Ref No:Ex/EE/5/T/512D/2024

B.E.E.(EVENING) 5TH YEAR 1ST SEMESTER EXAMINATION, 2024

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.	2+4
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 Sensor Fusion? Explain different levels of such a fusion strategy.	2+8
b)	Explain the operation of Direct Digital Synthesis (DDS) based Frequency synthesizer.	10
c)	A digital frequency synthesizer employs a 4 MHz crystal oscillator and gives a 512 step-sinusoid. Determine the maximum and minimum output frequency if the number of fractional bit is 4. 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 real valued data table as given below. Generate the discretized decision table using maximal discernible heuristics. Show the optimum set of cuts. Generate the set of rules from this.	10

Objects	Condition Attributes		Decision Attribute
	A	B	
U_1	0.25	5.5	0
U_2	0.75	4.0	0
U_3	1.25	5.5	1
U_4	0.25	1.5	0
U_5	1.25	1.5	1
U_6	0.75	4.0	0
U_7	0.75	1.5	1

4.	**Write notes on the followings**	
a)	Digital vector voltmeter using synchronous detection technique.	$(2X12\frac{1}{2}=25)$
b)	Algorithm for computing Continuous Wavelet Transform of a signal	

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BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)
FIFITH YEAR
FIRST SEMESTER EXAM 2024
SUBJECT: - ADVANCED INSTRUMENTATION -I

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

Question No.	PART I I	Marks
	ANSWER ANY *TWO* QUESTIONS	
1. (a)	**Bring out clearly the principle of Rogowski coil current transducer. Comment with relevant explanations, on the susceptibility of the transducer to the effect of stray time-varying current paths.**	3+7
	Why is electrostatic shielding necessary in such a transducer? How is such a shielding implemented effectively?	5+4
(b)	**Why does a Rogowski coil (unless specially constructed) requires an integrator, while a conventional current transformer with ferromagnetic core, does not? Explain with derivations.**	6
2. (a)	**A resistance temperature detector (RTD) is fed from a constant current source and the voltage across the sensor is measured. How can the value of the resistance to be connected in parallel with the RTD for linearization of the output voltage versus temperature characteristic, be calculated? Derive the expression used.**	8+3
	Explain the limitation of this method.	
(b)	**Why is a closed loop Hall effect current transducer known as zero-flux transducer? Elucidate with necessary figures and mathematical expressions. What are its advantages over the open-loop counterpart? Also point out its demerits.**	7+5+2

Question No.		PART I I	Marks
3.	(a)	How can a transistor carrying a constant collector current be used to measure the temperature to which it is exposed? Explain. What is the demerit of this sensor? How can the shortcoming be removed by using two-transistors? Elaborate.	6+3+7
	(b)	Explore the possibility of using a single transistor with two switched-current sources to implement a PTAT sensor for monitoring the temperature of processors.	9
4.		Write short notes on any two of the following.	
	(a)	Merits of Rogowski coil current transducer.	12 ½ +12 ½
	(b)	Series linearization circuit for NTC thermistors.	
	(c)	Op-amp based linearizing circuit for platinum RTD.	