

M.E. Sem II CBSSGS  
Stochastic Process.

P-Code 2632.

May 2017.

Q.P. Code :09632

[Time: 3 Hours]

[ Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Question No.1 is compulsory.
  2. Attempt any three questions out of the remaining questions.
  3. Assume suitable data wherever necessary.

Q.1 Briefly explain any four

20

- a) Bayes theorem
- b) Mittag Liffler function
- c) Least square estimation
- d) Binomial distribution
- e) Covariance

- a) Discuss the significance of Gaussian distribution in engineering applications.
- b) Discuss the stochastic characteristics of Poisson distribution.

20

- a) Derive the equations of kalman filter and discuss how filtering is done using it.
- b) Explain how the Extended Kalman filtering improves state estimate of a non-linear system.

10

- a) What is a random process? Explain how the stochastic characteristics of a random process can be described by auto correlation and Power spectral density.
- b) Discuss the concept of stationarity.

10

- a) Compare integer order calculus and fractional order calculus.
- b) Obtain ' $a^{th}$ ' fractional order derivative of a function  $f(t) = t^m$  where ' $a$ ' is a fractional number and ' $m$ ' is an integer

10

Write short notes on

20

- a) Exponential distribution
- b) Weighted least square estimation



May 2017

M.E. SEM II (INST. & CONTROL)  
Adv. Process Inst. & Control

Q.P. Code:16833

(3 Hours)

[Total Marks: 80]

N.B.: (1) Question No.1 is **compulsory**.

(2) Answer any **THREE** questions from Question Nos. 2 to 6.

(3) Assume suitable data if necessary.

(4) Figures to the right indicate full marks.

- 1 Answer the following questions :-
  - (a) Explain adjustable speed devices and their advantages. 5
  - (b) Explain the concept of dynamic coupling. 5
  - (c) List the methods of SIL determination. 5
  - (d) Explain the process and factory automation. 5
- 2
  - (a) Explain the optimization aspect and control strategies for Boiler. 10
  - (b) What is the need of dead time compensation and how it is handled? 10
- 3
  - (a) Discuss the components SIS and phases of its implementation. 10
  - (b) Explain the procedure of memory and power calculation of PLC system. 10
- 4
  - (a) What is constraint control? Explain MIMO constraint control with example. 10
  - (b) Draw and explain layout of DCS in plant function. 10
- 5
  - (a) Explain the concept of HPT and DART. 10
  - (b) Draw and explain the OSI model. 10
- 6 Write short notes (any TWO):- 20
  - (a) FISCO and FNICO.
  - (b) Wireless SCADA.
  - (c) HART.

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1 May 2017

Q.P. Code :16716

(Time : 3 Hours)

[Total Marks: 80]

Please check whether you have got the right question paper

- N. B.: (1) Question No. 1 is compulsory.  
 (2) Attempt any three questions from remaining five questions.  
 (3) Assume suitable data if necessary.  
 (4) Figures to the right indicate full marks.

1. Answer the following: 20
  - (a) Derive describing function for ideal relay.
  - (b) Explain Lyapunov indirect method of stability analysis.
  - (c) Explain different singular points.
  - (d) Explain small gain theorem.
2. (a) Explain how describing function method can be used for stability analysis of nonlinear systems. 10  
 (b) Explain the classification of nonlinear systems into minimum phase system and weakly minimum phase system. 10
3. (a) Discuss stability of the following nonlinear system. 10  

$$\dot{x}_1 = -x_1 + x_1 x_2$$

$$\dot{x}_2 = x_1 - x_2$$

Select the Lyapunov function  $V(x) = x_1^2 + x_2^2$ .

 (b) Explain MIMO system linearization by state feedback. 10
4. (a) Design sliding mode controller for the following system 10  

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u(t)$$
 (b) Explain the following terms with example 10
  - i) continuously differentiable
  - ii) continuous
  - iii) locally Lipschitz
  - iv) Globally Lipschitz
5. (a) Linearize the following system at equilibrium 10  

$$\dot{x}_1(t) = x_1(t)x_3(t)$$

$$\dot{x}_2(t) = x_1(t) + x_3(t)x_2(t)$$

$$\dot{x}_3(t) = 3x_2(t) - 5x_1(t)x_2(t) + u(t)$$
 (b) Explain how describing function method can be used for stability analysis of nonlinear systems. 10
6. Write notes on 20
  - (a) Bifurcation
  - (b) Local and global stability
  - (c) Limit cycles
  - (d) Lasalle Invariance principle

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Duration 3 Hours

[Total Marks : 80]

Note : 1. Question No. 1 is compulsory.

2. Attempt any three questions from remaining five questions.

3. Assume suitable data if necessary.

- Q. 1 a) Explain need and working of constant fraction discriminator. 05  
 b) Explain how the coincidence detection reduces effect of noise. 05  
 c) Explain the need and working of self powered neutron detectors. 05  
 d) Explain why low DNL is required in nuclear ADC. 05
- Q. 2 a) . Explain working of Timing spectroscopy system with block diagram. 10  
 b) Explain how low DNL can be obtained in Wilkinson ADC. Explain advantages and disadvantages of Wilkinson ADC over other nuclear ADCs. 10
- Q. 3 a) Explain various methods of neutron detection. 10  
 b) Explain various counting interferences in Liquid Scintillation counting. 10
- Q. 4 a) Explain working of Charge to Digital convertor with circuit diagram. 10  
 b) Explain need and working of Trigger system in astrophysics experiments. 10
- Q. 5 a) Explain working of PET imaging system with block diagram. 10  
 b) Explain in core and out of core instrumentation for nuclear reactor. 10
- Q. 6 Write short notes on any two of the following - 20  
 a) Channel profile of nuclear ADC.  
 b) Coordinate signal generation in gamma camera.  
 c) Gam's Sliding scale technique.



May 2017

M.E. SEM II CIBSGS | Elective IV

22 / T0653 ELECTIVE: IV : ME INSTRUMENTATION & CONTROL ENGG.(SEM. II) (CBSGS) INTELLIGENT AND AUTONOMOUS

Q.P.Code: 013946

(3 Hours)

[Total Marks 80]

- i. Q. 1. Compulsory. Attempt any 4.
  - ii. Attempt any three from the remaining.
  - iii. Assume suitable data.
- Q. 1**
- (a) Explain the importance of Endomorphism in an autonomous architecture. (5)
  - (b) Describe the role of scheduler at any one level in autonomous controller architecture. (5)
  - (c) Explain the functions of Job Planner in BG block. (5)
  - (d) Discuss various types of membership functions. (5)
  - (e) Define observability, stability, controllability, reachability and detectability of the system in control system theory. (5)
- Q. 2**
- (a) Develop the PN/CPN for a Traffic signal Control System. (10)
  - (b) Use either a Adaline Network and train it to learn the following (10)  
 $(1, 1, -1, -1)$  and  $(-1, -1, -1, -1)$  belong to class 1  
 $(1, 1, 1, 1)$  and  $(-1, -1, 1, -1)$  belong to class -1
- Q. 3**
- (a) Describe in detail the adaptive structural analogy in AI based planning system. (10)
  - (b) Discuss in detail the main blocks of RCS 4. (10)
- Q. 4**
- (a) Explain with the help of flowchart the participation of SES in task planning methodology. How does it differ from the participation of PES? (10)
  - (b) Design a Hebb net to implement OR function (consider bipolar inputs and targets). (10)
- Q. 5**
- (a) Develop the Fuzzy Logic based controller for any one application. State the assumptions clearly. (10)
  - (b) Implement ANDNOT function using McCulloch-Pitts neuron (use binary data representation). (10)
- Q. 6**
- (a) Discuss the World modelling block of autonomous system. (10)
  - (b) Explain the steps of GA with suitable example. Comment on the mutation rate and crossover rate. (10)