

Ref. No.: Ex/EE/PE/B/T/421D/2024(S)

B. E. ELECTRICAL ENGINEERING FOURTH YEAR SECOND SEMESTER SUPPLEMENTARY
EXAMINATION, 2024

SUBJECT: - ADVANCED INSTRUMENTATION-II

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
	<i>Answer any two questions.</i>	
1. (a)	Draw the block diagram and explain in detail the principle of operation of discrete Wiener filter. Hence derive the expression for its mean square error and the condition for achieving minimum mean square error.	13
(b)	Explain in detail the operating principle of an adaptive noise canceller. How can adaptive noise cancellation be carried out without an external reference source? When is decorrelation delay employed in such adaptive noise cancellers?	12
2. (a)	How can spatial filtering techniques be employed for low pass image filtering? How can median filtering be employed for image enhancement? How are digital approximations of first derivative and second derivative obtained in image processing?	13
(b)	How can isolated point detection be carried out for image segmentation using Laplacian? How are four different types of masks designed for this purpose?	12
3. (a)	Differentiate between crisp sets and fuzzy sets. What are the typical shapes of membership functions employed in fuzzy systems? Draw the block diagram of a generic fuzzy inference system and explain the role of each individual block.	12
(b)	What are the main features of variable structure control? What is the role of sliding surface in it? How can the method of equivalent control be employed in sliding mode control?	13
4.	Write short notes on <i>any two</i> of the following: i) Dynamic range compression and power law transformation for image enhancement. ii) Defuzzification strategies in fuzzy systems. iii) The Widrow-Hoff LMS algorithm.	12.5×2 =25

[Turn over

**B.E. ELECTRICAL ENGINEERING FOURTH YEAR SECOND
SEMESTER SUPPLEMENTARY EXAMINATION 2024**

Advanced Instrumentation -II

Time: Three Hours

Full Marks: 100

(50 Marks for each part)

Use a separate Answer Script for each Part

PART-II

Answer any two Questions

Q.1a) Define Controllability and Observability of a linear dynamic system. 7

b) Explain the principle of duality. 8

c) The system state and output equations are defined by

$$\dot{\mathbf{x}} = \mathbf{Ax} + \mathbf{Bu}$$

$$\mathbf{y} = \mathbf{Cx}$$

$$\text{Where } \mathbf{A} = \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -2 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 0 \\ 4 \\ 0 \end{bmatrix}, \mathbf{C} = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$$

Is the above system completely state controllable and observable? 10

Q.2 a) Briefly discuss the characteristics of penetrant materials used in liquid inspection testing. 7

b) Mention the advantages and disadvantages of magnetic particle testing. 8

c) Explain with neat sketch the principle of operation of non- destructive eddy current testing method. Also mention the different types of sensors used in this testing. 10

- Q.3a)** Explain the principle of sputter deposition process **5**
- b) Briefly explain the LPCVD process to deposit silicon nitride. **5**
- c) What is micromachining? Name the different processes involved in micromachining. **5**
- d) Explain the dry oxidation and wet oxidation processes for growing oxide on silicon and give the relative merits and demerits of each process. **10**
- Q. 4.** Write short notes on (any two):
- i) Radiographic Testing
 - ii) Lithography
 - iii) Kalman Filter
 - iv) Ultrasonic Transducer **(12.5*2)**