BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)
FIFITH YEAR SECOND SEMESTER SUPPLEMENTARY EXAM 2024

Advanced Instrumentation-II

Time: Three Hours **Full Marks: 100**

(50 Marks for each part)

Use a separate Answer Script for each Part

PART-I

Answer *Any Two* Questions

Q.1 a) Explain the principle of duality. **10**

b) The system state and output equations are defined by

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

$$y = Cx$$

Where $A=\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -5 & -6 & 0 \end{bmatrix}$, $B=\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$, $C=[1\ 0\ 0]$

Is the above system controllable and observable **15**

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

b) How flaw at right angles to the surface of the part (test object) can be detected by ultrasonic testing? **6**

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. **12**

Q.3 a) Explain the principle of sputter deposition process. **10**

b) Briefly explain the LPCVD process to deposite silicon nitride **10**

c) What is micromachining? Name the different processes involved in micromachining. **5**

Q.4 Write notes on (any two):

i) Lithography process

ii) Ultrasonic Transducer

iii) Wet and Dry Etching

iv) Radiographic Testing **(12.5*2)**

Ref No: **Ex/EE/5/T/522D/2024(S)**

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FIFTH YEAR SECOND SEMESTER SUPPLEMENTARY EXAM 2024

SUBJECT: - ADVANCED INSTRUMENTATION – II

Full Marks 100
Time: Three hours (50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART II	Marks
	Answer any two questions.	
1. (a)	Draw the block diagram and describe the operating principle of an *M*-weight adaptive digital FIR filter. How can the method of steepest descent be employed for adapting these filters?	13
(b)	Prove that in discrete Wiener filters, under some special considerations, the optimal filter gain is given by $H(\omega)=\frac{S_{ss}(\omega)}{S_{ss}(\omega)+S_{nn}(\omega)}$, where each symbol has its usual meaning.	12
2. (a)	Describe in detail how can ideal low-pass filters and Butterworth low-pass filters be employed for frequency domain image filtering.	12
(b)	Explain in detail the two approaches used in gray-level slicing in image enhancement. How are unsharp masking and high-boost filtering carried out for image enhancement?	13
3. (a)	Why and how are fuzzification and defuzzification carried out in fuzzy systems? What is universe of discourse? How can the fuzzy rules be framed for a fuzzy system using first-order Sugeno model?	13
(b)	Derive the necessary condition for convergence for steepest-descent based adaptive digital filters.	12
4.	Write short notes on ***any two*** of the following: *i*) Second derivative filters for image sharpening. *ii*) PI- and PD-fuzzy controllers in continuous-time systems. *iii)* Adaptive noise canceller as a notch filter.	12.5×2 =25