Ref No: Ex/EE/5/T/512D/2018 (Old)

# B.E. ELECTRICAL ENGINEERING (PART TIME) 5TH YEAR FIRST SEMESTER EXAM 2018 (OLD)

## SUBJECT: - ADVANCED INSTRUMENTATION-I

**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 |
|---|---|---|
| | **Answer any two** | **2X25=50** |
| 1. a) | How is the limitation of Fourier Transform overcome by Short Time Fourier Transform (STFT)? | 3 |
| b) | What are the shortcomings of STFT? Justify the application of Continuous Wavelet Transform (CWT) to overcome them. | 4 |
| | What is/are "*Continuous*" in Continuous Wavelet Transform? | 2 |
| c) | Explain the terms "*scale*" and "*translation*" in CWT. | 6 |
| d) | What are the properties of a *mother-wavelet*? | 4 |
| e) | How can you use Wavelet Transform for denoising a signal? | 6 |
| 2. a) | What is SCADA? Compare between different SCADA architectures. | 10 |
| b) | Discuss relative advantages and disadvantages of various modes for deploying SCADA systems. | 10 |
| c) | A digital frequency synthesizer employs a 4MHz crystal oscillator and gives a 256 step-sinusoid. Determine the maximum and minimum output frequency if the number of fractional bit is 2. Also find out the frequency control word for these cases. | 5 |
| 3. a) | What is a lock-in-amplifier? Explain with a basic scheme. | 8 |
| b) | How can you employ digital synthesis technique in such a lock-in-amplifier for better performance? | 7 |
| c) | A Rough Set based decision rule generation system uses a data table as given below. Generate the set of decision rules from this table. | 10 |

| Objects | Condition Attributes | | | Decision Attribute |
|---|---|---|---|---|
| | A | B | C | |
| $U_1$ | 0 | 1 | 0 | 1 |
| $U_2$ | 0 | 1 | 1 | 1 |
| $U_3$ | 1 | 1 | 1 | 0 |
| $U_4$ | 1 | 0 | 1 | 0 |
| $U_5$ | 1 | 0 | 2 | 1 |
| $U_6$ | 0 | 0 | 2 | 0 |
| $U_7$ | 1 | 0 | 0 | 0 |
| $U_8$ | 1 | 1 | 0 | 0 |

| | | |
|---|---|---|
| 4. | Write notes on the followings (Any 2) | $(2X12\frac{1}{2}=25)$ |
| a) | Digital vector voltmeter using synchronous detection technique. | |
| b) | Different levels of sensor fusion. | |
| c) | Algorithm for computing Continuous Wavelet Transform of a one dimensional signal | |

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# B.E. ELECTRICAL ENGINEERING (PART TIME) - FIFITH YEAR - FIRST SEMESTER (OLD)- 2018

## SUBJECT: - ADVANCED INSTRUMENTATION -I

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

| No. of Questions | PART II | Marks |
|---|---|---|
| | ANSWWER ANY *TWO* QUESTIONS | |
| 1. (a) | Distinguish between "Strict-sense stationary" and "Wide-sense stationary" (WSS) random processes. When can a WSS random process be described as ergodic? Explain. | 8 |
| (b) | Prove the following, for WSS random processes:<br>(i) $\lvert R_X(\tau) \rvert \leq R_X(0)$, for all $\tau$.<br>(ii) If $X(t)$ has a periodic component, then $R_X(\tau)$ will have a component with same time period.<br>(iii) $\lvert R_{XY}(\tau) \rvert \leq [R_X(0)\, R_Y(0)]^{1/2}$<br>(iv) If $Y(t) = K\,X(t-t_o)$, then, $R_{XY}(\tau) = K\,R_X(t-t_o)$.<br>The symbols have their usual meaning. | 3×4 |
| (c) | The expression for the autocorrelation function of an ergodic random process is $R_X(\tau) = e^{-\lvert\tau\rvert} + 0.25$. Determine the mean-square value and the mean value of the process. | 5 |
| 2. (a) | Explain the sources of errors in a full-flash ADC and point out how these errors increase with increase in the number of bits. | 15 |
| (b) | Explain the bit-switching problem in absolute type shaft encoders and point out the remedial measure. | 10 |
| 3. (a) | Explain the meaning of the terms – "White Noise", "Lowpass White Noise" and "Bandlimited White Noise".<br>Discuss how white noise can be utilized for determining the impulse response of an LTI system. | 6+6 |

| No. of Questions | PART II | Marks |
|---|---|---|
| (b) | With the help of a neat sketch, explain the working principle of an ultrasonic cross-correlation flowmeter. | 13 |
| 4. | Write short notes on *any two* of the following. | 12½ |
| | (a) Measurement of linear velocity of sheet metal by non-contact method.<br>(b) Quadrature decoder circuit for incremental motion encoders.<br>(c) Subranging ADC. | +12½ |
| | | 7 |

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