stability properties of the system are a function of the proportional feedback gain 'k'. Determine the range of 'k' over which the system is stable. (12 Marks)



- b. With neat sketch explain the working principle of conductivity meter. (8 Marks)
5. a. Explain the working concepts of On/Off, Proportional, Integral, Derivative mode controllers. And differentiate On/Off and PID controller. (12 Marks)
- b. List the conditions for system to stable in Routh Hurwitz criterion. (8 Marks)

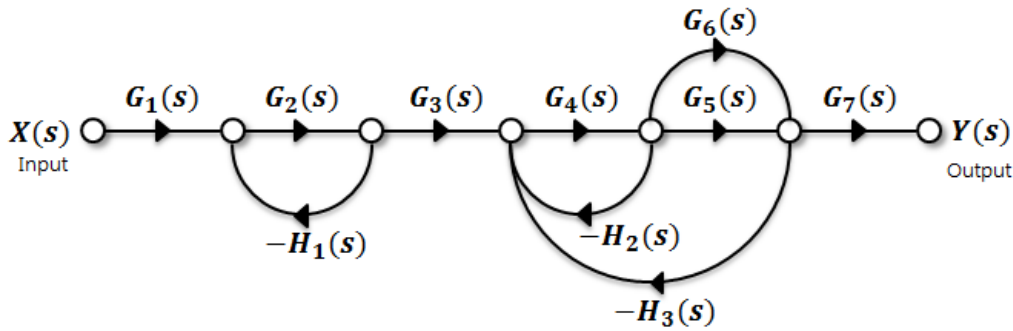
OR

6. Compare the following temperature transducers: (20 Marks)

- Thermistor
- Thermocouple
- RTD
- Thermistor

Illustrate your answer by defining the output from each, stating approximate temperature ranges that can be measured and sketch the relationship between temperature and output for each transducer. Also, list one advantage and disadvantage for each device.

7. a. Using Mason's gain formula, determine the overall transfer function of the system shown in Fig.



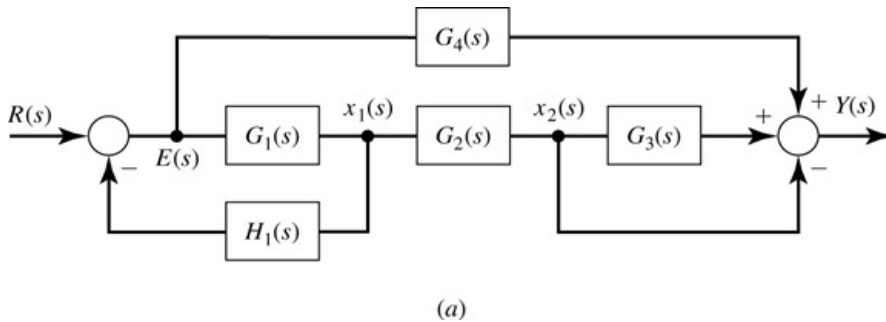
(12 Marks)

- b. Briefly explain about the Non dispersive Photometers with neat diagram. (8 Marks)

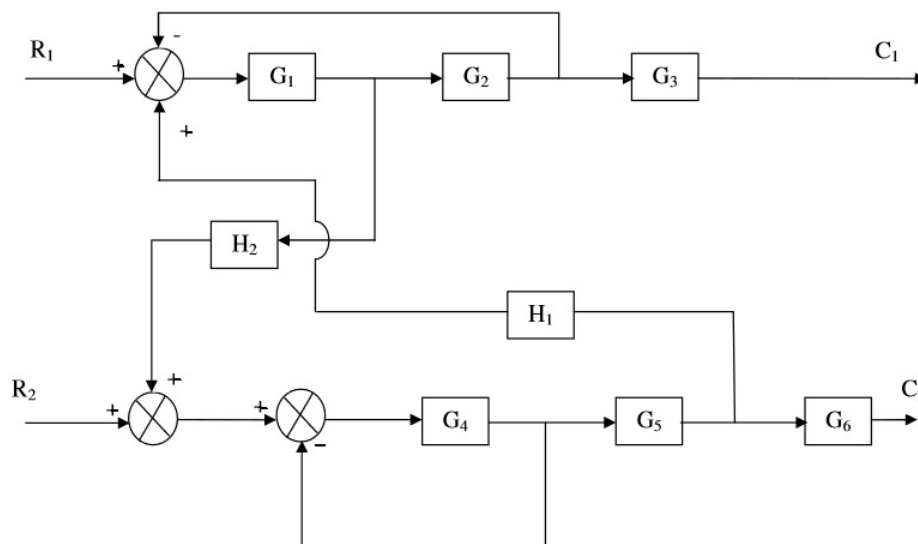
OR

8. a. Find the Laplace Transform of $\sin at$. (12 marks)

- b. Convert the block diagram into signal flow graph. (8 Marks)



9. a. Determine $C1/R1$ for the system represented by the block diagram shown in fig. (15 Marks)



- b. Write short note on servomechanism.

(5 Marks)

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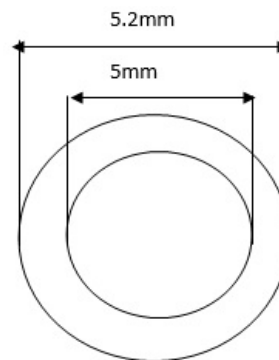
End Semester Examinations - Nov-Dec 2015 Exams

14EI3002 Instrumentation

Set A

Time : 3 hrs
Total Marks: 100

1. a) With neat diagrams explain the principal of Synchros and how it is used to transmit the position and angle. (10)
- b) Explain the various circuits used to detect the change in resistance of the strain gauge. (10)
- OR**
2. a) Derive the expression for gauge factor of resistive strain gauge. (8)
- b) Sketch the equivalent circuit of LVDT and obtain the transfer function of the same. (8)
- c) What is the maximum resolution for 360 deg. single turn wire wound with 20V excitation (4)
3. a) A piezo electric transducer has a capacitance of 1000pf and a charge sensitivity of 3.7×10^{-6} coulomb/cm. The connecting wires has a capacitance of 440pf. The display device has an input impedance of 1M Ohm resistance and 55pf capacitance connected in parallel.
- i. What is the voltage sensitivity of the piezo electric transducer alone?
- ii. What is the high frequency sensitivity in V/cm of the entire system?
- iii. What is the lowest frequency that can be measured with 2 percent error? (10)
- b.) Write a note on the theory of capacitance and how the capacitance is used as a sensor. also derive the expression for the same. (10)
- OR**
4. a) Explain the inductive type transducer that is used to measure pressure. (6)
- b) Explain in detail about condenser microphones. (6)
- c) A capacitive transducer is made up of two concentric cylinder plates as shown in the figure. The inner diameter of the outer cylinder is 5.2mm and the outer diameter of the inner cylinder is 5mm. the dielectric medium is air. The length of the electrodes is 25mm.
- i) Calculate the capacitance value.
- ii) If the outer cylinder is pulled by 5mm what is capacitance change. (8)



5. a.) Explain the working of the dual slope type DVM with the help of the Block diagram. (6)
- b.) Explain the working of the Integrating type DVM. (6)
- c.) Explain the operation of Digital Multimeter with required diagrams. (8)

OR

6. a.) Digital transducers are superior to analog transducers – justify (10)
- b.) With help of a diagram describe how the phase is measured using counters. (10)
7. a.) With the help of a neat diagram elaborate on the Architecture of Virtual Instrumentation. (12)
- b.) What is virtual instrumentation? List the difference between the traditional and virtual instrumentation (8)
- OR**
8. What are different communication methods available through which the field instruments are communicated? Explain any one with its Architecture. Also list the advantages. (20)
9. a. A balloon carrying a first order thermometer with a 15 secs time constant rises through the atmosphere at 10m/s. Assume that the temperature varies at $0.15^{\circ}\text{C}/50$ mts. The balloon radios temperature and altitude reading back to the ground. At 5000m the balloon radios the temperature as 15°C . What is the true temperature at 5000 mts? What is the true altitude at which 15°C occurs? (8)
- b. Write short note on linearity of transducer. (4)
- c. Obtain the frequency response of the first order transducer and obtain the transfer function for the same. (8)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3003 Advanced Process Control

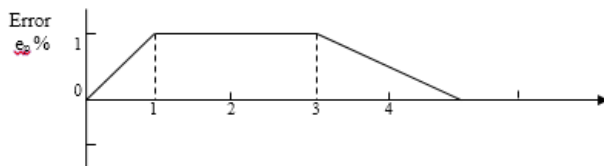
Set B

Time : 3 hrs
Total Marks: 100

1. a. Differentiate between open loop and closed loop control system. (5)
b. Derive the mathematical model of a two tank non-interacting system. (15)

OR

2. a. Obtain mathematical model of a RC network (12)
b. Illustrate a self-regulating and non-regulating process with an example (8)
3. a. A liquid level control system linearly converts a displacement of 2 to 3 m into a 4- to 20 mA control signal. A relay serves as the two position controller to open or close an inlet valve. The relay closes at 12 mA and opens at 10 mA
(i) Find the relation between displacement, level and current
(ii) Find the neutral zone or displacement gap in meter.
b. With the given values $K_p=5$, $K_I = 0.7 \text{ s}^{-1}$, $K_D= 0.5 \text{ s}$ and $p_I(0) = 20\%$, Design the PID Controller for the error as shown in figure below.



OR

4. Explain the working of various Continuous Control modes with necessary diagrams.(20)
5. a. Find out the tuning parameters of PI controller for the process $2.3/10s+1$ using Cohen and coon method .(12)
b. What is the impact of control valve sizing in process control (8)

OR

6. a. What is meant by tuning? (4)
b. Explain the Ziegler Nichols open loop and closed loop method of controller tuning. (16)
7. a. Suggest the necessary conditions to choose a feed forward controller and illustrate the same with an example.(15)
b. What are split range controllers (5)

OR

8. In detail discuss the design procedure for centralized and decoupled control of a MIMO process. (20)
9. a. Explain Adaptive mechanism using Model Reference adaptation method (10)
a. Design an Internal Model Controller for the plant with transfer function $G_p(s) = 0.4 / (10s+1)$ and the model of the plant is $G_m(s) = 0.5 / (12s+1)$. (10)

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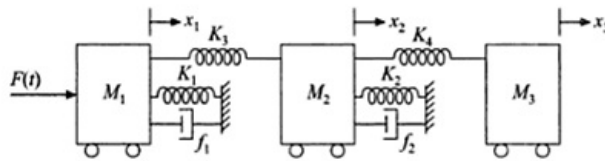
End Semester Examinations - Nov-Dec 2015 Exams

14EI3005 Advanced Control Systems

Set A

Time : 3 hrs
Total Marks: 100

1. a. Consider the mechanical system given below. Model the system and derive the transfer function in terms of $X_3(s)$ and $F(s)$ (14)



- b. What are the essential elements of control systems (6)

OR

2. a. Define a system. Obtain the state equations for a centrifugal governor. (14)
- b. What are the steps involved in the mathematical modeling of a process (6)
3. a. Solve the equation

$$\frac{dy}{dx} = 1 - y$$

with the initial condition $x = 0, y = 0$ using modified Euler's method and tabulate the solutions at $x = 0.1, 0.2$ and 0.3 . Compare the result with the results of the exact solution.

(12)

- b. Find $y(0.1)$ if $y(0) = 1$ by Taylor series method for the system (8)

$$y' = x^2 y - 1$$

OR

4. Determine the singular point and construct the phase trajectory, using the method of isoclines for a linear second order servo is described by the equation

$$\ddot{e} + 2\zeta\omega_n \dot{e} + \omega_n^2 e = 0$$

where

$$\zeta = 0.15, \omega_n = 1 \text{ rad/sec}, e(0) = 1.5 \text{ and } \dot{e}(0) = 0.$$

5. a. Give a short note on the relationship between controllability and observability. (5)
- b. The state model of a system is

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix} u$$

Convert the state model to controllable phase variable form. (15)

OR

6. a. State the Gilbert's method of testing observability. (5)

b. Consider a linear system described by the transfer function

$$\frac{Y(s)}{U(s)} = \frac{10}{s(s+1)(s+2)}$$

Design a feedback controller with a state feedback so that the closed loop poles are placed at $-2, -1 \pm j1$. (15)

7. a. Define the terms controllability and observability. (4)

b. A single-input system is described by the following state equation

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 1 & -2 & 0 \\ 2 & 1 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 10 \\ 1 \\ 0 \end{bmatrix} u$$

Design a state feedback controller which will give closed-loop poles at $-1+j2, -1-j2, -6$. (16)

OR

8. a. Deduce the controllability matrix for the state space design of control systems. (2)

b. State the conditions for complete state controllability and completely output observable in 's' plane. (4)

c. Check the observability and controllability of the system represented by the following differential equations:

$$\dot{x}_1 = x_2, \dot{x}_2 = x_3$$

$$\dot{x}_3 = -6x_1 - 11x_2 - 6x_3 + u$$

and output $y = 4x_1 + 5x_2 + x_3$. (16)

9. Comment on the significance of Lyapunov Stability. Explain in brief about Lyapunov Stability theorems

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3006 Discrete Control System

Set A

Time : 3 hrs
Total Marks: 100

1. a. Determine the one-sided z-transform for the given continuous time function. (8)

$$x(t) = e^{-at} \sin \omega t$$

- b. Determine the Initial Value and Final value of the given z-domain signal. (6)

$$X(z) = \frac{2 - 4z^{-1}}{1 + 2z^{-1} - 3z^{-2}}$$

- c. Find the Inverse z-transform for the given function. (6)

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

OR

2. a. Using Jury's Stability test, check for stability of the sampled data control system represented (10)
by the following characteristic equation:

$$2z^4 + 7z^3 + 10z^2 + 4z + 1 = 0$$

- b. Check for stability for the given characteristic polynomial using Bilinear Transformation. (10)

$$z^3 - 0.2z^2 - 0.25z + 0.05 = 0$$

3. a. A discrete-time system has the transfer function

$$\frac{Y(z)}{U(z)} = \frac{4z^3 - 12z^2 + 13z - 7}{(z-1)^2(z-2)}$$

Determine the state model of the system in Phase Variable form. (8)

- b. Obtain the State transition matrix of the following discrete time system: $x(k+1) = Gx(k) + Hu(k)$; $y(k) = Cx(k)$

$$\text{where, } G = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}; H = \begin{bmatrix} 1 \\ 1 \end{bmatrix}; C = [1 \quad 0]$$

Then obtain the state $x(k)$ and output $y(k)$ when the input $u(k) = 1$ for $k = 0, 1, 2, \dots$ (12)

OR

4. a. A discrete time system is described by the difference equation,

$$y(k+2) + 5y(k+1) + 6y(k) = u(k); y(0) = y(1) = 0; T = 1 \text{ sec}$$

Determine the State model in Canonical form and also find the State transition matrix. (13)

- b. Discuss about the different types of Canonical forms of Discrete time state-space equations. (7)

5. a. Consider the system $x(k+1) = Gx(k) + Hu(k)$,

$$G = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix}; H = \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix}.$$

Determine the suitable state feedback gain matrix K using Ackermann's formula, such that

the system will have the closed loop poles at $z=-2, -1\pm j1$. (15)

b. Check whether the given system is observable or not. (5)

$$G = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}; H = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}; C = [4 \ 5 \ 1]$$

OR

6. a. Check for Controllability for the given discrete time system, (5)

$$x(k+1)=Gx(k)+Hu(k); y(k)=Cx(k)$$

$$\text{where, } G = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}; H = \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}; C = [1 \ 0 \ 0]$$

b. Design a full-order state observer for the given system (10)

$$x(k+1)=Gx(k)+Hu(k); y(k)=Cx(k); \text{ where}$$

$$G = \begin{bmatrix} -1 & 1 \\ 1 & -2 \end{bmatrix}; C = [1 \ 0]$$

and the desired eigen values of the observer matrix are -5,-5.

c. Describe about the Pole Placement technique. (5)

7. a. Solve the Diophantine equation for the given Polynomial. (15)

$$A(z)=z^2+z+0.5; B(z)=z+2; D(z)=z^3$$

b. Write brief notes on Diophantine Equation. (5)

OR

8. With necessary block diagrams, describe the various configurations of control systems design based on polynomial equations approach in detail.

9. a. Elaborate the procedure for designing and implementing digital control algorithm for a Temperature process. (16)

b. Write brief notes on Dahlin's control algorithm. (4)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3007 Intelligent Controllers

Set A

Time : 3 hrs
Total Marks: 100

1. a. Explain McCulloch Pitts Neuron model. Realize AND function using the same model. (7)
- b. Calculate the value of final weight vector of neural network, which uses Hebbian value. Given weight

$$W_1 = \begin{pmatrix} 2 \\ -1 \\ 1 \\ 0.5 \end{pmatrix} \text{ for 3 sets of input vectors } x_1 = \begin{pmatrix} 1 \\ -1 \\ 0.5 \\ 0 \end{pmatrix} : x_2 = \begin{pmatrix} 1 \\ -0.5 \\ -2 \\ -1 \end{pmatrix} : x_3 = \begin{pmatrix} 0 \\ 2 \\ -1 \\ 2 \end{pmatrix}$$

Note: Assume Bipolar Activation Function. (7)

- c. Bring out the differences between Artificial Neural Network and Biological Neural Network. (6)

OR

2. a. Explain the architecture and derive the algorithm for weight updation in a back propagation network using delta learning rule. (14)
- b. Realize a two input OR function using Hebb net and explain the concept of linear separability. (6)
3. a. Write brief notes on schemes of neuro control and explain the concept of system identification using neural network. (8)
- b. Explain the architecture and training algorithm of Feedback Network. (8)
- c. Using the Correlation learning rule, find the weights for the following input vectors.
- $X_1 = [1 \ -2 \ 1.5 \ 0]^t$, $d_1 = 1$; $X_2 = [-1 \ -0.5 \ -2 \ -1.5]^t$, $d_2 = -1$; and $X_3 = [-1 \ 1 \ 0.5 \ -1]^t$, $d_3 = -1$. Use learning rate of 1, starting weights of $[1 \ -1 \ 0 \ 0.5]^t$. Find the weights at the end of first iterations during training. (4)

OR

4. a. Draw the structure of a biological neuron and explain the working of each part. Also obtain the mathematical model of an artificial Neural Network. (10)
- b. Implement Neural Controller for balancing an Inverted Pendulum using Visual Imaging Technique. (10)
5. a. Write brief notes on indirect learning and online learning of Neural network. (10)
- b. Three fuzzy sets are given as follows:

$$P = \left\{ \frac{0.2}{2} + \frac{0.6}{4} + \frac{0.8}{6} + \frac{0.3}{8} + \frac{0.1}{10} \right\}; Q = \left\{ \frac{0.4}{0.1} + \frac{0.3}{0.2} + \frac{0.5}{0.3} + \frac{0.1}{0.4} + \frac{0.8}{0.5} + \frac{1}{0.6} \right\}$$

$$T = \left\{ \frac{0.2}{0} + \frac{0.6}{0.5} + \frac{0.3}{1} \right\}$$

Perform the following operations using max-min composition. (10)

$$(i) R = PXQ \quad (ii) S = QXT \quad (iii) M = R \circ S$$

OR

6. a. Fuzzy sets A and B are defined in the universe of discourse (5)

$$X = \{0, 1, 2, 3, 4, 5, 6, 7\}$$

$$A = \left\{ \frac{0.3}{0} + \frac{1}{1} + \frac{0.8}{2} + \frac{0.1}{3} \right\}; B = \left\{ \frac{0}{0} + \frac{0.2}{1} + \frac{0.4}{2} + \frac{0.5}{3} + \frac{0.7}{4} + \frac{1}{5} + \frac{0.9}{6} + \frac{0.6}{7} \right\}$$

Perform the following fuzzy operations

$$(i) A \cup B \quad (ii) A \cap B \quad (iii) A' \quad (iv) B' \quad (v) \text{ Verify Demorgan's Law.}$$

- b. Write brief notes on Fuzzy Arithmetic operations with examples. (10)

- c. Discuss the various Fuzzy Propositions with examples. (5)

7. Implement a fuzzy logic controller for a water heating system for the given specifications.

- i) Two input fuzzy subsets – ‘TempIndex’ and ‘LevelIndex’ for indicating the temperature varying from

0° C to 125° C and level varying from between 0 to 10 cm.

- ii) An output fuzzy set ‘KnobPostn’ for positioning the heat knob ranging between 0-10.

- iii) Deduce the rules for controlling the different states of the plant.

- iv) Also for a given temperature 65°C and level 6.5 cm, infer the controller action by employing defuzzification using weighted average method.

OR

8. Two key variables in the production of a photographic plate are exposure time (A) denoted by the universe $X = \{0, 1, 2, 3\}$ and development time (B) denoted by the universe $Y = \{0, 1, 2, 3, 4, 5, 6, 7\}$.

Suppose we represent each of these variables as specific fuzzy sets.

$$A = \left\{ \frac{0}{0} + \frac{1}{1} + \frac{0.7}{2} + \frac{0.1}{3} \right\}; B = \left\{ \frac{0}{0} + \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.5}{3} + \frac{0.7}{4} + \frac{1}{5} + \frac{0.9}{6} + \frac{0.6}{7} \right\}$$

- a. Construct a relation for the compound proposition IF A THEN B. (14)

- b. Let a new exposure time be represented by $\left\{ \frac{0}{0} + \frac{1}{1} + \frac{0.4}{2} + \frac{0}{3} \right\}$.

Using max-min composition, find the fuzzy development time associated with the new exposure time. (6)

9. Explain the basic operators of Genetic Algorithm.

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3008 Optimal Control Theory

Set A

Time : 3 hrs
Total Marks: 100

1. a. Illustrate the selection of a performance measure to design an automatic control system for landing a high speed jet airplane on the deck of an aircraft carrier. (15)
b. Explain the characteristics of Dynamic Programming. (5)

OR

2. a. A first order system is described by the differential equation
 $\dot{x}(t) = x(t) + u(t)$;
Find the control law that minimizes the performance measure
 $J = (1/4)x^2(T) + \int_0^T (1/4)u^2(t)dt$
The final time T is specified and the admissible state and control values are not constrained by any boundaries. (15)

b. What are the advantages of state variable representation? (5)

3. a. Draw the flowchart which depicts the computational procedure for solving control problems. (10)
b. Explain the various performance measures for optimal control problems. (10)

OR

4. a. Derive the Euler Lagrange Equation (10)
b. Determine an extremal for the functional
 $J(x) = \int_0^2 [\dot{x}^2(t) + 2x(t)\dot{x}(t) + 4x^2(t)]dt$; $x(0)=1$ and $x(2)$ is free. (10)

5. a. Derive the Hamilton-Jacobi-Bellman Equation. (10)
b. Find an extremal for the functional $J(x) = \int_1^{tf} [2x(t) + \frac{1}{2}\dot{x}^2(t)]$; the boundary conditions are $x(1)=4$, $x(tf)=4$, and $tf > 1$ is free. (10)

OR

6. a. Derive ARE (Algebraic Riccati Equation) for linear tracking problem. (10)
b. Consider the system described by its state equation (10)
 $\dot{x}_1(t) = x_2(t)$
 $\dot{x}_2(t) = -x_2(t) + u(t)$
with initial conditions $x(t_0)=x_0$. The performance measure to be minimized is
 $J(u) = \int_{t_0}^{tf} \frac{1}{2} [x_1^2 + u^2(t)] dt$;
 tf is specified, and the final state $x(tf)$ is free.
i) Find necessary conditions for an unconstrained control to minimize J.
ii) Find necessary conditions for optimal control if $-1 \leq u(t) \leq +1$

7. a. The system $\dot{x}_1(t) = x_2(t)$
 $\dot{x}_2(t) = 2x_1(t) - x_2(t) + u(t)$
is to be controlled to minimize the performance measure
 $J(u) = [x_1(T) - 1]^2 + \int_0^T \{ [x_1(t) - 1]^2 + 0.0025u^2(t) \} dt$.
The final time T is specified, $x(T)$ is free, and the admissible states and controls are not bounded. Determine the optimal control law. (10)
b. Determine the form of the optimal control for a class of minimum-time problems. (10)

OR

8.

a. Find a necessary condition that must be satisfied by an extremal of the functional

$$F(x) = \int_{t_0}^{t_f} g(x, \dot{x}, t) dt \quad \text{where } t_0, x(t_0)=x_0 \text{ are specified and } t_f \text{ and } x(t_f) \text{ are free. (10)}$$

b. Find an extremal curve for the functional $J(x) = \int_{t_0}^{t_f} [1 + \dot{x}^2(t)]^{1/2} dt$; the boundary conditions $t_0=0, x(0)=0$ are specified, t_f and $x(t_f)$ are free, which begins at the origin and terminates on the curve $\theta(t) = \frac{1}{2}[t - 5]^2 - \frac{1}{2}$ (10)

9.

a) Discuss the method of Steepest Descent(or gradients)used for minimization of Functions.(10)

b)Compare the features of 3 iterative methods for solving non-linear 2-point boundary value problems.

(10)

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14EI3009 Industrial Instrumentation

Set A

Time : 3 hrs
Total Marks: 100

1. a). Illustrate the working principle of low pressure measurement using McLeod gauge. (10 Marks)
- b). A diaphragm gauge is constructed of spring steel to measure differential of 7MN/m^2 . The diameter of diaphragm is 1.25mm. Calculate the thickness of diaphragm, if the maximum deflection is 0.33 thickness. Also calculate the natural frequency of diaphragm. Young's modulus = 200GN/m^2 , Poisson's ratio = 0.28 and density of steel = 7800 kg/m^3 (10 Marks)

OR

2. a). Illustrate the construction and working principle of thermocouple, with its advantage and disadvantages. (15 Marks)
- b). A venturi tube of throat diameter 50mm has a discharge co-efficient of 0.98 and with a flow rate of $1\text{m}^3/\text{s}$, the pressure differential is 12.5 N/m^2 . determine the flow rate when an orifice of 50mm is used in the same pipe. The discharge co-efficient of orifice is 0.6 and pressure differential is the same. (5 Marks)
3. a). With neat sketch explain the operating principle of dead weight tester. (10 Marks)
- b). A simple U-tube mercury manometer is used for measurement of pressure of water in pipe line. The right limb of manometer is open to atmosphere while left limb is connected to the pipe. In the right limb, the upper surface of mercury column is in exact level with the centre of pipe and the difference of mercury levels in two limbs is 130mm. Calculate the pressure in the pipe in terms of head of water and in kN/m^2 . The densities of water and mercury are $1 \times 10^3\text{kg/m}^3$ and $13.56 \times 10^3\text{kg/m}^3$ respectively. (5 Marks)
- c). Write short note on high pressure measurement. (5 Marks)

OR

4. a). Discuss the importance of level measurements in industrial process. (10 Marks)
- b). with neat diagram explain direct methods of level measurement. (10 Marks)
5. a). A McLeod gauge has volume of bulb and measuring capillary $V = 100 \times 10^{-6}\text{m}^3$ and a measuring capillary diameter of 1mm. Calculate pressure indicated when reading of the measuring capillary is 30mm in case approximate formula is used. what is the error if the exact formula is used for measurement of pressure? (10 Marks)
- b). Explain, with neat sketch, the construction and working of capacitive pressure transducer, with its advantages and disadvantages. (10 Marks)

OR

6. a). Describe with neat sketch two types of Ultrasonic Flow meters (15 Marks)
- b). calculate the stagnation pressure if an aircraft is travelling at a speed of 800km/hr relative to air. The ambient conditions are: atmospheric pressure = 92.5kN/m^2 and temperature = -5°C . the gas constant. The gas constant is 287 J/kg . (5 Marks)
7. a). Explain the theory of fixed restriction variable head type flow meters with necessary diagrams. (15 Marks)
- b). Calculate the flow of water through a $400 \times 150\text{mm}$ horizontal venturimeter, if the mercury manometer connected between inlet and throat of the venture shows a differential pressure of 250 mm of mercury. Assume that specific gravity of mercury is 13.6 and the co-efficient of discharge is 0.98. water has density of 10^3kg/m^3 . (5 Marks)

OR

8. a). List out the elastic primary sensing elements for pressure measurement and explain each one of the sensing element. (15 Marks)
- b). Write the sources of error in manometers. (5 Marks)
9. a). With neat sketch explain the operating principle of turbine flow meters. (10 Marks)
- b). A pitot tube is used to measure flow velocity in water of density 1000kg/m^3 .
- i. Determine the flow velocity at the head of the pitot tube if it produces a differential pressure of 10kN/m^2 between its two outlets.
- ii. the same differential pressure is obtained in air at an altitude where the density of air is 0.65kg/m^3 . Determine velocity of air. (5 Marks)
- c). write short note on positive displacement flow meter . (5 Marks)

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14EI3010 Control System Design

Set B

Time : 3 hrs
Total Marks: 100

1. a. Consider a unity feedback system with open loop transfer function given below. Design a PID controller so that phase margin of the system is 45° at a frequency of 4rad/sec and the steady state error for unit ramp input is 0.1.

$$G(s) = \frac{100}{(s+1)(s+2)(s+10)}$$

(15)

- b. Write the transfer function of a PID controller and what are its effects on system performance. (5)

OR

2. a. Explain the concept of sampling as impulse modulator (10)
- b. Derive the mathematical model of zero-order hold circuit. (10)

3. Discuss minimization of functional, $F(x)$ for the boundary conditions

$$F(x) = \int_{t_0}^{t_1} g(x, \dot{x}, t) dt$$

- i. time t_1 is free ii. $x(t_1)$ is specified

OR

4. a. Discuss minimization of functional, $F(x)$ for the boundary conditions

$$F(x) = \int_{t_0}^{t_1} g(x, \dot{x}, t) dt$$

- i. time t_1 is specified ii. $x(t_1)$ is kept free.

(15)

- b. Name various types of constraints used in optimal control.

(2)

- c. For optimal control, is it necessary that the system is completely controllable and completely observable? (3)

5. a. Design a discrete optimal control system and derive its optimal control law that minimizes the performance measure. (16)

- b. How can a system be considered as completely state controllable and observable. (4)

OR

6. a. Investigate the use of H-J-B equation as a means of solving the general form of the continuous linear regulator problem. (15)

- b. Write the necessary and boundary conditions for optimal control problems. (5)

7. a. What are the practical aspects that should be considered while selecting the sampling rate? (10)

- b. Discuss the impulse invariant discretization method.
(10)

OR

8. a. Discuss various methods for the determination of state feedback gain matrix in pole placement technique
(15)
- b. What is the necessary and sufficient condition for arbitrary pole placement?
(5)
9. a. Explain Luenberger's observer with neat sketch. (15)
- b. Write short notes on the separation theorem. (5)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3014 Industrial Automation

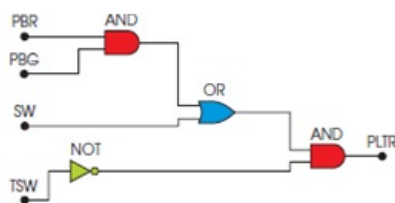
Set A

Time : 3 hrs
Total Marks: 100

1. a) Define the Types of Process Variable? (4 Marks)
b) What is the significance of PID controller? (6 Marks)
c) Discuss the advantages and disadvantages of PLC over other types of Controllers? (10 Marks)

OR

2. a) Incorporation of P-I action may lead to instability in the closed loop performance- justify. (12 Marks)
b) Give an example of an automated system, which contains a control system as a part of it? (8 Marks)
3. a) Explain with an example the addressing format of the PLC Register basics? (4 Marks)
b) Write ladder logic for a motor starter that has a start and stop button that uses latches. (6 Marks)
c) Create the PLC Ladder logic diagram for the logic circuit shown in the Fig: (10 marks)



OR

4. a) Describe briefly the function of various Register types used in PLC? (8 Marks)
b) The sawing operation takes 4.6 seconds. After the sawing takes place ,a blower to blow away the sawdust is to keep running until the operation is turned off. Draw a ladder logic program for this where both the saw, output A, and the blower output B, go on at the same time .The saw goes off after 4.6 sec. The blower continuous to run till the system is turned off by IN001 and IN002. (12 Marks)
 5. a) Draw the PLC ladder logic program for switching ON and OFF a single output Lamp for every 10 seconds. (8 Marks)
b) With suitable examples explain different Compare instructions used in PLC. (12 Marks)
- OR**
6. a) What are the advantages of a closed loop Servo Motion Control? (4 Marks)
b) Design the PLC ladder logic program to control the Motor speed using a Digital Switch. (6 Marks)
c) With suitable examples explain different Mathematical instructions used in PLC. (10 Marks)
 7. a) List the special features of CNC Machines. (8 Marks)
b) Design the ladder logic to the system which involved with an Analog Input and Digital Outputs. In that Output 6 must turn ON if the sensor signal exceeds 0.5 Ampere and the Output 7 must turn ON if the sensor signal is between 0.8 and 1.1 Amperes. (8 Marks)

c) Compare the features of Numerical Control and Manual Control. (4 Marks)

OR

8. a) Design the ladder logic that uses normal timers and counters to measure the times of 50.0 days. (8 Marks)
b) Mention the various programming languages used in PLC? Explain any one in detail. (12 Marks)
9. a) Design the ladder logic program for controlling simple Traffic Light concept. (8 Marks)
b) Explain different compute instructions in plc with suitable examples. (12 Marks)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3015 System Identification and Adaptive Control

Set B

Time : 3 hrs
Total Marks: 100

1. a. Discuss the various types of models and their criterion of classification.(10)
b. (i) With a block diagram explain the features of Hammerstein model. (5)
(ii) Write the salient features of Non-linear State space models.(5)
OR
2. a. Narrate the sources and causes for the existence of disturbances.(5)
b. What is meant by pseudolinear regression?(5)
c. Explain the modeling concept involved in noise representation and time-invariant kalman filter.(10)
3. a. Differentiate between static and dynamic plant transfer function.(5)
b. Compare the features of inverse feed forward and feedback neural control with a block diagram.(5)
c. Explain the concept of back propagation algorithm used in Neural Network for system validation. (10)
OR
4. a. Discuss the need for adaptation scheme in control system(2)
b. Discuss how adaptive control system is used in ship steering system. (10)
c. Explain the concept of Model Reference Adaptive Control System.(8)
5. a. Draw the general block diagram of adaptive control system.(2)
b. Discuss how adaptive control system is used in Heat exchanger.(10)
c. explain the concept of self tuning regulator adaptive control system.(8)
OR
6. a. Compare the features of inverse feedforward and feedback control with a block diagram.(10)
b. Explain the concept of back propagation algorithm used in Neural Network for system identification.(10)
7. a. Explain the Specialized on-line learning control architecture for static and dynamic plant.(10)
b. Draw the various Neural Network Configurations applied for plant identification and compare its features. (10)
OR
8. a. What are the two parts of an adaptive fuzzy controller? Explain.(10)
b. Design an adaptive fuzzy logic controller using performance criteria.(10)
9. a. What are fuzzy models? Illustrate with an example.(5)
b. Write the principle of Least Square Estimation.(5)
c. State and prove least square estimation theorem.(10)

End Semester Examinations - Nov-Dec 2015 Exams

14EI3016 SCADA systems and Applications

Set A

Time : 3 hrs
Total Marks: 100

1.
 - a. What factor makes SCADA different from other control and monitoring system.(3 Marks).
 - b. Most SCADA systems operate at relatively low data rates. How does this affect the selection of communication equipment? (3 Marks)
 - c. Draw the block diagram of SCADA system and explain each of its component functions.(14 Marks)

OR

2.
 - a. Develop a ladder logic programme for verifying logic gates truth table. (3 Marks)
 - b. Write the drawbacks of PLC based control systems.(3 Marks)
 - c. Illustrate construction, operation and working principle of 14 I/O,s PLC with wiring connections.(14 Marks)

3.
 - a. List out four form of signal can an RTU generate to control field equipment.(3Marks)
 - b. what is the function of a protocol driver program? (3Marks)
 - c. with neat sketch explain about remote terminal unit of SCADA system (14Marks)

OR

4.
 - a. How do you calculate a scan interval for SCADA systems explain with example (5 Marks).
 - b. With neat sketch and suitable example explain the working principle of real time SCADA system (15 Marks)

5.
 - a. What are the various functions of master terminal units?(5marks)
 - b. Explain in detail about open system interconnection model with neat diagram. (15 Marks)

OR

6.
 - a. what are the types of communication standards ? (3Marks)
 - b. write short note on different network topology (3Marks)

c.Explain in detail about various communication systems used in SCADA. (14Marks)

7. a. Why is simplex communication not used for SCADA (5 Marks)
b. With neat sketch explain the working principle of typical SCADA Radio system (15 Marks)

OR

8. a. Some applications of SCADA require much effort and design to increase the MTU Scanning speed. Why is this important. (5Marks)
b. Explain in detail about monitoring and controlling of a gas lift system using SCADA. (15Marks)
9. a. what is the purpose of an alarm log? (5Marks)
b. Explain in detail about various operator interface used in SCADA. (15Marks)

Wishing you All the Best

End Semester Examinations - Nov-Dec 2015 Exams

14EI3018 Piping and Instrumentation

Set B

Time : 3 hrs
Total Marks: 100

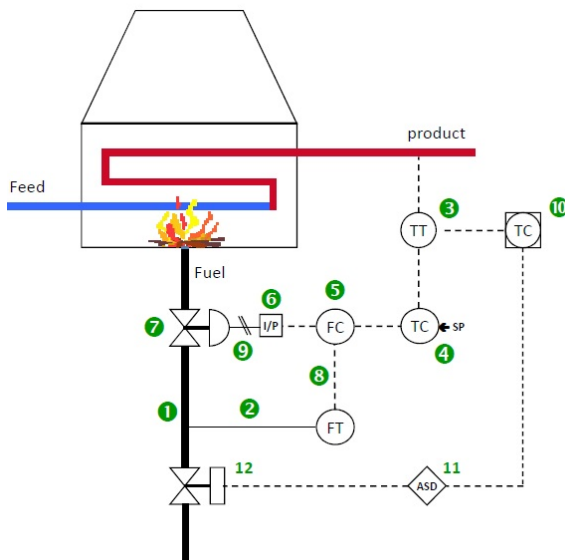
1. a. What is the purpose of process simulation? (4 Marks)
b. Explain in detail about the types of process diagrams with an example. (16 Marks)

OR

2. a. Describe the structure of chemical process design & explain. (10 Marks)
b. With neat sketch explain about the types of heat exchangers. (10 Marks)
3. a. Draw the P& ID symbols for the pumps, compressors and blowers (8 Marks)
b. Explain in detail about the nature of the process simulation problem. (12 Marks)

OR

4. a. Discuss in detail about the different types of flow sheets. (10 Marks)
b. Read the following P & ID symbols and explain. (10 Marks)



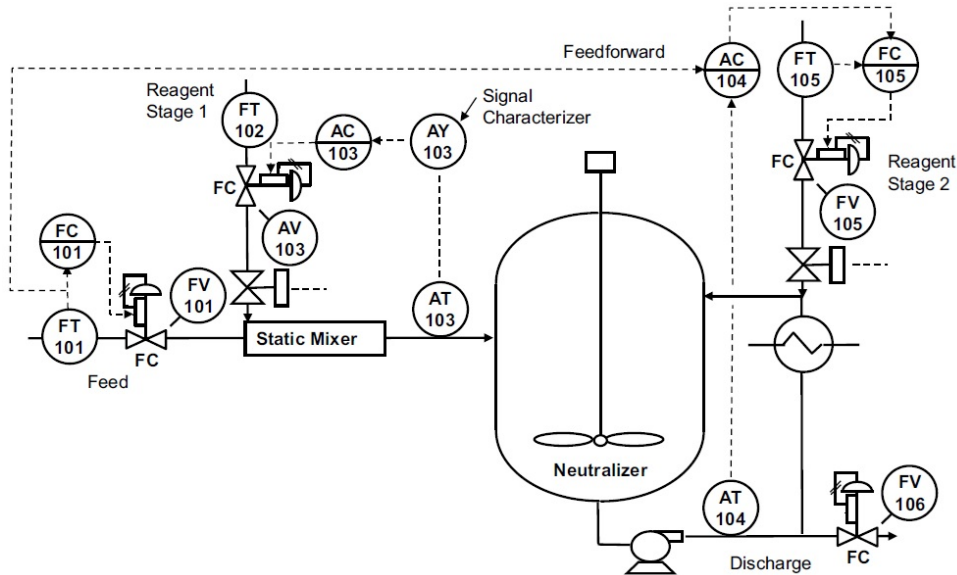
5. a. Construct P & ID for feedback and cascade process control schemes. (10 Marks)
b. Briefly explain about the analyzing & Succedding letters in P & ID. (10 Marks)

OR

6. a. Construct the basic distillation column control using P & ID. (10 Marks)
b. Narrate the commissioning process of various modules involved in designing a technical process system with a block diagram. (10 Marks)
7. a. Briefly discuss the general drafting rules in P & I Diagram. (10 Marks)
b. Summarize the minimum information to be shown on the P & I Diagram for various equipment indication. (10 Marks)

OR

8. a. Design & develop the Process Flow Diagram for Benzene process. (10 Marks)
- b. Draw the P &ID symbols for the following. (10 Marks)
- (i) Instrument function element
- (ii) Primary element symbols
- (iii) Self actuated symbols
9. Reviewing this diagram and answers the following questions. (20 Marks)



1. What tag number convention is shown in this example?
2. Do the valves have digital positioners?
3. What type of valve is being used to regulate flow?
4. Is the plant operator able to access the control functions indicated by AC103, AC104, FC101, and FC105?
5. Can the operator access flow measurements FT101, FT102, and FT105, as well as analytic (pH) measurements AT103 and AT104?
6. Are any on-off (blocking) valves used in this process?
7. What is the purpose of the function shown between AT103 and AC103, that is, AY103?
8. Is the pump fixed speed or variable speed?
9. How could the liquid in the vessel be heated?
10. How is the pH of the incoming stream adjusted?

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3019 Embedded Instrumentation

Set A

Time : 3 hrs
Total Marks: 100

1. (i) The table given below lists a sample of experimental data: (15)

Value	3	4	5	6	7	8	9	10	11
Frequency of Occurrences	1	2	3	6	7	6	4	2	1

Calculate: (i) Mean (ii) Mean Deviation (iii) Standard Deviation (iv) Variance

- (ii) A 0-50 V Voltmeter is specified to be accurate within $\pm 1\%$ of full scale. Calculating the limiting error. (4)

- (iii) In measurement system which of the following are undesirable Static Characteristics: (1)

- (a) Sensitivity and accuracy (b) drift, static error, dead zone
(c) Reproducibility and non-linearity (d) drift, static error, dead zone, and non-linearity

OR

2. (i) Define Piezo-Electric Effect. Explain how a Piezo-Electric Crystal is used for the measurement of force with necessary derivations. (16)
(ii) Brief out the operation of a Half-Effect transducer. (4)

3. (i) Explain the working and V-I characteristics of a Photodiode and Phototransistor. (10)
(ii) Explain how a Pyro-Electric Sensor work and list out its advantages. (10)

OR

4. (i) Explain the construction and principle of working of a Linear Voltage Differential Transformer (LVDT). Explain how the magnitude and direction of the displacement core of an

LVDT detected? (10)

- (ii) Explain how eddy current phenomenon can be utilized to make up a Proximity Switches. (10)

5. (i) Create a VI to display the varying potentiometer reading voltage on a 7 segment LCD. (10)
(10)

- (ii) Create a VI to demonstrate the various methods used to create an array. (10)

OR

6. (i) Create a VI to compare the elements of two clusters. If the values of corresponding elements of both the VIs are the same, switch on an LED in the output cluster. (10)

- (ii) Roll two dices and display a message "YOU WIN" when the sum of the two results equals 7. (10)

7. (i) Describe PCI Interrupt Handling with suitable diagrams. (12)

- (ii) Write a Programme to acquire data at the rate of 1 Hz from the ADC. (7)

- (iii) How many slot does a compact PCI support on a single bus when compared to PCI bus in desktop Computer? (1)

- (a) half (b) same as (c) twice (d) four times

OR

8. (i) Explain with necessary diagrams for the different interfacing techniques used in PC systems (19)
- (ii) which of the following Microprocessor support Hyper –Threading Technology? (1)
- (a) Pentium pro (b) Pentium II (c) Pentium III (d) Pentium IV
9. (i) Explain the functions of Pentium Motherboard Chipset Chip with a neat block diagram. (15)
- (ii) What are the factors to be considered in designing an AD board when used for any application? Explain with neat sketch. (5)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3020 Networks and Protocols for instrumentation and control

Set A

Time : 3 hrs
Total Marks: 100

1. a. Discuss in detail about the seven different layers of OSI model with neat diagram. (15)
b. Compare the features of RS 485 serial interface standard with RS232. (5)

OR

2. a. Explain the half duplex operation of RS232 with the signaling diagram.(12)
b. Describe the test equipments used in trouble shooting RS232 link . (8)

3. a.Explain in detail about the parallel interface IEEE 488 standard used in industries. (15)
b. What is the need for 4mA to 20mA current loop in a process industry? (5)

OR

4. a.Mention the different types of wired transmission mediums and elaborate on the type of medium that is used to transmit data in the form of light (15)
b.Find the data rate for the co-axial cable whose operating band of frequency is upto 1Gbps and Signal to Noise Ratio is 1000 (5)

5. a.With necessary diagrams explain in detail about radio Modems.(20)

OR

6. a.What are the different sources of electrical noise .(5)
b.Discuss in detail about the digital modulation methods. (15)

7. a.What are the different methods of multiplexing. (5)
b.Discuss the architecture of field bus communication protocol.(15)

OR

8. a.Draw the response frame for reading a single register of address 000A with content FFFF .(5)
b. Elaborate on the architecture of Profibus protocol.(15)

9. Discuss in detail about the protocol which is a typical smart instrumentation field bus that can operate in a hybrid 4 to 20 mA current loop in digital fashion. (20)

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End Semester Examinations - Nov-Dec 2015 Exams

14EI3023 Advanced Processors for control and automation

Set A

Time : 3 hrs
Total Marks: 100

-
1. a) How does a Microcontroller differ from Microprocessor? (4 Marks)
b) Explain in detail how the RISC core improves the performance of a MCU. (6 Marks)
c) What are the features of Harvard and Princeton architectures? (5 Marks)
d) Discuss various factors involved in selecting a microcontrollers. (5 Marks)
- OR**
2. a) Describe on-chip multi channel ADC applications and how the analog input maps with the converted bit. (10 Marks)
b) What are the uses of a power down-mode in an MCU? When does an MCU run in this mode? (6 Marks)
c) Explain the use of open-drain output.(4 Marks)
3. a) List the benefits of EEPROM and Flash. (6 Marks)
b) Write short notes on the following Microcontroller resources: (6 Marks)
i) Timer/Counter ii)PWM
c) Give an application of a Microcontroller in an automatic process control. (8 Marks)
- OR**
4. a) Draw the PSW format of 8051 microcontroller & state various conditions of flags. (4 Marks)
b) Describe the instructions SWAP A and MOVX @ DPTR, A with one example. (6 Marks)
c) Describe the function of PSEN, EA, XTAL1, XTAL2 and ALE pins of 8051microcontroller. (10 Marks)
5. a) Write an assembly language program using counter 0 in mode 1 to calculate the frequency of the input signal occurred at T0 terminal. Assume the frequency of the clock signal is 12MHz. (10 marks)
b) Write an assembly language program to add two numbers 2AH and F9H. write the status of different flags after this addition. (6 Marks)
c) List the On-Chip features of 8051 microcontroller. (4 Marks)
- OR**
6. a) Write an assembly language program to toggle all the bits of PORT1 every 200ms. Assume that the crystal frequency is 11.0592MHz, and that the system is using AT89C51. (10 Marks)
b) Draw circuit diagram to connect 64KB of external ROM memory to 8051microcontroller. (6 Marks)
c) Mention the various types of addressing modes used in 8051 instructions. (4 Marks)
7. a) Write an assembly language program to transfer a block of Data from one memory location to the other. (4 Marks)
b) With the neat sketch explain the functionality of the On-chip Timer in ARM7 processor. (8 Marks)
c) Describe the important of programming model of ARM7 processor. (8 Marks)
- OR**
8. a) Write an assembly language program to perform the following sequence (8 Marks)

$$X = 1*2 + 2*3 + 3*4 + + (N-1) * N$$

b) What is the function of IODIR Register? Give an example to enable GPIO0.7 to GPIO0.0 for Output function. (6 Marks)

c) With an example explain the Stack operation performed in ARM7 processor. (6 Marks)

9.

a) Assume an Array contains 30 Words of Data. A compiler associates variables x and y with register R0 and R1 respectively. Assume the starting address of the array is contained in R2. Translate the C statement below into assembly instructions: (5 Marks)

x = array[7] + y;

b) With an example explain the function of Pin Connect Block in ARM7 Microcontroller. (5 Marks)

c) With the neat sketch explain the architecture of ARM7TDMI processor core. (10 Marks)

Wishing you All the Best

End Semester Examinations - Nov-Dec 2015 Exams

14EI3023 Advanced Processors for control and automation

Set A

Time : 3 hrs
Total Marks: 100

-
1. a) How does a Microcontroller differ from Microprocessor? (4 Marks)
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c) What are the features of Harvard and Princeton architectures? (5 Marks)
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- OR**
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b) What are the uses of a power down-mode in an MCU? When does an MCU run in this mode? (6 Marks)
c) Explain the use of open-drain output.(4 Marks)
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b) Write short notes on the following Microcontroller resources: (6 Marks)
i) Timer/Counter ii)PWM
c) Give an application of a Microcontroller in an automatic process control. (8 Marks)
- OR**
4. a) Draw the PSW format of 8051 microcontroller & state various conditions of flags. (4 Marks)
b) Describe the instructions SWAP A and MOVX @ DPTR, A with one example. (6 Marks)
c) Describe the function of PSEN, EA, XTAL1, XTAL2 and ALE pins of 8051microcontroller. (10 Marks)
5. a) Write an assembly language program using counter 0 in mode 1 to calculate the frequency of the input signal occurred at T0 terminal. Assume the frequency of the clock signal is 12MHz. (10 marks)
b) Write an assembly language program to add two numbers 2AH and F9H. write the status of different flags after this addition. (6 Marks)
c) List the On-Chip features of 8051 microcontroller. (4 Marks)
- OR**
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b) With the neat sketch explain the functionality of the On-chip Timer in ARM7 processor. (8 Marks)
c) Describe the important of programming model of ARM7 processor. (8 Marks)
- OR**
8. a) Write an assembly language program to perform the following sequence (8 Marks)

$$X = 1*2 + 2*3 + 3*4 + + (N-1) * N$$

b) What is the function of IODIR Register? Give an example to enable GPIO0.7 to GPIO0.0 for Output function. (6 Marks)

c) With an example explain the Stack operation performed in ARM7 processor. (6 Marks)

9.

a) Assume an Array contains 30 Words of Data. A compiler associates variables x and y with register R0 and R1 respectively. Assume the starting address of the array is contained in R2. Translate the C statement below into assembly instructions: (5 Marks)

`x = array[7] + y;`

b) With an example explain the function of Pin Connect Block in ARM7 Microcontroller. (5 Marks)

c) With the neat sketch explain the architecture of ARM7TDMI processor core. (10 Marks)

Wishing you All the Best

End Semester Examinations - Nov-Dec 2015 Exams

14EI3049 Medical Devices And Safety

Set B

Time : 3 hrs
Total Marks: 100

1. Write short notes on:

- a. Risk perception and the various factors elevating and reducing perceived risk.(10marks)
- b. Risk analysis performed during medical device development (10marks)

OR

2. a. Give short notes about Risk management (10marks)
- b. Write a note on manufacturer's and physician's responsibilities towards risk management.(10marks)

3. a. Classify the medical device based on methodical risk, invasiveness and use duration (10marks)
- b. Explain the demarcation of medical devices to other type of products (10marks)

OR

4. a. Brief on basic assumptions in safety technology and safety classes (10marks)
- b. Briefly discuss about the impact on the environment caused by electromagnetic emissions.(10marks)

5. a. Elaborate on the Electrical safety aspects of medical devices in terms of: (10marks)
- i. Micro shock
 - ii. Macro shock

b. Discuss on Specific risks of electro medical device applications(10marks)

OR

6. a. "Protection goal is limiting leakage currents to safe values under normal and single fault Condition". Explain the four different types of leakage currents.(10marks)
- b. Explain about the ecological safety on medical devices. (10marks)

7. a. Give brief notes on the various directives framed for medical devices and patient Safety (15 Marks)
- b. Elaborate on the Design Control Guidance for Medical Device Manufacturers provided by FDA (5 Marks)

OR

8. write short notes

- i. Good laboratory and manufacturing practices (10 Marks)
- ii. List out the various information that are require for IDE application (10 Marks)

9. i. Explain in detail about the necessity of In Vitro Diagnostic Medical Devices Directive (15 marks)
- ii. Describe the process involved in choosing the appropriate directive for medical devices (5 Marks)

Wishing you All the Best

End Semester Examinations - Nov-Dec 2015 Exams

14EI3051 Medical Sensors and wearable devices

Set B

Time : 3 hrs
Total Marks: 100

-
1. (a) Classify the types of blood pressure measurements and explain any one of its working principle in detail. [15]
(b) Mention the linearity, sensitivity characteristics of medical devices. [5]
- OR**
2. (a) Discuss the architecture and working principle of implantable devices. [10]
(b) List the advantages and applications of micro system technology in medical devices. [10]
3. Discuss about ultrasonic flow measurement system with neat sketches. [10]
List the advantages and applications of ultrasonic measurements. [10]
- OR**
4. (a) Discuss in detail about the non invasive blood glucose measurement technique. [15]
(b) List the merits of non invasive measurements. [5]
5. Classify the linear and rotary displacement sensors in the measurement of movement in human limb. Detail the working principles of each type with suitable sketches. [20]
- OR**
6. (a) Discuss the principle of 3-axis accelerometer in measurement of human body posture. [15]
(b) List the merits of micro accelerometers in medical systems. [5]
7. (a) Give the detailed block diagram of the instrumentation system for muscle contraction measurement using strain gauge method. [15]
(b) Specify the advantages of capacitive force plate and its applications. [5]
- OR**
8. (a) Explain the estimation of heart rate using optical measurement method. [10]
(b) Explain the construction of a wearable wrist band for physiological parameter monitor. Mention its applications. [10]
9. Illustrate in detail about the advantages of the wearable device with a suitable application. [10]
Discuss about the necessities and scope of wearable devices in health care field. [10]
-

End Semester Examinations - Nov-Dec 2015 Exams

14EI3054 Biomechanics

Set B

Time : 3 hrs
Total Marks: 100

-
1. a. Illustrate how the arrangement of musculoskeletal system provides mechanical advantages in the human body. (14)
- b. With proper illustration explain the different types of stress in solids. (6)
- OR**
2. a. Illustrate the biomechanics of hip joint. (12)
- b. During a tensile test, a human bone specimen of length 125 mm and gage cross section of 3.75 x 2.5 mm (width x thickness) is observed at a point of 500 kN. The measured elongation was 0.06 mm in gage length. The dimension of the width is observed to have decreased by 0.005 mm. Calculate the Youngs' modulus and Poissons' ratio. (8)
3. Explain the standards to be followed to optimize the well being in work environment (20)
- OR**
4. a. Describe in detail the characteristics of viscoelastic material behaviour. (12)
- b. Explain the significance and application of Brain Gate. (8)
5. a. Illustrate detail the various methods for the mechanical testing of implants. (12)
- b. Explain Finite Element Modelling along with its limitations. (8)
- OR**
6. a. Give a detailed description of the total knee replacement (12)
- b. Bring out the biomechanical requirements for fracture healing (8)
7. a. Describe a driver operating model and the functional chain involving driving activity (12)
- b. With a neat schematic diagram, explain a human –machine system and the types of systems (8)
- OR**
8. a. What is human error? Data collection system for error management (12)
- b. What are the objectives of TRACE? Describe the operational workpackages defined in its structure (8)
9. a. Illustrate the common properties of living tissues and the biological characteristics of bone in detail. (10)
- b. Explain the biomechanics of bone screws and intramedullary rods (10)
-

End Semester Examinations - Nov-Dec 2015 Exams

14EI3058 Linear systems

Set B

Time : 3 hrs
Total Marks: 100

1.

- a. Check whether the following system is completely controllable. (10)

$$x(k+1)T = Gx(kT) + Hu(kT)$$

$$y(kT) = Cx(kT)$$

$$G = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}, H = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = [1 \quad 0 \quad 0]$$

- b. Perform observability test for the system given below. (10)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 6 \end{bmatrix} u$$

$$Y = [1 \quad 0 \quad 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

OR

2. a. Differentiate between transfer function and state space model. (5)
- b. Write the state space model for a discrete system. (5)
- c. With a block diagram, represent the canonical form of state model and explain. (10)

3.

A feedback system has a closed-loop transfer function

$$\frac{Y(s)}{X(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$$

Construct the three state models for the system. (20)

OR

4. a. Explain the concept of diagonalization. (5)
- b. Apply the concept of diagonalization to obtain the canonical form for the system given below (15)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 6 \end{bmatrix} u$$

$$Y = [1 \quad 0 \quad 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

=

5. a. Derive the solution of homogenous state equations. (10)
- b. State and prove Cayley-Hamilton Theorem. (10)

OR

6.

A linear time invariant system is described by the following state model. (20)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u$$

$$Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Transform this state model into a canonical state model. Also compute the state transition matrix e^{At}

7.

- Is it possible to determine the transfer function from state space? Justify your answer. (5)
- What is meant by eigen values and characteristic equation? (5)
- Find the eigen values and eigen vectors for the system matrix given. $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$ (10)

OR

8.

The state model of a system is given by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u$$

$$Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Convert the state model to controllable phase variable form. (20)

9.

- Write the Liapunov's stability theorems. (10)
- Explain the concept of Lyapunov's stability (10)

Wishing you All the Best
