

**UNIVERSITY OF PUNE**  
**[4364]-612**  
**B. E. (Instrumentation & Control)**  
**Process Dynamics and Control**  
**(2008 Course)**

**Total No. of Questions : 12**                      **[Total No. of Printed Pages :3]**  
**[Time : 3 Hours]**                                      **[Max. Marks : 100]**

**Instructions :**

- (1) *Answer three question from section-I and three question from section-II.*
  - (2) *Answers to the **two sections** should be written in **separate answer-books**.*
  - (3) *Neat diagram must be drawn wherever necessary.*
  - (4) *Black figures to the right indicate full marks.*
  - (5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
  - (6) *Assume suitable data, if necessary.*
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Q1.

- a) With the help of mathematical equations, explain how the stability of a process is determined numerically. [10]
- b) What are the objectives of developing process models? [6]

**OR**

Q2.

- a) State and explain various identifying parameters considered in process dynamics and control. [8]
- b) With the help of necessary equations explain the first order dynamic behavior of a stirred tank heater. [8]

Q3.

- a) Compare feedback + feedforward and Cascade control schemes for control of heat exchanger. Draw loop schematic and list advantages and disadvantages of each scheme. [10]

- b) Enumerate various measured variables, control variables and signal used for annunciation in a typical heat exchanger. [6]

**OR**

Q4.

- a) Elaborate the method to reduce measurement lag in a heat exchanger. [6]  
b) Discuss the dynamics of a Heat Exchanger. [10]

Q5.

- a) List the various optimization schemes used in a boiler. Explain Excess Air Optimization in detail. [12]  
b) Explain the Shrink and Swell Effects in boilers. [6]

**OR**

Q6. With the help of necessary P and I diagrams explain any four control loops used in a boiler. [18]

## **SECTION II**

Q7.

- a) State and explain various interlocks required in reactors. [9]  
b) Elaborate "Batch Recipe Management" [9]

**OR**

Q8.

- a) What are the different factors governing the performance of chemical reactions. Explain the effects of each factor on control and stability of chemical reactions. [9]  
b) Explain the importance of time sequence diagram in batch processes considering appropriate application. [9]

Q9.

- a) What is the necessity of distillation column temperature control? Comment on the location of the sensing element. [8]

- b) Explain the use of cascade and feed-forward control strategy for distillation column feed control. [8]

**OR**

Q10.

- a) Explain in detail the control of overhead composition in distillation process. [8]
- b) Discuss the importance of frequency response studies in distillation process. [8]

Q11. It is required to automate a water treatment plant. Explain in chronological order the steps and process data requirements to implement automation. Suggest appropriate automation strategy with neat sketches. [16]

**OR**

Q12.

- a) Explain the pressure and flow control in compressors considering the protection of the equipment. [8]
- b) Enumerate variable speed drives used in pumps. Elaborate variable frequency drive. [8]

**UNIVERSITY OF PUNE**  
**[4364]-601**  
**B. E. (Instrumentation & control)**  
**(Semester - I) Examination - 2013**  
**Process Instrumentation**  
**(2008 Pattern)**

**Total No. of Questions : 12**

**[Total No. of Printed Pages :3]**

**[Time : 3 Hours]**

**[Max. Marks : 100]**

**SECTION-1**

- Q. 1. a) Explain different Incentives of process control. (8)
- b) Explain in brief Time-Delay of processes. Discuss on the effect of P-control action on deadtime dominate processes. (8)

OR

- Q. 2. Discuss on (any four). (16)
- i. Multicapacity processes,
  - ii. Non-self regulation,
  - iii. Interacting processes,
  - iv. Nonlinear Dynamics
  - v. Degree of freedom

- Q. 3. a) Define the term 'scaling'. Using suitable example explain steps involved in scaling. (8)
- b) Enumerate specification of MLPC. (8)

OR

- Q. 4. a) Explain following terms. (8)
- i. Process gain,
  - ii. Valve gain,

iii. Transmitter gain,

iv. Variable time constant.

b) Explain analysis of flow control loop. (8)

Q. 5. a) Explain the control performance measure for common input changes. (10)

b) Explain procedure of determining tuning constant for good control performance. (8)

OR

Q.6. a) Explain following terms of practical applications of feedback control. (18)

i. Input processing,

ii. Output processing,

iii. Feedback control algorithm.

### SECTION-2

Q. 7. a) What are the implementation issues of cascade control system? (8)

b) Explain Feedforward -Feedback control with suitable example. (8)

OR

Q. 8. a) Explain Split range control strategy with suitable example. (8)

b) Explain ratio control configuration and its applications. (8)

Q. 9. a) The multivariable process is given by following transfer function. (16)

$$Gwb(s) = \begin{bmatrix} \frac{12.8e^{-s}}{16.7s + 1} & \frac{-18.9e^{-3s}}{21s + 1} \\ \frac{6.6e^{-7s}}{10.9s + 1} & \frac{-19.4e^{-3s}}{14.4s + 1} \end{bmatrix}$$

1. Calculate the relative gain array matrix for given system,

2. Select suitable controlled-manipulated variable pairing,

3. Design suitable static decouples,

4. Develop multivariable control system.

OR

Q. 10. a) What is an interactive? Explain its effect on stability and tuning of Multiloop control system. (8)

b) Explain enhancement of multiloop control performance using decoupling. (8)

Q. 11. a) What is Defuzzification. Enlist types of Defuzzification. (8)

b) What is an Artificial Neural Network? Explain training of artificial neural network. (10)

OR

Q. 12. Write short note on (any three) (18)

- i) Dynamic Matrix Controller,
- ii) Model Predictive Controller,
- iii) Internal Model Controller,
- (iv) Neuro-fuzzy Controller.

[Total No. of Questions: 12]

[Total No. of Printed Pages: 3]

**UNIVERSITY OF PUNE**

**[4364]-618**

**B. E. (Instrumentation and Control) (Semi - II) Examination - 2013**

**INSTRUMENTATION IN AGRICULTURE**

**(Elective - IV) (2008 Course)**

**[Time: 3 Hours]**

**[Max. Marks: 100]**

***Instructions:***

- 1 *Neat diagrams must be drawn wherever necessary.*
- 2 *Figures to the right indicate full marks.*
- 3 *Your answer will be valued as a whole*
- 4 *Assume suitable data, if necessary.*

**SECTION -I**

- Q.1    A    List any 8 properties of soil. Explain 2 properties of soil in details.    8
- B    What is a Hygrometer? List 2 types of Hygrometers. Draw and explain detail working principle of dry bulb and wet bulb type psychrometer.    10

**OR**

- Q.2    A    List any 6 principles used in analyzers. Explain two in detail with its application.    10

- B What is Humidity? Explain relative and Absolute Humidity in details. 8
- Q. 3 A Explain schematic flow chart of a fermentation process. List its applications (min. 4) 8
- B Explain different stages involved in the production in sugar industry. 8

**OR**

- Q. 4 A Draw and explain flow diagram for typical dairy plant. Also 4 important equipments used in dairy industry. 8
- B Draw and explain instrumentation involved in the sugar cane juice extraction process. 8
- Q. 5 A Discuss the factors affecting the selection of irrigation system.(min. 8 points) 8
- B Explain any 2 soil moisture measurement techniques in detail. 8

**OR**

- Q. 6 A Compare surface and micro methods of irrigation based on their relative advantages and disadvantages. 8
- B List and explain factors to be considered while scheduling irrigation. 8

**SECTION II**

- Q. 7 A Explain temperature and humidity control in green house. 8
- B Draw and explain ventilation and cooling of green house environment. 10



**OR**

- Q. 8    A    Explain instrumentation for monitoring the green house environment. Draw suitable block diagram.    10
- B    Explain use SCADA for various parameter controls.    8
- Q. 9    A    Explain various Hydraulic controls in farm tractor.    8
- B    List any 4 pumps used for agricultural purpose. Draw and explain any 1 in details.    8

**OR**

- Q. 10            Construct the ladder diagram for PLC application in packaging industry. Assume suitable data for the conveyor control. Also draw the diagram for above system.    16
- Q. 11    A    Explain agro-metrological instrumentation in weather stations.    8
- B    Explain ground water confined & unconfined aquifer.    8

**OR**

- Q. 12    A    Explain soil water content measurement using time-domain reflectometry (TDR)    8
- B    Explain infrared –IR & UV bio sensor methods in agriculture.    8

**UNIVERSITY OF PUNE**  
**[4364]-603**  
**B. E. (Instrumentation)**  
**Project Engineering & Management**  
**(2008 Pattern)**

**Total No. of Questions : 12**  
**[Time : 3 Hours]**

**[Total No. of Printed Pages :3]**  
**[Max. Marks : 100]**

**Instructions :**

- (1) *Answers to the two sections should be written in separate answer-books.*
- (2) *Neat diagram must be drawn wherever necessary.*
- (3) *Black figures to the right indicate full marks.*
- (4) *Assume suitable data, if necessary*
- (5) *All questions are compulsory.*

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**SECTION-I**

Q1.

- a) What is the role of Project team in developing the project statement? Explain in detail [8]
- b) What is organization structure? Draw an organizational structure for R&D [10]

OR

Q2.

- a) Explain multiagency interaction involved in project development with detail considerations. [10]
- b) Write a short note on various organizational structures. [6]
- c) What is project management? [2]

Q3.

- a) Prepare Technical specification sheet in s-20 format [8]
  - 1) Pneumatically Operated Control valve
  - 2) Level Transmitter
- b) What is P&ID? Draw the P&ID for Chemical Reactor. [8]

OR

- Q4.
- a) Explain importance & scope of material balance sheeting Project Engineering with suitable example. [8]
  - b) Explain in detail the tagging procedure in detail & state its importance. [8]

- Q5.
- a) Explain Cable selection guidelines. Also explain the cable trays. [8]
  - b) What are installation sketches? What purpose do they serve? Draw an installation sketch for DP type flow transmitter. [8]

OR

- Q6.
- a) Prepare & explain BOM for Flow Control Loop. [8]
  - b) What is loop wiring diagram? Develop Loop wiring diagram for Flow Loop [8]

## SECTION-II

- Q7.
- a) What is FAT, SAT & CAT? Prepare a fat for control panel. [12]
  - b) Give the classification of CAT cable. Also state its applications. [6]

OR

- Q8.
- a) List and explain the documents required during construction activity. [12]
  - b) What is Tendering? Explain it in detail. [6]

- Q9.
- a) Explain important feature of intelligent operator Interface. [8]
  - b) Explain the inspection Procedure for Pneumatic Control Panel. [8]

OR

- Q10.
- a) Explain guidelines, considerations in design of Control Panel. [8]
  - b) Explain straight control panel with neat sketch write advantages and disadvantages of using it. [8]

- Q11.
- a) What is PERT? Explain it with example [6]

- b) Write Notes [10]
- 1) Importance of Projection Specifications
  - 2) Procedure for Pricing Process in brief.

OR

Q12.

- a) List out various documents involved in project management. Explain SOW and WBS Preparations in detail.. [10]
- b) What is various software's used in Project Management? Discuss MS Project in detail. [6]

**UNIVERSITY OF PUNE**  
**[4364]-602**  
**B. E. Instrumentation & Control Engineering**  
**Examination :- May 2013**  
**Digital Control (406262)**  
**(Course 2008)**

[Total No. of Questions:]

[Total No. Printed Pages:4]

[Time : 3 Hours]

[Max. Marks : 100]

*Instructions :*

- 1) Answer **any three** questions from each I and three questions from section II
  - 2) Answers to the **two sections** should be written in **separate answer-books**.
  - 3) Neat diagrams must be drawn wherever necessary.
  - 4) Black figures to the right indicate full marks.
  - 5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - 6) Assume suitable data, if necessary.
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**SECTION -I**

Q.1 a) Define the Discrete time control system with neat block diagram [8]  
b) Determine the Z-Transform of [8]

i)  $\frac{1}{s(s+1)(s+2)}$       ii)  $\frac{2}{s(s+2)^2}$

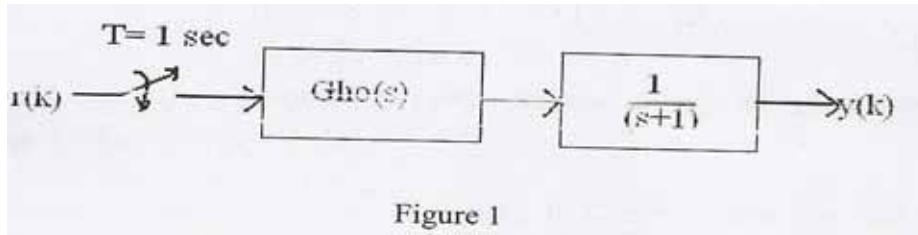
**OR**

Q.2 a) Derive the mathematical model for the sample data control system. [8]  
b) Find the inverse Z-Transform of [8]

i)  $\frac{2}{(2z-1)^2}$       ii)  $\frac{2}{s(s+2)^2}$

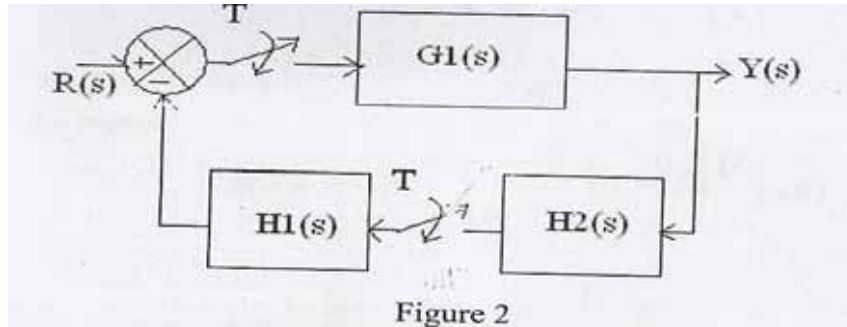
Q.3 a) Define pulse transfer function. Derive the transfer function for the digital PID controller. [8]

b) Obtain the response  $y(k)$  for the system shown in figure.1 [8]



Q.4 a) Define deadbeat response of controller. Also explain the concept of ringing of poles with example. [8]

b) Obtain the pulse transfer function of the system shown in figure.2 [8]



Q.5) Examine and comment on the stability of the system represented [18]

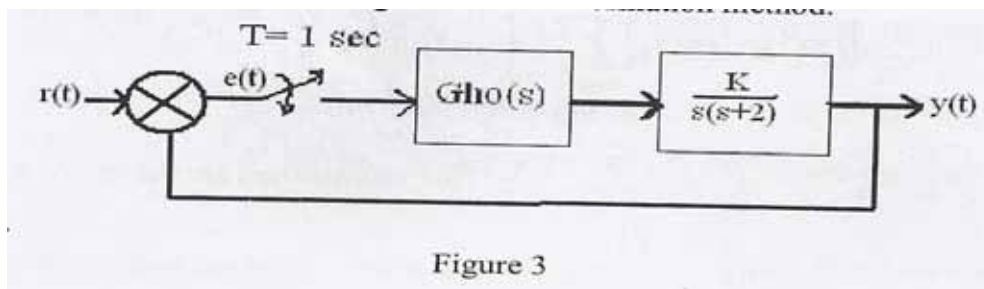
by its characteristics equation as given below using Jury's Stability criterion.  $p(z) = z^2 - 1.2z^3 + 0.07z^2 + 0.3z - 0.08 = 0$

Also verify the results using Routh's method and bilinear transformation method.

**OR**

Q.6) Find the range of the K for the closed loop stability of the system [18]

shown in figure 3 using Jury's Stability criterion. Verify the results using bilinear transformation method.



## SECTION – II

Q.7) a) Diagonalize the plant matrix given below. [8]

$$G = \begin{bmatrix} 2 & 1 & 4 \\ 0 & 2 & 0 \\ 0 & 3 & 1 \end{bmatrix}$$

b) Derive the formula to obtain the pulse transfer function for state model and use it to find PTF for the system given by. [10]

$$x(k+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 6 & -11 & 6 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(k)$$
$$y(k) = [3 \ 4 \ 1] x(k)$$

**OR**

Q.8) Obtain the transition matrix  $\psi(k)$  of the following discrete time system [18]

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(k)$$
$$y(k) = [1 \ 0] x(k)$$

Also obtain the state  $x(k)$  and output  $y(k)$  when the input in unit step.

Assume the initial conditions as  $x_1(0) = 1, x_2(0) = -1$ .

Q.9) a) Define the terms [6]

- i) Complete state controllability
- ii) Complete state observability

b) Investigate the controllability and observability of the following system [10]

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -0.4 & -1.3 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$$
$$y(k) = [0.8 \ 1] x(k)$$

**OR**

Q10) a) Consider the system [10]

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$$

Determine the suitable state feedback gain matrix  $K$  such that the system will have the closed loop poles at  $z = 0.5 \pm j0.5$ .

b) State and derive the necessary and sufficient condition for state observability. [6]

Q.11) Consider the discrete time control system defined by [16]

$x(k+1)=0.3679x(k)+0.6321u(k), x(0)=1$ . Determine the optimal control law to minimize the following performance index

$$J = \frac{1}{2} [x(10)^2] + \frac{1}{2} \sum_{k=0}^9 [x^2(k) + u^2(k)]$$

**OR**

Q.12) Minimize the following performance index [16]

$$J = \frac{1}{2} \sum_{k=0}^{\infty} x^T(k) Q x(k) + u^T(k) R u(k)$$

to follow the control law  $u(k) = -kx(k)$  with  $Q = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$  and  $R = 1$  for the system given by

$$x(k+1) = \begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix} x(k) + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(k)$$

$$x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

Also find the  $J_{\min}$ .



UNIVERSITY OF PUNE

[4364]-604

B. E. (Instrumentation & Control) Examination - 2013

BIOMEDICAL INSTRUMENTATION (2008 Pattern)

[Total No. of Questions:]

[Total No. of Printed Pages :2]

[Time : 3 Hours]

[Max. Marks : 100]

**Instructions :**

- (1) Answer **any three** from each section.
- (2) Answers to the **two sections** should be written in **separate answer-books**.
- (3) Neat diagrams must be drawn wherever necessary.
- (4) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.
- (5) Assume suitable data, if necessary.

Q1 a) Explain with neat sketch various types of electrodes. [8]

b) Explain electrode offset potential? How effect of electrode offset potential is overcome. Explain the various properties that bio electrode should possess.

OR

Q2 a) Draw the electrical equivalent circuit of a microelectrode and explain its electrical nature? [8]

b) List and explain the different parameters in ergonomic design of Operation table. [8]

Q3 a) Explain different chambers of heart. Explain an electrical conduction system of heart. [8]

b) Design a heart rate meter for rate & rhythm measurement. [8]

OR

Q4 a) Draw and explain Einthoven triangle. [8]

b) State the specifications of ECG recorder. [8]

Q5 a) Design and explain Photoplethysmography. And its applications. [8]

b) Discuss Doppler shift ultrasonic blood flow measurement along with neat diagram. [10]

OR

Q6 a) Describe in brief various techniques used for BP measurement. [10]

b) Explain phonocardiography. And its applications. [8]

## SECTION-II

Q7 a) What is EEG? What are various waveforms of EEG. Enlist them and give [8]  
Their significance?

b) What are the functions of somatic nervous system and spinal reflexes? [8]

OR

Q8 a) Explain 10-20 electrode placements for EEG recording. [8]

b) Draw the block diagram of an EEG unit and explain the different parts in it. [8]

Q9 a) Enlist various ophthalmic Instruments. [8]

b) Design instrument used for measurement of loss in the peripheral vision of [8]  
the subject.

OR

Q10 a) Draw the block diagram of automatic Bekesy audiometer and explain [8]  
the measurement procedure?

b) What is meant by evoked response audiometry system? [8]

Q11 a) Explain the needs of humidifiers, nebulizers, and aspirators. [8]

b) What are the methods available to measure respiration rate? Explain any [10]  
one in detail.

OR

Q12 a) Describe the possibilities of occurrence of electrical accidents for a [10]  
patient in a hospital.

b) Define let go current, macro shock, micro shock, leakage current? [8]

# UNIVERSITY OF PUNE

[4364]-605

B.E.(Instrumentation & control)

Elective-I : Laser Applications in Instrumentation  
(2008 course)

[Time : 3 Hours]

[Max. Marks:100]

Total No. of Questions : 12

[Total No. of Printed Pages:2]

## *Instructions :*

- (1) Answer **any three** questions from section I and section II.
  - (2) Answers to the **two sections** should be written in **separate answer-books**.
  - (4) Neat diagrams must be drawn wherever necessary.
  - (5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (6) Assume suitable data, if necessary.
- 

## Section I

Q.1) Explain in detail the process of emission and absorption of radiation. [16]  
Also explain the importance of Einstein's equations in emission of radiation.

**OR**

Q.2) Write short notes on [16]

- i) Laser modes
- ii) Q switching

Q.3 a) What are different laser system features which are applicable to most [9]  
Commercial and industrial lasers? Explain each in short.

b) Estimate the efficiency of a GaAs laser operating well above [4]  
threshold. The refractive index of material is 3.5 and laser cavity length is  
0.3mm The loss coefficient is 800 per meter length and the internal quantum  
efficiency is 0.7.

c) Explain safe laser laboratory operation? [5]

**OR**

Q.4 ) Explain the construction and working of GaAs homojunction [18]  
semiconductor diode laser. How the laser products are classified for safety  
standards?

Q.5 a) Describe how Fabry-Perot interferometers is used with small coherent length source for displacement measurements. [8]

b) What is Speckle Pattern? Describe subjective and objective speckles. [8]

**OR**

Q.6 a) Describe the dynamic tracking of speckle pattern for displacement measurements. [8]

b) What are the properties of speckle pattern? Describe each in short [8]

**Section II**

Q.7 a) Example the principle of operation of Laser velocimeter. [8]

b) What are the two options for the electronic processing of the Doppler signal? Compare it. [8]

**OR**

Q.8 a) Explain the frequency domain processing of Doppler signal in detail. [8]

b) Discuss the performance parameters of operation of laser velocimeter? [8]

Q.9) What is Sagnac effect? Show how is the phase shift is proportional to the angular velocity. What are the components required for all fiber FOG configuration? Explain each in short. [16]

**OR**

Q.10 a) Show that the frequency of the sagnac in RLG is proportional to the angular velocity of rotation. [8]

b) Explain in detail the closed loop configuration of Fiber Optic Gyroscope. [8]

Q.11 a) write a short note on Holographic Interferometer. [9]

b) What are different emulsions used to record the holograms? Mention the characteristics of it. [9]

Q.12) List out the applications of holographic interferometer that you know. Explain any two in detail. [18]

UNIVERSITY OF PUNE

[4364]-606

B.E. (Semester - I) Examination 2013  
(Instrumentation and Control Engineering)

Advanced Control Systems [406264]

(2008 Pattern) (Elective-I)

[Time : 3 Hours]

[Max. Marks :100]

Instructions :

- (1) Answer any three questions from each section.
- (2) Assume suitable data, if necessary.
- (3) Figures to the right indicate full marks.

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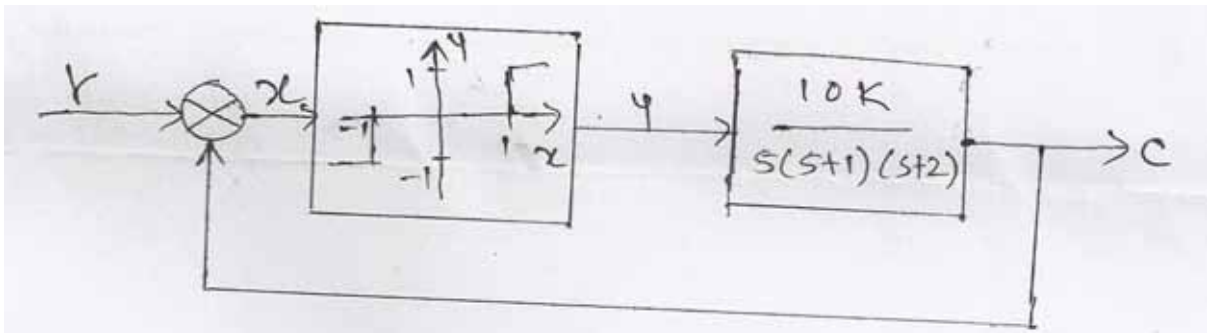
SECTION –I

Q.1 a) Explain in brief with neat diagram of Limit Cycle. [6]

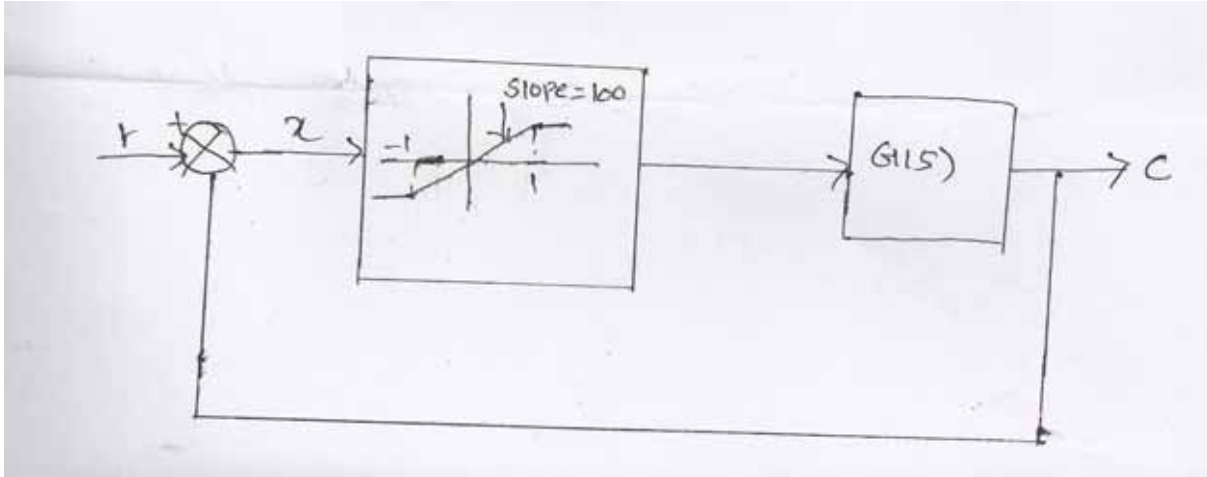
b) Define describing function. Determine describing function of the Relay with dead Zone. [12]

Q.2 a) Explain with neat diagram of singular points [6]

b) Obtain the range K for which the system shown in figure is stable [12]



Q.3) A Two Phase Servomotor is driven by an amplifier as shown in figure. [16]  
 The transfer function of motor is,  $G(s) = K e^{-0.1s}/s(0.1s+1)$  Investigate the stability of the system for  $k=0.2$ . what is the largest value of  $k$  for no limit cycle to exist.



**OR**

Q.4 a) Explain in brief of Popov's method.

b) A second order system represented by  $\dot{x}' = AX$  where [6]

$$A = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix}$$

by using Lyapunov's direct method. Determine the stability of the system [10]

Write the Lyapunov's function  $V(x)$ .

Q.5 a) Explain with neat diagram of Model Reference Adaptive Control [8]

(MRAC) System.

b) Explain in detail Discrete time MRAC system [8]

Q.6) Explain Lyapunov and MIT rule approaches for designing of Model Reference [16]

Adaptive controller.

**Section – II**

Q.7 a) with the help of net diagram explain the different element of the self tuning regulators. [6]

b) In the self tuning regulators (STR) following input output data has been obtained from the real plant : [12]

Time (t)	Input data [u(t)]	Output data [y(t)]
1	2.0	0.0
1	1.5	5.0
3	2.0	-1.5
4	2.5	4.0
5	1.5	2.0

use any regression to fit a model with the structure

$$y(t) + ay(t-1) = bu(t-1) + e(t)$$

Where  $e(t)$ =error signal

Or

Q8) Write short notes on : [18]

- i) Indirect Self Tuning Regulator.
- ii) Linear quadratic Self Tuning Regularor.
- iii) Continuous Time Self tuners.

Q9) A first order system is described by the following equation [16]

$$x(t) = 4x(t) + u(t)$$

It is desired to find the control law that minimizes the performance index given below;

$$J = \frac{1}{2} \int_0^t (3x^2 + \frac{1}{4}u^2) dt$$

$$t = 0.5 \text{ sec}$$

**OR**

Q.10) Obtain the control law which minimizes the performance index [16]

$$J = \int_0^{\infty} (x^2 + u^2) dt$$

For the system given below:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Q.11 a) Explain the adaptive control technique for temperature control in CSTR system. [8]

b) Explain in detail the general purpose adaptive regulator. [8]

**OR**

Q.12 a) Explain the requirements for the formulation of an optimal control problem. [8]

b) Discuss the performance measures for the optimal control problems. [8]



UNIVERSITY OF PUNE

[4364]-607

B. E. (Instrumentation & control) Examination - 2013

BUILDING AUTOMATION-1(406264) (2008 Pattern)

[Total No. of Questions:]

[Total No. of Printed Pages :2]

[Time : 3 Hours]

[Max. Marks : 100]

**Instructions :**

- (1) Answers to the **two sections** should be written in **separate answer-books**.
- (2) Black figures to the right indicate full marks.
- (3) Neat diagrams must be drawn wherever necessary.
- (4) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.
- (5) Assume suitable data, if necessary.

SECTION-1

Q1 a) Explain various stages of fire along with fire detectors? [8]

b) Enlist types of FAS architecture. Explain any one. [10]

OR

Q2 a) What is fire? Explain fire modes. [8]

b) Draw the block diagram of building life safety system & explain each block. [10]

Q3 a) Give classification FAS loops. Explain any one. [8]

b) Discuss voltage drop calculations of FAS. [8]

OR

Q4 a) Discuss supplementary operations to execute during fire. [8]

b) Explain fire suppression systems. [8]

Q5 a) Explain relays and contacts used in FAS. [8]

b) Explain FAS system with its advantages. [8]

OR

Q6 a) Explain different smoke detectors. [8]

b) Discuss manual initiating devices. [8]

#### SECTION-II

Q7 a) Draw and Explain the block diagram of access control systems. [10]

b) Discuss communication between card and card reader technology. [8]

OR

Q8 a) Explain biometrics for security systems. [8]

b) Describe the installation process of access control systems with suitable example. [10]

Q9 a) Discuss classification of camera in CCTV systems. [8]

b) Discuss role of Quads in video processing. [8]

OR

Q10 a) Explain selection criteria for lens of camera in CCTV systems. [8]

b) Compare various VDO compression standards. [8]

Q11 a) Explain block diagram of perimeter intrusion detection system. [8]

b) Explain PIDS for commercial buildings. [8]

OR

Q12 a) Discuss the need of PIDS. [8]

b) Explain technologies used for perimeter intrusion system. [8]

**UNIVERSITY OF PUNE**  
**[4364]-608**  
**B. E. (Semester I) Examination – 2013**  
**B.E(INSTRUMENTATION AND CONTROL)**  
**Environmental Instrumentation**  
**(40625A) (Course 2008)(Elective - II)**

**[Total No. of Questions:12]**  
**[Time : 3 Hours]**

**[Total No. Printed Pages: 2]**  
**[Max. Marks : 100]**

***Instructions :***

- 1) Neat diagrams must be drawn wherever necessary.*
  - 2) Black figures to the right indicate full marks.*
  - 3) Your answers will be valued as whole.*
  - 4) Assume suitable data, if necessary.*
- 
- 

**SECTION – I**

- Q.1 a) Explain the need of instrumentation control in environmental analysis. [10]  
b) Explain the photo-ionization method used for environmental analysis. [8]

**OR**

- Q.2 a) Explain ultraviolet analyzers used for environmental analysis. [8]  
b) Discuss on sensor requirements with respect to environmental parameters, [10]  
engineering requirements, sensor system and constraints on sensors.

- Q.3 Write short notes on any two of the following : [16]  
a) Drinking water quality standards.  
b) Water treatment objectives and considerations.  
c) Water treatment process design.

**OR**

- Q.4 a) Explain the various water quality parameters. [8]  
b) Explain the need of pH analyzers and describe any one application in [8]  
water quality treatment plants.

- Q.5 a) Derive the equation for settling of discrete particles in sedimentation. [8]  
b) Write a short note effect of temperature and viscosity on settling. [8]

**OR**

- Q.6 6) Write short notes on any two of the following [16]  
a) Factors considered for designing a setting tank.  
b) Coagulation and effect of temperature on coagulation.  
c) Ground water level measurements.

**SECTION – II**

- Q.7 a) Discuss the advantage and disadvantages of manual and automatic [8]  
sampling methods.  
b) Write a short note on automatic sampler subsystems. [10]

**OR**

- Q.8 a) List the different pressure measurements techniques in wastewater [10]  
treatment plants. Explain any two in details.  
b) Explain the instrumentation setup for a wastewater treatment plant. [8]

- Q.9 a) Which are the different air sampling methods and equipments? [8]  
Explain anyone method with equipment used in detail.

**OR**

- Q.10 a) Discuss on method for air pollution studies. [8]  
b) Discuss on control of air pollution. [8]
- Q.11 a) Discuss on air flow measurement techniques. [8]  
b) Write short note on quality assurance of strong water. [8]

**OR**

- Q.12 a) Explain non-open channel flow measurements. [8]  
b) What in the need of rain water harvesting? Discuss the method used for [8]  
rain water harvesting.

UNIVERSITY OF PUNE

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B. E. (Instrumentation & Control)

Examination - 2013

(406265)NANO INSTRUMENTATION

(2008 Pattern)

[Time : 3 Hours]

[Max. Marks : 100]

Total No. of Questions : 12

[Total No. of Printed Pages :3]

*Instructions :*

- (1) Answer **any three** questions from each section.
  - (2) Answers to the **two sections** should be written in **separate answer-books**.
  - (3) Black figures to the right indicate full marks.
  - (4) Neat diagrams must be drawn wherever necessary.
- 
- 

**SECTION I**

- Q1) a) Explain the ballistic transport of electrons in a medium? Give important characteristics on which it depends. [6]  
b) What is meant by self assembly? Explain the Langmuir Blodgett technique. [6]  
c) Explain the various types of nano-materials with their characteristics. [6]

**OR**

- Q2) a) Write a note on Nano lithography. [6]  
b) Explain the chemical vapour deposition for the synthesis of nano materials. [6]  
c) Give various types of nano magnetic materials and their properties. [6]

- Q3) a) Explain the magnetic and optical actuation of cantilevers. [8]  
b) Explain in detail about the Atomic force microscope. [8]

**OR**

- Q4) a) Give the main components of a scanning tunneling microscope and its working. [8]  
b) Write a note on scanning near field optical microscope. [8]  
Q5) a) Explain the working of carbon nanotube based field effect transistor. [8]  
b) Describe good micro wave absorbing materials w.r.t. important features of CNTs and fibers. [8]

**OR**

- Q6) a) Give comparison of mechanical properties of CNTs along their axial and radial directions. [8]  
b) Explain CNT based NEMS [8]

**SECTION II**

- Q7) a) Explain the term spintronics and the primary process involved in the dynamics of ensembles of spins. [8]  
b) Write a note on Giant magneto resistance effect. [8]

**OR**

- Q8) a) What is a spin transistor? Give its advantages over regular current based transistor. [8]  
b) Explain how spin-based computers are different from computers based on regular transistor. State the essential requirements for working of a practical quantum computer. [8]
- Q9) a) Write a note on a single electron transistor. [8]  
b) What are mesoscopic devices? Explain the working of a ballistic rectifier. [8]

**OR**

- Q10) a) Explain the down scaling of MOSFET dimension upto few nm and ballistic transport. [8]  
b) Explain resonant tunneling devices and circuits. [8]

- Q11) Write short notes on the following: [18]  
a) Nanomechanical sensors  
b) Emitting nanotransducers  
c) Magnetic nanotransducers

**OR**

- Q12) Write short notes on the following: [18]  
a) Nanowire optical wave guide  
b) Nano optical sensors and actuators  
c) Nanowire laser.

**UNIVERSITY OF PUNE**  
**[4364]-610**  
**B. E.(Instrumentation & Control)Examination - 2013**  
**ADVANCED DIGITAL SIGNAL PROCESSING(ELECTIVE-II)**  
**(2008 Pattern)**

[Total No. of Questions:]  
[Time : 3 Hours]

[Total No. of Printed Pages :3]  
[Max. Marks : 100]

***Instructions :***

- (1) Answer **any three** from each section.
- (2) Answers to the **two sections** should be written in **separate answer-books**.
- (4) Neat diagrams must be drawn wherever necessary.
- (5) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.
- (6) Assume suitable data, if necessary.

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**SECTION-I**

- Q1 a) Explain following: i) Decimator ii) Interpolator [8]  
b) Explain polyphase decomposition in multirate signal processing. [8]

**OR**

- Q2 a) Show that the decimators and expander is linear and time-varying [8]  
systems.  
b) Determine the Fourier transform of the signal  $x(n)$  when it is [8]  
i. down sampled by factor D and  
ii. up sampled by factor I
- Q3 a) Determine the Yule Walker equations or normal equations for ARMA [9]  
Process.  
b) Use the Levinson-Durbin algorithm to solve the normal equations for a[9]

signal having autocorrelation values  $\{1,0.25,0.5,0.5\}$

**OR**

- Q4 a) Derive the Yule Walker equations or normal equations for AR process.[9]  
b) Determine the FIR filter coefficients for  $K_1 = \frac{1}{4}, K_2 = \frac{1}{2}, K_3 = \frac{1}{4}$  [9]
- Q5 a) Define periodogram and determine it for  $x(n)=0.5^n u(n)$  [8]  
b) Explain the Bartlett method in detail. [8]

**OR**

- Q6 a) Define periodogram. Explain the estimation of power density spectrum[8]  
of random signals.  
b) What are the parametric methods in power spectrum estimation? [8]  
Explain any one in detail.

## **SECTION-II**

- Q7 a) Explain LMS algorithm for adaptive filtering. [8]  
b) Explain RLS algorithm for adaptive filtering. [8]

**OR**

- Q8 a) What are the main advantages of adaptive filters over fixed filters? [8]  
b) Compare LMS and RLS algorithms for adaptive filtering. [8]
- Q9 Draw and explain in detail the architecture of DSP processor. Also state [18]  
the features of DSP processor.

**OR**

- Q10 Compare the general purpose processor and DSP processor. Write the [18]



assembly language program for implementation of sum of product in DSP processor.

Q11 Compare FT, STFT and CWT. What are the short comings of Fourier Transform? [16]

**OR**

Q12 State the equations and properties of FT, STFT and CWT. Compare it. [16]

UNIVERSITY OF PUNE

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**B. E. (Instrumentation & Control)**  
**Examination – 2013 Elective II**  
**Automobile Instrumentation**  
**(2008 Pattern)**

[Time : 3 Hours]

[Max. Marks : 100]

[Total No. of Questions : 12]

[Total No. of Printed Pages :2]

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**SECTION I**

- Q1) a) What are the factors which motivates the automation in Automobile industry? [6]  
b) Explain various open loop and close loop components of engine management system? [10]

**OR**

- Q2) a) Explain the concept of electronic control System? [6]  
b) Explain about various components involved in mechanism of vehicle motion control system. [10]
- Q3) a) Explain principle of carburetor control system? [6]  
b) What is multi port or point fuel injection system in regards with automobile Engine? Operation? Explain it with neat block diagram? [10]

**OR**

- Q4) a) Explain ignition system in automobile. [8]  
b) What are the types of solid state ignition systems? Electronic spark timing control system (step involved) [8]
- Q5) a) Define following terms with Engine performance terms: [15]  
i) Power ii) BSFC iii) Volumetric Efficiency  
iv) Thermal Efficiency v) Calibration  
b) What is engine mapping? [3]

**OR**

- Q6) a) Concept of electronic engine control system? Components of an electronically controlled engine? [8]  
b) Explain various modes of electronic engine control system. [10]

**SECTION II**

- Q7) a) Explain the principle of electronic Braking? [6]  
b) Define and explain ABS, ASR and ESP? [10]

**OR**

- Q8) a) Explain automobile transmission electronic control circuit? [8]  
b) Write a short note on Cruise control circuit? [8]
- Q9) a) What is instrumentation involved w.r.t Automobile applications in: [10]  
i) Automotive central locking and  
ii) Anti theft system control technology
- b) Instrumentation involved in electronically controlled doors and windows. [6]

**OR**

- Q10) a) What is an air bag technology in automobile? What is its need? [6]  
b) List out various components involved in auto body control technology? [3]  
c) Explain in brief principle control circuit components and characteristics of any two of them in brief? [7]
- Q11) a) Explain role of Instrumentation in driver information system? [6]  
b) Write a short note on air conditioning in automobile control system? [6]  
c) Write a short note on emission standards in automobile sector? [6]

**OR**

- Q12) Explain in brief Ergonomics and safety aspect in automobile w.r.t following [18]  
points:  
i) Lighting system components  
ii) Steering control techniques

[Total No. of Questions:12]

[Total No. of Printed Pages: 2]

UNIVERSITY OF PUNE

[4364]-613

B. E. (*Instrumentation Engineering*) Examination - 2013

*Industrial Automation( 2008 Course)*

[Time: 3 Hours]

[Max. Marks: 100]

**Instructions:**

- 1 Answers to the **two sections** should be written in **separate answer-books**.
- 2 Draw neat diagrams wherever necessary.
- 3 Numbers to the right indicate **full marks**.
- 4 Assume suitable data, if necessary.
- 5 Answer **any three** questions from each section.

**SECTION –I**

- |           |   |  |    |
|-----------|---|--|----|
| Q.1       | A | List and explain the benefits of Automation in a plant.  | 8  |
|           | B | Assume that you are planning to modify a manually operated plant to a fully automatic plant. Prepare a list of your requirements for the same. | 8  |
| <b>OR</b> |   |  |    |
| Q.2       | A | Define a term “Control System Audit” and explain the benefits of the same.   | 8  |
|           | B | With a suitable example explain the role of SCADA in Automation.   | 8  |
| Q. 3      | A | Explain the difference between Modbus (ASCII) and Modbus(RTU) protocol.  | 8  |
|           | B | List and explain at least five Universal commands used in HART.  | 10 |
| <b>OR</b> |   |  |    |
| Q. 4      | A | Explain the role of Link Active Scheduler in Foundation Fieldbus communication.  | 8  |
|           | B | With respect to OSI model compare HART and Foundation Fieldbus protocols.  | 10 |
| Q. 5      | A | Explain the various steps involved in developing PLC based automation projects.  | 8  |
|           | B | Explain the PLC programming methods as per IEC 1131-3.   | 8  |

**OR**

- |      |   |   |   |
|------|---|---|---|
| Q. 6 | A | With some suitable example explain the “Sequential Function Chart”. | 8 |
|      | B | Write short note on CNC machine.                                    | 8 |

**SECTION II**

- |      |   |   |   |
|------|---|---|---|
| Q. 7 | A | Write the general specifications of a DCS system.                           | 8 |
|      | B | With some suitable example explain four major components of the DCS system. | 8 |

**OR**

- |      |   |  |    |
|------|---|--|----|
| Q. 8 | A | List and explain the Logical function blocks in the DCS system.          | 8  |
|      | B | Explain the need of alarm management system in DCS                       | 8  |
| Q. 9 | A | Explain different I/O function blocks available in any DCS system        | 8  |
|      | B | Explain the need of security and user access management in a DCS system. | 10 |

**OR**

- |       |   |   |    |
|-------|---|---|----|
| Q. 10 | A | Explain DCS support for Enterprise resource planning.                   | 8  |
|       | B | With the help of an example explain what “Third party interface?”       | 10 |
| Q. 11 | A | What is Process Hazard Analysis? List different method for PHA.         | 8  |
|       | B | What is HaZOp? With the help of flow chart explain the HaZOp procedure. | 8  |

**OR**

- |       |   |   |   |
|-------|---|---|---|
| Q. 12 | A | Explain the different layers of protection.                 | 8 |
|       | B | With the help of block diagram explain “Safety Life Cycle”. | 8 |

UNIVERSITY OF PUNE

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**B. E. (Instrumentation & Control) SEMI-II Examination - 2013**

**ELECTIVE: II ADVANCE BIOMEDICAL INSTRUMENTATION**

**(406269) (2008 Course)**

**[Time: 3 Hours]**

**[Max. Marks: 100]**

**Instructions:**

- 1 Answers to the two sections should be written in separate answer-books.*
- 2 Black figures to the right indicate full marks.*
- 3 Neat diagrams must be drawn wherever necessary.*
- 4 Assume suitable data, if necessary.*
- 5 Answer any three questions from Section I and any three questions from Section II*

**SECTION –I**

Q.1	A	Explain Heart lung machine. Why lung function is incorporated in Heart lung machine	10
	B	Explain importance of central monitoring system in ICU	8

OR

- |      |   |   |    |
|------|---|---|----|
| Q.2  | A | Explain different modes of ESU?   | 10 |
|      | B | What is the necessity Pacemaker? Differentiate between internal and Implanted Pacemaker | 8  |
| Q. 3 | A | What are different types of blood cell counters? Explain any one.                       | 8  |
|      | B | Explain Electrophoresis   | 8  |

OR

- |      |   |   |    |
|------|---|---|----|
| Q. 4 | A | Define telemetry & telemedicine. Explain different applications of telemedicine.            | 8  |
|      | B | Explain the need & working of Auto-analyzer   | 8  |
| Q. 5 | A | What are different techniques used for visualization of X-rays? Explain Image intensifiers. | 8  |
|      | B | Explain different image artifacts.  | 10 |

OR

- |      |   |  |    |
|------|---|--|----|
| Q. 6 | A | Explain image reconstruction techniques in tomography. | 10 |
|      | B | Explain rotating anode type of anode for X-ray machine | 6  |

## SECTION II

- Q. 7      A      Explain Positron Emission tomography      8
- B      Explain working of Scintillation Camera.      10

OR

- Q. 8      A      Explain the echocardiography.      8
- B      Explain Ultrasonic imaging techniques      10

- Q. 9      A      What is a retinal detachment? Explain its cause and  
            repairing methods?      8
- B      Explain effects of a laser beam on the biological tissue      8

OR

- Q. 10     A      Explain types of diathermy with application      8
- B      Explain basic endoscope system with its  
            Characteristics.      8

- Q. 11     A      Describe arthrotics & prosthetic devices along with its  
            materials.      8
- B      What it the principle of ultra sound lithotripsy?  
            Explain with neat diagram      8



OR

- Q. 12    A    Brief out different types of artificial kidney dialyzers    8
- B    What are wheelchair types along with materials?    8

[Total No. of Questions: 12]

[Total No. of Printed Pages: 3]

**UNIVERSITY OF PUNE**

**[4364]-615**

**B. E. (Instrumentation and Control) Examination - 2013**

***Fiber Optic Instrumentation***

***(2008 Course)***

[Time: 3 Hours]

[Max. Marks: 100]

***Instructions:***

- 1 *Answer three questions from section I and three questions from section II.*
- 2 *Answers to the two sections should be written in separate answer-books.*
- 3 *Neat diagrams must be drawn wherever necessary.*
- 4 *Assume suitable data, if necessary.*
- 5 *Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed*

**SECTION -I**

- Q.1    A    Explain following terms with respect to optical fibers    [9]  
with neat ray diagram:  
a) Total internal reflection  
b) Numerical aperture  
c) Acceptance angle
- B    Explain the different types of optical fibers.    [9]

**OR**

- Q.2    A    Explain how the optical fibers are classified.    [9]
- B    Explain the following concepts in optical fiber    [9]  
transmission:  
a) Evanescent field

b) Goos- Haenchen shift

c) Mode coupling.

Q.3     A     What are the various losses during optical fiber transmission? Explain in detail.     [16]

**OR**

Q. 4     A     Explain the principle and operation in OTDR with neat diagram.     [16]

Q. 5     A     Compare P-I-N diode with avalanche photodiode.     [8]

          B     Describe the construction of LED.     [8]

**OR**

Q. 6     A     Describe what is meant by the fusion splicing of optical fibers. Discuss the advantages and drawbacks of this jointing technique. Describe in detail a common technique for achieving a butt jointed fiber connector.     [16]

## **SECTION II**

Q. 7     A     Explain Intensity Modulated Optical Sensors (IMOS) in detail. Describe various techniques of sensing which is based on intensity modulation. Encoding based position sensors.     [16]

**OR**

Q. 8     A     What are the advantages and drawbacks of Optical Fiber Sensors?     [8]

          B     Explain encoding based position sensors.     [8]

Q. 9     A     Write short notes on     [16]  
a) Distributed optical fiber sensing

b) Fiber grating technology

**OR**

Q. 10    A        Explain Fiber grating technology and Fiber Bragg grating interrogations.        [16]

Q. 11    A        Explain how silicon laser amplifier and integrated optics are used in fiber optic sensing in detail.        [18]

**OR**

Q. 12    A        Write short notes on        [18]  
a) Directional coupler  
b) Bean splitter  
c) Integrated optics

[Total No. of Questions:12]

[Total No. of Printed Pages: 2]

UNIVERSITY OF PUNE

[4364]-616

B. E. (Instrumentation And Control) Examination - 2013

Process Modeling And Optimization ( 2008 Course)

[Time: 3 Hours]

[Max. Marks: 100]

**Instructions:**

- 1 Answer any **three** from question from section-I and **three** questions from section-II.
- 2 Answers to the **two** sections should be written in **separate answer-books**.
- 3 Use of non programmable calculator is allowed.
- 4 Assume suitable data, if necessary

**SECTION -I**

- Q.1 A Give suitable example of Mechanical first and second order system. Also derive mathematical model for same. 8
- B Explain how the process model can be developed in time domain. 8

**OR**

- Q.2 What is curve fitting? Why it is needed? Derive the equations to find the coefficients for exponential relation. 16
- Q. 3 A Derive the mathematical equations which represent the dynamics of a Jacketed CSTR in which Component A and B are flow into the tank to produce component C and D at reaction rate of k. The reaction is assumed to be exothermic and cooling liquid is pass through jacket to maintain the reaction temperature which is assumed to be perfectly mixed. Use lumped jacketed model. 12
- B Write mass and component balance equations for tubular reactor producing product C from material A and B constant rate of k. 4

**OR**

- Q. 4 A Develop mathematical model for CST Rs with variable holdups. 8
- B Develop a steady state mathematical model for multi-component flash drum. 8
- Q. 5 A Explain Sine wave testing for process identification. 9
- B Explain pulse testing for process identification. 9

**OR**

- Q. 6 A Derive the relation between frequency to time domain

B Explain ATV identification with neat sketch. 9

**SECTION II**

Q. 7 A Determine the stability of a 2 x 2 process with a diagonal feedback controller given as: 8

$$G_m = \begin{bmatrix} 4 & 0 \\ 2 & -3 \end{bmatrix}, B(s) = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

B Write a short note on Inverse Nyquist Array 8

**OR**

Q. 8 A Write a short note on applications of RGA and limitations of RGA 6

B Consider a distillation system described by, 10

$$\begin{bmatrix} X_D \\ X_B \end{bmatrix} = \begin{bmatrix} \frac{12.8e^{-s}}{1+16.7s} & \frac{-18.9e^{-3s}}{1+21s} \\ \frac{6.6e^{-7s}}{1+10.9s} & \frac{-19.4e^{-3s}}{1+14.4s} \end{bmatrix} \begin{bmatrix} R \\ V \end{bmatrix}$$

Find NI for this comment on stability. Repeat the procedure for  $X_D - V$  &  $X_B - R$  pairing.

Q. 9 A What is optimization? Explain the necessity of optimization. 8

B For the functions given below, analyze the concavity and convexity in each case. 10

- i.  $f(x_1, x_2) = (x_1 - x_2)^2 + x_2^2$
- ii.  $f(x) = 2x_1^2 + x_1x_2 + x_2^2 + 8x_1 + 7x_2 + 36$
- iii.  $f(x) = 7x + 24x^2 + 45x^3$
- iv.  $f(x_1, x_2) = 2x_1^2 - 4x_1x_2 + 6x_2^2$
- v.  $f(x) = x^4$

**OR**

Q. 10 A Determine the optimum values of  $x_1$  &  $x_2$  for the function 10  
 $y = \frac{x_1^2}{6} + \frac{3}{x_1x_2} + 7x_2$  and state whether point is minimum or maximum

B Write short note on scanning and bracketing procedures. 8

Q. 11 Write short notes on: 16

- i. Constrain and Unconstraint optimization techniques.
- ii. Quasi Newton method.

**OR**

Q.12 Write short notes on 16

- 1) Simplex Method of Optimization
- 2) Indirect Methods



[Total No. of Questions: 12]

[Total No. of Printed Pages: 2]

**UNIVERSITY OF PUNE**

[4364]-617

**B. E. (Instrumentation and Control) Examination - 2013**

**BUILDING AUTOMATION - II (2008 Course)**

[Time: 3 Hours]

[Max. Marks: 100]

**Instructions:**

- 1 *Answers to the two sections should be written in separate answer-books.*
- 2 *Black figures to the right indicate full marks.*
- 3 *Use of electronic calculator is allowed.*

**SECTION - I**

- |     |   |  |   |
|-----|---|--|---|
| Q.1 | A | Discuss the Scope of HVAC systems.   | 8 |
|     | B | Explain the terms; Specific Heat, Latent Heat, Sensible Heat, Dew Point temperature. | 8 |

**OR**

- |     |   |  |   |
|-----|---|--|---|
| Q.2 | A | Explain ASHRAE Psychometric charts with neat sketch. Explain the necessity of Psychometric charts. | 8 |
|     | B | What is Human comfort? Explain Human comfort zone and effect of heat, humidity on Human comfort.   | 8 |

- |      |   |  |    |
|------|---|--|----|
| Q. 3 | A | List the characteristics of Unitary equipments. Explain common types of Unitary equipment with applications and associated controls. | 12 |
|      | B | Explain HEPA filters and ULPA filters with respect to Air Handler Unit.  | 6  |

**OR**

- |      |   |   |    |
|------|---|---|----|
| Q. 4 | A | Draw a neat sketch of Central Fan System. Explain different sections of Central Fan System. | 12 |
|      | B | Sketch and Explain Direct Expansion Cooling System.   | 6  |



- Q. 5      A      Draw circuit diagram of commonly used as Digital I/O and Analog I/O configurations in HVAC. 10  
             B      Explain different steps in DDC control design process. 6

**OR**

- Q. 6      A      Draw a neat sketch of DDC controller architecture, Explain each block in detail. 10  
             B      Explain different Temperature and Flow switches in HVAC. 6

**SECTION II**

- Q. 7      A      What are major applications of MCC? Explain Auto start-stop circuit with neat sketch. 10  
             B      Explain the types of Modbus Protocols. 8

**OR**

- Q. 8      A      Explain the Building Automation and Control Networks Systems with different elements and system operations. 10  
             B      List and Explain HVAC Control Panel Components. 8

- Q. 9      A      Sketch different Regulatory Control Symbols with REGCTL and REGPV algorithms. 8  
             B      Define the terms Energy Management. Explain various energy measurement devices in HVAC. 8

**OR**

- Q. 10     A      Explain energy saving concept, what are different ways energy savings. 8  
             B      Explain Green Building concept with example. 8

- Q. 11     A      Explain Hierarchical BMS Configuration with neat sketch. 8  
             B      What are the functions and advantages of Building Management Systems? 8

**OR**

- Q. 12     A      Explain BMS verticals for Education buildings, Commercial buildings, Datacenters, Health centre. 8  
             B      Suggest the components and subsystem; If Building Management System is to be provide for commercial building with fire security. 8

**UNIVERSITY OF PUNE**  
**[4364]-619**  
**B.E. (Instru. And Control) Semester II Examination - 2013**  
**MICRO ELECTRO MECHANICAL SYSTEM**  
**(2008 Pattern)(406270)**

[Time: 3 Hours]

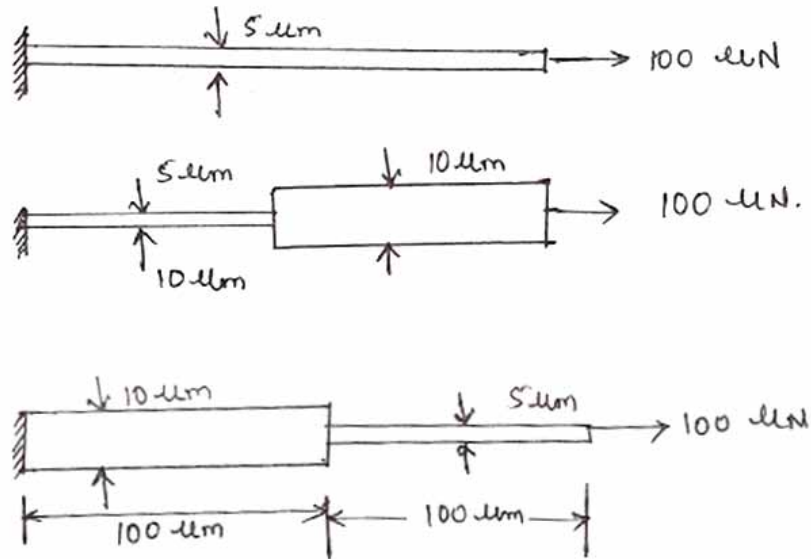
[Max. Marks: 100]

**SECTION - I**

- Q.1 A What are important elements of smart system? Explain structure of smart system. [8]  
B Explain working of Micro Pump actuator with neat diagram. [8]
- OR**
- Q.2 A What are the advantages of MEMS technology over conventional [8]  
Macrotecnology  
B Explain working of smart Bridge with neat sketch. Name sensors and their [8]  
function used in Smart Bridge
- Q.3 A Explain capacitive accelerometer with neat diagram. What are its application and [8]  
material used to form this device?  
B Explain working of magnetic micro relay with diagram. What are advantages of [8]  
micro relay
- OR**
- Q. 4 A Explain working of Conductometric gas sensor with neat diagram. What are its [8]  
applications  
B Explain working principle of Piezoelectric Inkjet actuator with neat diagram. [8]  
What are material used in it?
- Q. 5 A What is photolithography? What are different steps involved in it. [9]  
B What are the process-steps used in the fabrication of micro system? [9]
- OR**
- Q. 6 Explain following micromachining Technique with neat diagram [18]  
a) Thermal evaporation  
b) Chemical vapor deposition

**SECTION II**

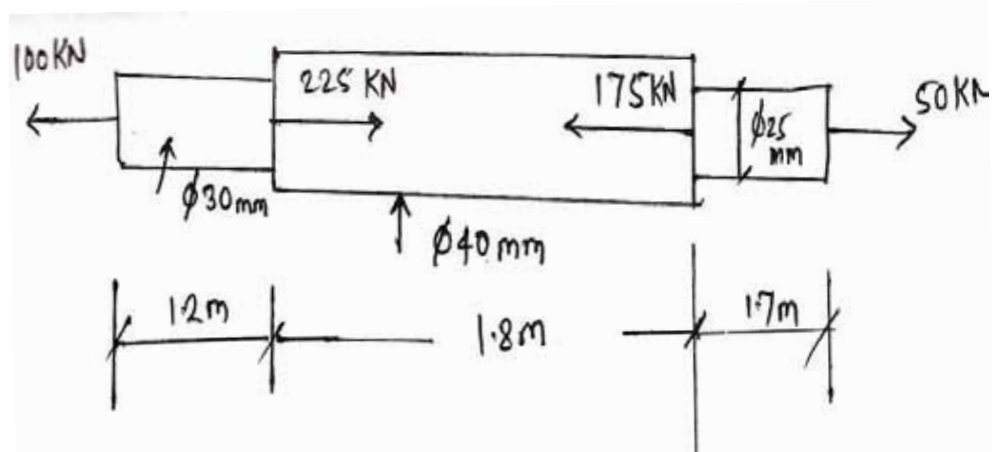
- Q. 7 A i) Define Hooks Law [6]  
ii) Young's modulus of elasticity  
B Fig shows three variants of a bar of square cross-section in a resonant mode force [10]  
sensor. An axial force of  $100 \mu\text{N}$  acts on it in all the three cases. Find the  
elongation of the bar and the maximum stress and strain in all three cases if the  
length of the bar is  $200 \mu\text{m}$ . Take silicon's Young's Modulus to be 150 GPa.



**Figure. A bar under axial load with its three variants**

**OR**

- Q. 8 A Define stress & strain [6]  
 B Determine the total elongation of the stepped steel bar under load as shown in fig. [10]  
 take  $E=210\text{GPa}$



- Q. 9 A Explain in detail the different between Finite Different Method and Finite Element Method. [8]  
 B Describe in detail the steps involved in solving structural problem using Finite Element Method [8]

**OR**

- Q. 10 A List advantages of Finite element Method over analytical method [8]  
 B List various fields of engineering where finite element method can be implemented [8]

- Q. 11 A Explain working of NPN transistor with neat diagram. [9]  
 B Draw and Explain Wheatstone Bridge for measurement of Change in Resistance. [9]

**OR**

- Q. 12 A Draw and explain op-amp based circuit of integrator and differentiator ? also Mention its applications. [9]  
 B What are different types of rectifier. Draw and explain full wave bridge rectifier. [9]



[Total No. of Questions: 12]

[Total No. of Printed Pages: 3]

**UNIVERSITY OF PUNE**  
**[4364]-620**  
**B.E. (Instrumentation & Control) Examination - 2013**  
***Digital Image Processing***  
***(2008 Course)(Elective IV)***

[Time: 3 Hours]

[Max. Marks: 100]

***Instructions:***

- 1 *Answers to the two sections should be written in separate answer-books.*
- 2 *Neat diagrams must be drawn wherever necessary.*
- 3 *Assume suitable data, if necessary.*
- 4 *Black figures to the right indicate full marks.*

**SECTION -I**

- |     |   |   |     |
|-----|---|---|-----|
| Q.1 | A | Write a short note on the elements of digital image processing systems. | [8] |
|     | B | Explain the different characteristics of an image digitizer.            | [8] |

**OR**

- |     |   |  |     |
|-----|---|--|-----|
| Q.2 | A | What is image? Explain the fundamental steps and components of image processing. | [8] |
|     | B | Write the short notes on Electronic Image Tube Cameras and Solid State Cameras.  | [8] |

- |     |   |   |     |
|-----|---|---|-----|
| Q.3 | A | Draw and explain the Structure of Human Eye.      | [6] |
|     | B | Write a short note on Perspective Transformation. | [6] |
|     | C | Explain Adjacency and Connectivity.               | [6] |

**OR**

- |      |   |  |     |
|------|---|--|-----|
| Q. 4 | A | Explain the simple Image Formation model and the representation of digital images. | [6] |
|      | B | Explain the different operations involved in Basic Transformation.                 | [6] |
|      | C | Explain the following (any three):<br>i) 4-connectivity.                           | [6] |

- ii) 8-connectivity
- iii) m-connectivity
- iv) Elements of visual perception

Q. 5 Write a short note on the following: [16]  
 1) Discrete cosine Transform (DCT).  
 2) Short time Fourier Transform (STFT)  
 3) Gabor Transform  
 4) 2-D DFT.

**OR**

Q. 6 A What is the need of Image Transform? How DCT is related with DFT? [6]  
 B List out the advantages, disadvantages, and applications of the following (any two): [10]  
 1) Radon Transform  
 2) Gabor Transform  
 3) STFT

**SECTION II**

Q. 7 A Define Image Enhancement. List out common Image Enhancement Techniques. [6]  
 B Write a short note on Histogram Equalization. [6]  
 C Explain in detail Homomorphic Filtering. [6]

**OR**

Q. 8 A Perform histogram equalization on the following image: [8]

4	4	4	4	4
3	4	5	4	3
3	5	5	5	3
3	4	5	4	3
4	4	4	4	4

B List and explain different types of Image Enhancement Filters used in frequency domain. [6]  
 C Explain Image Enhancement by control stretching. [4]

Q. 9 A Explain the model of the Image Degradation/ Restoration process. [8]  
 B Define and sketch any four noise probability density functions required for the analysis during Image Restoration process. [8]

**OR**

Q. 10    A        What is the need of Image Restoration in image processing and explain it with any one example.        [8]

          B        Write a short note on the following:        [8]  
                  1) Order-statistics filters  
                  2) Mean filters

Q. 11    A        What is Image Segmentation? Explain Detection of Discontinuities in detail.        [8]

          B        Explain the following (any two):        [8]  
                  1) Sobel Operator  
                  2) Prewitt Operator  
                  3) Laplacian of Gaussian( LoG) Filter

**OR**

Q. 12    A        Write a short note on Canny edge detection algorithm.        [8]

          B        Does the zero-crossing method for edge finding always result in edges that are closed contours? Give a reason for you answer.        [8]