Ref. No.: Ex/EE/5/T/522D/2018 (Old)

B.E. ELECTRICAL ENGINEERING (PART TIME) FIFITH YEAR SECOND SEMESTER EXAMINATION 2018 (Old)

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) 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

$$\dot{\mathbf{x}} = \mathbf{A}\mathbf{x} + \mathbf{B}\mathbf{u}$$

$$\mathbf{y} = \mathbf{C}\mathbf{x}$$

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

By using state feedback control $u = -Kx$, it is desired that the closed loop poles at $s_1 = -2-j4$, $s_2 = -2+j4$ and $s_3 = -10$. Determine the state feedback gain matrix K. **10**

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**

[Turn over

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 **5**

b) Briefly explain the LPCVD process to deposite silicon nitride. **5**

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

d) The system is given as

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u,$$

Prove that the system is completely state controllable. **10**

Q. 4. Write short notes on (any two):

i) Magnetic particle Testing

ii) Lithography

iii) Thermal Oxidation process

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

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B.E. ELECTRICAL ENGINEERING (PART TIME)
FIFTH YEAR SECOND SEMESTER EXAM 2018 (OLD)

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)	Derive the general expression of the mean square error of a discrete Wiener filter in terms of R_{xx}, R_{dd} and R_{xd}, where each term has its usual meaning. What will be the expression of this mean square error when the optimal filter coefficients h_m are obtained?	09
(b)	"In case of an adaptive noise canceller developed without an external reference source, the reference filter designed can always be replaced by a bulk delay stage." – Justify or correct this statement, citing suitable reasons.	05
(c)	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?	11
2. (a)	How can you design a dead-beat controller for a first-order plant with delay, using direct synthesis method? What are the strengths and the weaknesses of this method?	08
(b)	What is the key essence of designing predictive controllers? How can you employ model following design of predictive controllers? Does this design philosophy bear any resemblance with the design philosophy employed for Dahlin's controllers?	09
(c)	How can feedforward compensation be employed in predictive controllers? What are its advantages?	08

[Turn over

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B.E. ELECTRICAL ENGINEERING (PART TIME)
FIFTH YEAR SECOND SEMESTER EXAM 2018 (OLD)

SUBJECT: - ADVANCED INSTRUMENTATION – II

Full Marks 100
(50 marks for each part)

Time: Three hours

Use a separate Answer-Script for each part

No. of Questions	PART II	Marks
3. (a)	How can adaptive digital filters be employed as adaptive noise cancellers in (a) online ECG processing and (b) speech signal processing?	05+05
(b)	How can recursive computations of generalized auto-correlation matrix and cross-correlation vector be carried out in RLS algorithm?	08
(c)	Describe in detail the Correlation LMS algorithm and the Leaky LMS algorithm. What is the importance of leakage factor in Leaky LMS algorithm?	07
4.	Write short notes on ***any two*** of the following:	12.5×2 =25
(i)	Widrow-Hoff LMS algorithm.	
(ii)	Point processing techniques for image enhancement.	
(iii)	Ringing of digital controllers.	